Summary of Research

Final Report

On
Visualization of Atmospheric
Water Vapor Data for SAGE

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I. INTRODUCTION

The goal of this project was to develop visualization tools to study the water vapor dynamics using the Stratospheric Aerosol and Gas Experiment II (SAGE II) water vapor data. During the past years, we completed the development of a visualization tool called EZSAGE, and various Gridded Water Vapor plots, tools deployed on the web to provide users with new insight into the water vapor dynamics. Results and experiences from this project, including papers, tutorials and reviews were published on the main Web page. Additional publishing effort has been initiated to package EZSAGE software for CD production and distribution.

There have been some major personnel changes since Fall, 1998. Dr. Mou-Liang Kung, a Professor of Computer Science assumed the PI position vacated by Dr. Waldo Rodriguez who was on leave. However, former PI, Dr. Rodriguez continued to serve as a research adviser to this project to assure smooth transition and project completion. Typically in each semester, five student research assistants were hired and trained. Weekly group meetings were held to discuss problems, progress, new research direction, and activity planning. Other small group meetings were also held regularly for different objectives of this project. All student research assistants were required to submit reports for conference submission.

OBJECTIVES

Our objectives designed to meet the goal were to develop specific visualization tools and find the correlation of water vapor dynamics between high and low Atlantic and eastern Pacific storm activity years and El Nino Southern Oscillation years. In addition, various gridded water vapor images were plotted to provide us with new insight into the water vapor dynamics. Our results and experiences were disseminated via papers, seminars, tutorials, conference presentations, and the web. We have met our goal through attaining of the following objectives.

To Develop Visualization Tool

Use the IDL Programming Language to develop an interactive visualization tool EzSAGE to allow users to have full control of images created from SAGE II data.

To Study the Water Vapor Dynamics

Use EzSAGE to find the correlation of water vapor dynamics between high and low Atlantic and eastern Pacific storm activity years and El Nino Southern Oscillation years. In addition, exploit SAGE III capabilities should SAGE III water vapor data become available.
To Disseminate Information

Disseminate results and experiences including papers, tutorials and reviews via the Web.

II PROJECT ADMINISTRATION

1. Personnel

There was a major change in personnel. Dr. Mou-Liang Kung, Professor of Computer Science assumed the PI position vacated by Dr. Waldo Rodriguez who was on leave. The transfer was approved by Dr. William Chu. Supported personnel include: Dr. Kung (PI), Dr. Raj Chaudhury (Research Associate), Student Research Assistants: Eyad Youssef, Louay Youssef, Cyntrica Eaton, Bathsheba Farrow, Karim Muhammad, James Riddick, Lerone Banks, Joseph Patrick, Latita Pratt and Tiffany Mapp.

Former PI, Dr. Rodriguez continued to provide research advice and attended our weekly group meetings to discuss problems, progress, new research direction, and activity planning. Other small group meetings were held regularly for different objectives of this project. All student research assistants were required to submit reports in writing. Although research assistants were all undergraduate students, they were encouraged to produce scholarly paper for conference submission.

2. SciViz Laboratory

SciViz Lab is a dedicated visualization research laboratory, a part of the lab group called the BEST (Bringing Education and Science Together) Laboratory. In addition to computer peripherals (e.g. network switches, cables) and software (e.g. IDL, Dreamweaver) acquired in the past years, this grant provided the following additional computing equipment to the SciViz Lab:

- 1 SGI O2 workstations – visualization tool development
- 1 Intel-based Database and Web server – information management and dissemination
- 1 PC Notebook - presentation
- 2 Mac PowerBooks – presentation and demonstration

To complement this computing equipment, other computing resources were secured from NSU. Throughout the three years, new computers, furniture, locks, and two (2) 24 port 10/100 auto port Ethernet switches were secured and installed using the University resources. The SciViz Lab was also moved from a trailer to a new laboratory space in Room 103 of the Woods Science Building. We also
obtained other funding sources to equip the SciViz Lab with additional state of the art equipment. They include:

- 1 SGI Onyx2 InfiniteReality
- 1 ImmersaDesk R2
- 2 SGI Octane workstations
- 4 SGI O2 workstations (one was purchased from this grant),
- 2 Windows NT (additional hard disks were purchased from this grant),
- 2 G3 PowerMac,
- 2 printers (1 color, and 1 gray-scale)

The computers are all networked with access to Internet.

III. SUMMARY OF SIGNIFICANT ACCOMPLISHMENTS

During the past years, the following tasks were accomplished:

- Completed and updated the visualization tool, EzSAGE (Source code is in Appendix E),
- Created various Gridded Water Vapor plots to provide us with new insight into the water vapor dynamics,
- Presented our results at 1999 MUSPIN Annual User's Conference: Dr. Mou-Liang Kung (presentation), Dr. S. Raj Chaudhury (presentation) and Mr. Eyad Youssef (poster session);
- Packaged EzSAGE software outputs with public-domain visualization software for CD production and distribution,
- Sponsored a regional MUSPIN NRTS Workshop on Data Visualization at Norfolk State University (NSU) with three tutorials (samples are in Appendix B, C, D) given by our faculty members on this project,
- Secured other funding sources to help expand the SciViz Laboratory at Norfolk State University, a dedicated laboratory for scientific visualization research. New equipment includes an SGI Onyx2 InfiniteReality system and an ImmersaDesk R2.
- Additional research awards were received as a direct result of NASA MURED funding: MiLEN²IUM (NASA PAIR): $1,180,000 [4 years 2000-04], Digital Earth: $292,000 [3 years 2000-03], and indirectly, AFOSR $160,000 for visualization instrumentation [1-yr, 2000-2001]
- Many proposals were submitted including a visualization project proposal to NIMA.
RELAVANCE TO NASA STRATEGIC ENTERPRISES

Over the past years, our team developed EzSAGE Visualization Software used for visualizing and analyzing SAGE II data from NASA. It provides insights into the study of the atmospheric water vapor dynamics and its impact on global and local climate changes. Our effort and accomplishment directly support the Mission to Planet Earth in the area of atmospheric science. The project further prepares to utilize SAGE III data when they become available in the future. However, SAGE III data are yet available at this time. The SciViz visualization laboratory houses state of the art computing equipment to conduct earth science related research.

BENEFITS TO SOCIETY

Water vapor plays an important role in the energy and water cycle processes that determine weather and climate. Detailed observations on the water vapor dynamics are crucial to the improvement of the analysis and prediction of convective storms. Our project helps us understand the long and short-term atmospheric water vapor dynamics and its impact on climate changes so that better quality of life can be resulted from harmonizing human inhabitation with the environment.

STUDENT ACHIEVEMENTS

During each academic year, up to six students were divided into three teams to work on three parts of the project. Each team was headed by a faculty leader to work on the application of EzSAGE tool and results dissemination on the web. In the summer of 2000, we collaborated with the REESS program to provide partial support to 12 students in the study of earth science using NASA data.

Student research assistants, Mr. Eyad Youssef and Mr. Louay Youssef (please see Appendix A) worked on the coding of the EzSAGE tool and made a presentation in the poster session of the 1999 MUSPIN Annual User's Conference. Ms. Tiffany Mapp completed her senior physics project titled "Stratospheric Tropospheric Exchange" in which she used the SAGE II water vapor and Ozone data analyzed using the EzSAGE software to look at the occurrence of STE in the eastern Pacific region. The identification of outlier points in the data that do not follow the expected variation of species concentration with height is the signature of STE occurrence.

Most scientific data and documents can be disseminated on the web without much effort. However, interactive science learning tools are rarely ported for web delivery, since typical methods of using embedded Java applets for sophisticated software require a great deal of learning and programming effort. Our students have created a web interface for the EzSAGE tool coded with ION Script (Research System, Inc., http://www.rsinc.com
/ion/index.cfm), an XML based scripting language. The installation of the ION server is complete and a tutorial has been given (please see Appendix C). The ION server was also used in the CSC 450 Electronic Publishing course. However, the modification of EzSAGE tool (written in IDL programming language) for web delivery is yet completed. Students will continue on this project without additional support from the sponsor.
IV. FUTURE WORK PLANNED

1. Data Transformation and Handling Methods

Since the SAGE II data were sparsely populated over the Earth, short-term synoptic scale observations are difficult. Therefore the use of creative numerical methods to process the data are imperative. In addition to the former method of Gridding, Kriging, and Smoothing, we shall investigate other possibilities such as

- Trajectory Method: Using prediction on the assumption of smooth (continuous and differentiable) data migration
- Genetic Algorithms and Neural Network

These methods may provide approximations of synoptic scale water vapor concentrations, which would allow short-term studies. Faculty release time will be allocated to continue their investigations.

2. Interactive Visualization Techniques

EzSAGE is completed and will be released to the SAGE science team members interested on obtaining a copy. The Principal investigator of the SAGE II and III projects Dr. Patrick McCormick was provided a copy for his studies. A new course on Scientific Visualization (CSC 467) is being offered for Spring, 2001 in the department of Computer Science. EzSAGE to visualize remote sensing data will be incorporated into the course.

Virtual reality files of remote sensing data have also been produced. With the acquisition of an ImmersaDesk R2 and an Onyx2 supercomputer, utilization of virtual reality as a viable tool for remote sensing data analysis will be investigated. Funding from the School of Science and Technology of Norfolk State University will sponsor CaveLib Programming workshop (March 26 and 27 of 2001) to prepare science faculty to utilize the new facility to create immersive visualization tools.
APPENDIX A

EZ-SAGE Report
By Eyad Youssef and Louay Youssef

Over the past two semesters the VISAGE team has been working on a graphical user interface (gui), which fully exploits the data obtained by Stratospheric Aerosol and Gas Experiment II (SAGE II). The unique aspect of this data is the vertical resolution, which allows one to see vertical changes in the atmosphere. The user can select the various types of data and view it at certain latitudes, longitudes and altitudes. Another aspect of the program is the ability to change the grid size. This is ideal when one is viewing stratospheric changes regionally. The EZ-SAGE, which evolved from the year one program Wigettest, has a variety of applications for analyzing SAGE II data, which make it both a powerful and user-friendly tool.

Figure 1. The opening window for EZSAGE, created by the NSU VISAGE Team.

EZSAGE allows a user to select any of the following data sets: Aerosol Extinction at 1000 nm, 525nm, 450 nm, 385 nm, NO₂ Mixing Ratio and O₃ Mixing Ratio. The user many access the data in a variety of views, for example latitude versus longitude, altitude versus latitude, and altitude versus longitude. Once the user has selected the view, they are then able to select the units to view the altitude. Figure 2 shows all the options allowed in EZSAGE.
After the user has selected the data to be view, the user now has an option to resize the grid size, change the color bar, change the scale on the color bar, and resize the axis. These options allow the user to view the data with high accuracy, and detail. E ZSAGE fully exploits the data of the S A GE II instrument. The data viewed by this program can be manipulated to view certain atmospheric phenomena.
LinkWinds

By Bathsheba Farrow

The Linked Windows Interactive Data System is one of several visualization tools being explored at Norfolk State University. This system, also known as LinkWinds, was developed by JPL in the ANSI C language. LinkWinds uses a data linking paradigm, one of its most distinguishing features, providing a highly intuitive, easy-to-learn and easy-to-retain user interface. Data linking allows the user to link applications together, giving the applications greater capabilities and power than they would alone. LinkWinds provides interactive 2-dimensional and 3-dimensional graphical displays of data, interactive color manipulation, animation creation and displays. LinkWinds is also able to produce hard copies of graphical displays and text and perform interactive data subsetting either at the input or output. Additions to the list include journal and macro capability, context-sensitive help and network support for collaborative data.

LinkWinds accepts rectangularly gridded data. The datasets have different ranks ranging from 2 to 4. Any rank higher than 4 can not be read by LinkWinds at the present time. Therefore, if a dataset does have a rank higher than 4, only the first 4 dimensions encountered are used. The user should also beware of the fact that only scalar data is currently accepted. The user can add new databases into LinkWinds. However, there are several things that may have to be done to successfully add a database. First, the lw.config, which lists the directories which LinkWinds will search, must be changed. This will not need to be edited if data is placed in a directory that is already listed. Next, Databases, found in the top-level LinkWinds "databases" menu, must also undergo alterations unless wildcards have been used correctly. The .db file defining the metadata should be created if LinkWinds can not extract enough information from data in the standard format you are using. The formats accepted by LinkWinds include the Hierarchical Data Format (HDF), HDF-EOS, the Common Data Format (CDF), Network Common Data Format (NetCDF), Silicon Graphics, Inc. native RGB image format, data with Planetary Data System (PDS) headers, the Flexible Image Transport System (FITS), two data formats of UARS, the Upper Atmosphere Research Satellite and SAGE. Raw binary data and ASCII text is also accepted but each must be accompanied by a minimal amount of metadata given in an associated .db file.

What makes LinkWinds a great visualization tool is the fact that it has so many tools within its environment. Each tool, or application, has its own unique function and combines with other tools to rapidly and interactively access, display and analyze large datasets. AxisRotator is one of those tools. It rotates three dimensional applications about any three orthogonal axes. The LightTool adds simulated lighting to three-dimensional applications. The Animator has the ability to make time-based animations while the FrameAnimator makes animations by displaying a user specified number of frames of an application. LinkWinds also has a ColorTool that allows the user to alter the palette of a database or to substitute a new palette for the current one. Image displays a single slice of data from any of the three orthogonal axes or a composite RGB slice taken from three slices. Plane renders an image in relief with an accompanying height
filed. *VolumeView* displays all the points in an entire data set, rendering both with color and opacity. These

References: http://linkwinds.jpl.nasa.gov
Medium and Long Term Climate Change Predicting

By Cyntrica Eaton

I. INTRODUCTION

Predicting medium and long term climate change has been a topic of significant interest for many years. Unquestionably, the ability to make such predictions would be a powerful tool given the impact of climate change on food supply, energy allocation, and water resources. Satellites have been extremely instrumental in the study of climate change by providing global coverage in short periods of time as well as an extensive data collection. Most scientists currently interpret satellite data using two and three-dimensional graphs which may not fully exploit the capabilities of the available data. Recent increases in computing power allow visualization in more dimensions, which in turn would facilitate the detection of related trends that may otherwise be missed.

Water vapor plays a fundamental role in the energy and water cycle processes that determine weather and climate. Detailed water vapor observations, for example, are essential to the improved analysis and prediction of convective storms. The primary focus of the Visualization of Atmospheric Water Vapor Data for SAGE (ViSAGE) project is to study the long and short term atmospheric water vapor dynamics and its impact on climate changes. To facilitate this study, multi-dimensional scientific visualization procedures for analysis and interpretation of the Stratospheric Aerosol and Gas Experiment II (SAGE II) water vapor data are being developed. We intend to use the resulting images and animations to make conclusions regarding water vapor activity and its related trends.

II. METHOD

The raw data, which was collected by SAGE II between 1986 and 1990, was obtained from NASA Langley Research Center. We were particularly interested in observing monthly data spanning the 6.5 to 30.5 km altitude range. This data was sorted, reformatted, and averaged for ease of visualization by an in-house computer algorithm. The program opens the raw data file and selects only the desired segment to be analyzed. It then arranges the data into a water vapor mixing ratio versus latitude and longitude table, which allows reading by the gridding routine.

Data Conditioning

In order to create three-dimensional images, gridding, kriging, and smoothing of the formatted data had to be performed. Transform™, software distributed by Fortner Research LLC, assisted in this portion of our work.
Gridding

Due to the nature of the solar occultation technique and the satellite orbit, the latitude and longitude axis of the data do not fall in a uniform grid. Visualization tools generally require the raw data to be arranged into gridded bins. Each bin, which is a longitude-latitude box, is set to intervals appropriate for the data of interest. If more than one point falls within a box, the points are averaged to get one value per box. Gridding generally produces missing fields. The missing data is interpolated with the information from the surrounding bins by the kriging technique.

Kriging

Kriging is a powerful method for interpolating missing fields, which calculates the optimum weighting function and cut off radius at every point. This method estimates the missing data by using a variance curve as a weighting function. By estimating the variance at every location the routine assigns appropriate weight of the point for further extrapolation. During the validation of our visualization technique a linear interpolation with a row and column range of 350 and 150 passes were the optimal kriging parameters. The images produced using these parameters are comparable to those on the SAGE II CD-ROM [4] and to images found in published results [5].

A smooth fill of the kriged data yields smooth images. A smooth fill is a process where the kriged data is smoothed by using the average of its surrounding neighbors. In order to keep the images representative of the data, only a single pass smooth was performed.

Three-Dimensional Generation

Water Vapor Mixing Ratio vs. Latitude and Longitude

After gridding, kriging, and smoothing the water vapor concentration versus latitude and longitude data were overlayed over a cylindrical map projection to produce the images in Figure one. The false color represents the monthly average water vapor mixing ratios from 1986 to 1990. The scale is shown on the color bar below the images. The color pattern is a 16-bit rainbow with a minimum value of 1 part per million water vapor (ppm) and a maximum value of 9.5 ppm.

Water Vapor Mixing Ratio vs. Altitude and Month

The plates in Figure 2 represent the water vapor mixing ratio vs. altitude and month for latitudes of 30 to 40 degrees north. This figure shows the movement of the hygropause over the span of a year. To produce these images, the data were sorted and reformatted into a table of water vapor mixing ratio vs. altitude and month for the latitude range of interest using an in-house application. Since there is no missing data in the altitude dimension, kriging and smoothing is not necessary. However, to get a smooth image some interpolation was needed. The interpolation averages the surrounding points to
produce a smooth data set. Image generation was performed using Transform™ form Fortner LLC. The false color represents the water vapor mixing ratios with the scale shown on the color bar below the images. The color pattern chosen was a 16-bit rainbow with a minimum value of 2 ppm and a maximum value of 12 ppm. This scale clearly shows the hygropause dynamics.

Four-Dimensional Image Generation

Once three-dimensional images were generated for the 25 different altitudes between the 6.5 – 30.5 altitude range for each month we were able to create a four-dimensional image of the atmosphere. Slicer™ software, also distributed by Fortner, took each of the 25 slices and aligned them vertically in the order of increasing altitude. It then allowed us to take horizontal “slices” of the four-dimensional “block” it initially created so that we could observe water vapor patterns at specific altitudes. Slices have to be kept at a minimum to ensure that proper visualization was not inhibited. As a result, five altitudes, 8.5 km, 12.5 km, 17.5 km, 21.5 km, and 25 km, were chosen. A vertical slice was also taken at 0 km longitude. The exceptional aspect of this four dimensional image is the fact that figures can be viewed at the same time and in relation to each other.
Animations

After "slicer" images were produced for each month, we had the components needed to create an animation or movie that could help us observe patterns of water vapor in relation to time. To create these movies we utilized MoviePlayer™. We generated the January slicer image and saved it as a PICT file. The first image must be stored in this fashion in order to import it into MoviePlayer™. From there however, we only needed to copy and paste the following months into the MoviePlayer™ window.

III. RESULTS

The altitude resolution of the SAGE II instrument facilitates observation of the upper troposphere and lower stratosphere. The animations created further exploit this factor, showing the dynamics of water vapor in these regions over the course of a year. One of the trends observed is the movement of the high concentration >8.5 ppm band throughout the seasons. In particular, it appears to hover around warmer regions. The band, can be found in the Southern Hemisphere during January, a southern summer month, and is found in the Northern Hemisphere by July, a Northern summer month.

The third tier of the Slicer images found in the Results section of this poster seem to turn a lighter shade of blue as the months go on. What it is actually showing is that the hygropause, a dry region of the atmosphere located between the troposphere and stratosphere(?)

IV. CONCLUSION

The advancements in computer technology have facilitated rapid multi-pronged analyses of satellite data. Atmospheric water vapor data from the SAGE II instrument have been utilized to obtain 3 and 4 dimensional images, animations, and movies which dramatically reveal water vapor patterns in the atmosphere. Sorting, reformatting, kriging, smoothing, and image generation were techniques utilized to get an optimal image. These images were used to make yearly movies showing the dynamics of the hygropause as well as stratospheric and tropospheric water vapor concentration. Animations created from these four-dimensional images show the horizontal and vertical dynamics of atmospheric water vapor, giving scientists and researchers a valuable tool to study global trends which may not otherwise be revealed.
HDF File Viewer

By Karim Muhammud

In order to view a HDF file, it must first be compiled. After compiling the HDF file, type the view_hdf into the idl system prompt. When doing so a main menu pops up on the screen. It displays a selection of HDF files. I select one of the files from the pop up menu and open it with attribute, which allow me to view both the SDS and Vdata in the HDF file. After selecting the file from the menu I click the “OK” button. The “filter” button is used to refine the list of file names that is displayed. The filter button allows me to select a file that begins with “CER_BDS”. After the file is selected, view_hdf opens the HDF file and search for the names of all the SDS and Vdata structures. Then it lists them in the SDS and Vdata sets areas respectively. Before any data can be accessed, the data must be imported to the Current Subsets Area. For example, select “CERES TOT Filtered Radiance’s upwards”. A subset Data window pops up with starting, ending, and increment fields for each dimension of the SDS array. A range of data can be selected. The Increment field can be used to selectively sub sample each dimension. For example, the first dimension is for the number of records, and the second is the number of samples in each record. An increment integer $n$ causes every $n^{th}$ record to be selected. After finishing the input, click the “Done” button. The data are imported, and the SDS name will show on the Current Subsets Area. For importing Data, the procedure is slightly different from SDS because the fields in each Data are selected individually. The procedure is to select Data. Click on the desired Data set to import from the Data sets area. For example, select “Converted Temperatures”. Select the field from the window by clicking the button next to the field name. Then select “WN Black Body Temperature”. A subset Data window pops up with starting, ending, and increment fields. A range of data can then be selected to import. The increment field can be used to selectively sub sample each dimension. To input range. Input the starting and ending record numbers and the increment value for data importing. After finishing the input, click the “Done” button. The data are imported, and the Data field name will show in the Current Subsets area. After the data are imported, click on the name of the data in the Current Subsets. When clicking on the name current subsets automatically pop up the graphics menu. For example, select a “2D Graph” and click the “Done” button. A window with the plot pops up on the screen.

Colors Menu

This menu includes the options for selecting different color tables, editing and saving the color map, and changing the background and foreground colors. Options are used to select colors. When selecting the predefined color tables, the current color table is displayed and a list of available predefined color tables is given. Click on the name of a color table to load the color table. For example, the table “Rainbow + white” is useful for many CERES data products. Click the “Done” button when selection is completed. Edit the current color table. If this option is selected, all the colors in the current color map will displayed. Click on the color index or move the slider to select the color map to
display. Then click on the color index or move the slider to select the color index to edit. An RGB slider window will pop up for adjusting the RGB values. A small sample color square will show on the lower left corner of the select edit colors window. Click the “Done” button on the edit color cell window after adjusting the color. Click the “Done” button on the select edit colors window for the current session without saving to the color table file. Click the “save” button to save the modified color table file for later use. If the “save” button is selected, a window pops up entering the name of the new color table. After entering the name of the new color table, click the “Done” button to save the new color.

**Background color**

Value zero means the background color is the colors at the index zero in the current color table. Click the “Done” button to use a new value, or the “cancel” button to cancel.

**Foreground color**

The foreground color is the color table index of the default color to display text or graphics on the screen. The foreground color should not be the same as the background color. Click the “Done” button to use a new value, or the “Cancel” button to cancel.

Right now, I am in the process of viewing over other HDF formats that are inside of idluser. When I come up with something I will surely write it down in my final report.
APPENDIX B

IDL Programming Language Tutorial

Dr. Mou-Liang Kung,
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What Is IDL?

IDL (Interactive Data Language) is an integrated software development system for data handling, analysis and visualization from Research System, Inc. (ww.rsi.com).

How Much Does It Cost?

There are two versions: a Student version ($79/copy for PC and Mac) and a Professional version (educational site license, not for production sales is around $200/seat/year). There is a free demo version that can be downloaded directly from RSI (ftp.rsin.com). As expected, the student version has limited capability (in array sizes, scientific data file formats, etc.) and yet a very good learning tool. The demo version has a time limit, useful only as a demo tool. The on-line Help is a very useful feature. Other important sources include:

Is It All Programming?

IDL software came with an IDL application called Insight. Insight is an application (not available for student version) that runs under IDL environment for analyzing, visualizing, importing/exporting, conditioning and generating data. No IDL programming is needed. It does Line plot, scatter plot, Histogram plot, Polar plot, Contour Plot of a 2-dimn array, Images (2-D array), Surface (2-D array)

Data File Handling

The file formats that IDL can read and/or write include: BMF, GIF, JPEG, TIFF, CDF, netCDF, HDF, ...

IDL Applications

• Line Plot, Surface Plot, Contour Plot in 2D or 3D
• Surface of Revolution
• Display Data or Graphics on 15 different types of Map Projections (e.g. Mercator, Orthographic, …)
• Image and signal processing (Display and Manipulation: Smoothing, Noise-removal, …)
• Animation (image or graphics data)
• Spin or fly-through a surface, Shade and illuminate with multiple light sources
The Language

- **IDL Variables:** character strings NOT begin with digits or $, contain no characters such as "." or "/%".
- **IDL Data Types:**
  - scalar: e.g. a = 0.0; b = ‘Hello’; c = fix(5.8) (truncate to integer)
  - arrays (up to 8 dimensional): a = intarr(3,4,5), a 3-dimnl integer array of 3, 4, 5 elements in each dimn; b = fltarr(10, 20), a 2-dimnl array of floating points
    You can generate index automatically: a = indgen(100) generates an array a of 100 items with values 0 to 99. b = findgen(100) for floating 0.0 to 99.0.
  - structures: student = { name: ‘Jim’, snum: 12345}
  - pointers, objects

- IDL has the look of a **procedural language** (e.g. Pascal). The control statements should be very familiar to all programmers: Begin ... end; If ... then ... else; For ... endfor, While and Repeat .. Until loops; Case ... of; GOTO. It even supports Pointers for dynamic data structure (e.g. linked lists). IDL also has object-oriented construct that let users encapsulate data and routines into objects. Sophisticated object graphics can be created by instantiating atomic graphics objects from the atomic classes (e.g. axis class, image class, ...), then container objects for rendering.

- The IDL also comes with a **GUI toolkit** to create GUI (with buttons, slider, ...) for the data visualization application. In the Windows and Mac versions, rapid development environment (RDE) a la Visual Basic provides drag and drop capability.

- The Math and Statistics library provides routines for Data Interpolation (e.g. Linear, Cubic Spline), Random Number Generator, Curve (Least Square) and Surface Fitting, Multivariate Analysis (Cluster and Principal Components)

- It provides IDLMiner, an ODBC interface for IDL to access DBMS

- There are also interface to call other programs created in C, FORTRAN, ...

### Internet Resources on IDL

**Steve's IDL-WWW**

casa.colorado.edu/~spenton/idl_www/idl-cmd.html

(You don't need to buy IDL to try and learn IDL, just your Web browser will do. The ION, IDL On Internet, is another software package from RSI that uses Java to IDL capabilities to Web Browsers.)

RSI Site  [www.rsinc.com](http://www.rsinc.com)

(A good place to start)

**U of Washington IDL**


(A good site to search ready to use procedures or functions)

**IDL Tutorials**

- [Boston U](http://scv.bu.edu/SCV/Tutorials/IDL/idl_webtut.html)
- [NCSA](http://zonker.ncsa.uiuc.edu/docs/viz/Idl/)

**The IDL FAQ**

[www.ivsoftware.com/pub/idl_faq.html](http://www.ivsoftware.com/pub/idl_faq.html)

(Get it and print it out)

**Tips and Tricks:** [www.dfanning.com](http://www.dfanning.com)

(Good tips)

The newsgroup  **comp.lang.idl-pvwave**

(PVWave was a derivative of IDL and became a separate development. Comp.lang idl became the forum for discussing CORBA's IDL - Interface Definition Language)
A Quick IDL Tour  
(Based on the “Learning IDL, V5”, RSI, 1997)  
Annotated by Dr. Mou-Liang Kung  

1. How to Start IDL  
- **idlde** icon or type **idlde** (in a Shell window) to start the IDL Development Environment.  

2. How to Configure IDL  
File -> Preferences  
- Check the box to General -> Change Directory on Open  
  (to change default directory to where the file was opened)  
- **Check the box to Graphics -> Bitmap Buffered**  
  (to refresh the graphics when covered)  
- Leave Editor and Startup unchanged  
- Click Path to add any search path. Click on the box to include the search on all subdirectories as well.  

2.1 IDL is a command language (despite what manual says, it is non-case sensitive, except for UNIX file names).  
- You can enter interactive commands at the command prompt “**IDL>** “.  
- If a command line gets too long, type **$** at the end to mean to continue on the next line.  

**Note:** The next three sections 2.1, 2.2, 2.3 on entering commands interactively are “quick and dirty” methods, not good programming practices  

You can enter command lines at the **IDL>** as follows
Example:

IDL> print, 5+6
(The screen showed 11)
IDL> print, 'Hello'
(The screen echoes Hello)
Note: You will not be able to execute these two statements in sequence again, although you can take a peek at what you typed by typing help, /recall

Example:

IDL> help, var_name
(to check data type of the variable)

IDL> ?
(to start winhelp)

Example:

IDL> data = randomu(0.123, 50, 100)
; Replace 0.123 by seed if system random seed is used.
; Here is a two dimnl array of 50 X 100 uniformly distributed random numbers. Use randomN for normally distributed random num.
IDL> print, data[10, 3] ; column 10, row 3
IDL> print, data[310] ; 310 = 3 X 100 + 10
IDL> plot, data[2, *] ; plot in memory
IDL> wshow ; Visualize
IDL> subdata = data[10:30, 15:18] ; subdata is a subarray with indicated ranges
IDL> help, subdata ; print out the content of the variable

Example:

IDL> num = [6, 3, 9, 2, 8, 0]
IDL> I = [0, 3, 1]
IDL> print, num[I] ; use I to index num
6 2 3

Example:

IDL> student = { name:'Jim', ssnum=12345}
IDL> print, student.name ; return the field value of "name"
IDL> print, n_tags(student) ; return the number of fields
IDL> print, tag_names(student) ; return field names

2.2 You can group the interactive commands as you type so that those commands can be executed as a group again.
Type .run at the beginning, the IDL> prompt will be changed to - (a dash) and you may begin entering IDL commands. When you type End, the command input ends and you will get back to IDL> prompt.

Example:

IDL> .run
- print, 5+6
- print, 'Hello'
- end
2.3   An IDL script file (no pro, no end) can be created interactively using “journal” command. \textit{(A technique not too often used)}

Use the “journal” command before and after you enter the same command lines from example 1 at the IDL> prompt

Example 3:

```idl
journal, 'myscript' ;Create a new script (choose your own name) from
num = fltarr(40) ;the following input:
for i = 0,39 do num[i] = i * 10 ;num is an array of 40 floating point numbers
curve= sin(num * !DtoR) ;initialize these 40 entries
plot, curve ;change degrees to radians before calling sine function
journal ;plot
```

- Using the journal method to enter the command line, the resulting file will contain all input errors.
- To execute an IDL script, enter the following at the IDL> prompt:

```
@myscript
```

Note: Up till now, the interactive command entering method does not allow you to edit out the errors!!! Here is the better way:

2.4   Create an IDL program using the built-in editor (or any other text editor).
You must name it with .PRO file extension.

Example 4 (pp.22)  \underline{On the menu bar near the top, click: File -> New and now you can type in the following code in the editing area (see the figure in the previous page)}

```idl
num = fltarr(40) ;This is a comment
for i = 0,39 do num[i] = i * 10 ;num is an array of 40 floating point numbers
curve= sin(num * !DtoR) ;initialize these 40 entries
plot, curve ;DtoR changes degrees to radians
```

Click: File -> Save As, and give it a name, say your_name.pro. Now your can click: Run -> Compile your_name.pro (same as typing .COMPILE your_name.pro)and followed by Run -> Run your_name.exe (same as typing .GO) to execute.

Example 5: (2-D plot, pp.24-25)  \underline{Please type only the commands in bold. You don’t need to type the commented lines to work. (I have included alternative code that may accomplish the same in the commented commands for you to try out if time permits.)}

```idl
num = fltarr(40) ;Defining array of 40 floating points
for i = 0,39 do num[i] = i*10 ;Initialize num
;jnum=findgen(40)*10 ;Same as above, Floating Index Generator,
;magmified 10 times
;for i = 0,39 do print, num[i] ;Can be used to verify what’re stored
curve = sin(num * !DtoR) ;DtoR to change degrees to radians
```
;plot, num, curve, XRange=[0,360] ;Specifying range of X does not clip the graph
;plot, num, curve, psym=1 ;psym set to 1 (yes) to use plus symbol to mark points
;Can use LineStyle = 1 instead to plot dashed line
;Xtitle='Degrees', YTitle='Sine(x)', Title='Sine plot' ;Add labels separately, or
plot, num, curve, XTitle='Degrees', $ ;combine the last two with"$" as the continuation mark
YTitle='Sine(x)', Title='Sine plot', XStyle=1
polyfill, num[0:18], curve[0:18], color = 120 ;Fill area bounded by x-axis from 0 to
;18 and the curve
polyfill, num[18:36], curve[18:36], color=50 ;Use different color for other region
Again, click: File -> Save AS and name it your_name.pro. You can just click
Run -> run your_name.pro. (The system will automatically try to compile it for you
before execute.)

Example 6: (3-D Plot, pp.26-28) Click: File -> Open -> muspin .pro and you will
see the following content loaded:

file = Filepath(Root_dir='/usr/people/idluser/training', 'surface.dat')
;Specify the data file to read
OpenR, lun1, file, /Get_LUN ;Open the file, assign it logic unit called lun1
peak = fltarr(40,40) ;Define 2-D array called peak
ReadF, lun1, peak ;Read in 2-D array from the file
Free_LUN, lun1 ;Close the file
Print, Max(peak), Min(peak) ;Max and Min value of the data set
x = findgen(40)*2.5 ;X tic values are 0 thru 100 = 40*2.5
y = findgen(40)+50 ;Y tic values are 50 thru 90
surface, peak, x, y, Xtitle='X axis', Ytitle='Y axis', Title='Surface plot', $
    background=200, color=45, charsize=2.0
;Now we can put a snow cap on the mountain peak
file=Filepath(root_dir='/usr/people/idluser/training', 'surftop.dat')
OpenR, lun2, file, /Get_LUN ;Open the file
snow=fltarr(40,40) ;Define a 2-diml array of 40 by 40 floating points
readf, lun2, snow ;Read the data file into the 2-diml array
free_lun, lun2 ;Close the file
window, 1 ;Open another window
surface, snow ;Draw snow cap data in a separate window
window, 2 ;Open another window
shade_surf, peak, shades=snow ;Put snow cap data on top of peak
sub1 ;Call a subroutine called sub1. See section 4. next
end ;I had placed Example 1 in a procedure called sub1
Note: The following code is the WRONG way to read in arrays from a file:
    x = f1tarr(100)
y = f1tarr(100)
for i, 99 do begin
    readF, lun, x[i], y[i] ; parameters are pass-by-value
endfor
The CORRECT way is:
for i = 0, 99 do begin
4. An IDL program can call IDL procedures or functions (subroutines).

- The subroutines must precede the main program code in the same file named with .PRO extension.
- If a subroutine is placed in a separate file, then the file name must be identical to the subroutine name.
- An IDL program may consist of multiple modules (procedures or functions). However, only one can be the main program.
- If there are subroutines to be called by another subroutine, then called subroutines must precede the calling subroutine that bears same file name.

**Subroutines can be compiled and executed**

To compile procedure:  IDL> .COMPILE proc_name  
Then you can call it:  IDL> proc_name  
To compile function:  IDL> .COMPILE fen_name  
To use the compiled function:  IDL> num = fen_name(value1, value2, .., valuen)  
IDL> print, num

4.1 IDL Procedures

Pro proc_name, param1, param2, ..., paramn  
Idl_cmd  
...  
END

Example:

IDL> window  
(go to window #0)  
IDL> wshow, 3  
(to bring the window #3 to the front)  
IDL> wshow, 0, 0  
(to hide window #0)

Use the editor to create the following procedure that takes one input parameter:

pro whide, win  
wshow, win, 0  
return  
end

Now, save it as whide (identical name). Compile it and later you can use it to hide any window (e.g. IDL> whide, 2 to hide window #2)

Example: There are other window related options
IDL> window, 0, xsize=400, ysize=400, xpos=100, ypos=100, title='Test'  
IDL> window, /free  
; get the next free window number  
IDL> win = !d.window  
; get current window number
IDL> window, /pixmap  
; draw window in memory only. This is a way to  
; store multiple images for play back in an animation  
; display zoom in/out to a fixed window

Example: Here is to create an animation from multiple images:
pro imgplay
    file=Filepath(root_dir='\usr\people\idluser\training', 'abnorm.dat')
    OpenR, lun3, file, /Get_lun ;Open the file
    image = Assoc(lun3, BytArr(64, 64))
    window, 0
    ; for i = 0, 15 do TVScl, image[i] ; image too small, no wait, too fast
    for i = 0, 15 do TVScl, congrid(image[i], 400, 400) & wait, 0.1
end

4.2 IDL Functions
Function fcn_name, param1, param2, ..., paramn
    idl_cmd
    ...
    return, value
END

4.3 To compile a program and all called subroutines automatically:
- Make sure the directory name where subroutine files are kept is in the !PATH system variable
- Names of subroutines are identical to filename used. Lower case used in UNIX.

5. Plotting

- Normalized coord = (0.4, 0.5)
- device coord = (160 pixel, 150 pixel)
- device coord = (20, 40)
- 400 pixels
device coord

- Normal coord = (0.4, 0.5)
- 400 -> 1
device coord
Example:

\[ X = \text{FINDGEN}(11)/10. \] ; Make a vector of X values.
\[ D = \text{CONVERT\_COORD}(X, 2\times X, X^2, /T3D, /TO\_DEVICE) \]
; Convert the coordinates. D will be an (3,11) element array.
; The keywords TO\_DATA, TO\_DEVICE, and TO\_NORMAL

Example: Display strings at specific spot of the window

\[ \text{xyouts, 20, 30, 'Test,' /data} \]
\[ \text{xyouts, 160, 150, 'Test', /device} \]
\[ \text{xyouts, 0.4, 0.5, 'Test', /normal} \]

Example:

\[ x = \text{findgen}(360) - 180 \] ; generate index 0 - 180 thru 359 - 180
\[ y = \sin (\text{findgen}(360) \times !\text{DtoR}) \]
\[ \text{plot, y} \] ; plot y against 0 -> 359
\[ \text{plot, x, y} \] ; plot y against -180 -> 179
\[ \text{plot, x, y, xstyle = 1, xrange=[0,10], xtitle='Horizontal', ytitle='Vertical'} \]
\[ \text{charsize=20, charthick=2.0, font = 1, background=255, color = 0} \]
; white background, black plot

Example: Overlay plotting

\[ \text{plot, y} \]
\[ y = y - 0.5 \]
\[ \text{o} \]

Direct Graphics and Object Graphics

IDL graphics can be plotted in two different modes. Object Graphics mode is far more flexible than Direct Graphics mode. For example, you can use different fonts to label different axes in OG.

6.1 3D Direct Graphics
Selected Executive Commands (pp.34 – 40)

- On-line Help
- Compile xxx.pro: compile IDL program only, not script file
- Go: execute the compiled program
- Retail: reset button
- Run: compile and execute
- Run -l xxx.pro (or use -t flag) to show a listing of the file
- @ scriptfile: to execute an IDL script file, not program
- Continue: when program stopped due to error, can interactively correct the offending statement and resume
- &: connect multiple IDL statements on the same line
- $cmd: fork out a new process to execute the command cmd (on PCs, it is an escape to DOS)
- .Skip 10: to skip executing the next 10 lines or one line if not specified
- .Step: to step thru
- .Stepover: to step over calls to other program
- .Trace: display each line and then execute

- .Save, Filename='myfile.sav', /ALL
- .Save, /Routines, 'sub1', 'sub2'
- .Restore 'myfile.sav'

- plot, fcnname(param)

(Click Help on the menu bar) to display help

- Crt-Z: to send it to background. fg to send to foreground
- Crt\: to kill IDL instantly

IDL System Variable Examples

!Pi: pi (3.14159 ...)
!Dpi: double precision value of pi
!DtoR: convert degree to radian measure
!dw: current graphics window
APPENDIX C

Annotation to ION Script User's Guide
By Dr. Mou-Liang Kung

ION Script is an application of XML (eXtensible Markup Language). An ION Script looks similar to an HTML page with additional "tags" defined for IDL. An ION Script is a script file residing on the ION server. When a client (browser) clicks on the URL for that script file, it invokes the execution of the script on the ION server to produce an HTML page and have it sent back to the client. Before we begin, remember that ION is case sensitive.

1. Anatomy of an ION Script

```xml
<ION_SCRIPT>
  <ION_HEADER>
    <TITLE>My First ION Script</TITLE>
  </ION_HEADER>

  <ION_BODY>
    <H1>Hello, World!</H1>
    That's all, folks!
    <ION_IMAGE TYPE="DIRECT">
      <IDL>
        shade_surf, dist(30)
      </IDL>
    </ION_IMAGE>
  </ION_BODY>

</ION_SCRIPT>
```

Notice that

- `<ION_HEADER>` is optional. However, it is required to hold variable and event declarations. `<TITLE>` is an HTML tag placed inside the `<ION_HEADER>` section to be exported to the HTML page created by the server.
- `<ION_BODY>` component contains HTML tags (e.g. H1 tag that you see there) and/or ION tags (e.g. `<ION_IMAGE>`). TYPE is an attribute of `<ION_IMAGE>`, a DIRECT graphics image rather than OBJECT graphics.
- In this example, a graphic image is created from the IDL command (surrounded by `<IDL>` tags)

In this example, you saw the technique of placing a graphic image on a web page, where `<ION_IMAGE>` tags will be converted to `<IMG>` HTML tags. You can place data generated from IDL commands on a web page:

```xml
<ION_DATA_OUT>
  <IDL>
    Array=INDGEN(5)
    print, Array
  </IDL>
</ION_DATA_OUT>
```
You can add variables and events to create interactive web pages and flow control tags (e.g. ION_IF) to control the interaction.

2. Variables

There are user-defined variables and system variables. To access variable (e.g. num) value, placed the prefix $ in front of the variable name (e.g. $num).

Declaration of User Defined Variables

XML specification stated that all begin-tags (e.g. <ION_SCRIPT>) must be paired and nested properly with end-tags (</ION_SCRIPT>). However, you can simplify the tagging if there is no content in between the begin-tag and end-tag by using the form of <tag-name attributes .../>. Notice the / is placed before the end bracket, not after the begin-tag. This type of tag is called empty tag.

All variables are declared using the empty tags:

```xml
<VARIABLE_DCL NAME="num" TYPE="INT" VALUE="10" PERSIST="TRUE"/>
```

, where the INTeger variable num is initialized to 10. Other available data TYPES are DOUBLE, BOOL, and STR. This variable is persistent in the sense that it is available to any ION script that this script calls.

Since you can call other ION script from an ION script using <ION_INCLUDE SRC="..."/>, the variables from the calling script are “global” variables and become known to the called scripts. However, if a variable from the calling script is “persistent”, then it prevails over the variable with identical name in the called script.

Example:

**ex1.ion (calling script)**

```xml
<ION_SCRIPT>
  <ION_HEADER>
    <TITLE>My First ION Script</TITLE>
    <VARIABLE_DCL NAME="num1" TYPE="INT" VALUE="10"/>
    <VARIABLE_DCL NAME="num2" TYPE="INT" VALUE="10"/>
    <VARIABLE_DCL NAME="num3" TYPE="INT" VALUE="10", PERSIST="TRUE"/>
  </ION_HEADER>

  <ION_BODY>
    <ION_INCLUDE SRC="ion://ex2.ion"/>
  </ION_BODY>
</ION_SCRIPT>
```

**ex2.ion (called script)**

```xml
<ION_SCRIPT>
  <ION_HEADER>
    <TITLE>My First ION Script</TITLE>
    <!-- num2 and num3 are redefined in this called script-->
    <VARIABLE_DCL NAME="num2" TYPE="INT" VALUE="20"/>
  </ION_HEADER>
</ION_SCRIPT>
```
The value of num1 is <ION_VARIABLE NAME="$num1"/>
The value of num2 is <ION_VARIABLE NAME="$num2"/>
The value of num3 is <ION_VARIABLE NAME="$num3"/>

The resulted web would show

The value of num1 is 10
The value of num2 is 20
The value of num3 is 10

where num1 from ex1.ion is global to ex2.ion; num2 from ex1.ion is superceded by the num2 in ex2.ion, and num3 from ex1.ion is persistent over everything, including the num3 defined in ex2.ion.

System variables

System variables are accessible from all scripts. A system variable is more like a record in Pascal or struct in C or C++. Therefore a system variable may have many fields:

Example: $BROWSER.HTTP_USER_AGENT, where $BROWSER is the variable used to access CGI environment variables, and HTTP_USER_AGENT shows what brand of browser this is.

3. Expressions

Numerical Expressions: +, -, *, /, MOD, and ^ (power)
Examples: 1+6
          $num1 + $num2

Boolean Expressions: GT, GE, LT, LE, EQ, and NE
Examples:  $num GE 5
          $num1 NE $num2

String Expressions: EQ, NE, + (concatenation), and CONTAINS
Examples:  ‘My name is’+ $name
          $name CONTAINS ‘Kung’
Note: If you assign a STR variable with numerical string constant with decimal point, say “34.5” the constant will end up being “34.500000”. Therefore always use “’34.5’” with another layer of single quotes.

Logical Expressions: AND, OR, NOT

4. Flow Control: ION_IF, ION_ELSEIF, ION_ELSE

Example:

```xml
<ION_IF EXPR="$name CONTAINS 'Kung' ">
  <!-- statements when TRUE -->
</ION_IF>

<ION_ELSEIF EXPR="$age GT 50"/>
  <!-- statements when ELSEIF is TRUE -->
</ION_ELSEIF>

<ION_ELSE>
  <!-- statements for ELSE -->
</ION_ELSE>
```

5. IDL Commands within <IDL>, </IDL> tags

- <IDL> tags must reside inside of <ION_IMAGE> or <ION_DATA_OUT>
- All commands entered must be on a single line or use $ as continuation mark to extend to the next line. The $ character itself should be prefixed with \ to escape from the continuation interpretation.
- Certain IDL code will not work:
  - No OBJ_NEW function call to create a new window
  - Can’t use WINDOW procedure
  - Widgets and compound widgets are not available
  - Multiline syntax will not work:
    ```
    FOR X=1,20 DO BEGIN
      PRINT, X
    ENDFOR
    ```

6. Creating ION Script Applications

Specifying URL:

HTTP URL: [http://www.junk.com/file](http://www.junk.com/file)

FILE URL: In Unix: file:///usr/home/kung/file
  In Windows: file:///c|dir1/dir2/file

ION URL: For files in default location: ion://myscript.ion
  For files elsewhere: In Windows: ion:///c:\mydir\myscript.001
    In Unix, ion:///usr/home/kung/myscript.002

ION Script Forms:

ION forms are more versatile than HTML forms. An ION form can have assign different events to different ION_BUTTON, ION_IMAGE, and ION_LINK. ION form can also have ION_CHECKBOX and ION_RADIO.
Example: Create a button on the web page. When the button is clicked, it will load and execute page2.ion

```xml
<ION_SCRIPT>
  <ION_HEADER>
    <EVENTS>
      <EVENT_DCL NAME = "Hello" ACTION="ion://page2.ion"/>
    </EVENTS>
  </ION_HEADER>

  <ION_BODY>
    <ION_FORM>
      <ION_BUTTON EVENT="PAGE2" TYPE="BUTTON"/>
    </ION_FORM>
  </ION_BODY>
</ION_SCRIPT>
```

Use HTML Frames with ION Scripts

Example (p.62 -63)

The web page Main.html loads two frames, one with a text box and a button (by invoking Frame1.ion) and one a blank frame (blank.html). Upon the button click, Frame1.ion invokes Frame2.ion, and a graphic image is loaded in the blank frame.

Open a new Window upon Clicking

Select the target window or frame using TARGET attribute of ION_FORM, ION_IMAGE, ION_LINK upon event occurrence. TARGET value is to be the NAME attribute value of the FRAME or IFRAME tag:

```html
<FRAME NAME="form" SRC="http://www.junk.com">
...<ION_BODY>
  <ION_FORM TARGET= "form">
    ...
</ION_FORM>
</ION_BODY>
```

Include JavaScript or VBScript in ION Script

- Use HTML <SCRIPT> tag or
- Use ION tags:
  ```xml
  <ION_BODY ONLOAD="script_name">
  <ION_BODY ONUNLOAD="script_name">
  <ION_FORM ONRESET="script_name">
  <ION_FORM ONSUBMIT="script_name">
  ```
Appendix D

Unix Workshop Agenda

First Hour (40 minutes Hands-on Lecture)

I. Customize Your Working Environment
   1. Keyboard and mouse button shortcuts
   2. File manipulation: link, copy, find, and preview
   3. Publish Your Own Web Page
   4. Configure the Mysterious Dot Files

(10 Minute Independent Hands-on, followed by 10 minute break)

Second Hour (40 minutes)

II. Useful Tricks to Increase Productivity
   1. Screen Capture
   2. Placing Oftenly Used Tools in One Place
   3. Network Utilities: Telnet, FTP, NFS
   4. Start X windows from Remote

(10 Minute Independent Hands-on, followed by 10 minute break)

Third Hour (40 minutes)

III. System Configuration and Maintenance
   1. Use Someone Else's resources - Hardware manager
   2. Find and Install New (free) Software - Software Manager
   3. What to do with System Update or patch
   4. How to Resolve Software Conflicts
   5. User Account Maintenance - User Manager
   6. Network Configuration and Simple Debugging - Network manager
   7. System Boot and Shutdown
A Unix Workshop

on

Managing Your SGI Workstation
(And Making it More Productive)

by

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Department of Computer Science
Norfolk State University

May 21, 1999
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Part I: Customize Your Working Environment

Unit 1 Editors and Basic Shell Commands

1. **Changing the font size of Shell command window**
   (Click Toolchest -> Desktop -> Open UNIX Shell to start)

   Point anywhere inside a winterm and click the right button. Click Font and then choose your font name or size. Note: Different fonts have different sizes, and vice versa.

2. **Changing Default Viewer and Editor Utilities**

   When you double click a text file, you will open the file in a text editor. To choose a different default text editor (or Web browser, image viewer, mail handler, book viewer, or PostScript viewer), click Toolchest -> Customize -> Utilities to start Default Viewer and Editor Utilities panel. For example, if you choose Vi instead of NEdit, any text document icons you double-click will open in Vi. To open this panel, choose Desktop > Customize > Utilities from the Toolchest.

   We have included the use of VI editor in Appendix C. It is nice to get familiar with it when you have to access your workstation from remote using VT100 terminal emulation using telnet or other remote access software (e.g. procomm).

3. **Using Shell Commands**

   Click Toolchest -> Desktop -> Open Unix Shell to open a Shell window:

   - to change password: `passwd`
   - to find the time and date: `date`
   - to find out who is currently login: `who`
   - to find out what your login name is: `who am i`
   - to find out the full path name of the current directory: `pwd`
   - to list all file names in the current directory, but not hidden files: `ls`
   - to list all file names in the current directory, including hidden files: `ls -a`
   - to list all file names in the current directory in detail: `ls -l`
   - to list all file names in the current directory in detail, all: `ls -al`
   - to print a message on the console: `echo You are the Greatest!`
   - to create a text file called junk: `> junk`
   - to view the content of a text file: `cat junk`
   - to concatenate two files into a third: `cat file1 file2 > file3`
   - to delay 20 seconds then execute a command: `sleep 20; echo Tea is Ready!`
   - to find out what type of terminal emulation

   Please see Appendix A for more commands and Appendix B for shell scripts.
Part 1  Customize Your Working Environment

Unit 2  File Manipulation

1. Simple File and Directory Commands
   to traverse the file system directories: cd ..
   (.. = parent directory, . = current directory)
   to copy file1 to file2: cp file1 file2
   to create a subdirectory: mkdir subdir_name
   to copy an entire directory: cp -r srcdir dstdir
   to rename a file or directory: mv oldname newname
   to delete a file: rm filename
   to view text file one screen at a time: more filename
   (or page filename)
   to find the location of a file: find / -name filename -print
   to delete a subdirectory and everything in it: rm -r subdir_name

2. Change Permissions to Protect Your Files or Directories
   Type chmod 760 filename when you wish to grant all permissions (7 = binary 1112 for read=1, write=1, execute=1) to yourself, read and write only for your group members (6=1102 for read=1, write=1, execute=0), and no permissions for other users (0=0002 for read=0, write=0, execute=0). If you plan not to share anything with anyone, add the line umask 077 in your .cshrc file.

3. Create a link or a copy to a file icon
   Drag and drop an icon will only create a link (filename is in italic), but with Ctrl key pressed down while drag and drop will create a copy.

4. Preview the Contents of Files (text files, images, movies, sound files, VRML, WebJumper, and HTML files)
   You can open a file by double clicking its icon or click and highlight a file icon and then choose Options > Show Content Viewer.

5. Avoid scrolling the entire file listing in an Icon View of the directory that contains the file you want
   Click once in the Icon View background. Then begin typing the name of the file or directory, say "junkmail" you want to select. When you press each letter in sequence, a "tick" sound means there are files begins with "j". If you hear a "ding" sound then that means the unique match is found. So while you are typing "junkmail", it may sound like j (tick), u (tick), n (ding). With only three letters "jun", you have a unique match. Now press Enter to execute or open it.
Part I  Customize Your Working Environment

Unit 3  Mouse Button Shortcuts to Copy and Paste

1. Insert Previously Typed Text into the Command Line

Crop (highlight) the text and then click the middle button to paste at the command line.

2. “Crop” Any Text and Dump into a New Text File

Crop (highlight) any block of text in an application window, then move the mouse pointer to any place on the desktop and click the middle mouse button. A new file, named “pasted text” will be created containing the selected text.

Unit 4  Configure the Dot Files

Dot files (e.g. .cshrc) are hidden files (i.e. not visible when you type ls. Most dot files are application initialization files. For example, nedit has .nedit, vi has .exrc, .... These dot files are text files that you can edit to customize the behavior of the application.

When you login, UNIX will start a Shell, typically, Bourne Shell or C Shell. However, there are other new and improved Shells such as Bash (Bourne Again Shell, superset of Bourne shell), TCsh (improvement on Csh, in IRIX) and Korn Shell (most recent Bourne shell improvement, in IRIX).

Find out what Shell you login for: As you log in, use cat /etc/passwd to check the passwd file to find user’s entry (kung in this case):

Kung:x:201:101:Mou-Liang Kung:/export/srv/home/fac/kung:/bin/csh

If you have su privilege, then you can edit this text file and change to /bin/sh, /bin/csh, /bin/bash, /bin/tcsh or /bin/ksh.

If you use Bourne Shell (command prompt is $), the system will automatically execute the file .profile. But if you are using the C Shell (command prompt is %), first .login and then .cshrc will be executed. These files are called hidden files since their names do not appear when you do ls. Any file name begins with a . (dot) is a hidden file.

.profile, .login, .cshrc are all called Shell Scripts, files contains command lines.
.login can be used to check what type of terminal you are using, check the message of the day (/etc/motd) and whether you have any new mail. You can add more lines to initialize environment variables using set and setenv commands only once when you login. For example, you want to prevent accidental overwrite of your files, you can use Textedit to add the line:

```
set noclobber
```

to the bottom of .login.

.cshrc typically contains set statements to set up C Shell variables and aliases for favorite command lines. For example

```
alias dir ls
```

would mean that dir will execute ls.

Warning: When you are editing Shell scripts, do not press return key unless you meant that is the end of a command line.

Some common changes users like to make:

- change umask 002 to (or add the line) umask 077
- change the command search path:
  
  ```
  set path=(/bin /usr/bin your-favorite-cmd-path $path)
  ```
- change the line of MANPATH to
  
  ```
  setenv MANPATH your-favorite-man-path:/usr/man:
  ```
- If you telnet into UNIX system from a VT100 terminal software, add the lines:

  ```
  if ( `tty` != "/dev/console" ) then
    stty erase `^?`
    setenv TERM vt100
  endif
  ```

To make changes to .cshrc effective immediately, rather than the next time you login, type source .cshrc at the % command prompt of a shell window.

There is yet another hidden file .logout of command lines used by csh when you logout to clean up everything when you leave.

For Bourne Shell or Korn Shell users, .profile can be edited except that

```
PATH=.:SPATH:/usr/kung/myfavorite
```
Unit 5   X Windows

X windows X11R6 (generic) comes in different windows managers: Motif, OpenLook (sun), and others (e.g. Tom’s Window Manager). X server is the software piece that controls yours console, X clients are X-applications running from remote or local sites. Free X server for PC (X11R5) or Mac (X11R6) is available at http://tnt.microimages.com/freestuf/mix/download.htm

1. How to start a Remote X-window

Let’s say you are on the console of a machine called Poseidon (199.111.120.30) and wish to open an X-window application from a remote machine called nino (199.111.120.40). Type in the following lines in a Shell window (you may be able to use the machine name nino instead of 199.... ).

```
xhost +199.111.120.40
telnet 199.111.120.40
   (login now)
xterm -d 199.111.112.219:0.0 &
   (or for a particular X window application such as toolchest)
xterm -d 199.111.112.219:0.0 -e /usr/bin/X11/toolchest -name ToolChest &
```

If a host is often accessed, you can create a file /etc/X0.hosts and place that host name or IP number there.

Question: Can I use X-window software on my PC, Mac or others to have the exact SGI Desktop on my PC or Mac screen?
Answer: No, you can not. The reason is that the SGI Desktop is the 4Dwm in execution. Your PC or Mac has its own window manager, which is a part of your X-window software.

2. X-Windows Initialization Files (Dot files)

4DWM, the SGI X windows manager is an enhanced Motif Window Manger (mwm). A user can alter the default settings of the window manager by

a. cp /usr/lib/X11/system.4Dwmrc $HOME/.4Dwmrc
b. Use nedit to edit .4Dwmrc (.mwmrc for mwm). Fr example, you can change the menu as you press down left or right button.

If you wish to change the behavior (foreground and background color, fonts, size and location,...) of X-applications, then you can edit the file .Sgiresources (or .Xresources).
3. Start Generic X-Windows (X11) from the Command line Console

Old Unix systems (or new systems for some reason) start a command line console when you log in. You need to start X windows manually. First use text editor (such as vi) to create a file called .xinitrc in the home directory with the following content:

```
xterm -sb 2 > /dev/null &
mwm 2 > /dev/null
```

Then type xinit at the command line.

**Note:** mwm is the Motif Window Manager. There are other window managers (e.g. twm, Tom’s Window Manager) came with the X11 distribution.

---

**Unit 6 In case of Emergency**

1. **Control-C or Del key**
   
   These are the panic buttons to push when you wish to terminate the current foreground process. Nastier programs can be “killed” (see item 4).

2. **In case the Mouse Cursor Got Stucked**

   When the mouse cursor appears to be stuck, try pressing the Esc key to release it.

3. **Bringing Back the Toolchest**

   If you accidentally close the Toolchest, you can bring it back by typing toolchest& in a shell window.

4. **In Case the Console Is Frozen**

   Don’t turn the power switch off!!! Go to another networked computer and telnet into this frozen computer. If you can not telnet, the system is definitely crashed and your need to power off and on again. If you can telnet into it, then login, and type the following command:
ps -e (or ps -ef for detailed listing)

to list all processes. Take note of the owner (e.g. kung or root) and the number right next to it (PID, the process ID). Try to kill each process:

kill pid or kill -9 pid (all 9 lives of it)

from the largest pid you own to the smallest one, one by one to see if the console can be unfrozen.

5. (Command): not found?

You know the command exists and was spelled correctly, but the console keeps on saying that Command Not Found. Try typing the full path name of the command. If you are root user, you will be forced to type all commands in full path name (or ./cmd for those in the current working directory) to avoid Trojan Horse commands. If you are not the root user, you can add the directory name to the PATH variable. Type set to reveal the search Path for commands. Your command may not be in the search PATH. If it is not, edit PATH in your .cshrc or .profile.

Unit 7 Miscellaneous Commands

1. UNIX even lets you type in a new file without a text editor

   This is extremely convenient, if you want to create a simple and short Shell Script without having to get in and then out of an editor:

   % cat > newfile
   Dear Mr. Kung,
   I am so thrilled to be in your class ...
   (Ctrl-D when finish and save or Ctrl-C to quit without saving)
   %

2. UNIX e-mail

   To read, type mail
   To send someone (say, kung) an e-mail, use the text editor to type up a letter and
   type
   mail kung < newfile

3. Continue executing a cmd even one logged out: nohup cmd &
Unit 1. Screen Capture and Icons

Step 1 In the ToolChest Window, Click Find -> Media Tools

You will then see the next window.

Step 2 Click MediaTools tab and then media recorder.

You will see the window on the right. This is the main control for screen capture.

Step 3 Select Tasks -> Show Task Setting -> File Format, to select the file format you wish to save as, say GIF.

Step 4 Click down the image icon, you will see Image From Screen and then select one of the four choices as you go to the right of the arrow, and you will see a camera icon.

Select Area and Record - click and crop any area of the screen and let go the button. That’s it.
Select Area - Click and crop any area of the screen and then click the red dot button

Window Area - Click the Title bar (at the top) of a window and then click the red dot button

Full Screen - Click the red dot button

Images captured will automatically be named image?.gif

Step 5 To View the captured image file, click the red dot button. To stop viewing, click the red dot button

Now the GIF file can be found in your home directory to be imported into a word processor or presentation.

Note: You Can Quickly Close a Window by quickly double-clicking the little bar here.

Unit 2 Create a folder icon on desktop for quick access

Point and select any block of text which is a directory (folder) full path name (e.g. /usr2/kung) in an application window (or type it in at the Shell command prompt), then move the mouse pointer to any place on the desktop and click the middle mouse button. A folder icon with the name “kung” will appear on the desktop.

Unit 3 Web Pages

1. Publish Your Own Web Page (by Putting Them in public_html)

Any HTML file, say mywebpage.html that you put in the public_html directory (located in your home directory), can be accessed as http://mysite.nsu.edu/~kung/mywebpage.html

Note:
- Use chmod to change the permission on your HTML files to 755
- An HTML file named index.html will be the default when a browser requested http://mysite.nsu.edu/~kung
2. Create a desktop icon for a Web page (a WebJumper)

Point and select a Web page URL address in an application window, then move
the mouse pointer to any place on the desktop and click the middle mouse button.
A WebJumper icon for that Web page will be created.

Unit 4 Use Your Photo as your Login Icon in the Login Window

1. Use the Attached Camera

Start Media Recorder by clicking the camera or microphone icon. Click and
select Tasks - > Show Task Settings -> File Format -> GIF . Click image icon
(one with the lady’s face) and select image from camera. Now click the circular
dot button to record.

2. Import a Photo

Step 1 Use a scanner to scan in your photo, trim it into a square shape, and save it
as GIF or JPG format, say kung.jpg
Step 2 FTP your kung.jpg to your home directory on an SGI station.

3. Make Your Photo into an Icon

Step 1 Execute the command imgview at a shell command window, and you
will see a window appear
Step 2 Click File -> Open and open kung.jpg
Step 3 Click File -> Save As and change the file extension name in the
Selection box from jpg to rgb and also click infer from file name bar
to select Classic SGI Image
Step 4 Click OK and exit this window.
Step 5 In a Shell command window, type /usr/sbin/istat kung.rgb and you’ll see

xsize ysize zsize ...
173 182 3 ...

Step 6 Use a calculator to compute 100/173 = 0.578 (to the thousandths), and
also
Compute 100/182 = 0.549
Step 7 In a Shell command window, type /usr/sbin/izoom kung.rgb login.icon
0.578 0.549
Step 8 In a Shell command window, type mkdir .icons
Step 9 In a Shell command window, type cp login.icon .icons
You can log out now and find your picture appears as your login icon.
Part III System Configuration and Maintenance

Even though you can log in as root to perform system level tasks, it is best that you log in as a common user and switch to root using su (“switch user” or “superuser”) at shell command prompt when needed. Any user can click Toolchest - > System - > System Manager to view system settings or perform certain tasks without being a su.

Unit 1 Backup and Restore

You need to have a full system backup to a tape system every few months and incremental backup once a week to make sure your important software (especially you configured with software licenses) and data can be restored in case of crash. For example, a SCSI Exabyte 8505 (8 mm) tape drive can be plugged in after you shutdown the system. Reboot the system, the system will automatically recognize it for you to backup or restore.

Unit 2 Resource Sharing (Someone Else's CD, Floppy, or DAT Drive)

If you want to use someone’s hardware on your network does, choose Desktop > Shared Resources > On a Remote Workstation from the Toolchest. This brings up a window that lets you display another system’s shared resources so that you can drag the CD, floppy drive, or DAT drive icon onto your desktop.

Unit 3 Find and Install New Software

Open a Web browser and go to http://www.sgi.com/fun/ and click on SGI Free. You will find all sorts of software already compiled and ready to be installed. Just click the install icon to proceed.

Unit 4 System Update and Resolve System Conflicts

Find all CDs from the past upgrade. When you see conflicts red button, click it to see another window asking you which action to take. Select add and then eject and insert all past CDs one by one to resolve them.

Unit 5 How to Check Disk Usage (No need to be su)

1. In order to check the file or directory size (in 1024 blocks) of everything under the current directory: du -k dirame
2. Check all local and remote-mounted (NFS) disk sizes: df -k
Unit 6  User Account Maintenance

You can use toolchest or shell commands to add (say john) or delete users by directly insert or delete an entry in the /etc/passwd file. Doing so also means that later you need to create or delete their home directories (mkdir /usr/john) and give the proper ownership (chown john /home/john).

Unit 7  Network Configuration and Debugging

You need basic skills to test if the network (software and hardware) is functioning correctly. You do not have to be su just to view without change the settings.

1. **inetd** is a network super server that listens for network connection and starts appropriate daemon (server program) to handle the request. It uses a configuration file called /etc/inetd.conf (a text file viewable by cat or page). You should always comment out (insert # sign) the lines starts with systat, tftp, and link for security reason.

2. If you suspect the network or a host (say, Vger) is down, try

   /usr/etc/ping 192.68.217.10  (that's Vger)
   /usr/etc/netstat -nr | grep def  (to check if default router is down)
   /usr/etc/netstat -i  (to check network reliability, where lerrs and Oerrs should be 0)
   /usr/etc/traceroute 192.68.217.10  (to trace which routers the packets hopped over on their way to that destination)

3. /etc/hosts (a text file) contains all host aliases. You can add the frequently used host addresses to it

4. /etc/hosts.equiv (a text file) contains the host you trust (for such cmds: rsh or nfs) without user authentication. You should delete + (used in NIS) and only add those hosts you can trust.

Unit 8  System Boot and Shutdown Commands

    shutdown -g30 -y -in

where 30 means 30 seconds for all to log-off, y means all responses to the interaction are yes, and n is 0 to halt and drop down to firmware level (when a disk crashed, system will only go into firmware state), n is 6 to reboot, n is 1, s or
Part III. System Configuration and Maintenance

S to go to single user mode (to mount only the root file system for service). If you wish to power-off as well, add the -p flag to that line.

Note: Shutdown can be done using toolchest. When lightening or power failure is imminent, you should protect the equipment by shutting down (state 0)

Unit 9 System or Disk Crashes

Go to another SGI and click on help to search the topic of Recovering Data After System Corruption and Using the Command (PROM) Monitor, and print them out. To recover root file system crashes, you need an IRIX System CD and a full system backup tape. When the system is powered on and you see Staring up the system ..., press esc to bring up the System Maintenance Menu (you are in firmware mode). Select option 4 for the System Recovery Menu and follow the printed instruction.

Unit 10 System Security

When a workstation owner becomes familiar with his/her station, he/she should invest some time in system security. Get a few books or free guides and implement the recommendations. Nothing can be more valuable than applying the system patches and updates which typically dealt with recently discovered security holes. Here are just a few simple tasks you can perform:

- There should be no login account without a password. A quick glance of /etc/passwd will reveal the logins without passwords. If the text in the second field of the passwd entries is missing, add something in.
- Disable (comment out) any Network services which you do not require from /etc/inetd.conf. For example: tftp, rexd, exec and finger
- Delete the "+", '!' or '#' from /etc/hosts.equiv
- Keep only a small number of "setuid" programs owned by root. Never allow any setuid shell scripts, especially setuid root. To scan the file system for setuid files owned by root, type
  
  $ find / -user root -perm 4000 -print

- .profile, .login, .csirc, .xinitrc, .excrc, ... are protected with no permission to write or read by anyone except the owner
- Add the following to your .csirc to check the time last time you supposedly logged in:
  
  echo "Last time logged in was:"
  ls -lc $HOME/.lastlogin | cut -c42-53
  touch $HOME/.lastlogin
  mesg n

- Check the users and login time kept in /var/adm/wtmp by typing:
  who /var/adm/wtmp or last or lactcomm
C Shell

Command Execution

\texttt{cmd &} \quad \text{execute \textit{cmd} in the background}
\texttt{cmd1 ; cmd2} \quad \text{execute \textit{cmd1} in sequence}
\texttt{(cmd1 ; cmd2)} \quad \text{two sequential commands as one}
\texttt{cmd1 | cmd2} \quad \text{Two parallel commands, output of \textit{cmd1} is PIPED as input to \textit{cmd2}}
\texttt{cmd1 && cmd2} \quad \text{if \textit{cmd1} is successful, then \textit{cmd2} will be executed, else \textit{cmd2} will not}
\texttt{cmd1 || cmd2} \quad \text{if \textit{cmd1} is successful, then \textit{cmd2} will NOT be executed, else \textit{cmd2} will be}
\texttt{'cmd'} \quad \text{forced execution of \textit{cmd} in a subshell and the output text will be placed where backward quotes `'` were.}

I/O Redirection

\texttt{cmd < file-name} \quad \text{cmd will take input from a file named “file-name”}
\texttt{cmd > file-name} \quad \text{cmd will dump its output to a file named “file-name”}
\texttt{cmd >> file-name} \quad \text{if “file-name” exists, it will be overwritten!!!, else created}
\texttt{cmd appends output to the file named “file-name”}

C Shell Variable Names

A C shell variable name consists of up to 20 letters or digits beginning with a letter. \texttt{set} and \texttt{unset} are used to create and assign value or destroy the variables. The value of a variable, \texttt{prefixed with \$}, is any string bounded by ():

\% set \texttt{junk }=\texttt{(Hello, how are you?)}
\% echo $\texttt{junk}
Hello, how are you?
\% echo $#\texttt{junk}
4 \quad \texttt{(4 is the number of words in the value of the variable)}
\% set \texttt{Junk }=\texttt{”Hello, world!”}
\% echo $\texttt{Junk}
Hello, world!

Quotes

Single quote pairs ‘ ‘ and double quote pairs “ “ both quoting a string as one word. But single quotes ‘ ’ suppresses variable-value substitution while double quotes “ “ always substitute.

\% set \texttt{junk }=\texttt{Hello}
\% echo ‘I like to say $\texttt{junk’}
I like to say $\texttt{junk}
\% echo “I like to say $\texttt{junk”}
I like to say Hello
Appendix A

File Name Substitution

* matches any, 0 or more, characters
? matches any single character
[abcde, s -z] matches any one character a, b, c, d, e or any between s and z
{cat, bat} matches strings cat or bat
For example: % ls {cat, bat}* will list all file names preceded 
by cat or bat, such as "catalog", "battery", ...
~kung home directory of user named "kung"

Expressions and Operators

+, -, *, / Arithmetic operations
% Remainder (Modulo math)
<, >, <=, >= Logical operators
==, != Logical operators for STRING COMPARISON!!
=~ =~ Checks if matches a filename substitution pattern
-r, -w, -x file-name Checks user's permission on the file named "file-name"
-e file-name Checks if the file exists
-f file-name Checks if it is a plain file
-d file-name Checks if it is a directory

C Shell Script controls:

dforeach varname (word-list separated by spaces)

... end

if (expression) single-cmd

... else

endif (Any else if pairs allowed, but only a single else)

switch (string)

case pattern1:

... breaksw

case pattern2:

... breaksw

... default:

...
Environment Variables and Shell Variables

Environment Variables are exported to any new C shell or process it invokes while C shell variables are only valid in the current shell. Use `setenv` to define environment variables, but use `set` to define C shell variables. Default environment variables are HOME, SHELL, PATH, MANPATH, USER, TERM, PWD, .... These environment variables are also copied into C shell variables in lower case: home, user, ...

In C Shell, $0 = cmd argument; $1 = first argument followed cmd, ..., $argv = all arguments, except the cmd argument

$$ = current process ID

Shell variable numerical conversion and manipulation

@ is used to set the numerical values instead of string

% set sum = 1
% @ sum = $sum + 1
% echo $sum 2

Some Important C Shell Builtin Commands

exec cmd execute cmd in place of current shell
exit (expr) exit the shell and assign exit status to be "expr"
jobs list all current background jobs
kill pid kill the background job with process ID = pid
kill %2 kill background job number 2
nohup cmd let the cmd continue executing even logged out
onintr - ignore all interrupts
onintr restore shell interrupts
onintr label go to "label" upon interrupt
shift varname shift arguments left by one word ($2 becomes $1, ...)
time cmd time the shell execution of the cmd
wait wait for the background to finish or an interrupt
Creating C Shell Scripts

1 Edit the Scripts
Double click the Text Editor icon and enter the following text and save as cmd1

#!/bin/csh

echo Greetings! This is my first C Shell script
who | wc
date

Note: A. If a line gets too long, do not press return to get to the next line, type \\ instead.
  e.g. echo 'My name is kung and I do like to watch football games \\ and fishing as well!'
  B. You should always specify what shell is used to run this script and also use #, the comment statement to document your script:
(No indentation here)

2 Make the Script you just created "executable" in order to run
Go to a cmdtool window and type chmod 700 cmd1
Now you can execute cmd1 by typeing cmd1 in a cmdtool window.

Examples of C Shell Scripts:

Ex1.
#!/bin/csh
set cmds = ("date" "who" "ls")
$cmds[1]
$cmds[2]
$cmds[3]
echo "$#cmds commands were executed"

Ex2.
#!/bin/csh
foreach cmd ($argv)
  $cmd
echo "$#argv commands were executed"
Ex3.

```csh
#!/bin/csh
@ count = 1
while ($count <= 10)
    echo $count
    @ count = $count + 1
end
```

Ex4.

```csh
#!/bin/csh
foreach tile ('is-a')
    if (! -d Stile) then
        echo Stile
    endif
endforeach
```

Ex5.

```csh
#!/bin/csh
echo 1. date
echo 2. who
echo Please enter your choice (1 or 2)"
set answer =$<
if (answer == 1) then
    echo You wanted to find Date
else    echo You wanted to find Who
endif
```

Ex6.

```csh
#!/bin/csh
# This script is called dirsearch
# Proper usage: dirsearch filename dirname
#
switch ($#argv)
case 2:
    foreach name (*)
        if (-d name) then
            dirsearch $argv[1] $name
        else if ($name == $argv[1]) then
            echo Target found at `pwd`
        endif
    end
default:
    echo Usage: dirsearch filename dirname
exit(1)
endsw
```

Appendix B
The VI Editor

VI editor has two modes: command mode and edit mode. You should always know what mode it is in.

1. To invoke vi:
   $ vi rnyfile
   You are now in command mode, you should see a ~ at the top of the screen.

2. To exit vi:
   Press Esc key and type :wq to save and quit
   Or type :q! to quit without saving
   Or type :w newname to save in a new file and then
   :q to quit

3. To get in/out editing mode:
   Press the letter a key, (don’t press return key) to start to append
   Or Press the letter i to insert after the cursor

4. To Switch between Command/Edit Modes
   From command to edit: use a or i to edit
   From edit to command: press Esc key

5. Inserting text
   Move cursor using the arrow keys before pressing a to append or i to insert.
   Note: Back space key will back the cursor one character at a time for you to overstrike, but not necessarily deleted, not until you type something over it.

6. Deleting text
   Press ESC to change to command mode, move the cursor to the character to be deleted and press x to delete a character or dd to remove a whole line

7. The deleted line can be pasted below the cursor by typing ESC:p

8. To search/locate a string
   Press Esc, and type :/targetstring and then press n for forward search, N for backward search.

9. To search and replace a string
   Method A. Press Esc, type :g/oldstring/s/newstring/c
             You will be prompted to answer y or n at each occurrence.
   Method B. Press Esc, type :g/oldstring/s/newstring/g
             You will NOT be asked for your approval to replace!
Appendix C

10. **To copy or move a block of text**
    Move cursor to the starting character of the block and press Esc and type `:15dd` to remove 15 lines from the cursor or `:15yy` to copy 15 lines. Then move the cursor to the destination and press `:p` to paste below the cursor or `:P` above the cursor.

11. **To insert an external file into the text:**
    Move the cursor to the destination and press `ESC : r filename`

12. **To save a block of text (say line 7 thru line 20) into a file**
    Press Esc: 7,20w newfile (creating new file)
    or `:7,20w! oldfile` (overwrite old file)
    or `:7,20w >> myfile` (append to myfile)

13. **To Page-up/down:**
    `CTRL-F` to go Forward, or `CTRL-B` (back) to go back

14. **To find out which line the cursor is on:** Press Esc, and type `:nu`

15. **You can execute sh command while in vi:** Press Esc, type `:sh` (Now you will see $ prompt.) Type exit to return back to vi.

16. **There are many other useful editor commands.** For example, to change a single character from lower to upper case:
    Press Esc, and then type ~ (to toggle)

17. **To insert the output of a command (say, date) directly into the text:**
    Press `ESC` and type `:r!date`

18. **Use VI to create a file called .exrc at your home directory to contain the following 4 lines:**
    Set nu
    Set showmode
    Set shiftwidth=3
    Set bf
Appendix E

EzSAGE Source Code

**NSU Code**
cc_sage.pro
colorbar.pro
ez_sage.pro
Getinfo.pro
Get_more_info.pro
get_scale_info.pro
Grid_Smooth_Map.pro
Month_Read.pro
plot_points.pro
ReadSage.pro
reset.pro

**Two subroutines from RSI**
normal_scat.pro
cw_f1slider.pro
pro getinfo_events, event
;Ignores anything that is not a button
eventname = tag_names(event, /structure_name)

If eventname ne 'WIDGET_BUTTON' then return

;Does button event.
widget_control, event.top, get_uvalue=info, /no_copy
widget_control, event.id, get_value=buttonvalue

case buttonvalue of
   'Cancel': widget_control, event.top, /destroy
   'Accept': begin
      ;Get the values entered in the fields.
      Widget_Control, info.nummonthID, get_value=nummonth
      Widget_Control, info.altitudeID, get_value=altitude
      if (info.surf_type ne i) then Widget_Control, info.rangeID, get_value=range
      if (info.file_type eq 3) then begin
         Widget_control, info.indateID, get_value=in_day
         Widget_control, info.fidateID, get_value=fi_day
      endif
      Widget_Control, info.headerID, get_value=header
   ;Test for range
   endif
   if (info.file_type eq 3) then begin
      if (info.surf_type ne 1) then begin
         ;Sends then to the pointer
         (*info.ptr).nummonth = nummonth
         (*info.ptr).altitude = altitude
         (*info.ptr).range = range
         (*info.ptr).header = header[0]
         (*info.ptr).in_day = in_day
         (*info.ptr).fi_day = fi_day
         (*info.ptr).cancel = 0
      endif else begin
pro getinfo, nummonth, altitude, header, alt_unit, surf_type, range, file_type, in_day, fi_day, cancel=cancel, parent=parent

; Gets information from the user in order to give the proper surface
; nummonth = the number of months to be studied
; altitude = the surface to be studied, lat, lon or altitude

On_Error, 2 ; Return to Caller
On_Error, 2 ; Return to Caller

If n_elements(nummonth) eq 0 then nummonth = 1
If n_elements(in_day) eq 0 then in_day = 1
If n_elements(fi_day) eq 0 then fi_day = 30
If n_elements(file_type) eq 0 then file_type = 1
If n_elements(header) eq 0 then header = 'Do not know.'
; altitude = 700
; alt_unit = 'latitude Degrees'
; surf_type = 2
device, get_screen_size = screensize
xcenter = fix(screensize[0] / 2.0)
ycenter = fix(screensize[1] / 2.0)
xoff = xcenter - 150
yoff = ycenter - 150

If n_elements(parent) ne 0 then begin
tlb = widget_base(column=1, xoffset=xoff, yoffset=yoff, title = 'Enter
Output Information', $modal, group_leader=parent, /floating)
endif else begin
tlb = widget_base(column=1, xoffset=xoff, yoffset=yoff, title = 'Enter
Output Information')
endelse

; Create subbase for text widgets

subbase = widget_base(tlb, column=1, frame=1)
nummonthID= cw_field(subbase,title='Number of month to be studied.',value = nummonth, /integer)
altitudeID= cw_field(subbase,title='Surface to be studied in '+ alt_unit +'.',value = altitude, /floating)
If (surf_type ne i) then rangeID= cw_field(subbase,title='Degree range to be
studied in '+ alt_unit +'.',value = range, /floating)
If (file_type eq 3) then begin
   indateID= cw_field(subbase,title='Initial
day number of the date
range.',value = in_day, /integer)
fidateID= cw_field(subbase,title='Final day number of the date
range.',value = fi_day, /integer)
endif

headerID = cw_field(subbase,title='Enter a 30 character description of the
output file.', value = header, xsize=30, /string)

; Create subbase for buttons

butbase = widget_base(tlb, row=1)
cancel = widget_Button(butbase, value='Cancel')
accept = widget_Button(butbase, value='Accept')

Widget_Control, tlb, /realize

; Set pointer to store information entered
ptr = ptr_new({nummonth:1, altitude:11.5, range:5.0, in_day:1, fi_day:30,
header: ' ', cancel:1})

; Test for range
If file_type eq 3 then begin
   If (surf_type ne 1) then begin
info = {nummonthID:nummonthID, altitudeID:altitudeID, rangeID:rangeID, headerID:headerID, fidateID(fidateID, indateID:indateID, surf_type:surf_type, file_type:file_type, ptr:ptr)
endif else begin

info = {nummonthID:nummonthID, altitudeID:altitudeID, rangeID:rangeID, headerID:headerID, fidateID:fidateID, indateID:indateID, surf_type:file_type, file_type:file_type, ptr:ptr}
endforeachelse

If (surf_type ne 1) then begin

info = {nummonthID nummonthID, altitudeID:altitudeID, rangeID:rangeID, headerID:headerID, fidateID:fidateID, indateID:indateID, surf_type:file_type, file_type:file_type, ptr:ptr}
endforeachelse

info = {nummonthID nummonthID, altitudeID:altitudeID, headerID:headerID, surf_type:file_type, file_type:file_type, ptr:ptr}
endforeachelse

endforeach

;Set information on the widget as a user value
widget_control, tlb, set_uvalue=info, /no_copy

xmanager, 'getinfo', tlb, event_handler='getinfo_events'

;Recover the information from the pointer location

fileinfo = *ptr
ptr_free, ptr

;Error handler on entered info
catch, error
If error ne 0 then begin

;ok = dialog_message(!err_string)
;cancel = 1
;return
endforeach

;User pressed cancel button.

cancel = fileinfo.cancel
If cancel eq 1 then return

nummonth = fileinfo.nummonth
altitude = fileinfo.altitude
range = fileinfo.range
header= fileinfo.header
in_day = fileinfo.in_day
in_day = fileinfo.in_day

; print, nummonth, altitude, range, header
return
end
PRO colorbar, BOTTOM=bottom, CHARSIZE=charsize, COLOR=color, DIVISIONS=divisions, $
  \text{FORMAT}=\text{format}, \text{POSITION}=\text{position}, \text{MAX}=\text{max}, \text{MIN}=\text{min}, \text{NCOLORS}=\text{ncolors}, $
  \text{PSCOLOR}=\text{pscolor}, \text{TITLE}=\text{title}, \text{VERTICAL}=\text{vertical}, \text{TOP}=\text{top}, \text{RIGHT}=\text{right}$

\text{NAME:}
  \text{COLORBAR}

\text{PURPOSE:}
  \text{The purpose of this routine is to add a color bar to the current}
  \text{graphics window.}

\text{CATEGORY:}
  \text{Graphics, Widgets.}

\text{CALLING SEQUENCE:}
  \text{COLORBAR}

\text{INPUTS:}
  \text{None.}

\text{KEYWORD PARAMETERS:}

\text{BOTTOM: The lowest color index of the colors to be loaded in}
  \text{the bar.}

\text{CHARSIZE: The character size of the color bar annotations. Default is}
  1.0.

\text{COLOR: The color index of the bar outline and characters. Default}
  \text{is ncolors - 1 + bottom.}

\text{DIVISIONS: The number of divisions to divide the bar into. There will}
  \text{be (divisions + 1) annotations. The default is 2.}

\text{FORMAT: The format of the bar annotations. Default is '(F6.2)'.}

\text{MAX: The maximum data value for the bar annotation. Default is}
  \text{NCOLORS-1.}

\text{MIN: The minimum data value for the bar annotation. Default is 0.}

\text{NCOLORS: This is the number of colors in the color bar.}

\text{POSITION: A four-element array of normalized coordinates in the same}
  \text{form as the POSITION keyword on a plot. Default is}
  \text{[0.88, 0.15, 0.95, 0.95] for a vertical bar and}
  \text{[0.15, 0.88, 0.95, 0.95] for a horizontal bar.}

\text{PSCOLOR: This keyword is only applied if the output is being sent to}
  \text{a PostScript file. It indicates that the PostScript device}
  \text{is configured for color output. If this keyword is set, then}
  \text{the annotation is drawn in the color specified by the COLOR}
  \text{keyword. If the keyword is not set, the annotation is drawn}
  \text{in the color specified by the !P.COLOR system variable}
  \text{(usually this will be the color black). In general, this}
  \text{gives better looking output on non-color or gray-scale}
  \text{printers. If you are not specifically setting the annotation}
  \text{color (with the COLOR keyword), it will probably}
  \text{be better NOT to set this keyword either, even if you}
  \text{are outputting to a color PostScript printer.}
; RIGHT: This puts the labels on the right-hand side of a vertical
; color bar. It applies only to vertical color bars.
; TITLE: This is title for the color bar. The default is to have
; no title.
; TOP: This puts the labels on top of the bar rather than under it.
; The keyword only applies if a horizontal color bar is rendered.
; VERTICAL: Setting this keyword give a vertical color bar. The default
; is a horizontal color bar.

COMMON BLOCKS:
None.

SIDE EFFECTS:
Color bar is drawn in the current graphics window.

RESTRICTIONS:
The number of colors available on the display device (not the
PostScript device) is used unless the N_COLORS keyword is used.

EXAMPLE:
To display a horizontal color bar above a contour plot, type:

LOADCT, 5, N_COLORS=100
CONTOUR, DIST(31,41), POSITION=[0.15, 0.15, 0.95, 0.75], $ 
C_COLORS=INDGEN(25)*4, N_LEVELS=25
COLORBAR, N_COLORS=100

MODIFICATION HISTORY:
Written by: David Fanning, 10 JUNE 96.
10/27/96: Added the ability to send output to PostScript. DWF
11/4/96: Substantially rewritten to go to screen or PostScript
file without having to know much about the PostScript device or
what the current graphics device is. DWF
1/27/97: Added the RIGHT and TOP keywords. Also modified the
way the TITLE keyword works. DWF
7/15/97: Fixed a problem some machines have with plots that have
no valid data range in them. DWF

; Is the PostScript device selected?

POSTSCRIPT_DEVICE = (!D.NAME EQ 'PS')

; Check and define keywords.

IF N_ELEMENTS(ncolors) EQ 0 THEN BEGIN

; Most display devices to not use the 256 colors available to
; the PostScript device. This presents a problem when writing
; general-purpose programs that can be output to the display or
; to the PostScript device. This problem is especially bothersome
; if you don't specify the number of colors you are using in the
; program. One way to work around this problem is to make the
default number of colors the same for the display device and for
; the PostScript device. Then, the colors you see in PostScript are
; identical to the colors you see on your display. Here is one way to
; do it.

IF postScriptDevice THEN BEGIN
    oldDevice = !D.NAME

        ;; What kind of computer are we using? SET_PLOT to appropriate
        ;; display device.
    thisOS = !VERSION.OS_FAMILY
    thisOS = STRMID(thisOS, 0, 3)
    thisOS = STRUPCASE(thisOS)
    CASE thisOS of
'MAC': SET_PLOT, thisOS
'WIN': SET_PLOT, thisOS
ELSE: SET_PLOT, 'X'
ENDCASE

        ;; Open a window (to make sure !D.N_COLORS is accurate).
    WINDOW, /FREE, /PIXMAP, XSIZE=10, YSIZE=10
    WDELETE, !D.WINDOW

        ;; Here is how many colors we should use.
    ncolors = !D.N_COLORS
    SET_PLOT, oldDevice
    ENDIF ELSE ncolors = !D.N_COLORS
ENDIF

IF N_ELEMENTS(bottom) EQ 0 THEN bottom = 0B
IF N_ELEMENTS(charsize) EQ 0 THEN charsizesize = 1.0
IF N_ELEMENTS(format) EQ 0 THEN format = '(F6.2)'
IF N_ELEMENTS(color) EQ 0 THEN color = ncolors - 1 + bottom
IF N_ELEMENTS(min) EQ 0 THEN min = 0.0
IF N_ELEMENTS(max) EQ 0 THEN max = FLOAT(ncolors) - 1
IF N_ELEMENTS(divisions) EQ 0 THEN divisions = 2
IF N_ELEMENTS(title) EQ 0 THEN title = ''
pscolor = KEYWORD_SET(pscolor)

IF KEYWORD_SET(vertical) THEN BEGIN
    bar = REPLICATE(1B, 10) # BINDGEN(256)
IF N_ELEMENTS(position) EQ 0 THEN position = [0.88, 0.15, 0.95, 0.95]
ENDIF ELSE BEGIN
    bar = BINDGEN(256) # REPLICATE(1B, 10)
    IF N_ELEMENTS(position) EQ 0 THEN position = [0.15, 0.88, 0.95, 0.95]
ENDELSE

    ;; Scale the color bar.
    bar = BYTSCL(bar, TOP=ncolors-1) + bottom

    ;; Get starting locations in DEVICE coordinates.
    xstart = position(0) * !D.X_VSIZE
    ystart = position(1) * !D.Y_VSIZE

    ;; Get the size of the bar in DEVICE coordinates.
    xsize = (position(2) - position(0)) * !D.X_VSIZE
    ysize = (position(3) - position(1)) * !D.Y_VSIZE

    ;; For PostScript output only, draw the annotation in !P.COLOR
; unless "pscolor" is set. This makes better output on grayscale
; printers.

IF postScriptDevice AND (pscolor NE 1) THEN BEGIN
  oldcolor = color
  color = !P.COLOR
ENDIF

; Display the color bar in the window. Sizing is
; different for PostScript and regular display.

IF postScriptDevice THEN BEGIN
  TV, bar, xstart, ystart, XSIZE=xsize, YSIZE=ysize
ENDIF ELSE BEGIN
  bar = CONGRID(bar, CEIL(xsize), CEIL(ysize), /INTERP)
  TV, bar, xstart, ystart
ENDELSE

; Annotate the color bar.

IF KEYWORD_SET(vertical) THEN BEGIN
  IF KEYWORD_SET(right) THEN BEGIN
    PLOT, [min,max], [min,max], /NODATA, XTICKS=1, $
    YTICKS=divisions, XSTYLE=1, YSTYLE=9, $
    POSITION=position, COLOR=color, CHARSIZE=charsize, /NOERASE, $
    YTITLE=YTICKFORMAT='(AI)', XTICKFORMAT='(AI)', YTICKLEN=0.1, $
    XRANGE=[min, max], XTITLE=title
    AXIS, YAXIS=1, YRANGE=[min, max], YTITLE=YTITLE=format, YTICKS=divisions, $
    YTITLE=YTICKLEN=0.1, YSTYLE=1, COLOR=color, CHARSIZE=charsize
  ENDIF ELSE BEGIN
    PLOT, [min,max], [min,max], /NODATA, XTICKS=1, $
    YTITLE=YTICKFS=divisions, XSTYLE=9, YSTYLE=1, $
    POSITION=position, COLOR=color, CHARSIZE=charsize, /NOERASE, $
    YTITLE=YTICKFORMAT='(AI)', XTICKFORMAT='(AI)', YTICKLEN=0.1 , $
    YRANGE=[min, max]
    AXIS, YAXIS=1, YRANGE=[min, max], YTITLE=YTITLE=format, YTICKS=divisions, $
    YTITLE=YTICKLEN=0.1, YSTYLE=1, COLOR=color, CHARSIZE=charsize
  ENDELSE
ENDIF ELSE BEGIN
  IF KEYWORD_SET(top) THEN BEGIN
    PLOT, [min,max], [min,max], /NODATA, XTICKS=divisions, $
    YTITLE=YTICKS=divisions, XSTYLE=9, YSTYLE=1, $
    POSITION=position, COLOR=color, CHARSIZE=charsize, /NOERASE, $
    YTITLE=YTICKFORMAT='(AI)', XTICKFORMAT='(AI)', YTICKLEN=0.1 , $
    XRANGE=[min, max], XTITLE=title
  ENDIF ELSE BEGIN
    PLOT, [min,max], [min,max], /NODATA, XTICKS=divisions, $
    YTITLE=YTICKS=divisions, XSTYLE=9, YSTYLE=1, $
    POSITION=position, COLOR=color, CHARSIZE=charsize, /NOERASE, $
    YTITLE=YTICKFORMAT='(AI)', XTICKFORMAT='(AI)', YTICKLEN=0.1 , $
    XRANGE=[min, max], XTITLE=title
AXIS, XTICKS=divisions, XSTYLE=1, COLOR=color, CHARSIZE=charsize, $  
XTICKFORMAT=format, XTICKLEN=0.1, XRANGE=[min, max], XAXIS=1  

ENDIF ELSE BEGIN  
  PLOT, [min,max], [min,max], /NODATA, XTICKS=divisions, $  
    YTICKS=1, XSTYLE=1, YSTYLE=1, $  
    POSITION=position, COLOR=color, CHARSIZE=charsize, /NOERASE, $  
    YTICKFORMAT='(AI)', XTICKFORMAT=format, XTICKLEN=0.1, $  
    XRANGE=[min, max], TITLE=title  
  ENDELSE  
ENDELSE  

; Restore color variable if changed for PostScript.  
IF postScriptDevice AND (pscolor NE 1) THEN color = oldcolor  
END
;Copyright (c) 1999, NSU SciViz Lab. All rights reserved.
; Unauthorized reproduction prohibited.

; NAME:
;     ez_sage.pro
;
; RESTRICTIONS:
;     Works with SAGE II data, g2p v5.931
;
;*
;***********************************************************************
**

pro ez_sage

call_procedure, 'ReadSage'

end
;******************************************************************************
**
;Copyright (c) 1999, NSU SciViz Lab. All rights reserved.
;   Unauthorized reproduction prohibited.
;+
; NAME:
;   Get_more_info.pro
;
; RESTRICTIONS:
;   Works with SAGE II data, g2p v5.931
;
;-
;******************************************************************************
**
pro get_more_info_events, event

; Ignores anything that is not a button

eventname = tag_names(event, /structure_name)

If eventname ne 'WIDGET_BUTTON' then return

; Does button event.

widget_control, event.top, get_uvalue=info_grid, /no_copy

widget_control, event.id, get_value=buttonvalue

case buttonvalue of
   'Cancel': widget_control, event.top, /destroy

   'Accept': begin

   ; Get the values entered in the fields.
   Widget_Control, info_grid.lat_stepID, get_value=lat_step
   Widget_Control, info_grid.lon_stepID, get_value=lon_step
   Widget_Control, info_grid.smooth_passID, get_value=smooth_pass

   ; Sends them to the pointer
   (*info_grid.ptr_grid).lat_step = lat_step
   (*info_grid.ptr_grid).lon_step = lon_step
   (*info_grid.ptr_grid).smooth_pass = smooth_pass
   (*info_grid.ptr_grid).cancel = 0

   ; Resets variables for passing
   widget_control, event.top, set_uvalue=info_grid

   widget_control, event.top, /destroy

   endcase

end
end

------------------------------------------------------------------------
------------------------------------------------------------------------
pro get_more_info, surf_type, lat_step, lon_step, smooth_pass, cancel=cancel,
parent=parent

; Error Handler.

On_Error, 2 ; Return to Caller
; Set defaults
If n_elements(lat_step) eq 0 then lat_step = 8.0
If n_elements(lon_step) eq 0 then lon_step = 10.0
If n_elements(smooth_pass) eq 0 then smooth_pass = 9

; Set dialog in the middle of the screen
device, get_screen_size = screensize
xcenter = fix(screensize[0] / 2.0)
ycenter = fix(screensize[1] / 2.0)
xoff = xcenter - 150
yoff = ycenter - 150

If n_elements(parent) ne 0 then begin
    tlb = widget_base(column=1, xoffset=xoff, yoffset=yoff, title = 'Enter
    Regridding and Smoothing Information',
        /modal, group_leader=parent, /floating)
endif else begin
    tlb = widget_base(column=1, xoffset=xoff, yoffset=yoff, title = 'Enter
    Gridding and Smoothing Information')
endelse

case surf_type of
    1: begin
        lat_title = 'Enter the latitude bin size.'
        lon_title = 'Enter the longitude bin size.'
    end
    2:begin
        lat_title = 'Enter the altitude bin size.'
        lon_title = 'Enter the latitude bin size.'
    end
    3:begin
        lat_title = 'Enter the altitude bin size.'
        lon_title = 'Enter the longitude bin size.'
    end
endcase

; Create subbase for text widgets
subbase = widget_base(tlb, column=1, frame=1)
lat_stepID= cw_field(subbase,title=lat_title,value = lat_step, /floating)
lon_stepID= cw_field(subbase,title=lon_title,value = lon_step, /floating)
smooth_passID = cw_field(subbase,title='Enter the number of desired smoothing
passes.',value = smooth_pass, /integer)

; Creates subbase for buttons
butbase = widget_base(tlb, row=1)
cancel = widget_Button(butbase, value='Cancel')
accept = widget_Button(butbase, value='Accept')

Widget_Control, tlb, /realize

;Set pointer to store information entered
ptr_grid = ptr_new({lat_step:3.0, lon_step:10.0, smooth_pass:9.0, cancel:1})

;Set information on the widget as a user value
info_grid = {lat_stepID:lat_stepID, lon_stepID:lon_stepID, smooth_passID:smooth_passID, ptr_grid:ptr_grid}

widget_control, tlb, set_uvalue=info_grid, /no_copy

xmanager, 'get_more_info', tlb, event_handler='get_more_info_events'

;Recover the information from the pointer location
fileinfo = *ptr_grid
ptr_free, ptr_grid

;Error handler on entered info

catch, error
If error ne 0 then begin
    ok = dialog_message(!err_string)
cancel = 1
    return
endif

;User pressed cancel button.

cancel = fileinfo.cancel
If cancel eq 1 then return

;Reset the parameters.

lat_step = fileinfo.lat_step
lon_step = fileinfo.lon_step
smooth_pass= fileinfo.smooth_pass

return
end
pro get_scale_info_events, event

; Ignores anything that is not a button

eventname = tag_names(event, /structure_name)

if eventname ne 'WIDGET_BUTTON' then return

; Does button event.

widget_control, event.top, get_uvalue=info, /no_copy

widget_control, event.id, get_value=buttonvalue

case buttonvalue of
  'Cancel': begin
    (*info.ptr).cancel = 1
    widget_control, event.top, /destroy
  end

  'Accept': begin
    ; Get the values entered in the fields.
    widget_control, info.x_axis_minID, get_value=x_axis_min
    widget_control, info.x_axis_maxID, get_value=x_axis_max
    widget_control, info.y_axis_minID, get_value=y_axis_min
    widget_control, info.y_axis_maxID, get_value=y_axis_max

    (*info.ptr).x_axis_min = x_axis_min
    (*info.ptr).x_axis_max = x_axis_max
    (*info.ptr).y_axis_min = y_axis_min
    (*info.ptr).y_axis_max = y_axis_max
    (*info.ptr).cancel = 0
    widget_control, event.top, /destroy
  endcase
end
end

pro get_scale_info, x_axis_max, x_axis_min, y_axis_max, y_axis_min, cancel=

; Gets information from the user in order to give the proper surface
; Error Handler.
On_Error, 2 ;Return to Caller

If n_elements(x_axis_max) eq 0 then x_axis_max = 180
If n_elements(x_axis_min) eq 0 then x_axis_min = -180
If n_elements(y_axis_min) eq 0 then y_axis_min = 10
If n_elements(y_axis_max) eq 0 then y_axis_max = 70

; Set dialog in the middle of the screen
device, get_screen_size = screensize
xcenter = fix(screensize[0] / 2.0)
ycenter = fix(screensize[1] / 2.0)
xoff = xcenter - 150
yoff = ycenter - 150

If n_elements(parent) ne 0 then begin
    tlb = widget_base(column=1, xoffset=xoff, yoffset=yoff, title = 'Enter Output Information', $
        /modal, group_leader=parent, /floating)
endif else begin
    tlb = widget_base(column=1, xoffset=xoff, yoffset=yoff, title = 'Enter Output Information')
endelse

;Create subbase for text widgets
subbase = widget_base(tlb, column=1, frame=1)
x_axis_minID = cw_field(subbase,title='Enter desired x axis minimum.',value = x_axis_min, /integer)
x_axis_maxID = cw_field(subbase,title='Enter desired x axis maximum.',value = x_axis_max, /integer)
y_axis_minID = cw_field(subbase,title='Enter desired y axis minimum.',value = y_axis_min, /floating)
y_axis_maxID = cw_field(subbase,title='Enter desired y axis maximum.',value = y_axis_max, /floating)

;Creates subbase for buttons
butbase = widget_base(tlb, row=1)
cancel = widget_Button(butbase, value='Cancel')
accept = widget_Button(butbase, value='Accept')

Widget_Control, tlb, /realize

;Set pointer to store information entered
ptr = ptr_new({x_axis_min:x_axis_min, x_axis_max:x_axis_max, y_axis_min:y_axis_min, y_axis_max:y_axis_max, cancel:1})
info = {x_axis_minID:x_axis_minID, x_axis_maxID:x_axis_maxID, y_axis_minID:y_axis_minID, y_axis_maxID:y_axis_maxID, ptr:ptr}
; Set information on the widget as a user value
widget_control, tlb, set_uvalue=info, /no_copy
xmanager, 'get_scale_info', tlb, event_handler='get_scale_info_events'

; Recover the information from the pointer location
fileinfo = *ptr
ptr_free, ptr

; Error handler on entered info
catch, error
If error ne 0 then begin
    ok = dialog_message(!err_string)
cancel = 1
    return
endif

; User pressed cancel button.
cancel = fileinfo.cancel
If cancel eq 1 then return

x_axis_min = fileinfo.x_axis_min
x_axis_max = fileinfo.x_axis_max
y_axis_min = fileinfo.y_axis_min
y_axis_max = fileinfo.y_axis_max

return
end
pro cc_sage

call_procedure, 'ReadSage_cc'

return

dec
;Copyright (c) 1999, NSU SciViz Lab. All rights reserved.
; Unauthorized reproduction prohibited.

NAME:
Grid_Smooth_Map.pro

RESTRICTIONS:
Works with SAGE II data, g2p v5.931

 pro Grid_Smooth_Map, outfile, y_step, x_step, smooth_pass, cont_levels, x_axis_max, x_axis_min, y_axis_max, y_axis_min

;Setting graphics
device, pseudo=8, retain=2
@error_catch

;Background color for plot.
!p.background = 0

;Setting variables
norm_factor = lel
unit = ',
y_unit = 1
surf_type = 1
max_val = 9.999e-1
if n_elements(y_step) eq 0 then y_step = 8.0
if n_elements(x_step) eq 0 then x_step = 10.0
if n_elements(smooth_pass) eq 0 then smooth_pass = 9
If n_elements(cont_levels) eq 0 then cont_levels= findgen(11)
If n_elements(x_axis_max) eq 0 then x_axis_max = 0
If n_elements(x_axis_min) eq 0 then x_axis_min = 0
If n_elements(y_axis_min) eq 0 then y_axis_min = 0
If n_elements(y_axis_max) eq 0 then y_axis_max = 0

;!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!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reads, header(10), y_unit
reads, header(13), norm_factor
reads, header(16), surf_type
reads, header(19), max_val

; Reading data

If (surf_type eq 1) then begin

datacolumn = fltarr(4, 100000)
temp_peak = fltarr(4)
i = 0
while (not eof(lun)) do begin
readf, lun, temp_peak
datacolumn[*, i] = temp_peak
i = i + 1
endwhile
datacolumn = datacolumn[*, 0:i-1]

free_lun, lun

; Setting arrays

date = datacolumn[0,*]
lon = datacolumn[1,*]
lat = datacolumn[2,*]
raw_data = datacolumn[3,*]

endif else begin

datacolumn = fltarr(5, 80000)
temp_peak = fltarr(5)
i = 0
while (not eof(lun)) do begin
readf, lun, temp_peak
datacolumn[*, i] = temp_peak
i = i + 1
endwhile
datacolumn = datacolumn[*, 0:i-1]

free_lun, lun

; Setting arrays

date = datacolumn[0,*]
lon = datacolumn[1,*]
lon = datacolumn[2,*]
raw_data = datacolumn[3,*]
dataerr = datacolumn[4,*]
endelse

sr = SIZE(raw_data)

; Eliminates unusual data.
dr = sr(1) - 1
er = sr(2) - 1
for m = 1, er do begin
  for n = 1, er do begin
    if (raw_data[m, n] LT 0) then raw_data[m, n] = 0
    if (raw_data[m, n] GT max_val) then raw_data[m, n] = 0
  endfor
endfor
Case surf_type of
  1: begin
    x = lon
    y = lat
    ; Finds the latitude and longitude range of the data for gridding
    xMax = MAX(x)
    xMin = Min(x)
    yMax = MAX(y)
    yMin = Min(y)
    max_raw = max(raw_data) * norm_factor
    If x_axis_max eq 0 then x_axis_max = xmax
    If x_axis_min eq 0 then x_axis_min = xmin
    If y_axis_min eq 0 then y_axis_min = ymin
    If y_axis_max eq 0 then y_axis_max = ymax
    ; Set up the map projection.
    MAP_SET, /CONTINENTS, /MERCATOR, limit=[y_axis_min, x_axis_min, y_axis_max, x_axis_max], position=[0.01, 0.2, 0.99, 0.99], color=255
    colorbar_position = [0.02, 0.06, 0.98, 0.11]
    ; Grids and interpolates spherical data.
    gridData= SPH_SCAT(x, y, raw_data, BOUNDS=[xMin, yMin, xMax, yMax], GS=[x_step, y_step], BOUT=bout)
  end
  2: begin
    x = lat
    y = lon
    ; Finds the range of the data for max min defaults
    xMax = MAX(x)
    xMin = Min(x)
    yMax = MAX(y)
    yMin = Min(y)
    max_raw = max(raw_data) * norm_factor
If \( x_{\text{axis\_max}} \) eq 0 then \( x_{\text{axis\_max}} = x_{\text{max}} \)
If \( x_{\text{axis\_min}} \) eq 0 then \( x_{\text{axis\_min}} = x_{\text{min}} \)
If \( y_{\text{axis\_min}} \) eq 0 then \( y_{\text{axis\_min}} = y_{\text{min}} \)
If \( y_{\text{axis\_max}} \) eq 0 then \( y_{\text{axis\_max}} = y_{\text{max}} \)

\[ \text{colorbar\_position} = [0.1, 0.06, 0.97, 0.11] \]

\text{case y\_unit of}
\begin{align*}
2: & \text{ plot, } x, y, \text{ xrange}=[x_{\text{axis\_min}}, x_{\text{axis\_max}}], \text{ yrange}=[y_{\text{axis\_min}}, y_{\text{axis\_max}}], \text{ position}=[0.1, 0.3, 0.97, 0.99], \text{ xtitle} = \text{`Latitude'}, \text{ ytitle} = \text{`Altitude'}, \text{ color}=255, /\text{nodata} \\
3: & \text{ plot, } x, y, \text{ xrange}=[x_{\text{axis\_min}}, x_{\text{axis\_max}}], \text{ yrange}=[y_{\text{axis\_max}}, y_{\text{axis\_min}}], \text{ position}=[0.1, 0.3, 0.97, 0.99], \text{ xtitle} = \text{`Latitude'}, \text{ ytitle} = \text{`Altitude'}, \text{ color}=255, /\text{ylog}, /\text{nodata} \\
4: & \text{ plot, } x, y, \text{ xrange}=[x_{\text{axis\_min}}, x_{\text{axis\_max}}], \text{ yrange}=[y_{\text{axis\_min}}, y_{\text{axis\_max}}], \text{ position}=[0.1, 0.3, 0.97, 0.99], \text{ xtitle} = \text{`Latitude'}, \text{ ytitle} = \text{`Altitude'}, \text{ color}=255, /\text{nodata} \\
\end{align*}
\text{endcase}

\text{ind\_test} = \text{where}(y \gt 0.1)

\text{If ind\_test}(0) ne -1 then begin 
\begin{align*}
\text{date} &= \text{date}(\text{ind\_test}) \\
\text{x} &= \text{x}(\text{ind\_test}) \\
\text{y} &= \text{y}(\text{ind\_test}) \\
\text{raw\_data} &= \text{raw\_data}(\text{ind\_test}) \\
\text{dataerr} &= \text{dataerr}(\text{ind\_test}) \\
\end{align*}
\text{endif}

;Finds the range of the data for gridding 
\text{xMax} = \text{MAX}(x) \\
\text{xMin} = \text{Min}(x) \\
\text{yMax} = \text{MAX}(y) \\
\text{yMin} = \text{Min}(y) \\

;Grids and interpolates non spherical data.
\text{gridData} = \text{normal\_SCAT}(x, y, \text{raw\_data}, \text{BOUNDS}=[\text{xMin}, \text{yMin}, \text{xMax}, \text{yMax}], \text{GS}=[\text{x\_step}, \text{y\_step}], \text{BOUT}=\text{bout})
\text{end}

3: begin 
\begin{align*}
\text{x} &= \text{lat} \\
\text{y} &= \text{lon} \\
\end{align*}
;Finds the latitude and longitude range of the data for gridding 
\text{xMax} = \text{MAX}(x) \\
\text{xMin} = \text{Min}(x) \\
\text{yMax} = \text{MAX}(y) \\
\text{yMin} = \text{Min}(y) \\
\text{max\_raw} = \text{max}(\text{raw\_data})*\text{norm\_factor}
If x_axis_max eq 0 then x_axis_max = xmax
If x_axis_min eq 0 then x_axis_min = xmin
If y_axis_min eq 0 then y_axis_min = ymin
If y_axis_max eq 0 then y_axis_max = ymax

colorbar_position = [0.1, 0.06, 0.97, 0.11]

case y_unit of
  2: plot, x, y, xrange=[x_axis_min, x_axis_max], yrange=[y_axis_min, y_axis_max], position=[0.1, 0.3, 0.97, 0.99], xtitle = 'Longitude', ytitle = 'Altitude', color=255, /nodata
  3: plot, x, y, xrange=[x_axis_min, x_axis_max], yrange=[y_axis_max, y_axis_min], position=[0.1, 0.3, 0.97, 0.99], xtitle = 'Longitude', ytitle = 'Altitude', color=255, /ylog, /nodata
  4: plot, x, y, xrange=[x_axis_min, x_axis_max], yrange=[y_axis_min, y_axis_max], position=[0.1, 0.3, 0.97, 0.99], xtitle = 'Longitude', ytitle = 'Altitude', color=255, /nodata
endcase

ind_test = where(y gt 0.1)
If ind_test(0) ne -1 then begin
  date = date(ind_test)
  x = x(ind_test)
  y = y(ind_test)
  raw_data = raw_data(ind_test)
  dataerr = dataerr(ind_test)
endif

;Finds the range of the data for gridding
xMax = MAX(x)
xMin = Min(x)
yMax = MAX(y)
yMin = Min(y)

;Grids and interpolates non spherical data.
gridData= normal_SCAT(x, y, raw_data, BOUNDS=[xMin, yMin, xMax, yMax], GS=[x_step, y_step], BOUT=bout)

endcase

s = SIZE(gridData)

;Calculate xlon and ylat vectors corresponding to gridded data.
xx = FINDGEN(s(1))*((bout(2) - bout(0))/(s(1)-1)) + bout(0)
yy = FINDGEN(s(2))*((bout(3) - bout(1))/(s(2)-1)) + bout(1)

;Eliminates Data that is too low or too high resulting from the gridding.
d =s(1)-1
e =s(2)-1
formatData = fltarr(s(1),s(2))

for m = i, d do begin
    for n = i, e do begin
        if (gridData[m,n] LT 0) then gridData[m,n]=0
        if (gridData[m,n] GT max_val) then gridData[m,n]=0
        formatData[m,n] = gridData[m,n]*norm_factor
    endfor
endfor

; Smoothes data

If (smooth_pass eq 0) then begin
    Final_data = format_data
endif else begin
    Final_data = smooth(formatData, smooth_pass, /Edge_Truncate)
endelse

; Put the contours on the map.

lab_levels = cont_levels[1:9]

CONTOUR, Final_data, xx, yy, LEVELS=lab_levels,$
    C_COLORS=[23,47,70,93,117,140,163,187,210],cell_fill=1, /overplot ; ,
    /closed

; Set up the map projection.

If (surf_type eq 1) then MAP_SET,/CONTINENTS,/MERCATOR,/grid,/label,limit=
    [y_axis_min,x_axis_min,y_axis_max,x_axis_max],position=[0.01, 0.2, 0.99, 0.99]
    ,/noerase,color=255

; Plots the tropopause

    index_trop = where(date eq 000000)
    If (surf_type ne 1) then oplot, x(index_trop), y(index_trop), psym = 6,
    symsize=.5, color=255

; Color bar routine. Keep in mind that the max and min follow the levels set at the contour.

call_procedure, 'COLORBAR', divisions=9, Position=colorbar_position, Max=cont_levels[10], Min=cont_levels[0], $
    Format='(f5.2)',Title=header(1) + unit

; Resets Background
!p.background = 255

RETURN
END
pro Month_Read, specie_type, surf_type, nummonth, chosen_surf, header, range, outfile, norm_factor, unit, surf_unit, y_unit, max_value

;specie_type = 1
altitude = chosen_surf
large_val = 0.0
;nummonth = 2
;header = '

;Opens file for writing
outfile = Dialog_Pickfile(path = '/usr/people/idluser/Desktop', /write)

;Opening output file
    openw, outlun, outfile, /get_lun

;Writing header
    printf, outlun, ' ', format='(a1)'
    printf, outlun, header, format='(a30)'
    printf, outlun, ' ', format='(a1)'
    printf, outlun, 'Surface Units', format='(a21)'
    printf, outlun, surf_unit, format='(a1)'
    printf, outlun, ' ', format='(a1)'
    printf, outlun, 'Specie Unit', format='(a13)'
    printf, outlun, unit, format='(a1)'
    printf, outlun, 'Y axis unit = 1=degrees, 2=Km, 3=mb, and 4=K.'
    printf, outlun, y_unit
    printf, outlun, ' ', format='(a1)'
    printf, outlun, 'Normalization Factor', format='(a1)'
    printf, outlun, norm_factor
    printf, outlun, 'Surface Type = 1=lon-lat, 2=alt-lat, and 3=alt-lon.'
    printf, outlun, surf_type
    printf, outlun, ' ', format='(a1)'
    printf, outlun, 'Maximun Possible value for this specie. Utilized to check data.'
    printf, outlun, max_value
    printf, outlun, ' ', format='(a1)'

for h = 0, (nummonth-1) do begin

    ;Enter the file to be read and studied.
    filename = dialog_pickfile(path = '/usr/people/idluser/Desktop')
;DEFINE VARIABLES!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!

;--------------------------
; Include the template
;--------------------------

#########################################################################
;File - G2PSTRUCT.PRO
;Date - April 28, 1991
;Purpose-
; Contains the Structure for the SAGE I database records which is in
; the
; original G2P file format. This file may be included into an IDL
; program
; with @G2PSTRUCT as needed.
;#########################################################################

; Make some temporary arrays
tmpf4 = fltarr(4)
tmpf8 = fltarr(8)
tmpf25 = fltarr(25)
tmpf60 = fltarr(60)
tmpf70 = fltarr(70)

; Define the structure

g2p = (G2P_PROF, $

;Field Type Description
DATE: 0., $; Event Date (ymmd.m.d) at 40 km
TIME: 0., $; Event Time (hmmss.m) at 40 km
LAT: 0., $; Subtangent Latitude (-90 to 90)
LON: 0., $; Subtangent Longitude (-180 to 180)
TYPE_INST: 0., $; Event Type, Instrument (0=sr, l=ss)
NMCTEMP: tmpf25, $; NMC Temperature (K) profile
NMCERR: tmpf25, $; Error in NMC Temperature (K)
NMCALT: tmpf25, $; Geopotential Height (meters)
NMCDEN: tmpf25, $; Air Density profile (g/cm^-3)
NMCDENR: tmpf25, $; Error in NMC Air Density (%)
BETA: 0., $; Spacecraft Beta angle (degrees)
MET_REV_DATE: 0., $; LaRC Met Model Rev Date (ymmd.m.d)
DRIVER_REV: 0., $; LaRC Driver Revision Level
TRANS_REV: 0., $; LaRC Transmission Revision Level
INV_REV: 0., $; LaRC Inversion Revision Level
NMC_FLAG: 0., $; LaRC Missing Met Data Flag
TYPE_LOCAL: 0., $; Event Type, Local (0=sr, l=ss)
MET_CODE: 0., $; LaRC Met Model Code
MET_POINTER: 0., $; LaRC Met Model Pointer
TAG: 0.00, $; LaRC Event Tag
SBTNALT: tmpf8, $; Subtangent altitudes (0,10,20,...,70)
SBTNLAT: tmpf8, $; Subtangent Latitudes
SBTNLON: tmpf8, $; Subtangent Longitudes
TIMEOFYR: 0., $; Time of Year (ddd.fraction)
TIMESPAN: 0., $; Duration of event (seconds)
METCOR: tmpf4, $; NMC Temp corrections (5,2,1,0.4 mb)
GEOALT: tmpf70, $; Geometric Altitudes (.5,1.5,2.5,...,70.
5)
PRESS: tmpf70, $; Pressure profile (mb)
TEMP: tmpf70, $; Temperatre profile (K)
SPOD600: tmpf70, $; Slant Path Optical Depth @600nm
SPODE600: tmpf70, $; Error in Slant Path Optical Depth @ 600nm
REXT600: tmpf70, $; Rayleigh Extintion @ 600 nm (i/km)
REXE600: tmpf70, $; Error in Rayleigh Extintion @ 600 nm (i/km)
O3ND:  tmpf70, $; O3 number density profile (cm^-3)
O3NDE:  tmpf70, $; Error in O3 number density profile (cm^-3)
O3MR:  tmpf70, $; O3 mixing ratio profile
O3MRE:  tmpf70, $; Error in O3 mixing ratio profile
QUALF1000: 0., $; Quality factor in 1000nm channel
QUALF940: 0., $; Quality factor in 940nm channel
QUALF600: 0., $; Quality factor in 600nm channel
QUALF525: 0., $; Quality factor in 525nm channel
QUALF453: 0., $; Quality factor in 450nm channel
QUALF448: 0., $; Quality factor in 448nm channel
QUALF385: 0., $; Quality factor in 385nm channel
MEANSBTALT: 0., $; Mean subtngt alt evnt cal (v5.6 only)
MIRROR_CAL: 0., $; Scan Mirror Calibration Code(yymmdd.0)
FILLVAL: 0., $; Fill value (vers 5.6 onwards only)
SPOD1000: tmpf60, $; Slant Path Optical Depth @ 1000nm
SPODE1000: tmpf60, $; Error in Slant Path Optical Depth @ 1000nm
REXT1000: tmpf60, $; Rayleigh Extintion @ 1000 nm (i/km)
REXE1000: tmpf60, $; Error in Rayleigh Extintion @ 1000 nm (i/km)
SPOD940: tmpf60, $; Slant Path Optical Depth @ 940nm
SPODE940: tmpf60, $; Error in Slant Path Optical Depth @ 940nm
REXT940: tmpf60, $; Rayleigh Extintion @ 940nm (i/km)
REXE940: tmpf60, $; Error in Rayleigh Extintion @ 940 nm (i/km)
SPOD525: tmpf60, $; Slant Path Optical Depth @ 525nm
SPODE525: tmpf60, $; Error in Slant Path Optical Depth @ 525nm
REXT525: tmpf60, $; Rayleigh Extintion @ 525nm (i/km)
REXE525: tmpf60, $; Error in Rayleigh Extintion @ 525 nm (i/km)
SPOD453: tmpf60, $; Slant Path Optical Depth @ 453nm
SPODE453: tmpf60, $; Error in Slant Path Optical Depth @ 453nm
REXT453: tmpf60, $; Rayleigh Extintion @ 453 nm (i/km)
REXE453: tmpf60, $; Error in Rayleigh Extintion @ 453 nm (i/km)
SPOD448: tmpf60, $; Slant Path Optical Depth @ 448nm
SPODE448: tmpf60, $; Error in Slant Path Optical Depth @ 448nm
REXT448: tmpf60, $; Rayleigh Extintion @ 448nm (i/km)
REXE448: tmpf60, $; Error in Rayleigh Extintion @ 448nm (i/km)
SPODE385: tmpf60, $; Error in Slant Path Optical Depth @ 385nm
SPODE385: tmpf60, $; Error in Slant Path Optical Depth @ 385nm
REXT385: tmpf60, $; Rayleigh Extintion @ 385 nm (i/km)
REXE385: tmpf60, $; Error in Rayleigh Extintion @ 385 nm (i/km)
EXT1000:  tmpf60, $; 1000nm Extinction (i/km)
EXT1000:  tmpf60, $; 1000nm Extinction (i/km)
EXT525:  tmpf60, $; 525nm Extinction (i/km)
EXT525:  tmpf60, $; 525nm Extinction (i/km)
EXT450:  tmpf60, $; 450nm Extinction (i/km)
EXT450:  tmpf60, $; 450nm Extinction (i/km)
EXT385:  tmpf60, $; 385nm Extinction (i/km)
EXT385:  tmpf60, $; 385nm Extinction (i/km)
EXTRAT:  tmpf60, $; 1000nm Extinction Ratio
EXTRATE:  tmpf60, $; Error in 1000nm Extinction Ratio
NO2ND:  tmpf60, $; NO2 number density profile (cm^-3)
NO2NDE:  tmpf60, $; Error in NO2 number density profile (cm^-3)
NO2MR:  tmpf60, $; NO2 mixing ratio profile
NO2MRE:  tmpf60, $; Error in NO2 mixing ratio profile
H2OND:  tmpf60, $; Spare Vector (H2O Number density)
H2ONDE:  tmpf60, $; Spare Vector (H2O Number density error)
H2OMR:  tmpf60, $; Spare Vector (H2O Mixing ratio)
H2O: \( \text{tmpf60, } $; \text{Spare Vector (H2O Mixing ratio error)} \)
TRAN940: \( \text{tmpf60, } $; \text{Transmission ratio (940/1020 nm)} \)
TRANER940: \( \text{tmpf60, } $; \text{Transmission ratio error (940/1020 nm)} \)
TRAN448: \( \text{tmpf60, } $; \text{Transmission ratio (448/453 nm)} \)
TRANER448: \( \text{tmpf60, } $; \text{Transmission ratio error (448/453 nm)} \)
CRE_DATE: \( 0., \ $; \text{Profile creation date (yymmdd.)} \)
CRE_TIME: \( 0. \ ) ; \text{Profile creation time (hhmmss.)} \)

; Define the header index structure

g2pidx$ = {G2P_INDEX,
; Field Type Description
DATE1: 0L, $; Event date( yymmdd.0) at 40 km
TIME: 0L, $; Event Time (hhmmss.0) at 40 km
LAT: 0L, $; Subtangent Latitude (-90 to 90)
LON: 0L, $; Subtangent Longitude (-180 to 180)
EVENT_TYPE: 0L, $; Event Type, Instrument (0=ss, 1=ss)
LOW_ALT: 0L, $; Low Altitude (0 to 30km)
BETA: 0L, $; Spacecraft Beta angle (degrees)
TIME_SPAN: 0L, $; Time span of event (10-180 seconds)
MET_POINTER: 0L, $; Array pointer to model met (normally 19)
SPARE: 0L, $; Spare Value
SPARE1: 0L, $; Spare Value
REC_NUM: 0L } ; Record Number where event is stored

padarray = lonarr(105) ; array to pad the index structure to match the
g2p

index = REPLICATE({G2P_INDEX},300)
indrec = {IDX, krec: 0L, profile: bytarr(16), num: 0L, numixt: 0L,
idxtag: index,$
dummy: padarray }

; Open input file
openr,inlun, filename,/get_lun

; Read the four header index records

head = assoc(inlun, indrec)

for k = 0, 3 do begin

indx = head(k)

; This tests for the system that the program runs under
; If it is DEC OSF, then a byteorder is necessary to read
; the ieee 'big-endian' input data

if(!version.os eq 'OSF') then begin

byteorder, indx, /LSWAP
file = indx.profil
byteorder, file, /LSWAP ; the byte array file name has to be
swapped back

endif else begin

file = indx.profil

endelse
endfor

; Depending on the specie chosen by the user, the program does a case.
Case specie_type of
  0: Return
  1: begin; Aerosol Extinction @ 1000nm vs. lat & lon @ Altitude in Km
    ; Read the g2p data record
    data = assoc(inlun,g2p,59392)
    i = 0
    while(not EOF(inlun)) do begin
      ; Sets recd to the association to the file via data
      recd = data(i)
      ; Checks for something
      if(!version.os eq 'OSF') then begin
        byteorder, recd,/LSWAP
      endif
      ; Finds the size of the altitude array
      s = size(recd.ext1000)
      alt60 = fltarr(s(1))
      ; Creates altitude array of appropriate size.
      for j = 0, (s(1)-1) do begin
        alt60(j) = recd.geoalt(j)
      endfor
      ; Interpolation of the specie to the desired altitude
      A1000_inter = interpol(recd.ext1000,alt60, altitude)
      ; Writes result to file.
      ; if((recd.date ge dateini) and (recd.date le datefin)) then
        printf, outlun, recd.date, recd.lat, recd.lon, A1000_inter, $
        format='(I6, 2f7.1, e14.5)'$
      ; endif
      i = i + 1
    endwhile
  end
  2: begin; Aerosol Extinction @ 1000nm vs. lat & lon @ pressure
; Read the g2p data record

data = assoc(inlun,g2p,59392)

i = 0
while(not EOF(inlun)) do begin

;Sets recd to the association to the file via data
recd = data(i)

;Checks for something
if(!version.os eq 'OSF') then begin

byteorder, recd, /LSWAP
endif

;Finds the size of the altitude array
s = size(recd.ext1000)
alt60 = fltarr(s(1))

;Creates altitude array of appropriate size.
for j = 0, (s(1)-1) do begin

alt60(j) = recd.geoalt(j)
endfor

;Interpolation of the specie to the desired pressure
A1000_inter = interpol(recd.ext1000, alt60, altitude)

;Writes result to file.
begin

if((recd.date ge dateini) and (recd.date le datefnl)) then

printf, outlun, recd.date, recd.lat, recd.lon,
A1000_inter, $

format='(I6, 2f7.1, e14.5)'
end

i = i + 1
endwhile
end

3: begin; Aerosol Extintion @ 1000nm vs. lat & lon @ zeta

; Read the g2p data record
;
i = 0
data = assoc(inlun,g2p,59392)
while(not EOF(inlun)) do begin

;Sets recd to the association to the file via data
recd = data(i)
; Checks for something
if(!version.os eq 'OSF') then begin
    byteorder, recd, /LSWAP
endif

; Finds the size of the altitude array
s = size(recd.ext1000)
alt60 = fltarr(s(1))

; Creates altitude array of appropriate size.
for j = 0, (s(1)-1) do begin
    alt60(j) = recd.geoalt(j)
endfor

; Finds the size of the altitude array
s = size(alt60)
zeta = fltarr(s(1))

; Calculates the Potential Temperatures
for j = 0, (s(1)-1) do begin
    zeta(j) = recd.temp(j)*((recd.press(j)/le3)^(-.286))
endfor

; Interpolation of the specie to the desired Potential Temperature
A1000_inter = interpol(recd.ext1000, zeta, altitude)

; Writes result to file.
; if((recd.date ge dateini) and (recd.date le datefni)) then
printf, outlun, recd.date, recd.lat, recd.lon,
    format='(I6, 2f7.1, e14.5)'

i = i + 1
endwhile

end

4: begin; Aereosol Extintion @ 1000nm vs. Altitude in Km & lat @ lon

; Read the g2p data record
; i = 0
data = assoc(inlun, g2p, 59392)

while(not EOF(inlun)) do begin
    ; Sets recd to the association to the file via data
    recd = data(i)
;Checks for something
if(!version.os eq 'OSF') then begin
     byteorder,recd,/LSWAP
endif

;Finds the size of the altitude array
s = size(recd.ext1000)
alt60 = fltarr(s(1))

;Creates altitude array of appropriate size.
for j : 0, (s(1)-1) do begin
     alt60(j) = recd.geoalt(j)
endfor

begin
   If (((chosen_surf recd.lon)^2)^(.5)) le range) then
   begin
      ;Finds the size of the altitude array
      s = size(alt60)
      for j : 0, (s(1)-1) do begin
         ;Writes result to file.
         printf,outlun, recd.date, recd.lat,alt60(j),
         recd.ext1000(j), recd.exte1000(j), $
         format='(I6, 2f7.1, 2e14.5)'
      endfor
      ;Saves tropopause Location
      tropopause = recd.nmcalt(24)/1000
      if tropopause lt 30.0 and tropopause gt 5 then $
      printf,outlun, 000000, recd.lat,tropopause,large_val,
      format='(I6, 2f7.1, 2e14.5)'
   endif
   i = i + 1
endwhile
end

5:begin; Aereosol Extintion @ 1000nm vs. Altitude in mb & lat @ lon
   ; Read the g2p data record
   ;
i = 0
data = assoc(inlun,g2p,59392)
while(not EOF(inlun)) do begin
     ;Sets recd to the association to the file via data
     recd = data(i)
begin
; Checks for something
if (!version.os eq 'OSF') then begin
    byteorder, recd, /LSWAP
endif

; Finds the size of the altitude array
s = size(recd.extl000)
alt60 = fltarr(s(1))

; Creates altitude array of appropriate size.
for j = 0, (s(1)-1) do begin
    alt60(j) = recd.geoalt(j)
endfor

begin
If (((chosen_surf - recd.lon)^2)^(.5)) le range) then

; Finds the size of the altitude array
s = size(alt60)
for j = 0, (s(1)-1) do begin

; Writes result to file.
printf, outlun, recd.date, recd.lat, recd.press(j), recd.extl000(j), recd.extel000(j), $format='(I6, 2e14.5, 2e14.5)'
endfor

; Saves tropopause Location
; Interpolation of the tropopause in terms of mb
p = recd.nmcalt(24)/1000.0
print, outlun, 000000, recd.lat, tropopause, large_val, $format='(I6, 2e14.5, 2e14.5)'
end

i = i + 1
endwhile
end

6: begin;
Aerosol Extinction @ 1000nm vs. Potential Temperature & lat @
lon

; Read the g2p data record
;
i = 0
data = assoc(inlun, g2p, 59392)
while(not EOF(inlun)) do begin

;Sets recd to the association to the file via data
recd = data(i)

;Checks for something
if (!version.os eq 'OSF') then begin
  byteorder, recd, /LSWAP
endif

;Finds the size of the altitude array
alt60 = fltarr(g(1))

;Creates altitude array of appropriate size.
for j = 0, (g(1)-1) do begin
  alt60(j) = recd.geoalt(j)
endfor

If (((chosen_surf - recd.lon)^2)^(.5)) lt range) then

begin

;Finds the size of the altitude array
s = size(alt60)
zeta = fltarr(s(1))

for j = 0, (s(1)-1) do begin
  ;Calculates the Potential Temperatures
  zeta(j) = recd.temp(j)*((recd.press(j)/1e3)^(-.286))
endfor

;Writes result to file.
printf(outlun, recd.date, recd.lat, zeta(j), recd.ext1000(j), recd.extel1000(j), $
  format='(I6, 2f7.1, 2e14.5)'$
endfor

;Saves tropopause Location
;Interpolation of the tropopause in terms of Potential Temperature

pot_temp = recd.nmcalt(24)/1000.0
tropopause = interpol(zeta, alt60, pot_temp)

printf(outlun, 000000, recd.lat, tropopause, large_val, $
  format='(I6, 2f7.1, 2e14.5)'$
endfor

i = i + 1

endwhile
7:begin; Ozone Mixing Ratio vs. Altitude in Km & longitude @ latitude

; Read the g2p data record
i = 0
data = assoc(inlun,g2p,59392)

while(not EOF(inlun)) do begin

;Sets recd to the association to the file via data
recd = data(i)

;if(!version.os eq 'OSF') then begin
byteorder,recd,/LSWAP
endif

;Finds the size of the altitude array
alt60 = fltarr(g(1))

;Creates altitude array of appropriate size.
for j = 0, (g(1)-1) do begin
alt60(j) = recd.geoalt(j)
endfor

If (((chosen_surf - recd.lat)^2)^(.5)) lt range) then

;Finds the size of the altitude array
s = size(alt60)

for j = 0, (s(1)-1) do begin
;Writes result to file.
printf,outlun, recd.date, recd.lon, recd.
geoalt(j),recd.ext1000(j), recd.exte1000(j), $
format='(I6, 2f7.1, 2e14.5)'
endfor

;Saves tropopause Location
 tropopause = recd.nmcalt(24)/1000
printf,outlun, 000000, recd.lon,tropopause,large_val, $
format='(I6, 2f7.1, 2e14.5)'
endif

i = i + 1

endwhile
8:begin; Ozone Mixing Ratio vs. Altitude in mb & longitude @ latitude

; Read the g2p data record
;i = 0
data = assoc(inlun,g2p,59392)

while(not EOF(inlun)) do begin

;Sets recd to the association to the file via data
recd = data(i)

;Checks for something
if(!version.os eq 'OSF') then begin

  byteorder,recd,/LSWAP

endif

;Finds the size of the altitude array
alt60 =fltarr(g(1))

;Creates altitude array of appropriate size.
for j = 0, (g(1)-1) do begin
  alt60(j) = recd.geoalt(j)
endfor

begin
  If ((((chosen_surf - recd.lat)^2)^(.5)) lt range) then

  ;Finds the size of the altitude array
  s = size(alt60)
  for j = 0, (s(1)-1) do begin

    ;Writes result to file.
    printf,outlun, recd.date, recd.lon,recd.press(j),
    recd.extl000(j), recd.extel000(j), $
    format='(I6, 2e14.5, 2e14.5)'

  endfor

  ;Saves tropopause Location
  tropopause = interpol(recd.press,recd.geoalt,
  trop_temp)
  printf,outlun, 000000, recd.lon,tropopause,large_val,
  large_val, $
  format='(I6, 2e14.5, 2e14.5)'

  endif

  i = i + 1
endwhile
end

9:begin; Ozone Mixing Ratio vs. Potential Temperature & longitude @ lat

; Read the g2p data record
i = 0
data = assoc(inlun,g2p,59392)

while(not EOF(inlun)) do begin

;Sets recd to the association to the file via data
recd = data(i)

;Checks for something
if(!version.os eq 'OSF') then begin
byteorder,recd,/LSWAP
endif

;Finds the size of the altitude array
g = size(recd.ext1000)
alt60 =fltarr(g(1))

;Creates altitude array of appropriate size.
for j = 0, (g(1)-1) do begin
alt60(j) = recd.geoalt(j)
endfor

begin
If ((((chosen_surf - recd.lat)^2)^(.5)) lt range) then

;Finds the size of the altitude array
s = size(alt60)
zeta =fltarr(s(1))

for j = 0, (s(1)-1) do begin

;Calculates the Potential Temperatures
zeta(j) = recd.temp(j)*((recd.press(j)/le3)^( -.286))

;Writes result to file.
printf,outlun, recd.date, recd.lon, zeta(j),recd.

ext1000(j), recd.ext1000(j), $
format='(I6, 2f7.1, 2e14.5)'
endfor

;Saves tropopause Location
;Interpolation of the tropopause in terms of Potential Temperature
trop_temp = recd.nmcal(24)/1000.0
tropopause = interpol(zeta,alt60,trop_temp)
printf,outlun, 000000, recd.lon,tropopause,large_val,
large_val, $ 

    format='(I6, 2f7.1, 2e14.5)' 

    endif 
    
i = i + 1 

    endwhile 
end 

10:begin; Aerosol Extintion @ 525nm vs. lat & lon @ Altitude in Km 
; Read the g2p data record 
data = assoc(inlun,g2p,59392) 
i = 0 
while(not EOF(inlun)) do begin 
    ;Sets recd to the association to the file via data 
    recd = data(i) 
    ;Checks for something 
    if(!version.os eq 'OSF') then begin 
        byteorder,recd,/LSWAP 
    endif 
    ;Finds the size of the altitude array 
    s = size(reccd.ext525) 
    alt60 = fltarr(s(1)) 
    ;Creates altitude array of appropiate size. 
    for j = 0, (s(1)-1) do begin 
        alt60(j) = recd.geoalt(j) 
    endfor 
    ;Interpolation of the specie to the desired altitude 
    A525_inter = interpol(reccd.ext525,alt60, altitude) 
    ;Writes result to file. 
    ;if((recd.date ge dateini) and (recd.date le datefnl)) then
    begin 
        printf,outlun, recd.date, recd.lat, recd.lon, 
        A525_inter, $ 
        format='(I6, 2f7.1, e14.5)' 
    ;endif 
    i = i + 1 
endwhile 
end
begin; Aerosol Extinction @ 525nm vs. lat & lon @ pressure

; Read the g2p data record
data = assoc(inlun,g2p,59392)
i = 0
while(not EOF(inlun)) do begin
    ;Sets recd to the association to the file via data
    recd = data(i)
    ;Checks for something
    if(!version.os eq 'OSF') then begin
        byteorder, recd, /LSWAP
    endif
    ;Finds the size of the altitude array
    s = size(recd.ext525)
    alt60 = fltarr(s(1))
    ;Creates altitude array of appropriate size.
    for j = 0, (s(1)-1) do begin
        alt60(j) = recd.geoalt(j)
    endfor
    ;Interpolation of the specie to the desired pressure
    A525_inter = interpol(recd.ext525, alt60, altitude)
    ;Writes result to file.
    if((recd.date ge dateini) and (recd.date le datefnl)) then
        printf, outlun, recd.date, recd.lat, recd.lon,
        A525_inter, $
        format='(I6, 2f7.1, e14.5)'
    endif
    i = i + 1
endwhile
end

begin; Aerosol Extinction @ 525nm vs. lat & lon @ zeta

; Read the g2p data record
;
i = 0
data = assoc(inlun,g2p,59392)
while(not EOF(inlun)) do begin
    ;Sets recd to the association to the file via data
recd = data(i)

;Checks for something
if(!version.os eq 'OSF') then begin
    byteorder, recd, /LSWAP
endif

;Finds the size of the altitude array
s = size(recd.ext525)
alt60 = fltarr(s(1))

;Creates altitude array of appropriate size.
for j = 0, (s(1)-1) do begin
    alt60(j) = recd.geoalt(j)
endfor

;Finds the size of the altitude array
s = size(alt60)
zeta = fltarr(s(1))

;Calculates the Potential Temperatures
for j = 0, (s(1)-1) do begin
    zeta(j) = recd.temp(j)*((recd.press(j)/le3)^(-.286))
endfor

;Interpolation of the specie to the desired Potential
A525_inter = interpol(recd.ext525, zeta, altitude)

;Writes result to file.
;if((recd.date ge dateini) and (recd.date le datefnl)) then
    printf, outfile, recd.date, recd.lat, recd.lon,
    format='(I6, 2f7.1, e14.5)'
endif

i = i + 1

endwhile

end

13:begin; Aereosol Extintion @ 525nm vs. Altitude in Km & lat @ lon

; Read the g2p data record
;
i = 0
data = assoc(inlun, g2p, 59392)

while(not EOF(inlun)) do begin
;Sets recd to the association to the file via data
recd = data(i)

;Checks for something
if(!version.os eq 'OSF') then begin
    byteorder, recd, /LSWAP
endif

;Finds the size of the altitude array
s = size(recd.ext525)
alt60 = fltarr(s(1))

;Create altitude array of appropriate size.
for j = 0, (s(1)-1) do begin
    alt60(j) = recd.geoalt(j)
endfor

begin
If (((chosen_surf - recd.lon)^2)^(.5)) le range then

;Finds the size of the altitude array
s = size(alt60)
for j = 0, (s(1)-1) do begin
    ;Writes result to file.
    if recd.ext525(j) lt 1.0 and recd.ext525(j) gt 0.0 then$
        printf, outlun, recd.date, recd.lat, recd.ext525(j), recd.exte525(j),$
        $format='(I6, 2f7.1, Z2e14.5)'$
endfor

;Saves tropopause Location
 tropopause = recd.nmcalt(24)/1000
if tropopause lt 30.0 and tropopause gt 5 then$
    printf, outlun, 000000, recd.lat, tropopause, large_val,$
    $format='(I6, 2f7.1, Z2e14.5)'$
endif

i = i + 1
endwhile

end

14:begin; Aereosol Extintion @ 525nm vs. Altitude in mb & lat @ lon

; Read the g2p data record
;
i = 0
data = assoc(inlun, g2p, 59392)
while(not EOF(inlun)) do begin

  ;Sets recd to the association to the file via data
  recd = data(i)

  ;Checks for something
  if(!version.os eq 'OSF') then begin
    byteorder, recd, /LSWAP
  endif

  ;Finds the size of the altitude array
  s = size(recd.ext525)
  alt60 =fltarr(s(1))

  ;Creates altitude array of appropriate size.
  for j = 0, (s(1)-1) do begin
    alt60(j) = recd.geoalt(j)
  endfor

  If (((chosen_surf - recd.lon)^2)^(.5)) le range) then begin

    ;Finds the size of the altitude array
    s = size(alt60)
    for j = 0, (s(1)-1) do begin
      ;Writes result to file.
      if recd.ext525(j) lt 1.0 and recd.ext525(j) gt 0.0 then $
        printf, outlun, recd.date, recd.lat, recd.press(j),
        recd.ext525(j), recd.exte525(j), $
        format=('(I6, 2e14.5, 2e14.5)')
    endfor

    ;Saves tropopause Location
    ;Interpolation of the tropopause in terms of mb
    trop_temp = recd.nmcalt(24)/1000.0
    tropopause = interpol(recd.press, recd.geoalt, trop_temp)
    if tropopause(0) lt 800 and tropopause(0) gt 50 then $
      printf, outlun, 000000, recd.lat, tropopause, large_val, $
      format=('(I6, 2e14.5, 2e14.5)')
  endif

  i = i + 1
endwhile
end

15: begin; Aereosol Extintion @ 525nm vs. Potential Temperature & lat @
lon

; Read the g2p data record

i = 0
data = assoc(inlun,g2p,59392)

while(not EOF(inlun)) do begin

;Sets recd to the association to the file via data
recd = data(i)

;Checks for something
if(!version.os eq 'OSF') then begin
byteorder,recd,/LSWAP
endif

;Finds the size of the altitude array
alt60 =fltarr(g(1))

;Creates altitude array of appropriate size.
for j : 0, (g(1)-l) do begin
alt60(j) = recd.geoalt(j)
endfor

If (((chosen_surf - recd.lon)^2)^(.5)) lt range) then

begin

;Finds the size of the altitude array
s = size(alt60)
zeta =fltarr(s(1))

for j = 0, (s(1)-l) do begin

;Calculates the Potential Temperatures
zeta(j) = recd.temp(j)*((recd.press(j)/le3)^(-.286))

;Writes result to file.
if recd.ext525(j) lt 1.0 and recd.ext525(j) gt 0.0 then $
printf, outlun, recd.date, recd.lat, zeta(j), recd.ext525(j), recd.exte525(j), $
format='(I6, 2f7.1, 2e14.5)'
endfor

;Saves tropopause Location

;Interpolation of the tropopause in terms of Potential Temperature

trop_temp = recd.nmcalt(24)/1000.0
tropopause = interpol(zeta,alt60,trop_temp)

printf, outlun, 000000, recd.lat, tropopause, large_val,
large_val, $
\begin{align*}
\text{format} & = ' (I6, 2f7.1, 2e14.5) ' \\
\end{align*}
\text{endif}
\begin{align*}
i & = i + 1 \\
\end{align*}
\text{endwhile}
\text{end}

16: \text{begin}; \text{Ozone Mixing Ratio vs. Altitude in Km} \& \text{longitude} \text{ latitude}
\begin{align*}
; \text{Read the g2p data record} \\
i & = 0 \\
data & = \text{assoc(inlun,g2p,59392)} \\
\text{while}(\text{not EOF(inlun)}) \text{ do begin} \\
\end{align*}
\begin{align*}
; \text{Sets recd to the association to the file via data} \\
\text{recd} & = \text{data}(i) \\
; \text{Checks for something} \\
\text{if}(\text{!version.os eq 'OSF'}) \text{ then begin} \\
\text{byteorder,recd,/LSWAP} \\
\text{endif} \\
; \text{Finds the size of the altitude array} \\
g & = \text{size}(\text{recd.ext525}) \\
\text{alt60} & = \text{fltarr}(g(1)) \\
; \text{Creates altitude array of appropriate size.} \\
\text{for } j & = 0, (g(1)-1) \text{ do begin} \\
\text{alt60}(j) & = \text{recd.geoalt}(j) \\
\text{endfor} \\
\end{align*}
\text{begin} \\
\text{If } (((\text{chosen_surf} - \text{recd.lat})^2)^{.5}) \text{ lt range} \text{ then} \\
\begin{align*}
; \text{Finds the size of the altitude array} \\
s & = \text{size}(\text{alt60}) \\
\text{for } j & = 0, (s(1)-1) \text{ do begin} \\
\end{align*}
\begin{align*}
\end{align*}
\text{begin} \\
\text{if } \text{recd.ext525}(j) \text{ lt 1.0 and recd.ext525}(j) \text{ gt 0.0 then}$
\begin{align*}
\text{printf, outlun, recd.date, recd.lon, recd.} \\
\text{geoalt}(j), \text{recd.ext525}(j), \text{ recd.exte525}(j), \text{ $} \\
\text{format} = ' (I6, 2f7.1, 2e14.5) ' \\
\text{endfor} \\
\end{align*}
\text{end} \\
\text{end} \\
\text{end} \\
\text{end} \\
\text{end}
large_val, $ printf,outlun, 000000, recd.lon,tropopause,large_val,
    format='(I6, 2f7.1, 2e14.5)'
endif

i = i + 1
endwhile
end

begin; Ozone Mixing Ratio vs. Altitude in mb & longitude @ latitude
; Read the g2p data record
; i = 0
data = assoc(inlun,g2p,59392)
while(not EOF(inlun)) do begin
 ;Sets recd to the association to the file via data
crcd = data(i)

;Checks for something
if(!version.os eq 'OSF') then begin
    byteorder,recd,/LSWAP
endif

;Finds the size of the altitude array
g = size(recd.ext525)
alt60 =fltarr(g(1))

;Creates altitude array of appropiate size.
for j = 0, (g(1)-l) do begin
    alt60(j) = recd.geoalt(j)
endfor
If ((((chosen_surf - recd.lat)^2)^(.5)) lt range) then begin
    ;Finds the size of the altitude array
    s = size(alt60)
    for j = 0, (s(1)-l) do begin
        ;Writes result to file.
        if recd.ext525(j) lt 1.0 and recd.ext525(j) gt 0.0 then $
            printf,outlun, recd.date, recd.lon, recd.press(j),
            recd.ext525(j), recd.ext525(j), $
            format='(I6, e14.5, e14.5)'
endfor
    ;Saves tropopause Location
    ;Interpolation of the tropopause in terms of mb
trop_temp = recd.nmcalt(24)/1000.0

tropopause = interpol(recd.press, recd.geoalt,
large_val, $

printf, outlun, 000000, recd.lon, tropopause, large_val,
format='(I6, 2e14.5, 2e14.5)'
endif
i = i + 1
endwhile
eend

18:begin; Ozone Mixing Ratio vs. Potential Temperature & longitude @ lat

; Read the g2p data record
; i = 0
data = assoc(inlun, g2p, 59392)
while(not EOF(inlun)) do begin
;Sets recd to the association to the file via data
recd = data(i)
;Checks for something
if(!version.os eq 'OSF') then begin
byteorder, recd,/LSWAP
endif
;Finds the size of the altitude array
g = size(recd.ext525)
alt60 = fltarr(g(1))
;Creates altitude array of appropiate size.
for j = 0, (g(1)-1) do begin
alt60(j) = recd.geoalt(j)
endfor
If (((chosen_surf - recd.lat)^2)^(.5)) lt range) then

;Finds the size of the altitude array
s = size(alt60)
zeta = fltarr(s(1))
for j = 0, (s(1)-1) do begin
;Calculates the Potential Temperatures
zeta(j) = recd.temp(j)*((recd.press(j)/1e3)^(-.286))
;Writes result to file.
if recd.ext525(j) lt 1.0 and recd.ext525(j) gt
0.0 then 
$ext525(j), recd.exte525(j),$
$\text{printf, outlun, recd.date, recd.lon, zeta(j), recd.}$
$\text{format='(I6, 2f7.1, 2e14.5)'}$
$\text{endfor}$

; Saves tropopause Location
; Interpolation of the tropopause in terms of

\text{Potential Temperature}
\text{trop_temp = recd.nmcaln(24)/1000.0}
\text{tropopause = interpol(zeta, alt60, trop_temp)}
$\text{printf, outlun, 000000, recd.lon, tropopause, large_val,}$
$\text{format='(I6, 2f7.1, 2e14.5)'}$
$\text{endif}$
\text{i = i + 1}$
$\text{endwhile}$
$\text{end}$

19:begin; Aerosol Extintion @ 450nm vs. lat & lon @ Altitude in Km

; Read the g2p data record
\text{data = assoc(inlun, g2p, 59392)}
\text{i = 0}$
\text{while(not EOF(inlun)) do begin}$
\text{; Sets recd to the association to the file via data}$
\text{recd = data(i)}$
\text{; Checks for something}$
\text{if(!version.os eq 'OSF') then begin}$
\text{byteorder, recd, /LSWAP}$
\text{endif}$
\text{; Finds the size of the altitude array}$
\text{s = size(recd.ext450)}$
\text{alt60 = fltarr(s(1))}$
\text{; Creates altitude array of appropriate size.}$
\text{for j = 0, (s(1)-1) do begin}$
\text{alt60(j) = recd.geoalt(j)}$
\text{endfor}$
\text{; Interpolation of the specie to the desired altitude}$
\text{A450_inter = interpol(recd.ext450, alt60, altitude)}$
\text{; Writes result to file.}$
\text{if((recd.date ge dateini) and (recd.date le datefnl)) then}
begin

printf,outlun, recd.date, recd.lat, recd.lon,
A450_inter, $
format='(I6, 2f7.1, e14.5)'

; endif

i = i + 1

endwhile
end

20: begin; Aerosol Extinction @ 450nm vs. lat & lon @ pressure

; Read the g2p data record

data = assoc(inlun,g2p,59392)
i = 0
while(not EOF(inlun)) do begin

; Sets recd to the association to the file via data
recd = data(i)

; Checks for something
if(!version.os eq 'OSF') then begin

byteorder, recd,/LSWAP

endif

; Finds the size of the altitude array
s = size(recd.ext450)
alt60 = fltarr(s(1))

; Creates altitude array of appropriate size.
for j = 0, (s(1)-1) do begin

alt60(j) = recd.geoalt(j)

endfor

; Interpolation of the specie to the desired pressure
A450_inter = interpol(recd.ext450, alt60, altitude)

; Writes result to file.

begin

; if((recd.date ge dateini) and (recd.date le datefnl)) then

printf,outlun, recd.date, recd.lat, recd.lon,
A450_inter, $
format='(I6, 2f7.1, e14.5)'

; endif

i = i + 1
21:begin; Aereosol Extintion @ 450nm vs. lat & lon @ zeta

; Read the g2p data record
i = 0
data = assoc(inlun,g2p,59392)
while(not EOF(inlun)) do begin

;Sets recd to the association to the file via data
recd = data(i)

;Checks for something
if((!version.os eq 'OSF') then begin
    byteorder,recd,/LSWAP
endif

;Finds the size of the altitude array
s = size(recd.ext450)
alt60 = fltarr(s(1))

;Creates altitude array of appropriate size.
for j = 0, (s(1)-1) do begin
    alt60(j) = recd.geoalt(j)
endfor

;Finds the size of the altitude array
s = size(alt60)
zeta = fltarr(s(1))

;Calculates the Potential Temperatures
for j = 0, (s(1)-1) do begin
    zeta(j) = recd.temp(j)*((recd.press(j)/le3)^(-.286))
endfor

;Interpolation of the specie to the desired Potential
A450_inter = interpol(recd.ext450,zeta, altitude)

;Writes result to file.
;if((recd.date ge dateini) and (recd.date le datefinl)) then
A450_inter, $
printf, outlun, recd.date, recd.lat, recd.lon,
format='(I6, 2f7.1, e14.5)'

;endif
i = i + 1
endwhile

end

22:begin;
Aeropisol Extinction @ 450nm vs. Altitude in Km & lat @ lon

; Read the g2p data record
;
i = 0
data = assoc(inlun,g2p,59392)

while(not EOF(inlun)) do begin
 ;Sets recd to the association to the file via data
 recd = data(i)

 ;Checks for something
 if(!version.os eq 'OSF') then begin
byteorder, recd,/LSWAP
endif

;Finds the size of the altitude array
s = size(recd.ext450)
alt60 = fltarr(s(1))

;Creates altitude array of appropriate size.
for j = 0, (s(1)-1) do begin
    alt60(j) = recd.geoalt(j)
endfor

begin
If (((chosen_surf - recd.lon)^2)^(.5)) le range) then

;Finds the size of the altitude array
s = size(alt60)

for j = 0, (s(1)-1) do begin
    ;Writes result to file.
    if recd.ext450(j) lt 1.0 and recd.ext450(j) gt 0.0 then $
        printf, outlun, recd.date, recd.lat, alt60(j), recd.ext450(j), recd.exte450(j), $
        format='(I6, 2f7.1, 2e14.5)'
endfor

;Saves tropopause Location
 tropopause = recd.nmcalt(24)/1000
 printf, outlun, 000000, recd.lat, tropopause, large_val, $
 large_val, $
        format='(I6, 2f7.1, 2e14.5)'
endif
```
i = i + 1
endwhile
end

23: begin; Aerosol Extinction @ 450nm vs. Altitude in mb & lat @ lon

; Read the g2p data record
;
i = 0
data = assoc(inlun,g2p,59392)

while (not EOF(inlun)) do begin

; Sets recd to the association to the file via data
recd = data(i)

; Checks for something
if (!version.os eq 'OSF') then begin
byteorder, recd,/LSWAP
endif

; Finds the size of the altitude array
s = size(recd.ext450)
alt60 = fltarr(s(1))

; Creates altitude array of appropriate size.
for j = 0, (s(1)-1) do begin
alt60(j) = recd.geoalt(j)
endfor

if (((chosen_surf - recd.lon)^2)^(.5)) le range) then

begin

; Finds the size of the altitude array
s = size(alt60)

for j = 0, (s(1)-1) do begin

; Writes result to file.
if recd.ext450(j) lt 1.0 and recd.ext450(j) gt 0.0 then $
printf, outlun, recd.date, recd.lat, recd.press(j),
, recd.ext450(j), recd.exte450(j), $
format='(I6, 2e14.5, 2e14.5 ' trop_temp)

; Saves tropopause Location
; Interpolation of the tropopause in terms of mb

trop_temp = recd.nmcalt(24)/1000.0
tropopause = interpol(reccd.press, recd.geoalt,
trop_temp)

printf, outlun, 000000, recd.lat, tropopause, large_val,
```

large_val, $ 

format='(I6, 2e14.5, 2e14.5)'

endif

i = i + 1

endwhile

end

24:begin; Aereosol Extintion @ 450nm vs. Potential Temperature & lat @ lon

; Read the g2p data record

i = 0
data = assoc(inlun,g2p,59392)

while(not EOF(inlun)) do begin

;Sets recd to the association to the file via data
recd = data(i)

;Checks for something
if(!version.os eq 'OSF') then begin

byteorder,recd,/LSWAP
endif

;Finds the size of the altitude array
g = size(recd.ext450)
alt60 =fltarr(g(1))

;Creates altitude array of appropriate size.
for j = 0, (g(1)-1) do begin

alt60(j) = recd.geoalt(j)
endfor

If (((chosen_surf - recd.lon)^2)^(.5)) lt range) then

begin

;Finds the size of the altitude array
s = size(alt60)
zeta =fltarr(s(1))

for j = 0, (s(1)-1) do begin

;Calculates the Potential Temperatures
zeta(j) = recd.temp(j)*((recd.press(j)/le3)^(-.0.0 then $
printf, outlun, recd.date, recd.lat, zeta(j), recd.ext450(j), recd.exte450(j), $
format='(I6, 2f7.1, 2e14.5)'
endfor

; Saves tropopause Location
; Interpolation of the tropopause in terms of
trop_temp = recd.nmcalt(24)/1000.0
tropopause = interpol(zeta, alt60, trop_temp)

large_val, $
printf, outlun, 000000, recd.lat, tropopause, large_val,
format='(I6, 2f7.1, 2e14.5)'
endif

i = i + 1
endwhile
end

25: begin; Ozone Mixing Ratio vs. Altitude in Km & longitude @ latitude
; Read the g2p data record
;
i = 0
data = assoc(inlun, g2p, 59392)
while(not EOF(inlun)) do begin

; Sets recd to the association to the file via data
recd = data(i)

; Checks for something
if(!version.os eq 'OSF') then begin
byteorder, recd, /LSWAP
endif

; Finds the size of the altitude array
g = size(recd.ext450)
alt60 = fltarr(g(1))

; Creates altitude array of appropriate size.
for j = 0, (g(1)-1) do begin
alt60(j) = recd.geoalt(j)
endfor

begin
If ((((chosen_surf - recd.lat)^2)^(.5)) lt range) then

; Finds the size of the altitude array
s = size(alt60)
for j = 0, (s(1)-1) do begin
    ; Writes result to file.
    if recd.ext450(j) lt 1.0 and recd.ext450(j) gt 0.0 then $
        printf,outlun, recd.date, recd.lon, recd.geoalt(j), recd.ext450(j), recd.ext450(j), $
        format='(I6, 2f7.1, 2e14.5)'
    endfor
    ; Saves tropopause Location
    tropopause = recd.nmcalt(24)/1000
    printf,outlun, 000000, recd.lon, tropopause, large_val, $
    format='(I6, 2f7.1, 2e14.5)'
    endif
    i = i + 1
endwhile
end

26: begin; Ozone Mixing Ratio vs. Altitude in mb & longitude @ latitude
; Read the g2p data record
; i = 0
data = assoc(inlun,g2p,59392)
while(not EOF(inlun)) do begin
    ; Sets recd to the association to the file via data
    recd = data(i)
    ; Checks for something
    if(!version.os eq 'OSF') then begin
        byteorder,reccd, /LSWAP
    endif
    ; Finds the size of the altitude array
    g = size(recd.ext450)
    alt60 = fltarr(g(1))
    ; Creates altitude array of appropriate size.
    for j = 0, (g(1)-1) do begin
        alt60(j) = recd.geoalt(j)
    endfor
    begin
        If (((chosen_surf - recd.lat)^2)^(.5)) lt range) then
        ; Finds the size of the altitude array
        s = size(alt60)
for j = 0, (s(1)-1) do begin
    ; Writes result to file.
    if recd.ext450(j) lt 1.0 and recd.ext450(j) gt 0.0 then $
        printf, outlun, recd.date, recd.lon, recd.press(j), recd.ext450(j), recd.ext450(j),$
        format='(I6, 2e14.5, 2e14.5 ' endfor

; Saves tropopause Location
; Interpolation of the tropopause in terms of mb
trop_temp = recd.nmcalt(24)/1000.0
 tropopause = interpol(recd.press, recd.geoalt, trop_temp)
 large_val, $
    printf, outlun, 000000, recd.lon, tropopause, large_val, $
    format='(I6, 2e14.5, 2e14.5')$
endif

i = i + 1
endwhile

27: begin; Ozone Mixing Ratio vs. Potential Temperature & longitude @ lat
    ; Read the g2p data record
    ; i = 0
    data = assoc(inlun, g2p, 59392)
    while(not EOF(inlun)) do begin
        ; Sets recd to the association to the file via data
        recd = data(i)
        ; Checks for something
        if(!version.os eq 'OSF') then begin
            byteorder, recd, /LSWAP
        endif
        ; Finds the size of the altitude array
        g = size(recd.ext450)
        alt60 = fltarr(g(1))
        ; Creates altitude array of appropriate size.
        for j = 0, (g(1)-1) do begin
            alt60(j) = recd.geoalt(j)
        endfor
        begin
            If (((chosen_surf - recd.lat)^2)^(.5)) 1t range) then

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; Creates altitude array of appropriate size.
for j = 0, (s(1)-1) do begin
    alt60(j) = recd.geoalt(j)
endfor

; Interpolation of the specie to the desired altitude
A385_inter = interpol(recd.ext385, alt60, altitude)

; Writes result to file.
begin
    if((recd.date ge dateini) and (recd.date le datefnl)) then
        printf, outlun, recd.date, recd.lat, recd.lon,
        format='(I6, 2f7.1, e14.5)'
    endif
    i = i + 1
endwhile
end

29: begin; Aerosol Extintion @ 385nm vs. lat & lon @ pressure

; Read the g2p data record
data = assoc(inlun, g2p, 59392)
i = 0
while(not EOF(inlun)) do begin
    ; Sets recd to the association to the file via data
    recd = data(i)

    ; Checks for something
    if(!version.os eq 'OSF') then begin
        byteorder, recd, /LSWAP
    endif

    ; Finds the size of the altitude array
    s = size(recd.ext385)
    alt60 = fltarr(s(1))

    ; Creates altitude array of appropriate size.
    for j = 0, (s(1)-1) do begin
        alt60(j) = recd.geoalt(j)
    endfor

    ; Interpolation of the specie to the desired pressure
    A385_inter = interpol(recd.ext385, alt60, altitude)
begin

A385_inter, $

; Writes result to file.
;if((recd.date ge dateini) and (recd.date le datefnl)) then

printf,outlun, recd.date, recd.lat, recd.lon,

format='(I6, 2f7.1, e14.5)'

; endif

i = i + 1

endwhile

end

30:begin; Aereosol Extintion @ 385nm vs. lat & lon @ zeta

; Read the g2p data record
;
i = 0
data = assoc(inlun,g2p,59392)

while(not EOF(inlun)) do begin

; Sets recd to the association to the file via data
recd = data(i)

; Checks for something
if(!version.os eq 'OSF') then begin

byteorder, recd,/LSWAP
endif

; Finds the size of the altitude array
s = size(recd.ext385)
alt60 = fltarr(s(1))

; Creates altitude array of appropriate size.
for j = 0, (s(1)-1) do begin

alt60(j) = recd.geoalt(j)
endfor

; Finds the size of the altitude array
s = size(alt60)
zeta = fltarr(s(1))

; Calculates the Potential Temperatures
for j = 0, (s(1)-1) do begin

zeta(j) = recd.temp(j)*((recd.press(j)/le3)^(-.286))
endfor

Temperature

; Interpolation of the specie to the desired Potential Temperature
A385_inter = interpol(recd.ext385, zeta, altitude) 

; Writes result to file.
; if((recd.date ge dateini) and (recd.date le datefinl)) then

A385_inter, $ 

printf, outlun, recd.date, recd.lat, recd.lon, 

format='(I6, 2f7.1, e14.5)'

; endif

i = i + 1 

endwhile 

end 

31:begin; Aereosol Extintion @ 385nm vs. Altitude in Km & lat @ lon 

; Read the g2p data record
;
; i = 0 

data = assoc(inlun, g2p, 59392) 

while(not EOF(inlun)) do begin 

; Sets recd to the association to the file via data 
recd = data(i) 

; Checks for something 
if(!version.os eq 'OSF') then begin 
byteorder, recd, /LSWAP 
endif 

; Finds the size of the altitude array 
; s = size(recd.ext385) 
alt60 = ftlarr(s(1)) 

; Creates altitude array of appropriate size. 
for j = 0, (s(1)-1) do begin 
alt60(j) = recd.geoalt(j) 
endfor 

If (((chsoned_surf - recd.lon)^2)^(.5)) le range then begin 

; Finds the size of the altitude array 
s = size(alt60) 

for j = 0, (s(1)-1) do begin 

; Writes result to file. 
if recd.ext385(j) lt 1.0 and recd.ext385(j) gt 

0.0 then $ 

printf, outlun, recd.date, recd.lat, alt60(j),
large_val, $\$

format='(I6, 2f7.1, 2e14.5)'

done

32:begin; Aereosol Extintion @ 385nm vs. Altitude in mb & lat @ lon 

; Read the g2p data record
;
i = 0
data = assoc(inlun,g2p,59392)

while(not EOF(inlun)) do begin

;Sets recd to the association to the file via data
recd = data(i)

;Checks for something
if(!version.os eq 'OSF') then begin

byteorder,recd,/LSWAP
endif

;Finds the size of the altitude array
s = size(recd.ext385)
alt60 = fltarr(s(1))

;Creates altitude array of appropriate size.
for j = 0, (s(1)-1) do begin

alt60(j) = recd.geoalt(j)
endfor

begin

If (((chosen_surf - recd.lon)^2)^(.5)) le range) then

;Finds the size of the altitude array
s = size(alt60)

for j = 0, (s(1)-1) do begin

;Writes result to file.
if recd.ext385(j) lt 1.0 and recd.ext385(j) gt 0.0 then "$
printf, outlun, recd.date, recd.lat, recd.press(j), recd.ext385(j), recd.exte385(j), 
$format='(I6, 2e14.5, 2e14.5)' 
endfor
:Saves tropopause Location
:Interpolation of the tropopause in terms of mb

trop_temp)

tropopause = interpol(recd.press, recd.geoalt, 
large_val, $

printf, outlun, 000000, recd.lat, tropopause, large_val, 
$format='(I6, 2e14.5, 2e14.5)' 
endif 
i = i + 1
endwhile
end

33: begin; Aereosol Extintion @ 385nm vs. Potential Temperature & lat @ lon

; Read the g2p data record
; i = 0
data = assoc(inlun, g2p, 59392)
while(not EOF(inlun)) do begin

;Sets recd to the association to the file via data
recd = data(i)

;Checks for something
if(!version.os eq 'OSF') then begin
byteorder, recd, /LSWAP
endif

;Finds the size of the altitude array
g = size(recd.ext385)
alt60 = fltarr(g(1))

;Creates altitude array of appropriate size.
for j = 0, (g(1)-1) do begin
alt60(j) = recd.geoalt(j)
endfor

If (((chosen_surf - recd.lon)^2)^(.5)) lt range) then begin

;Finds the size of the altitude array
s = size(alt60)
zeta = fltarr(s(1))

for j = 0, (s(1)-1) do begin

; Calculates the Potential Temperatures
zeta(j) = recd.temp(j)*((recd.press(j)/1e3)^(-.286)))

; Writes result to file.
if recd.ext385(j) lt 1.0 and recd.ext385(j) gt 0.0 then $
printf,
outlun,
recd.date,
recd.lat,zeta(j),
recd.ext385(j),
recd.exte385(j),$
format='(I6, 2f7.1, 2e14.5)'
endfor

; Saves tropopause Location
; Interpolation of the tropopause in terms of Potential Temperature

trop_temp = recd.nmcalt(24)/1000.0

tropopause = interpol(zeta,alt60,trop_temp)

printf,
outlun,
000000,
recd.lat,tropopause,large_val,$
format='(I6, 2f7.1, 2e14.5)'
endif

i = i + 1
endwhile
end

34: begin; Ozone Mixing Ratio vs. Altitude in Km & longitude @ latitude

; Read the g2p data record
;
i = 0
data = assoc(inlun,g2p,59392)

while(not EOF(inlun)) do begin

; Sets recd to the association to the file via data
recd = data(i)

; Checks for something
if(!version.os eq 'OSF') then begin

byteorder,recd,/LSWAP
endif

; Finds the size of the altitude array

g = size(recd.ext385)
alt60 = fltarr(g(1))

; Creates altitude array of appropriate size.
for j = 0, (g(1)-1) do begin
    alt60(j) = recd.geoalt(j)
endfor

begin
    If (((chosen_surf - recd.lat)^2)^(.5)) lt range) then
        ; Finds the size of the altitude array
        s = size(alt60)
        for j = 0, (s(1)-1) do begin
            ; Writes result to file.
            if recd.ext385(j) lt 1.0 and recd.ext385(j) gt 0.0 then $
                printf, outlun, recd.date, recd.lon, recd.
                geoalt(j), recd.ext385(j), recd.exte385(j), $
                format='(I6, 2f7.1, 2e14.5)'
            endif
            ; Saves tropopause Location
            tropopause = recd.nmcalt(24)/1000
            printf, outlun, 000000, recd.lon, tropopause, large_val, $
            format='(I6, 2f7.1, 2e14.5)'
        endif
        i = i + 1
    endwhile
end

35: begin; Ozone Mixing Ratio vs. Altitude in mb & longitude @ latitude
    ; Read the g2p data record
    ; i = 0
data = assoc(inlun, g2p, 59392)
while(not EOF(inlun)) do begin
    ; Sets recd to the association to the file via data
    recd = data(i)
    ; Checks for something
    if(!version.os eq 'OSF') then begin
        byteorder, recd, /LSWAP
    endif
    ; Finds the size of the altitude array
    g = size(recd.ext385)
    alt60 = f1tarr(g(1))
; Creates altitude array of appropriate size.
for j = 0, (g(1)-1) do begin
    alt60(j) = recd.geoalt(j)
endfor

begin
    if ((((chosen_surf - recd.lat)^2)^(.5)) lt range) then
        ; Finds the size of the altitude array
        s = size(alt60)
        for j = 0, (s(1)-1) do begin
            ; Writes result to file.
            if recd.ext385(j) lt 1.0 and recd.ext385(j) gt 0.0 then $
                printf,outlun, recd.date, recd.lon, recd.press(j), recd.ext385(j), recd.exte385(j), $format='(I6, 2e14.5, 2e14.5 ' trop_temp)
        endfor
        ; Saves tropopause Location
        ; Interpolation of the tropopause in terms of mb
        trop_temp = recd.nmcalt(24)/1000.0
        tropopause = interpol(recd.press, recd.geoalt, trop_temp)
        printf,outlun, 000000, recd.lon, tropopause, large_val, $format='(I6, 2e14.5, 2e14.5 ' endif
        i = i + 1
    endwhile
end

36: begin; Ozone Mixing Ratio vs. Potential Temperature & longitude @ lat
; Read the g2p data record
; i = 0
data = assoc(inlun,g2p,59392)
while(not EOF(inlun)) do begin
    ; Sets recd to the association to the file via data
    recd = data(i)
    ; Checks for something
    if(!version.os eq 'OSF') then begin
        byteorder, recd, /LSWAP
    endif
;Finds the size of the altitude array
g = size(recd.ext385)
alt60 =fltarr(g(1))

;Creates altitude array of appropriate size.
for j = 0, (g(1)-1) do begin
    alt60(j) = recd.geoalt(j)
endfor

begin
    If (((chosen_surf - recd.lat)^2)^(.5)) lt range) then
        ;Finds the size of the altitude array
        s = size(alt60)
zeta =fltarr(s(1))
        for j = 0, (s(1)-1) do begin
            ;Calculates the Potential Temperatures
            zeta(j) = recd.temp(j)*(recd.press(j)/le3)^(-0.0375)
            ;Writes result to file.
            if recd.ext385(j) lt 1.0 and recd.ext385(j) gt 0.0 then $
                printf,outlun, recd.date, recd.lon,zeta(j),recd.
                ext385(j), recd.exte385(j), $
                format='(I6, 2f7.1, 2e14.5)'
            endif
            large_val, $
            printf,outlun, 000000, recd.lon,tropopause, large_val, $
            format='(I6, 2f7.1, 2e14.5)'
        endfor
        ;Saves tropopause Location
        ;Interpolation of the tropopause in terms of
        tropopause = interpol(zeta,alt60,trop_temp)
        printf,outlun, 000000, recd.lon,tropopause,large_val, $
        format='(I6, 2f7.1, 2e14.5)'
    endif
    i = i + 1
endwhile
end

37:begin; NO2 Mixing Ratio vs. lat & lon @ Altitude in Km
    ; Read the g2p data record
data = assoc(inlun,g2p,59392)
i = 0
while(not EOF(inlun)) do begin
    ;Sets recd to the association to the file via data
recd = data(i)

;Checks for something
if(!version.os eq 'OSF') then begin
    byteorder,recd,/LSWAP
endif

;Finds the size of the altitude array
s = size(recd.no2mr)
alt60 = fltarr(s(1))

;Creates altitude array of appropriate size.
for j = 0, (s(1)-1) do begin
    alt60(j) = recd.geoalt(j)
endfor

;Interpolation of the specie to the desired altitude
NO2MR_inter = interpol(recd.no2mr, alt60, altitude)

;Writes result to file.
;if((recd.date ge dateini) and (recd.date le datefnl)) then
    printf,outlun, recd.date, recd.lat, recd.lon,
    format='(I6, 2f7.1, e14.5)'
endif

i = i + 1
endwhile
end

38:begin; NO2 Mixing Ratio vs. lat & lon @ pressure

; Read the g2p data record
data = assoc(inlun, g2p, 59392)
i = 0
while(not EOF(inlun)) do begin
    ;Sets recd to the association to the file via data
    recd = data(i)

    ;Checks for something
    if(!version.os eq 'OSF') then begin
        byteorder, recd, /LSWAP
    endif

    ;Finds the size of the altitude array
    s = size(recd.no2mr)
alt60 = fltarr(s(1))
; Creates altitude array of appropriate size.
for j = 0, (s(1)-1) do begin
    alt60(j) = recd.geoalt(j)
endfor

; Interpolation of the specie to the desired pressure
NO2MR_inter = interpol(recd.no2mr, alt60, altitude)
; Writes result to file.
begin
    if((recd.date ge dateini) and (recd.date le datefnl)) then
        printf, outlun, recd.date, recd.lat, recd.lon,
            format='(I6, 2f7.1, e14.5)'
    endif
    i = i + 1
endwhile
end

39: begin; NO2 Mixing Ratio vs. lat & lon @ zeta
; Read the g2p data record
i = 0
data = assoc(inlun, g2p, 59392)
while(not EOF(inlun)) do begin
    ; Sets recd to the association to the file via data
    recd = data(i)
    ; Checks for something
    if(!version.os eq 'OSF') then begin
        byteorder, recd, /LSWAP
    endif
    ; Finds the size of the altitude array
    s = size(recd.no2mr)
    alt60 = fltarr(s(1))
    ; Creates altitude array of appropriate size.
    for j = 0, (s(1)-1) do begin
        alt60(j) = recd.geoalt(j)
    endfor
; Finds the size of the altitude array
s = size(alt60)
zeta = fltarr(s(1))

; Calculates the Potential Temperatures
for j = 0, (s(1)-1) do begin
    zeta(j) = recd.temp(j)*((recd.press(j)/le3)^(-.286))
endfor

; Interpolation of the specie to the desired Potential
NO2MR_inter = interpol(recd.no2mr, zeta, altitude)

; Writes result to file.
;if((recd.date ge dateini) and (recd.date le datefnl)) then
    printf, outlun, recd.date, recd.lat, recd.lon,
    NO2MR_inter, $
    format='(I6, 2f7.1, e14.5)'
; endif
    i = i + 1
endwhile

40: begin; NO2 Mixing Ratio Altitude in Km & lat @ lon

; Read the g2p data record
i = 0
data = assoc(inlun, g2p, 59392)
while(not EOF(inlun)) do begin
    ; Sets recd to the association to the file via data
    recd = data(i)

    ; Checks for something
    if(!version.os eq 'OSF') then begin
        byteorder, recd, /LSWAP
    endif

    ; Finds the size of the altitude array
    s = size(recd.no2mr)
    alt60 = fltarr(s(1))

    ; Creates altitude array of appropriate size.
    for j = 0, (s(1)-1) do begin
        alt60(j) = recd.geoalt(j)
    endfor
begin

If (((chosen_surf - recd.lon)^2)^(.5)) le range) then

;Finds the size of the altitude array
s = size(alt60)

for j = 0, (s(1)-1) do begin

;Writes result to file.
if recd.no2mr(j) lt 1.0 and recd.no2mr(j) gt 0.0 then $
printf,outlun, recd.date, recd.lat,alt60(j), recd.no2mr(j), recd.no2mre(j),$
format='(I6, 2f7.1, 2e14.5)'
endfor

;Saves tropopause Location
tropopause = recd.nmcalt(24)/1000
printf,outlun, 000000, recd.lat,tropopause,large_val,$
format='(I6, 2f7.1, 2e14.5)'

endif

i = i + 1
endwhile

end

41:begin; NO2 Mixing Ratio Altitude in mb & lat @lon

; Read the g2p data record

; i = 0
data = assoc(inlun,g2p,59392)

while(not EOF(inlun)) do begin

;Sets recd to the association to the file via data
recd = data(i)

;Checks for something
if(!version.os eq 'OSF') then begin
byteorder,recd,/LSWAP
endif

;Finds the size of the altitude array
s = size(recd.no2mr)
alt60 =fltarr(s(1))

;Creates altitude array of appropriate size.
for j = 0, (s(1)-1) do begin

alt60(j) = recd.geoalt(j)
endfor
If (((chosen_surf - recd.lon)^2)^(.5)) le range) then

begin

;Finds the size of the altitude array
s = size(alt60)

for j = 0, (s(1)-1) do begin

;Writes result to file.
if recd.no2mr(j) lt 1.0 and recd.no2mr(j) gt 0.

printf,outlun, recd.date, recd.lat, recd.press(j)
, recd.no2mr(j), recd.no2mre(j), $ format='(I6, 2e14.5, 2e14.5)'

endfor

;Saves tropopause Location
;Interpolation of the tropopause in terms of mb
trop_temp = recd.nmcalt(24)/1000.0
tropopause = interpol(recd.press, recd.geoalt, trop_temp)

printf,outlun, 000000, recd.lat, tropopause, large_val, $ format='(I6, 2e14.5, 2e14.5)'

endif

i = i + 1

endwhile

end

42:begin; NO2 Mixing Ratio Potential Temperature & lat @ lon

; Read the g2p data record
i = 0
data = assoc(inlun, g2p, 59392)

while(not EOF(inlun)) do begin

;Sets recd to the association to the file via data
recd = data(i)

;Checks for something
if(!version.os eq 'OSF') then begin

byteorder, recd, /LSWAP

endif

;Finds the size of the altitude array
g = size(recd.no2mr)
alt60 = fltarr(g(1))
; Creates altitude array of appropriate size.
for j = 0, (g(1)-1) do begin
    alt60(j) = recd.geoalt(j)
endfor

If (((chosen_surf - recd.lon)^2)^(.5)) lt range) then
begin

; Finds the size of the altitude array
s = size(alt60)
zeta = fltarr(s(1))
for j = 0, (s(1)-1) do begin

; Calculates the Potential Temperatures
zeta[j] = recd.temp(j)*((recd.press(j)/le3)^(-.286))

; Writes result to file.
if recd.no2mr(j) lt 1.0 and recd.no2mr(j) gt 0.
    printf, outlun, recd.date, recd.lat, zeta(j),
    recd.no2mr(j), recd.no2mre(j), $
    format='(I6, 2f7.1, 2e14.5)'
endfor

; Saves tropopause Location
; Interpolation of the tropopause in terms of Potential Temperature
trop_temp = recd.nmcalt(24)/1000.0
tropopause = interpol(zeta, alt60, trop_temp)
printf, outlun, 000000, recd.lat, tropopause, large_val,
format='(I6, 2f7.1, 2e14.5)'
endif

i = i + 1
endwhile

end

43: begin; NO2 Mixing Ratio vs. Altitude in Km & longitude @ latitude

; Read the g2p data record
; i = 0
data = assoc(inlun,g2p,59392)
while(not EOF(inlun)) do begin

; Sets recd to the association to the file via data
recc = data(i)
;Checks for something
if(!version.os eq 'OSF') then begin
  byteorder, recd, /LSWAP
endif

;Finds the size of the altitude array
g = size(recd.no2mr)
alt60 = fltarr(g(1))

;Creates altitude array of appropriate size.
for j = 0, (g(1)-1) do begin
  alt60(j) = recd.geoalt(j)
endfor

begin
  If ((((chosen_surf - recd.lat)^2)^(.5)) lt range) then

    ;Finds the size of the altitude array
    s = size(alt60)
    for j = 0, (s(1)-1) do begin
      ;Writes result to file.
      if recd.no2mr(j) lt 1.0 and recd.no2mr(j) gt 0.
       .printf(out lun, recd.date, recd.lon, recd. geoalt(j), recd.no2mr(j), recd.no2mre(j),
        format='(I6, 2f7.1, 2e14.5)'
      endif
    endif

    ;Saves tropopause Location
    tropopause = recd.nmcalt(24)/1000
    printf(out lun, 000000, recd.lon, tropopause, large_val, $
    format='(I6, 2f7.1, 2e14.5)'
  endif

  i = i + 1
endwhile
end

44:begin; NO2 Mixing Ratio vs. Altitude in mb & longitude @ latitude

; Read the g2p data record
; i = 0
data = assoc(inlun, g2p, 59392)
while(not EOF(inlun)) do begin
  ;Sets recd to the association to the file via data
  recd = data(i)
...
Checks for something
if(!version.os eq 'OSF') then begin
    byteorder, recd, /LSWAP
endif

;Finds the size of the altitude array
alt60 = fltarr(size(recd.no2mr(1))

;Creates altitude array of appropriate size.
for j = 0, (size(alt60)-1) do begin
    alt60(j) = recd.geoalt(j)
endfor

begin
    If (((chosen_surf - recd.lat)^2)^(.5)) lt range) then
        s = size(alt60)
    for j = 0, (size(alt60)-1) do begin
        ; writes result to file.
        ; If recd.no2mr(j) lt 1.0 and recd.no2mr(j) gt 0.
        printf, outlun, recd.date, recd.lon, recd.press(j), recd.no2mr(j), recd.no2mre(j), format='(I6, 2e14.5, 2e14.5)' $
    endif

    ; saves tropopause location
    trop_temp = recd.nmcalt(24)/1000.0
    tropopause = interpol(recd.press, recd.geoalt, trop_temp)
    printf, outlun, 000000, recd.lon, tropopause, large_val, format='(I6, 2e14.5, 2e14.5)' $
end

i = i + 1
endwhile
end

45: begin; NO2 mixing ratio vs. potential temperature & longitude @ lat

; Read the g2p data record
i = 0
data = assoc(inlun, g2p, 59392)
while(not EOF(inlun)) do begin

;Sets recd to the association to the file via data
recd = data(i)

;Checks for something
if(!version.os eq 'OSF') then begin
    byteorder, recd, /LSWAP
endif

;Finds the size of the altitude array
g = size(recd.no2mr)
alt60 = fltarr(g(1))

;Creates altitude array of appropriate size.
for j = 0, (g(1)-1) do begin
    alt60(j) = recd.geoalt(j)
endfor

begin

If (((chosen_surf - recd.lat)^2)^(.5)) lt range then

;Finds the size of the altitude array
s = size(alt60)
zeta = fltarr(s(1))
for j = 0, (s(1)-1) do begin
    ;Calculates the Potential Temperatures
    zeta(j) = recd.temp(j)*((recd.press(j)/le3) ^(-.286))
endfor

;Writes result to file.
if recd.no2mr(j) lt 1.0 and recd.no2mr(j) gt 0.
no2mr(j), recd.no2mre(j),

printf, outlun, recd.date, recd.lon, zeta(j), recd.
format=('I6, 2f7.1, 2e14.5')
endfor

;Saves tropopause Location
;Interpolation of the tropopause in terms of

Potential Temperature

trop_temp = recd.nmcalt(24)/1000.0
tropopause = interpol(zeta, alt60, trop_temp)

printf, outlun, 000000, recd.lon, tropopause, large_val,
format=('I6, 2f7.1, 2e14.5')
endif

i = i + 1
endwhile
end

64:begin; Ozone Mixing Ratio vs. lat & lon @ Altitude in Km
    ; Read the g2p data record
    data = assoc(inlun,g2p,59392)
    i = 0
    while(not EOF(inlun)) do begin
        ;Sets recd to the association to the file via data
        recd = data(i)
        ;Checks for something
        if(!version.os eq 'OSF') then begin
            byteorder,recd,/LSWAP
        endif
        ;Interpolation of the specie to the desired altitude
        o3mr_inter = interpol(recd.o3mr,recd.geoalt, altitude)
        ;Writes result to file.
        ;if((recd.date ge dateini) and (reed.date le datefnl)) then
        printf,outlun, recd.date, recd.lat,recd.lon,
        o3mr_inter, $
        format='(I6, 2f7.1, e14.5)'
        ;endif
        i = i + 1
    endwhile
end

65:begin; Ozone Mixing Ratio vs. lat & lon @ pressure
    ; Read the g2p data record
    data = assoc(inlun,g2p,59392)
    i = 0
    while(not EOF(inlun)) do begin
        ;Sets recd to the association to the file via data
        recd = data(i)
        ;Checks for something
        if(!version.os eq 'OSF') then begin
            byteorder,recd,/LSWAP
        endif
        ;Interpolation of the specie to the desired pressure
        o3mr_inter = interpol(recd.o3mr,recd.press, altitude)
; Writes result to file.
begin
if((recd.date ge dateini) and (recd.date le datefnl)) then
    printf(outlun, recd.date, recd.lat, recd.lon,
    format='(I6, 2f7.1, e14.5)'
    endif
i = i + 1
endwhile
end

Begin; Ozone Mixing Ratio vs. lat & lon @ zeta
;
Read the g2p data record
;
i = 0
data = assoc(inlun, g2p, 59392)
while(not EOF(inlun)) do begin
;
Sets recd to the association to the file via data
recd = data(i)
;
Checks for something
if(!version.os eq 'OSF') then begin
    byteorder, recd, /LSWAP
endif
;
Finds the size of the altitude array
s = size(recd.geoalt)
zeta = fltarr(s(1))
;
Calculates the Potential Temperatures
for j = 0, (s(1)-1) do begin
    zeta(j) = recd.temp(j)*((recd.press(j)/le3)^(-.286))
endfor
;
Temperature
o3mr_inter = interpol(recd.o3mr, zeta, altitude)
;
Interpolation of the specie to the desired Potential

begin

o3mr_inter, $
;
Writes result to file.
if((recd.date ge dateini) and (recd.date le datefnl)) then
    printf(outlun, recd.date, recd.lat, recd.lon,
    format='(I6, 2f7.1, e14.5)'
    endif

i = i + 1 
endwhile 
end 

67: begin; Ozone Mixing Ratio vs. Altitude in Km & lat @ lon 
; Read the g2p data record 
; i = 0 
data = assoc(inlun,g2p,59392) 
while(not EOF(inlun)) do begin 
 ;Sets recd to the association to the file via data 
 recd = data(i) 
 ;Checks for something 
if(!version.os eq 'OSF') then begin 
   byteorder, recd, /LSWAP 
end 
If (((chosen_surf - recd.lon)^2)^(.5)) le range) then begin 
 ;Finds the size of the altitude array 
s = size(recd.geoalt) 
for j = 0, (s(1)-1) do begin 
 ;Writes result to file. 
 printf, outlun, recd.date, recd.lat, recd. 
 geoalt(j), recd.o3mr(j), recd.o3mre(j), $ 
   format='(I6, 2f7.1, 2e14.5)' 
endfor 
 ;Saves tropopause Location 
tropopause = recd.nmcalt(24)/1000 
printf, outlun, 000000, recd.lat, tropopause, large_val, 
large_val, $ 
   format='(I6, 2f7.1, 2e14.5)' 
end 
i = i + 1 
endwhile 
end 

68: begin; Ozone Mixing Ratio vs. Altitude in mb & lat @ lon 
; Read the g2p data record 
; i = 0
data = assoc(inlun,g2p,59392)
while(not EOF(inlun)) do begin
    ;Sets recd to the association to the file via data
    recd = data(i)
    ;Checks for something
    if(!version.os eq 'OSF') then begin
        byteorder,recd,/LSWAP
        endif
    ;Finds the size of the altitude array
    s = size(recd.o3mr)
    alt70 = fltarr(s(1))
    ;Creates altitude array of appropriate size.
    for j = 0, (s(1)-l) do begin
        alt70(j) = recd.geoalt(j)
    endfor
    endif
    begin
        If (((chosen_surf recd.lon)^2)^(.5)) le range) then

        ;Finds the size of the altitude array
        s = size(alt70)
        for j = 0, (s(1)-l) do begin
            ;Writes result to file.
            if recd.o3mr(j) lt 1.0 and recd.o3mr(j) gt 0.0 then $
            printf,outlun, recd.date, recd.lat,recd.press(j)
            ,recd.o3mr(j), recd.o3mre(j), $
            format='(I6, 2e14.5, 2e14.5)'
            endif
            ;Saves tropopause Location
            ;Interpolation of the tropopause in terms of mb
            trop_temp = recd.nmcalt(24)/1000.0
            tropopause = interpol(recd.press,recd.geoalt,
            trop_temp)
            printf,outlun, 000000, recd.lat,tropopause,large_val,
            format='(I6, 2e14.5, 2e14.5)'
        endfor
        i = i + 1
    endwhile
end
69:begin; Ozone Mixing Ratio vs. Potential Temperature & lat @ lon

; Read the g2p data record
;
i = 0
data = assoc(inlun,g2p,59392)

while(not EOF(inlun)) do begin

;Sets recd to the association to the file via data
recd = data(i)

;Checks for something
if(!version.os eq 'OSF') then begin
	byteorder,recd,/LSWAP
endif

begin

If (((chosen_surf - recd.lon)^2)^(.5)) lt range) then

;Finds the size of the altitude array
s = size(recd.geoalt)
zeta = fltarr(s(1))

for j = 0, (s(1)-1) do begin

;Calculates the Potential Temperatures
zeta(j) = recd.temp(j)*((recd.press(j)/le3)^(-.286))

;Writes result to file.
printf,outlun, recd.date, recd.lat, zeta(j), recd.
o3mr(j), recd.o3mre(j), $
format='(I6, 2f7.1, 2e14.5)'
endfor

;Saves tropopause Location
;Interpolation of the tropopause in terms of
Potential Temperature

trop_temp = recd.nmcalt(24)/1000.0

tropopause = interpol(zeta,recd.geoalt,trop_temp)

printf,outlun, 00000, 'recd.lat,tropopause,large_val,' large_val, $
format='(I6, 2f7.1, 2e14.5)'

endif

i = i + 1

endwhile
end

70:begin; Ozone Mixing Ratio vs. Altitude in Km & longitude @ latitude

; Read the g2p data record
; i = 0
data = assoc(inlun,g2p,59392)

while(not EOF(inlun)) do begin

;Sets recd to the association to the file via data
recd = data(i)

;Checks for something
if(!version.os eq 'OSF') then begin
byteorder,recd,/LSWAP
endf

begin

If (((chosen_surf - recd.lat)^2)^(.5)) lt range) then

;Finds the size of the altitude array
s = size(recd.geoalt)

for j = 0, (s(1)-1) do begin

;Writes result to file.
printf,outlun, recd.date, recd.lon, recd.
geoalt(j),recd.o3mr(j), recd.o3mre(j), $
format='(I6, 2f7.1, 2e14.5)' 
endfor

;Saves tropopause Location
 tropopause = recd.nmcalt(24)/1000
printf,outlun, 000000, recd.lon,tropopause,large_val, $
format='(I6, 2f7.1, 2e14.5)' 
endf

i = i + 1

endwhile

e

71:begin; Ozone Mixing Ratio vs. Altitude in mb & longitude @ latitude

; Read the g2p data record
;
i = 0
data = assoc(inlun,g2p,59392)

while(not EOF(inlun)) do begin

;Sets recd to the association to the file via data
recd = data(i)

;Checks for something
if(!version.os eq 'OSF') then begin

byteorder,recd,/LSWAP
begin

If (((chosen_surf - recd.lat)^2)^(.5)) lt range) then

;Finds the size of the altitude array
s = size(recd.geoalt)

for j = 0, (s(1)-1) do begin

;Writes result to file.
if recd.o3mr(j) lt 1.0 and recd.o3mr(j) gt 0.0

then $

printf, oulun, recd.date, recd.lon, recd.press(j), recd.o3mr(j), recd.o3mre(j),
format='(I6, 2e14.5, 2e14.5)'

endfor

;Saves tropopause Location
;Interpolation of the tropopause in terms of mb

trop_temp = recd.nmcalt(24)/1000.0

tropopause = interpol(recd.press, recd.geoalt, trop_temp)

printf, oulun, 000000, recd.lon, tropopause, large_val,
format='(I6, 2e14.5, 2e14.5)'

endif

i = i + 1

endwhile

end

72:begin; Ozone Mixing Ratio vs. Potential Temperature & longitude @ lat

; Read the g2p data record
;
i = 0
data = assoc(inlun, g2p, 59392)

while(not EOF(inlun)) do begin

;Sets recd to the association to the file via data
recd = data(i)

;Checks for something
if(!version.os eq 'OSF') then begin

byteorder, recd, /LSWAP

endif

begin

If (((chosen_surf - recd.lat)^2)^(.5)) lt range) then

;Finds the size of the altitude array
s = size(recd.geoalt)
zeta = fltarr(s(1))

for j = 0, (s(1)-1) do begin
  ;Calculates the Potential Temperatures
  zeta(j) = recd.temp(j)*((recd.press(j)/le3)^(-.
  
  ;Writes result to file.
  printf(outlun, recd.date, recd.lon, zeta(j), recd.
  o3mr(j), recd.o3mre(j), $
  format='(I6, 2f7.1, 2e14.5)'
endfor

;Saves tropopause Location
;

Potential Temperature

  trop_temp = recd.nmcal(24)/1000.0
  tropopause = interpol(zeta, recd.geoalt, trop_temp)

  printf(outlun, 000000, recd.lon, tropopause, large_val,
  format='(I6, 2f7.1, 2e14.5)'
endif

i = i + 1
endwhile
end

;---

82:begin; Water Vapor Mixing Ratio vs. lat & lon @ Altitude in Km

; Read the g2p data record

data = assoc(inlun, g2p, 59392)

i = 0
while(not EOF(inlun)) do begin

  ;Sets recd to the association to the file via data
  recd = data(i)

  ;Checks for something
  if(!version.os eq 'OSF') then begin

    byteorder, recd, /LSWAP

  endif

  ;Interpolation of the specie to the desired altitude
begin

H2Omr_inter = interpol(recd.H2Omr, recd.geoalt, altitude)

; Writes result to file.
; if((recd.date ge dateini) and (recd.date le datefnl)) then
begin

printf,outlun, recd.date, recd.lat, recd.lon,
format='(I6, 2f7.1, e14.5)'

; endif
i = i + 1
endwhile
end

83: begin; Water Vapor Ratio vs. lat & lon @ pressure

; Read the g2p data record

data = assoc(inlun,g2p,59392)
i = 0
while(not EOF(inlun)) do begin

; Sets recd to the association to the file via data
recd = data(i)

; Checks for something
if(!version.os eq 'OSF') then begin

byteorder, recd,/LSWAP
endif

; Interpolation of the specie to the desired pressure
H2Omr_inter = interpol(recd.H2Omr, recd.press, altitude)

; Writes result to file.
; if((recd.date ge dateini) and (recd.date le datefnl)) then
begin

printf, outlun, recd.date, recd.lat, recd.lon,
format='(I6, 2f7.1, e14.5)'

; endif
i = i + 1
endwhile
end

84: begin; Water Vapor Mixing Ratio vs. lat & lon @ zeta

; Read the g2p data record
;
i = 0
data = assoc(inlun,g2p,59392)

while(not EOF(inlun)) do begin

;Sets recd to the association to the file via data
recd = data(i)

;Checks for something
if(!version.os eq 'OSF') then begin
    byteorder, recd, /LSWAP
endif

;s = size(recd. H2Omr)
zeta = fltarr(s(1))

;zeta(j) = recd.temp(j)*((recd.press(j)/le3)^(-.286))
endfor

H2Omr_inter = interpol(recd.H2Omr, zeta, altitude)

begin
    printf, outlun, recd. date, recd.lat, recd.lon,
H2Omr_inter, $
    format='(I6, 2f7.1, e14.5)'
end
i = i + 1
endwhile

end

85:begin; Water Vapor Ratio vs. Altitude in Km & lat @ lon

; Read the g2p data record
;
i = 0
data = assoc(inlun, g2p, 59392)

while(not EOF(inlun)) do begin

;Sets recd to the association to the file via data
recd = data(i)

;Checks for something
if(!version.os eq 'OSF') then begin
    byteorder, recd, /LSWAP
endif
begin

If (((chosen_surf - recd.lon)^2)^.5) le range) then
begin

;Finds the size of the altitude array
s = size(recd.H2Omr)
for j = 0, (s(1)-1) do begin

; writes result to file.
printf,outlun, recd.date, recd.lat, recd.geoalt(j), recd.H2Omr(j), recd.H2Omre(j), $
format='(I6, 2f7.1, 2e14.5)'
endfor

;Saves tropopause Location
 tropopause = recd.nmcalt(24)/1000
printf,outlun, recd.date, recd.lat, tropopause,
large_val, large_val, $
format='(I6, 2f7.1, 2e14.5)'
end
i = i + 1
endwhile
end

86:begin; Water Vapor Ratio vs. Altitude in mb & lat @ lon

; Read the g2p data record
;
i = 0
data = assoc(inlun, g2p, 59392)
while(not EOF(inlun)) do begin

;Sets recd to the association to the file via data
recd = data(i)

;Checks for something
if(!version.os eq 'OSF') then begin
byteorder, recd, /LSWAP
endif
If (((chosen_surf - recd.lon)^2)^.5) le range) then
begin

;Finds the size of the altitude array
s = size(recd.H2Omr)
for j = 0, (s(1)-1) do begin

; Writes result to file.
printf(outlun, recd.date, recd.lat, recd.press(j),
    recd.H20mr(j), recd.H20mre(j),
    format='(I6, f7.1, f7.3, 2e14.5)'
endfor

; Saves tropopause Location
; Interpolation of the tropopause in terms of mb

tropopause = interpol(recd.press, recd.geoalt, trop_temp)

end

87: begin; Water Vapor Ratio vs. Potential Temperature & lat @ lon
Print, 'OK'
; Read the g2p data record
; i = 0
data = assoc(inlun, g2p, 59392)
while(not EOF(inlun)) do begin
    ; Sets recd to the association to the file via data. Is
    ; going to read one record.
    recd = data(i)
    ; Checks for something
    if(!version.os eq 'OSF') then begin
        byteorder, recd, /LSWAP
    endif
    begin
        If (((chosen_surf - recd.lon)^2)^(.5)) lt range) then

        ;; Finds the size of the altitude array
        s = size(recd.H20mr)
        zeta = fltarr(s(1))
        alt_fixed = fltarr(s(1))
        for j = 0, (s(1)-1) do begin
            ;; Calculates the Potential Temperatures
            zeta(j) = recd.temp(j)*((recd.press(j)/le3)^(-.286))
            alt_fixed(j) = recd.geoalt(j)
H2Omre(j), recd.H2Omre(j), $ 
printf,outlun, recd.date, recd.lat,zeta(j),recd. 
format='(I6, 2f7.1, 2e14.5)' 
endfor 
;Saves tropopause Location 
;Interpolation of the tropopause in terms of 
Potential Temperature 
trop_temp = recd.nmcalt(24)/1000.0 
tropopause = interpol(zeta,alt_fixed, trop_temp) 
large_val,large_val, $ 
printf,outlun, recd.date, recd.lat,tropopause, 
format='(I6, 2f7.1, 2e14.5)' 
endif 
i = i + 1 ;RECORD (profile) counter 
endwhile 
end 

88:begin; Water Vapor Mixing Ratio vs. Altitude in Km & longitude @ latitude 

; Read the g2p data record 
; i = 0 
data = assoc(inlun,g2p,59392) 
while(not EOF(inlun)) do begin 
;Sets recd to the association to the file via data 
recd = data(i) 
;Checks for something 
if(!version.os eq 'OSF') then begin 
byteorder,recd,/LSWAP 
endif 
If (((chosen_surf - recd.lat)\^2)^(.5)) lt range) then begin 
;Finds the size of the altitude array 
s = size(recd.H2Omr) 
for j = 0, (s(1)-1) do begin 
;Writes result to file. 
printf,outlun, recd.date, recd.lon,recd. 
geoalt(j),recd.H2Omr(j), recd.H2Omre(j), $ 
format='(I6, 2f7.1, 2e14.5)' 
endfor
large_val, large_val, $
$
; Saves tropopause Location
tropopause = recd.nmcalt(24)/1000
printf.outlun, recd.date, recd.lon, tropopause,
format='{I6, 2f7.1, 2e14.5}'}

endif

i = i + 1

endwhile

e

89: begin; Water Vapor Mixing Ratio vs. Altitude in mb & longitude @ latitude

; Read the g2p data record
;
i = 0
data = assoc(inlun, g2p, 59392)
while(not EOF(inlun)) do begin

; Sets recd to the association to the file via data
crd = data(i)

; Checks for something
if(!version.os eq 'OSF') then begin
byteorder, recd, /LSWAP
endif

begin

If (((chosen_surf - recd.lat)^2)^(.5)) lt range) then
begin

; Finds the size of the altitude array
s = size(recd.H2Omr)
for j = 0, (s(1)-1) do begin

; Writes result to file.
printf.outlun, recd.date, recd.lon, recd.press(j), recd.H2Omr(j), recd.H2Omre(j), $
format='{I6, f7.1, f7.3, 2e14.5}'}

endfor

; Saves tropopause Location
; Interpolation of the tropopause in terms of mb
trop_temp = recd.nmcalt(24)/1000.0
tropopause = interpol(recd.press, recd.geoalt,
large_val, large_val, $
format='{I6, 2f7.1, 2e14.5}'}

endif
i = i + 1

endwhile

end

90:begin; Water Vapor Mixing Ratio vs. Potential Temperature & longitude @ lat

; Read the g2p data record
;
i = 0
data = assoc(inlun,g2p,59392)

while(not EOF(inlun)) do begin

;Sets recd to the association to the file via data
recd = data(i)

;Checks for something
if(!version.os eq 'OSF') then begin
byteorder, recd, /LSWAP
endif
begin
If (((chosen_surf - recd.lat)^2)^(.5)) lt range) then
begin

;Finds the size of the altitude array
s = size(recd.H2Omr)
zeta = fltarr(s(1))
alt_fixed = fltarr(s(1))

for j = 0, (s(1)-1) do begin

;Calculates the Potential Temperatures
zeta(j) = recd.temp(j)*((recd.press(j)/1e3)^(-"alt_fixed(j) = recd.geoalt(j)

;Writes result to file.
printf, outlun, recd.date, recd.lon, zeta(j), recd.H2Omr(j), recd.H2Omre(j), $
format=’(I6, 2f7.1, 2e14.5)’
endfor

;Saves tropopause Location
;Interpolation of the tropopause in terms of Potential Temperature
trop_temp = recd.nmcalt(24)/1000.0
tropopause = interpol(zeta, alt_fixed, trop_temp)
printf, outlun, recd.date, recd.lon, tropopause,
large_val, large_val, $
format=’(I6, 2f7.1, 2e14.5)’
endif
i = i + 1
endwhile
  end
endcase
free_lun, inlun
endfor
free_lun, outlun
return
end
pro plot_points, outfile, surf_type, levels, x_axis_max, x_axis_min, y_axis_max, y_axis_min

;Setting graphics
device, pseudo=8, retain=2

;Setting Variables
If n_elements(levels) eq 0 then levels= findgen(11)
If n_elements(x_axis_max) eq 0 then x_axis_max = 0
If n_elements(x_axis_min) eq 0 then x_axis_min = 0
If n_elements(y_axis_min) eq 0 then y_axis_min = 0
If n_elements(y_axis_max) eq 0 then y_axis_max = 0

norm_factor = 1e1
unit = ''
y_unit = 1
surf_type = 1

;Background color for plot.
!p.background = 0

;Setting Symbol
!psym=0

;******************************************************************************
;If you want to run the program alone uncomment the following commands,******
;******************************************************************************

;outfile = dialog_pickfile()
;window, /free
;******************************************************************************

;Open file
openr, lun, outfile, /get_lun

;Reading header
header = strarr(21)
readf, lun, header, format='(a36)'

;Reading Normalization Factor, Specie Unit, and Surface Type
reads, header(7), unit
reads, header(10), y_unit
reads, header(13), norm_factor
reads, header(16), surf_type
;Reading data

If (surf_type eq 1) then begin
  datacolumn = fltarr(4, 100000)
  temp_peak = fltarr(4)
  i = 0
  while (not eof(lun)) do begin
    readf, lun, temp_peak
    datacolumn[*, i] = temp_peak
    i = i + 1
  endwhile
  datacolumn = datacolumn[*, 0:i-1]
  free_lun, lun

;Setting arrays
  date = datacolumn[0,*]
  lat = datacolumn[1,*]
  lon = datacolumn[2,*]
  data = datacolumn[3,*]*norm_factor
endif else begin
  datacolumn = fltarr(5, 80000)
  temp_peak = fltarr(5)
  i = 0
  while (not eof(lun)) do begin
    readf, lun, temp_peak
    datacolumn[*, i] = temp_peak
    i = i + 1
  endwhile
  datacolumn = datacolumn[*, 0:i-1]
  free_lun, lun

;Setting arrays
  date = datacolumn[0,*]
  lat = datacolumn[1,*]
  lon = datacolumn[2,*]
  data = datacolumn[3,*]*norm_factor
  dataerr = datacolumn[4,*]*norm_factor
endelse

LonMax = MAX(lon)
LonMin = Min(lon)
LatMax = MAX(lat)
LatMin = Min(lat)

;Sets the axes and the plot parameters for the appropriate surface chosen
case surf_type of
  1: begin
x = lon
y = lat
;Finds the axes range of the data
xMax = MAX(x)
xMin = Min(x)
yMax = MAX(y)
yMin = Min(y)
If x_axis_max eq 0 then x_axis_max = xmax
If x_axis_min eq 0 then x_axis_min = xmin
If y_axis_min eq 0 then y_axis_min = ymin
If y_axis_max eq 0 then y_axis_max = ymax

MAP_SET, /CONTINENTS, /MERCATOR, limit=[y_axis_min, x_axis_min, y_axis_max, x_axis_max], position=[0.01, 0.2, 0.99, 0.99], color=255
end

2: begin ;Specie vs. Altitude and Latitude

x = reform(lat)
y = reform(lon)
;Finds the axes range of the data
xMax = MAX(x)
xMin = Min(x)
yMax = MAX(y)
yMin = Min(y)
If x_axis_max eq 0 then x_axis_max = xmax
If x_axis_min eq 0 then x_axis_min = xmin
If y_axis_min eq 0 then y_axis_min = ymin
If y_axis_max eq 0 then y_axis_max = ymax

case y_unit of
2: plot, x, y, xrange=[x_axis_min, x_axis_max], yrange=[y_axis_min, y_axis_max], position=[0.1, 0.3, 0.97, 0.99], xtitle='Latitude', ytitle='Altitude', color=255, /nodata
3: plot, x, y, xrange=[x_axis_min, x_axis_max], yrange=[y_axis_max, y_axis_min], position=[0.1, 0.3, 0.97, 0.99], xtitle='Latitude', ytitle='Altitude', color=255, /ylog, /nodata
4: plot, x, y, xrange=[x_axis_min, x_axis_max], yrange=[y_axis_min, y_axis_max], position=[0.1, 0.3, 0.97, 0.99], xtitle='Latitude', ytitle='Altitude', color=255, /nodata
endcase
end

3: begin
x = lat
y = lon
;Finds the axes range of the data
xMax = MAX(x)
xMin = Min(x)
yMax = MAX(y)
yMin = Min(y)
If x_axis_max eq 0 then x_axis_max = xmax
If x_axis_min eq 0 then x_axis_min = xmin
If y_axis_min eq 0 then y_axis_min = ymin
If y_axis_max eq 0 then y_axis_max = ymax

case y_unit of
   2: plot, x, y, xrange=[x_axis_min,x_axis_max], yrange=[y_axis_min,y_axis_max], position=[0.1, 0.3, 0.97, 0.99], xtitle='Longitude', ytitle='Altitude', color=255, /nodata
   3: plot, x, y, xrange=[x_axis_min,x_axis_max], yrange=[y_axis_max,y_axis_min], position=[0.1, 0.3, 0.97, 0.99], xtitle='Longitude', ytitle='Altitude', color=255, /ylog, /nodata
   4: plot, x, y, xrange=[x_axis_min,x_axis_max], yrange=[y_axis_min,y_axis_max], position=[0.1, 0.3, 0.97, 0.99], xtitle='Longitude', ytitle='Altitude', color=255, /nodata
endcase
endcase

val=levels
index0=where((data ge levels(0)) and (data lt levels(1)))
index1=where((data ge levels(1)) and (data lt levels(2)))
index2=where((data ge levels(2)) and (data lt levels(3)))
index3=where((data ge levels(3)) and (data lt levels(4)))
index4=where((data ge levels(4)) and (data lt levels(5)))
index5=where((data ge levels(5)) and (data lt levels(6)))
index6=where((data ge levels(6)) and (data lt levels(7)))
index7=where((data ge levels(7)) and (data lt levels(8)))
index8=where((data ge levels(8)) and (data lt levels(9)))
index9=where(data ge levels(9))

;Lets Plot
!psym=4
xx = [0.0, 0.5, -0.8, 0.8, -0.5,0.0]
yy = [1.0, -0.8, 0.3, 0.3, -0.8,1.0]
usersym, xx, yy, /fill

!color=210
if index9(0) ne -1 then oplot x(index9),y(index9), psym=8, symsize=2.0
!color=187
if index8(0) ne -1 then oplot x(index8),y(index8), psym=8, symsize=2.0
!color=163
if index7(0) ne -1 then oplot x(index7),y(index7), psym=8, symsize=2.0
!color=140
if index6(0) ne -1 then oplot x(index6),y(index6), psym=8, symsize=2.0
!color=117
if index5(0) ne -1 then oplot x(index5),y(index5), psym=8, symsize=2.0
!color=93
if index4(0) ne -1 then oplot x(index4),y(index4), psym=8, symsize=2.0
!color=70
if index3(0) ne -1 then oplot x(index3),y(index3), psym=8, symsize=2.0
!color=47
if index2(0) ne -i then oplot, x(index2), y(index2), psym=8, symsize=2.0
!color=23
if index1(0) ne -i then oplot, x(index1), y(index1), psym=8, symsize=2.0
!color=10
if index0(0) ne -i then oplot, x(index0), y(index0), psym=8, symsize=2.0
!psym=0

; Plots the tropopause

    index_trop = where(date eq 000000)
    If (surf_type ne 1) then oplot, x(index_trop), y(index_trop), psym = 6, symsize=.5, color=255

; Set up the map projection.

; If (surf_type eq 1) then MAP_SET, /CONTINENTS, /MERCATOR, /grid, /label, /noerase, color=255

colorbar_position = [0.02, 0.06, 0.98, 0.11]
call_procedure, 'COLORBAR', divisions=9, Position=colorbar_position, Max=levels[10], Min=levels[0], $ Format='(f6.2)', Title=header(1) + unit

return
end
**
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; Unauthorized reproduction prohibited.
+ NAME:
  ReadSage.pro
;
; RESTRICTIONS:
; Works with SAGE II data, g2p v5.931
;
******************************************************************************
s.............................................................................
pro rescale, ev
parent = ev.top
x_axis_max = state.x_axis_max
x_axis_min = state.x_axis_min
y_axis_max = state.y_axis_max
y_axis_min = state.y_axis_min

call_procedure, 'get_scale_info', x_axis_max, x_axis_min, y_axis_max,
y_axis_min, cancel=cancel, parent=parent

;Sets window to the appropriate draw widget
wset, winid

call_procedure, 'plot_points', state.outfile, state.surf_type, state.levels,
x_axis_max, x_axis_min, y_axis_max, y_axis_min

;Sets window to the appropriate draw widget
wset, winid

;Grids the data and draws a cellfilled contour.
call_procedure, 'Grid_Smooth_Map', state.outfile, state.lat_step, state.
on_step, state.smooth_pass, state.levels, x_axis_max, x_axis_min, y_axis_max,
y_axis_min

state.x_axis_max = x_axis_max
state.x_axis_min = x_axis_min
state.y_axis_max = y_axis_max
state.y_axis_min = y_axis_min

wset, winid

return

return
end

---

pro regrid, ev

; Gets the passing variables through uvalue structure STATE.
widget_control, ev.top, get_uvalue=state

; Sets the local variables to be passed.
parent = ev.top
specie_type = state.specie_type
surf_type = state.surf_type
outfile = state.outfile
max_val = state.max_val
norm_factor = state.norm_factor
unit = state.unit
lat_step = state.lat_step
lon_step = state.lon_step
smooth_pass = state.smooth_pass
levels = state.levels

; Gets information from the user about the file to be opened.
call_procedure, 'get_more_info', surf_type, lat_step, lon_step, smooth_pass,
cancel=cancel, parent=parent

; Sets window to the appropriate draw widget
widget_control, state.draw2, get_value=winid
wset, winid

; Sets window to the appropriate draw widget
widget_control, state.draw, get_value=winid
wset, winid

; Grids the data and draws a cellfilled contour.
call_procedure, 'Grid_Smooth_Map', outfile, lat_step, lon_step, smooth_pass,
levels, state.x_axis_max, state.x_axis_min, state.y_axis_max, state.y_axis_min

; Resets passing variable uvalue
state.lat_step = lat_step
state.lon_step = lon_step
state.smooth_pass = smooth_pass
widget_control, ev.top, set_uvalue=state

return
end

---

pro specie_file, ev

; Gets the passing variables through uvalue structure STATE.
widget_control, ev.top, get_uvalue=state

; Prompts for file name
outfile = dialog_pickfile()

; Sets the local variables to be passed.
lat_step = 8.0
lon_step = 10.0
smooth_pass = 9.0

;Sets window to the appropriate draw widget
widget_control, state.draw2, get_value=winid
wset, winid

;Plots the raw data.
call_procedure,'plot_points', outfile, surf_type

;Sets window to the appropriate draw widget
widget_control, state.draw, get_value=winid
wset, winid

;Grids the data and draws a cellfilled contour.
call_procedure, 'Grid_Smooth_Map', outfile, lat_step, lon_step, smooth_pass

;Resets passing variable uvalue
state.lat_step = lat_step
state.lon_step = lon_step
state.smooth_pass = smooth_pass
state.outfile = outfile
state.surf_type = surf_type
widget_control, ev.top, set_uvalue=state

return
end

 pro OpenAl00011km, ev

;Set default variables and widget values for Aerosol Extintion @ 1000nm.
specie_type = 1
surf_type = 1
max_val = 9.9999999999999e-1
norm_factor=le3 ;Will give ppt.
unit = '(10^-3) (1/km)'
surf = 14.5
surf_unit = 'km'
y_unit = 1
x_unit = 1
outfile = 'temp'
widget_control, ev.top, get_uvalue=state
parent = ev.top

;Gets information from the user about the file to be opened.
call_procedure, 'getinfo', nummonth, surf, header, surf_unit, surf_type,
range, cancel=cancel, parent=parent

;Reads the data and creates and output file.
call_procedure,'month_read', specie_type, surf_type, nummonth, surf, header,
range, outfile, norm_factor, unit, surf_unit, y_unit, max_val

;Sets the file name for passing.
state.specie_type = specie_type
state.surf_type = surf_type
state.max_val = max_val
state.norm_factor = norm_factor
state.unit = unit
state.outfile = outfile
widget_control, ev.top, set_uvalue=state

;Sets window to the appropriate draw widget
widget_control, state.draw2, get_value=winid
wset, winid

call_procedure, 'reset', ev

return
end

---

pro OpenAl00011mb, ev

;Set default variables and widget values for Aerosol extinction @ 1000nm at
Pressure (mb).
specie_type = 2
surf_type = 1
max_val = 9.9999999999999e-1
norm_factor=le5 ;Will give ppm.
unit = '(10^-5) (1/km)'
surf = 144
surf_unit = 'mb'
y_unit = 1
x_unit = 1
outfile = 'temp'
widget_control, ev.top, get_uvalue=state
parent = ev.top

;Gets information from the user about the file to be opened.
call_procedure, 'getinfo', nummonth, surf, header, surf_unit, surf_type,
range, cancel=cancel, parent=parent

;Reads the data and creates and output file.
call_procedure, 'month_read', specie_type, surf_type, nummonth, surf, header,
range, outfile, norm_factor, unit, surf_unit, y_unit, max_val

;Sets the file name for passing.
state.specie_type = specie_type
state.surf_type = surf_type
state.max_val = max_val
state.norm_factor = norm_factor
state.unit = unit
state.outfile = outfile
widget_control, ev.top, set_uvalue=state

;Sets window to the appropriate draw widget
widget_control, state.draw2, get_value=winid
wset, winid

call_procedure, 'reset', ev

return
end

---
pro OpenAl00011K, ev

; Set default variables and widget values for Aerosol Extinction @ 1000nm at Potential Temperature.
specie_type = 3
surf_type = 1
max_val = 9.9999999999999e-1
norm_factor=1e5 ; Will give ppm.
unit = '10^-5) (1/km)'
surf = 700.0
surf_unit = 'Potential Temperature'
y_unit = 1
x_unit = 1
outfile = 'temp'
widget_control, ev.top, get_uvalue=state
parent = ev.top

; Gets information from the user about the file to be opened.
call_procedure, 'getinfo', nummonth, surf, header, surf_unit, surf_type, range, cancel=cancel, parent=parent

; Reads the data and creates an output file.
call_procedure, 'month_read', specie_type, surf_type, nummonth, surf, header, range, outfile, norm_factor, unit, surf_unit, y_unit, max_val

; Sets the file name for passing.
state.specie_type = specie_type
state.surf_type = surf_type
state.max_val = max_val
state.norm_factor = norm_factor
state.unit = unit
state.outfile = outfile
widget_control, ev.top, set_uvalue=state

; Sets window to the appropriate draw widget
widget_control, state.draw2, get_value=winid
wset, winid

call_procedure, 'reset', ev

return
end

-----

pro OpenAl000alakm, ev

; Set default variables and widget values for Aerosol 1000 nm in km.
specie_type = 4
surf_type = 2
max_val = 9.9999999999999e-1
norm_factor=1e4 ; Will give ppm.
unit = '10^-4) (1/km)'
surf = 70
range = 10
surf_unit = 'longitude degrees'
y_unit = 2
x_unit = 1
outfile = 'temp'
widget_control, ev.top, get_uvalue=state
parent = ev.top

; Gets information from the user about the file to be opened.
call_procedure, 'getinfo', nummonth, surf, header, surf_unit, surf_type,
range, cancel=cancel, parent=parent

; Reads the data and creates a output file.
call_procedure, 'month_read', specie_type, surf_type, nummonth, surf, header,
range, outfile, norm_factor, unit, surf_unit, y_unit, max_val

; Sets the file name for passing.
state.specie_type = specie_type
state.surf_type = surf_type
state.max_val = max_val
state.norm_factor = norm_factor
state.unit = unit
state.outfile = outfile
widget_control, ev.top, set_uvalue=state

; Sets window to the appropriate draw widget
widget_control, state.draw2, get_value=winid
wset, winid

call_procedure, 'reset', ev

return
end

;-----------------------------------------------

pro OpenAl000alamb, ev

; Set default variables and widget values for Aerosol 1000 nm at Pressure (mb).
specie_type = 5
surf_type = 2
max_val = 9.9999999999999e-1
norm_factor=1e5 ; Will give ppm.
unit = '[(10^-5)(l/km)]'
surf = 70
range = 10
surf_unit = 'longitude degrees'
y_unit = 3
x_unit = 1
outfile = 'temp'
widget_control, ev.top, get_uvalue=state
parent = ev.top

; Gets information from the user about the file to be opened.
call_procedure, 'getinfo', nummonth, surf, header, surf_unit, surf_type,
range, cancel=cancel, parent=parent

; Reads the data and creates an output file.
call_procedure, 'month_read', specie_type, surf_type, nummonth, surf, header,
range, outfile, norm_factor, unit, surf_unit, y_unit, max_val

; Sets the file name for passing.
state.specie_type = specie_type
state.surf_type = surf_type
state.max_val = max_val
state.norm_factor = norm_factor
state.unit = unit
state.outfile = outfile
widget_control, ev.top, set_uvalue=state

;Sets window to the appropriate draw widget
widget_control, state.draw2, get_value=winid
wset, winid

call_procedure,'reset', ev

return
end

------------------------------------------------------------------------------
--

pro OpenAl000alaK, ev

;Set default variables and widget values for Aerosol 1000 nm at Potential
Temperature.
specie_type = 6
surf_type = 2
max_val = 9.9999999999999e-1
norm_factor=le4 ;Will give ppm.
unit = '(10^-4) (1/km)',
surf = 70
range = 10
surf_unit = 'longitude degrees'
y_unit = 4
x_unit = 1
outfile = 'temp'
widget_control, ev.top, get_uvalue=state
parent = ev.top

;Gets information from the user about the file to be opened.
call_procedure, 'getinfo', nummonth, surf, header, surf_unit, surf_type,
range, cancel=cancel, parent=parent

;Reads the data and creates and output file.
call_procedure,'month_read', specie_type, surf_type, nummonth, surf, header,
range, outfile, norm_factor, unit, surf_unit, y_unit, max_val

;Sets the file name for passing.
state.specie_type = specie_type
state.surf_type = surf_type
state.max_val = max_val
state.norm_factor = norm_factor
state.unit = unit
state.outfile = outfile
widget_control, ev.top, set_uvalue=state

;Sets window to the appropriate draw widget
widget_control, state.draw2, get_value=winid
wset, winid

call_procedure,'reset', ev
pro OpenAl000alokm, ev

;Set default variables and widget values for Aerosol extinction @ km
specie_type = 7
surf_type = 3
max_val = 9.9999999999999e-1
norm_factor = 1e4 ;Will give ppm.
unit = '(10^-4) (I/km)'
surf = 40
range = 5
surf_unit = 'latitude degrees'
y_unit = 2
x_unit = 1
outfile = 'temp'
wset, parent = ev.top, get_uvalue = state

;Gets information from the user about the file to be opened.
call_procedure, 'getinfo', nummonth, surf, header, surf_unit, surf_type,
range, cancel, parent = parent

;Reads the data and creates and output file.
call_procedure, 'month_read', specie_type, surf_type, nummonth, surf, header,
range, outfile, norm_factor, unit, surf_unit, y_unit, max_val

;Sets the file name for passing.
state.specie_type = specie_type
state.surf_type = surf_type
state.max_val = max_val
state.norm_factor = norm_factor
state.unit = unit
state.outfile = outfile
wset, winid, state = ev.top, set_uvalue = state

;Sets window to the appropriate draw widget
wset, winid, state = ev.top, set_uvalue = state

return
end

pro OpenAl000alomb, ev

;Set default variables and widget values for Aerosol extinction @ mb.
specie_type = 8
surf_type = 3
max_val = 9.9999999999999e-1
norm_factor=1e5 ;Will give ppm.
unit = '(10^-5)/(1/km)'
surf = 40
range = 5
surf_unit = 'latitude degrees'
y_unit = 3
x_unit = 1
outfile = 'temp'
wset, winid

;Gets information from the user about the file to be opened.
call_procedure, 'getinfo', nummonth, surf, header, surf_unit, surf_type,
range, cancel=cancel, parent=parent

;Reads the data and creates an output file.
call_procedure, 'month_read', specie_type, surf_type, nummonth, surf, header,
range, outfile, norm_factor, unit, surf_unit, y_unit, max_val

;Sets the file name for passing.
state.specie_type = specie_type
state.surf_type = surf_type
state.max_val = max_val
state.norm_factor = norm_factor
state.unit = unit
state.outfile = outfile
wset, winid

call_procedure, 'reset', ev

return
end
call_procedure, 'getinfo', nummonth, surf, header, surf_unit, surf_type, range, cancel=cancel, parent=parent

; Reads the data and creates and output file.
call_procedure, 'month_read', specie_type, surf_type, nummonth, surf, header, range, outfile, norm_factor, unit, surf_unit, y_unit, max_val

; Sets the file name for passing.
state.specie_type = specie_type
state.surf_type = surf_type
state.max_val = max_val
state.norm_factor = norm_factor
state.unit = unit
state.outfile = outfile
widget_control, ev.top, set_uvalue=state

; Sets window to the appropriate draw widget
widget_control, state.draw2, get_value=winid
wset, winid

call_procedure, 'reset', ev

return
end

-------
pro OpenA52511km, ev

; Set default variables and widget values for Aerosol Extinction @ 525 nm in
Kilometers (km).
specie_type = 10
surf_type = 1
max_val = 9.9999999999999e-1
norm_factor=1e3 ; Will give ppt.
unit = '(10^-3)*(1/km)'
surf = 14.5
surf_unit = 'km'
y_unit = 1
x_unit = 1
outfile = 'temp'
widget_control, ev.top, get_uvalue=state
parent = ev.top

; Gets information from the user about the file to be opened.
call_procedure, 'getinfo', nummonth, surf, header, surf_unit, surf_type, range, cancel=cancel, parent=parent

; Reads the data and creates and output file.
call_procedure, 'month_read', specie_type, surf_type, nummonth, surf, header, range, outfile, norm_factor, unit, surf_unit, y_unit, max_val

; Sets the file name for passing.
state.specie_type = specie_type
state.surf_type = surf_type
state.max_val = max_val
state.norm_factor = norm_factor
state.unit = unit
state.outfile = outfile
widget_control, ev.top, set_uvalue=state

;Sets window to the appropriate draw widget
widget_control, state.draw2, get_value=winid
wset, winid

call_procedure,'reset', ev

return
end

--

pro OpenA52511mb, ev

; Set default variables and widget values for Aerosol extinction @ 525nm at
Pressure (mb).
specie_type = ii
surf_type = 1
max_val = 9.9999999999999e-1
norm_factor=le5 ;Will give ppm.
unit = '(',10^-5),/(1/km),'
surf = 144
surf_unit = 'mb'
y_unit = 1
x_unit = 1
outfile = 'temp'
widget_control, ev.top, get_uvalue=state
parent = ev.top

; Gets information from the user about the file to be opened.
call_procedure, 'getinfo', nummonth, surf, header, surf_unit, surf_type,
range, cancel=cancel, parent=parent

; Reads the data and creates an output file.
call_procedure,'month_read', specie_type, surf_type, nummonth, surf, header,
range, outfile, norm_factor, unit, surf_unit, y_unit, max_val

; Sets the file name for passing.
state.specie_type = specie_type
state.surf_type = surf_type
state.max_val = max_val
state.norm_factor = norm_factor
state.unit = unit
state.outfile = outfile
widget_control, ev.top, set_uvalue=state

; Sets window to the appropriate draw widget
widget_control, state.draw2, get_value=winid
wset, winid

call_procedure,'reset', ev

return
end

--
pro OpenA52511K, ev

; Set default variables and widget values for Aerosol Extinction @ 525 nm at
Potential Temperature.
specie_type = 12
surf_type = 1
max_val = 9.9999999999999e-1
norm_factor=1e5 ;Will give ppm.
unit = '10^-5 (I/km)'
surf = 700.0
surf_unit = 'Potential Temperature'
y_unit = 1
x_unit = 1
outfile = 'temp'
widget_control, ev.top, get_uvalue=state
parent = ev.top

; Gets information from the user about the file to be opened.
call_procedure, 'getinfo', nummonth, surf, header, surf_unit, surf_type,
range, cancel=cancel, parent=parent

; Reads the data and creates and output file.
call_procedure, 'month_read', specie_type, surf_type, nummonth, surf, header,
range, outfile, norm_factor, unit, surf_unit, y_unit, max_val

; Sets the file name for passing.
state.specie_type = specie_type
state.surf_type = surf_type
state.max_val = max_val
state.norm_factor = norm_factor
state.unit = unit
state.outfile = outfile
widget_control, ev.top, set_uvalue=state

; Sets window to the appropriate draw widget
widget_control, state.draw2, get_value=winid
wset, winid

call_procedure, 'reset', ev

return
end

-----
-----

pro OpenA525alakm, ev

; Set default variables and widget values for Aerosol 525 nm in km.
specie_type = 13
surf_type = 2
max_val = 9.9999999999999e-1
norm_factor=1e4 ;
unit = '10^-4 (I/km)'
surf = 70
range = 10
surf_unit = 'longitude degrees'
y_unit = 3
x_unit = 1
outfile = 'temp'
pro OpenA525alamb, ev

;Set default variables and widget values for Aerosol 525 nm at Pressure (mb).
specie_type = 14
surf_type = 2
max_val = 9.999999999999e-1
norm_factor=1e5 ;Will give ppm.
unit = ‘(10^-5) (1/km)’
surf = 70
range = 10
surf_unit = ‘longitude degrees’
y_unit = 3
x_unit = 1
outfile = 'temp'
widget_control, ev.top, get_uvalue=state
parent = ev.top

;Gets information from the user about the file to be opened.
call_procedure, 'getinfo', nummonth, surf, header, surf_unit, surf_type,
range, cancel=cancel, parent=parent

;Reads the data and creates and output file.
call_procedure,'month_read', specie_type, surf_type, nummonth, surf, header,
range, outfile, norm_factor, unit, surf_unit, y_unit, max_val

;Sets the file name for passing.
state.specie_type = specie_type
state.surf_type = surf_type
state.max_val = max_val
state.norm_factor = norm_factor
state.unit = unit
state.outfile = outfile

widget_control, ev.top, get_uvalue=state

;Sets window to the appropriate draw widget
widget_control, state.draw2, get_value=winid
wset, winid

return
end

-----

---
state.norm_factor = norm_factor
state.unit = unit
state.outfile = outfile
widget_control, ev.top, set_uvalue=state

;Sets window to the appropriate draw widget
widget_control, state.draw2, get_value=winid
wset, winid
call_procedure, 'reset', ev

return
end

--

pro OpenA525alaK, ev

;Set default variables and widget values for Aerosol 525 nm at Potential Temperature.
specie_type = 15
surf_type = 2
max_val = 9.9999999999999e-1
norm_factor=le4 ;Will give ppm.
unit = '(10^-4)(1/km)'
surf = 70
range = 10
surf_unit = 'longitude degrees'
y_unit = 4
x_unit = 1
outfile = 'temp'
widget_control, ev.top, get_uvalue=state
parent = ev.top

;Gets information from the user about the file to be opened.
call_procedure, 'getinfo', nummonth, surf, header, surf_unit, surf_type, range, cancel=cancel, parent=parent

;Reads the data and creates an output file.
call_procedure, 'month_read', specie_type, surf_type, nummonth, surf, header, range, outfile, norm_factor, unit, surf_unit, y_unit, max_val

;Sets the file name for passing.
state.specie_type = specie_type
state.surf_type = surf_type
state.max_val = max_val
state.norm_factor = norm_factor
state.unit = unit
state.outfile = outfile
widget_control, ev.top, set_uvalue=state

;Sets window to the appropriate draw widget
widget_control, state.draw2, get_value=winid
wset, winid
call_procedure, 'reset', ev

return
pro OpenA525alokm, ev

;Set default variables and widget values for Aerosol extinction @ km
specie_type = 16
surf_type = 3
max_val = 9.9999999999999e-1
norm_factor=1e4 ;Will give ppm.
unit = '(10^-4)(1/km)'
surf = 40
range = 5
surf_unit = 'latitude degrees'
y_unit = 2
x_unit = 1
outfile = 'temp'
widget_control, ev.top, get_uvalue=state
parent = ev.top

;Gets information from the user about the file to be opened.
call_procedure, 'getinfo', nummonth, surf, header, surf_unit, surf_type, range, cancel=cancel, parent=parent

;Reads the data and creates output file.
call_procedure, 'month_read', specie_type, surf_type, nummonth, surf, header, range, outfile, norm_factor, unit, surf_unit, y_unit, max_val

;Sets the file name for passing.
state.specie_type = specie_type
state.surf_type = surf_type
state.max_val = max_val
state.norm_factor = norm_factor
state.unit = unit
state.outfile = outfile
widget_control, ev.top, set_uvalue=state

;Sets window to the appropriate draw widget
widget_control, state.draw2, get_value=winid
wset, winid

call_procedure, 'reset', ev

return
end

---

pro OpenA525alomb, ev

;Set default variables and widget values for Aerosol extinction @ mb
specie_type = 17
surf_type = 3
max_val = 9.9999999999999e-1
norm_factor=1e5 ;Will give ppm.
unit = '(10^-5)(1/km)'
surf = 40
range = 5
surf_unit = 'latitude degrees'
y_unit = 3
x_unit = 1
outfile = 'temp'
widget_control, ev.top, get_uvalue=state
parent = ev.top

;Gets information from the user about the file to be opened.
call_procedure, 'getinfo', nummonth, surf, header, surf_unit, surf_type,
range, cancel=cancel, parent=parent

;Reads the data and creates and output file.
call_procedure, 'month_read', specie_type, surf_type, nummonth, surf, header,
rangle, outfile, norm_factor, unit, surf_unit, y_unit, max_val

;Sets the file name for passing.
state.specie_type = specie_type
state.surf_type = surf_type
state.max_val = max_val
state.norm_factor = norm_factor
state.unit = unit
state.outfile = outfile
widget_control, ev.top, set_uvalue=state

;Sets window to the appropriate draw widget
widget_control, state.draw2, get_value=winid
wset, winid
call_procedure, 'reset', ev
return
end

;---------------------------------------------

pro OpenA525aloK, ev

;Set default variables and widget values for Aerosol extinction @ Potential
Temperature.
specie_type = 18
surf_type = 3
max_val = 9.9999999999999e-1
norm_factor=le4 ;Will give ppm.
unit = '(10^-4) (1/km)' 
surf = 40
range = 5
surf_unit = 'latitude degrees'
y_unit = 4
x_unit = 1
outfile = 'temp'
widget_control, ev.top, get_uvalue=state
parent = ev.top

;Gets information from the user about the file to be opened.
call_procedure, 'getinfo', nummonth, surf, header, surf_unit, surf_type,
range, cancel=cancel, parent=parent

;Reads the data and creates and output file.
call_procedure, 'month_read', specie_type, surf_type, nummonth, surf, header,
range, outfile, norm_factor, unit, surf_unit, y_unit, max_val

;Sets the file name for passing.
state.specie_type = specie_type
state.surf_type = surf_type
state.max_val = max_val
state.norm_factor = norm_factor
state.unit = unit
state.outfile = outfile
widget_control, ev.top, set_uvalue=state

;Sets window to the appropriate draw widget
widget_control, state.draw2, get_value=winid
wset, winid

call_procedure,'reset', ev

return
eend

--
pro OpenA45011km, ev

;Set default variables and widget values for Aerosol Extinction @ 450nm at
Kilometer (km).
specie_type = 19
surf_type = 1
max_val = 9.9999999999999e-1
norm_factor=le3 ;Will give ppt.
unit = '(10^-3) (1/km)' surf = 14.5
surf_unit = 'km'
y_unit = 1
x_unit = 1
outfile = 'temp'
widget_control, ev.top, get_uvalue=state
parent = ev.top

;Gets information from the user about the file to be opened.
call_procedure, 'getinfo', nummonth, surf, header, surf_unit, surf_type,
range, cancel=cancel, parent=parent

;Reads the data and creates and output file.
call_procedure,'month_read', specie_type, surf_type, nummonth, surf, header,
range, outfile, norm_factor, unit, surf_unit, y_unit, max_val

;Sets the file name for passing.
state.specie_type = specie_type
state.surf_type = surf_type
state.max_val = max_val
state.norm_factor = norm_factor
state.unit = unit
state.outfile = outfile
widget_control, ev.top, set_uvalue=state

;Sets window to the appropriate draw widget
widget_control, state.draw2, get_value=winid
wset, winid
call_procedure,'reset', ev

return
end

---

pro OpenA45011mb, ev

; Set default variables and widget values for Aerosol extinction @ 450nm at Pressure (mb).
specie_type = 20
surf_type = 1
max_val = 9.9999999999999e-1
norm_factor=1e5 ;Will give ppm.
unit = '(10^-5)(1/km)' surf = 144
surf_unit = 'mb'
y_unit = 1
x_unit = 1
outfile = 'temp'
widget_control, ev.top, get_uvalue=state
parent = ev.top

; Gets information from the user about the file to be opened.
call_procedure,'getinfo', nummonth, surf, header, surf_unit, surf_type, range, cancel=cancel, parent=parent

; Reads the data and creates an output file.
call_procedure,'month_read', specie_type, surf_type, nummonth, surf, header, range, outfile, norm_factor, unit, surf_unit, y_unit, max_val

; Sets the file name for passing.
state.specie_type = specie_type
state.surf_type = surf_type
state.max_val = max_val
state.norm_factor = norm_factor
state.unit = unit
state.outfile = outfile
widget_control, ev.top, set_uvalue=state

; Sets window to the appropriate draw widget
widget_control, state.draw2, get_value=winid
wset, winid

call_procedure,'reset', ev

return
end

---

pro OpenA45011K, ev

; Set default variables and widget values for Aerosol Extinction @ 450nm at
Potential Temperature.
specie_type = 21
surf_type = 1
max_val = 9.9999999999999e-1
norm_factor=1e5 ;Will give ppm.
unit = '(10^-5) (1/km)'
surf = 700.0
surf_unit = 'Potential Temperature'
y_unit = 1
x_unit = 1
outfile = 'temp'
widget_control, ev.top, get_uvalue=state
parent = ev.top

;Gets information from the user about the file to be opened.
call_procedure, 'getinfo', nummonth, surf, header, surf_unit, surf_type,
range, cancel=cancel, parent=parent

;Reads the data and creates and output file.
call_procedure,'month_read', specie_type, surf_type, nummonth, surf, header,
range, outfile, norm_factor, unit, surf_unit, y_unit, max_val

;Sets the file name for passing.
state.specie_type = specie_type
state.surf_type = surf_type
state.max_val = max_val
state.norm_factor = norm_factor
state.unit = unit
state.outfile = outfile
widget_control, ev.top, set_uvalue=state

;Sets window to the appropriate draw widget
widget_control, state.draw2, get_value=winid
wset, winid

call_procedure,'reset', ev

return
def

----------

pro OpenA450alakm, ev

;Set default variables and widget values for Aerosol 450 nm in km.
specie_type = 22
surf_type = 2
max_val = 9.9999999999999e-1
norm_factor=1e4 ;Will give ppm.
unit = '(10^-4) (1/km)'
surf = 70
range = 10
surf_unit = 'longitude degrees'
y_unit = 2
x_unit = 1
outfile = 'temp'
widget_control, ev.top, get_uvalue=state
parent = ev.top
pro OpenA450alamb, ev

; Set default variables and widget values for Aerosol 450 nm at Pressure (mb).
specie_type = 23
surf_type = 2
max_val = 9.9999999999999e-1
norm_factor=le5 ;Will give ppm.
unit = '(10^-5) (1/km)'
surf = 70
range = 10
surf_unit = 'longitude degrees'
y_unit = 3
x_unit = 1
outfile = 'temp'
widget_control, ev.top, get_uvalue=state
parent = ev.top

; Gets information from the user about the file to be opened.
call_procedure, 'getinfo', nummonth, surf, header, surf_unit, surf_type,
range, cancel=cancel, parent=parent

; Reads the data and creates and output file.
call_procedure, 'month_read', specie_type, surf_type, nummonth, surf, header,
range, outfile, norm_factor, unit, surf_unit, y_unit, max_val

; Sets the file name for passing.
state.specie_type = specie_type
state.surf_type = surf_type
state.max_val = max_val
state.norm_factor = norm_factor
state.unit = unit
state.outfile = outfile
widget_control, ev.top, set_uvalue=state

; Sets window to the appropriate draw widget
widget_control, state.draw2, get_value=winid
wset, winid

call_procedure, 'reset', ev

return
end
state.outfile = outfile
widget_control, ev.top, set_uvalue=state

;Sets window to the appropriate draw widget
widget_control, state.draw2, get_value=winid
wset, winid

call_procedure, 'reset', ev

return
end

pro OpenA450a1aK, ev

;Set default variables and widget values for Aerosol 450 nm at Potential Temperature.
specie_type = 24
surf_type =2
max_val = 9.9999999999999e-1
norm_factor=le4 ;Will give ppm.
unit = '({10^-4}) (1/km)'
surf = 70
range = 10
surf_unit = 'longitude degrees'
y_unit = 4
x_unit = 1
outfile = 'temp'
widget_control, ev.top, get_uvalue=state
parent = ev.top

;Gets information from the user about the file to be opened.
call_procedure, 'getinfo', nummonth, surf, header, surf_unit, surf_type, range, cancel=cancel, parent=parent

;Reads the data and creates an output file.
call_procedure, 'month_read', specie_type, surf_type, nummonth, surf, header, range, outfile, norm_factor, unit, surf_unit, y_unit, max_val

;Sets the file name for passing.
state.specie_type = specie_type
state.surf_type = surf_type
state.max_val = max_val
state.norm_factor = norm_factor
state.unit = unit
state.outfile = outfile
widget_control, ev.top, set_uvalue=state

;Sets window to the appropriate draw widget
widget_control, state.draw2, get_value=winid
wset, winid

call_procedure, 'reset', ev

return
end
pro OpenA450alokm, ev

;Set default variables and widget values for Aerosol extinction @ km
specie_type = 25
surf_type = 3
max_val = 9.9999999999999e-1
norm_factor = 1e4 ;Will give ppm.
unit = '(10^-4)(1/km)'
surf = 40
range = 5
surf_unit = 'latitude degrees'
y_unit = 2
x_unit = 1
outfile = 'temp'
widget_control, ev.top, get_uvalue=state
parent = ev.top

;Gets information from the user about the file to be opened.
call_procedure, 'getinfo', nummonth, surf, header, surf_unit, surf_type,
range, cancel, parent=parent

;Reads the data and creates an output file.
call_procedure, 'month_read', specie_type, surf_type, nummonth, surf, header,
range, outfile, norm_factor, unit, surf_unit, y_unit, max_val

;Sets the file name for passing.
state.specie_type = specie_type
state.surf_type = surf_type
state.max_val = max_val
state.norm_factor = norm_factor
state.unit = unit
state.outfile = outfile
widget_control, ev.top, set_uvalue=state

;Sets window to the appropriate draw widget
widget_control, state.draw2, get_value=winid
wset, winid

call_procedure, 'reset', ev

return
end

---

pro OpenA450alomb, ev

;Set default variables and widget values for Aerosol extinction @ mb.
specie_type = 26
surf_type = 3
max_val = 9.9999999999999e-1
norm_factor = 1e5 ;Will give ppm.
unit = '(10^-5)(1/km)'
surf = 40
range = 5
surf_unit = 'latitude degrees'
y_unit = 3
x_unit = 1
outfile = 'temp'
widget_control, ev.top, get_uvalue=state
parent = ev.top

; Gets information from the user about the file to be opened.
call_procedure, 'getinfo', nummonth, surf, header, surf_unit, surf_type,
range, cancel=cancel, parent=parent

; Reads the data and creates and output file.
call_procedure, 'month_read', specie_type, surf_type, nummonth, surf, header,
range, outfile, norm_factor, unit, surf_unit, y_unit, max_val

; Sets the file name for passing,
state.specie_type = specie_type
state.surf_type = surf_type
state.max_val = max_val
state.norm_factor = norm_factor
state.unit = unit
state.outfile = outfile
widget_control, ev.top, set_uvalue=state

; Sets window to the appropriate draw widget
widget_control, state.draw2, get_value=winid
wset, winid
call_procedure, 'reset', ev

return
end

pro OpenA450aloK, ev

; Set default variables and widget values for Aerosol extinction @ Potential
Temperature.
specie_type = 27
surf_type = 3
max_val = 9.9999999999999e-1
norm_factor=le4 ;Will give ppm.
unit = '(10^-4)(i/km)'
surf = 40
range = 5
surf_unit = 'latitude degrees'
y_unit = 4
x_unit = 1
outfile = 'temp'
widget_control, ev.top, get_uvalue=state
parent = ev.top

; Gets information from the user about the file to be opened.
call_procedure, 'getinfo', nummonth, surf, header, surf_unit, surf_type,
range, cancel=cancel, parent=parent

; Reads the data and creates and output file.
call_procedure, 'month_read', specie_type, surf_type, nummonth, surf, header,
range, outfile, norm_factor, unit, surf_unit, y_unit, max_val

;Sets the file name for passing.
state.specie_type = specie_type
state.surf_type = surf_type
state.max_val = max_val
state.norm_factor = norm_factor
state.unit = unit
state.outfile = outfile
widget_control, ev.top, set_uvalue=state

;Sets window to the appropriate draw widget
widget_control, state.draw2, get_value=winid
wset, winid
call_procedure,'reset', ev

return
end

---

pro OpenA38511km, ev

;Set default variables and widget values for Aerosol Extinction @ 1000nm at
Kilometers (km).
specie_type = 28
surf_type = 1
max_val = 9.9999999999999e-1
norm_factor=le3 ;Will give ppt.
unit = '(10^-3) (1/km)'
surf = 14.5
surf_unit = 'km'
y_unit = 1
x_unit = 1
outfile = 'temp'
widget_control, ev.top, get_uvalue=state
parent = ev.top

;Gets information from the user about the file to be opened.
call_procedure,'getinfo', nummonth, surf, header, surf_unit, surf_type,
range, cancel=cancel, parent=parent

;Reads the data and creates an output file.
call_procedure,'month_read', specie_type, surf_type, nummonth, surf, header,
range, outfile, norm_factor, unit, surf_unit, y_unit, max_val

;Sets the file name for passing.
state.specie_type = specie_type
state.surf_type = surf_type
state.max_val = max_val
state.norm_factor = norm_factor
state.unit = unit
state.outfile = outfile
widget_control, ev.top, set_uvalue=state

;Sets window to the appropriate draw widget
pro OpenA38511mb, ev

; Set default variables and widget values for Aerosol extinction @ 1000nm at Pressure (mb).
specie_type = 29
surf_type = 1
max_val = 9.9999999999999e-1
norm_factor=le5 ;Will give ppm.
unit = '(i0^-5) (i/km)' 
surf = 144
surf_unit = 'mb'
y_unit = 1
x_unit = 1
outfile = 'temp'
widget_control, ev.top, get_uvalue=state
parent = ev.top

; Gets information from the user about the file to be opened.
call_procedure, 'getinfo', nummonth, surf, header, surf_unit, surf_type, 
range, cancel=cancel, parent=parent

; Reads the data and creates and output file.
call_procedure,'month_read', specie_type, surf_type, nummonth, surf, header, 
range, outfile, norm_factor, unit, surf_unit, y_unit, max_val 

; Sets the file name for passing.
state.specie_type = specie_type
state.surf_type = surf_type
state.max_val = max_val
state.norm_factor = norm_factor
state.unit = unit
state.outfile = outfile
widget_control, ev.top, set_uvalue=state

; Sets window to the appropriate draw widget
widget_control, ev.top, get_value=winid
wset, winid

call_procedure,'reset', ev

return
end

pro OpenA38511K, ev

; Set default variables and widget values for Aerosol Extintion @ 1000nm at
Potential Temperature.

specie_type = 30
surf_type = 1
max_val = 9.9999999999999e-1
norm_factor=1e5 ;Will give ppm.
unit = '10^-5) (1/km)'
surf = 700.0
surf_unit = 'Potential Temperature'
y_unit = 1
x_unit = 1
outfile = 'temp'
widget_control, ev.top, get_uvalue=state
parent = ev.top

;Gets information from the user about the file to be opened.
call_procedure, 'getinfo', nummonth, surf, header, surf_unit, surf_type, range, cancel=cancel, parent=parent

;Reads the data and creates and output file.
call_procedure,'month_read', specie_type, surf_type, nummonth, surf, header, range, outfile, norm_factor, unit, surf_unit, y_unit, max_val

;Sets the file name for passing.
state.specie_type = specie_type
state.surf_type = surf_type
state.max_val = max_val
state.norm_factor = norm_factor
state.unit = unit
state.outfile = outfile
widget_control, ev.top, set_uvalue=state

;Sets window to the appropriate draw widget
widget_control, state.draw2, get_value=winid
wset, winid

call_procedure,'reset', ev

return
end

-----

pro OpenA385alakm, ev

;Set default variables and widget values for Aerosol 1000 nm in km.
specie_type = 31
surf_type = 2
max_val = 9.99999999999999e-1
norm_factor=1e4 ;Will give ppm.
unit = '10^-4) (1/km)'
surf = 70
range = 10
surf_unit = 'longitude degrees'
y_unit = 2
x_unit = 1
outfile = 'temp'
widget_control, ev.top, get_uvalue=state
parent = ev.top
; Gets information from the user about the file to be opened.
call_procedure, 'getinfo', nummonth, surf, header, surf_unit, surf_type, range, cancel=cancel, parent=parent

; Reads the data and creates an output file.
call_procedure, 'month_read', specie_type, surf_type, nummonth, surf, header, range, outfile, norm_factor, unit, surf_unit, y_unit, max_val

; Sets the file name for passing.
state.specie_type = specie_type
state.surf_type = surf_type
state.max_val = max_val
state.norm_factor = norm_factor
state.unit = unit
state.outfile = outfile
widget_control, ev.top, set_uvalue=state

; Sets window to the appropriate draw widget
widget_control, state.draw2, get_value=winid
wset, winid

call_procedure, 'reset', ev

return
end

;------------------------------------------
--
pro OpenA385alamb, ev

; Set default variables and widget values for Aerosol 1000 nm at Pressure (mb).
specie_type = 32
surf_type = 2
max_val = 9.9999999999999e-1
norm_factor=le5 ; Will give ppm.
unit = '(10^-5)(1/km)' 
surf = 70
range = 10
surf_unit = 'longitude degrees'
y_unit = 3
x_unit = 1
outfile = 'temp'
widget_control, ev.top, get_uvalue=state
parent = ev.top

; Gets information from the user about the file to be opened.
call_procedure, 'getinfo', nummonth, surf, header, surf_unit, surf_type, range, cancel=cancel, parent=parent

; Reads the data and creates an output file.
call_procedure, 'month_read', specie_type, surf_type, nummonth, surf, header, range, outfile, norm_factor, unit, surf_unit, y_unit, max_val

; Sets the file name for passing.
state.specie_type = specie_type
state.surf_type = surf_type
state.max_val = max_val
state.norm_factor = norm_factor
state.unit = unit
state.outfile = outfile
widget_control, ev.top, set_uvalue=state

;Sets window to the appropriate draw widget
widget_control, state.draw2, get_value=winid
wset, winid

call_procedure,'reset', ev

return
end

;---------------------------------------------
--

pro OpenA385alaK, ev

;Set default variables and widget values for Aerosol 1000 nm at Potential Temperature.
specie_type = 33
surf_type = 2
max_val = 9.9999999999999e-1
norm_factor=1e4 ;Will give ppm.
unit = '(10^-4) (1/km)'
surf = 70
range = 10
surf_unit = 'longitude degrees'
y_unit = 4
x_unit = 1
outfile = 'temp'
widget_control, ev.top, get_uvalue=state
parent = ev.top

;Gets information from the user about the file to be opened.
call_procedure, 'getinfo', nummonth, surf, header, surf_unit, surf_type, range, cancel=cancel, parent=parent

;Reads the data and creates and output file.
call_procedure,'month_read', specie_type, surf_type, nummonth, surf, header, range, outfile, norm_factor, unit, surf_unit, y_unit, max_val

;Sets the file name for passing.
state.specie_type = specie_type
state.surf_type = surf_type
state.max_val = max_val
state.norm_factor = norm_factor
state.unit = unit
state.outfile = outfile
widget_control, ev.top, set_uvalue=state

;Sets window to the appropriate draw widget
widget_control, state.draw2, get_value=winid
wset, winid

call_procedure,'reset', ev

return
end
pro OpenA385alokm, ev

; Set default variables and widget values for Aerosol extinction @ km
specie_type = 34
surf_type = 3
max_val = 9.9999999999999e-1
norm_factor = 1e4 ; Will give ppm.
unit = '(10^-4)(1/km)'
surf = 40
range = 5
surf_unit = 'latitude degrees'
y_unit = 2
x_unit = 1
outfile = 'temp'
widget_control, ev.top, get_uvalue=state
parent = ev.top

; Gets information from the user about the file to be opened.
call_procedure, 'getinfo', nummonth, surf, header, surf_unit, surf_type, range, cancel=cancel, parent=parent

; Reads the data and creates an output file.
call_procedure, 'month_read', specie_type, surf_type, nummonth, surf, header, range, outfile, norm_factor, unit, surf_unit, y_unit, max_val

; Sets the file name for passing.
state.specie_type = specie_type
state.surf_type = surf_type
state.max_val = max_val
state.norm_factor = norm_factor
state.unit = unit
state.outfile = outfile
widget_control, ev.top, set_uvalue=state

; Sets window to the appropriate draw widget
widget_control, state.draw2, get_value=winid
wset, winid

call_procedure, 'reset', ev

return
drop state
end

--

pro OpenA385alomb, ev

; Set default variables and widget values for Aerosol extinction @ mb.
specie_type = 35
surf_type = 3
max_val = 9.9999999999999e-1
norm_factor = 1e5 ; Will give ppm.
unit = '(10^-5)(1/km)'
surf = 40
range = 5
surf_unit = 'latitude degrees'
y_unit = 3
x_unit = 1
outfile = 'temp'
widget_control, ev.top, get_uvalue=state
parent = ev.top

; Gets information from the user about the file to be opened.
call_procedure, 'getinfo', nummonth, surf, header, surf_unit, surf_type,
range, cancel=cancel, parent=parent

; Reads the data and creates an output file.
call_procedure, 'month_read', specie_type, surf_type, nummonth, surf, header,
range, outfile, norm_factor, unit, surf_unit, y_unit, max_val

; Sets the file name for passing.
state.specie_type = specie_type
state.surf_type = surf_type
state.max_val = max_val
state.norm_factor = norm_factor
state.unit = unit
state.outfile = outfile
widget_control, ev.top, set_uvalue=state

; Sets window to the appropriate draw widget.
widget_control, state.draw2, get_value=winid
wset, winid

call_procedure, 'reset', ev

return
end

pro OpenA385aloK, ev

; Set default variables and widget values for Aerosol extinction @ Potential Temperature.
specie_type = 36
surf_type = 3
max_val = 9.9999999999999e-1
norm_factor=le4 ; Will give ppm.
unit = '(10^-4)(1/km)'
surf = 40
range = 5
surf_unit = 'latitude degrees'
y_unit = 4
x_unit = 1
outfile = 'temp'
widget_control, ev.top, get_uvalue=state
parent = ev.top

; Gets information from the user about the file to be opened.
call_procedure, 'getinfo', nummonth, surf, header, surf_unit, surf_type,
range, cancel=cancel, parent=parent

; Reads the data and creates an output file.
call_procedure, 'month_read', specie_type, surf_type, nummonth, surf, header,
range, outfile, norm_factor, unit, surf_unit, y_unit, max_val

;Sets the file name for passing.
state.specie_type = specie_type
state.surf_type = surf_type
state.max_val = max_val
state.norm_factor = norm_factor
state.unit = unit
state.outfile = outfile
widget_control, ev.top, set_uvalue=state

;Sets window to the appropriate draw widget
widget_control, state.draw2, get_value=winid
wset, winid

call_procedure, 'reset', ev

return
end

-----------------------------
--

pro OpenNO2MR11km, ev

;Set default variables and widget values for NO2 Mixing Ratio @ km.
specie_type = 37
surf_type = 1
max_val = 9.9999999999999e-1
norm_factor=1e9 ;Will give ppb.
unit = '(ppb)'
surf = 14.5
surf_unit = 'km'
y_unit = 1
x_unit = 1
outfile = 'temp'
widget_control, ev.top, get_uvalue=state
parent = ev.top

;Gets information from the user about the file to be opened.
call_procedure, 'getinfo', nummonth, surf, header, surf_unit, surf_type, range, cancel=cancel, parent=parent

;Reads the data and creates output file.
call_procedure, 'month_read', specie_type, surf_type, nummonth, surf, header, range, outfile, norm_factor, unit, surf_unit, y_unit, max_val

;Sets the file name for passing.
state.specie_type = specie_type
state.surf_type = surf_type
state.max_val = max_val
state.norm_factor = norm_factor
state.unit = unit
state.outfile = outfile
widget_control, ev.top, set_uvalue=state

;Sets window to the appropriate draw widget
widget_control, state.draw2, get_value=winid
wset, winid
call_procedure, 'reset', ev

return
end

--

pro OpenNO2MR1mb, ev

; Set default variables and widget values for NO2 Mixing Ratio at Pressure (mb)
specie_type = 38
surf_type = 1
max_val = 9.999999999999e-1
norm_factor=1e9 ;Will give ppb.
unit = '(ppb)'
surf = 144
surf_unit = 'mb'
y_unit = 1
x_unit = 1
outfile = 'temp'
widget_control, ev.top, get_uvalue=state
parent = ev.top

; Gets information from the user about the file to be opened.
call_procedure, 'getinfo', nummonth, surf, header, surf_unit, surf_type, range, cancel=cancel, parent=parent

; Reads the data and creates an output file.
call_procedure, 'month_read', specie_type, surf_type, nummonth, surf, header, range, outfile, norm_factor, unit, surf_unit, y_unit, max_val

; Sets the file name for passing.
state.specie_type = specie_type
state.surf_type = surf_type
state.max_val = max_val
state.norm_factor = norm_factor
state.unit = unit
state.outfile = outfile
widget_control, ev.top, set_uvalue=state

; Sets window to the appropriate draw widget
widget_control, state.draw2, get_value=winid
wset, winid

call_procedure, 'reset', ev

return
end

--

pro OpenNO2MR11K, ev

; Set default variables and widget values for NO2 Mixing Ratio at Potential Temperature.
specie_type = 39
surf_type = 1
max_val = 9.9999999999999e-1
norm_factor=1e9 ;Will give ppb.
unit = '(ppb)'
surf = 700.0
surf_unit = 'Potential Temperature'
y_unit = 1
x_unit = 1
outfile = 'temp'
widget_control, ev.top, get_uvalue=state
parent = ev.top

;Gets information from the user about the file to be opened.
call_procedure, 'getinfo', nummonth, surf, header, surf_unit, surf_type,
range, cancel=cancel, parent=parent

;Reads the data and creates an output file.
call_procedure,'month_read', specie_type, surf_type, nummonth, surf, header,
range, outfile, norm_factor, unit, surf_unit, y_unit, x_unit, max_val

;Sets the file name for passing.
state.specie_type = specie_type
state.surf_type = surf_type
state.max_val = max_val
state.norm_factor = norm_factor
state.unit = unit
state.outfile = outfile
widget_control, ev.top, set_uvalue=state

;Sets window to the appropriate draw widget
widget_control, state.draw2, get_value=winid
wset, winid

call_procedure,'reset', ev

return

end

------------------------------

-----

pro OpenNO2MRalakm, ev

;Set default variables and widget values for NO2 Mixing Ratio in km.
specie_type = 40
surf_type = 2
max_val = 9.9999999999999e-1
norm_factor=1e9 ;Will give ppb.
unit = '(ppb)'
surf = 70
range = 10
surf_unit = 'longitude degrees'
y_unit = 2
x_unit = 1
outfile = 'temp'
widget_control, ev.top, get_uvalue=state
parent = ev.top

;Gets information from the user about the file to be opened.
call_procedure, 'getinfo', nummonth, surf, header, surf_unit, surf_type,
range, cancel=cancel, parent=parent

; Reads the data and creates and output file.
call_procedure,'month_read', specie_type, surf_type, nummonth, surf, header, range, outfile, norm_factor, unit, surf_unit, y_unit, max_val

; Sets the file name for passing.
state.specie_type = specie_type
state.surf_type = surf_type
state.max_val = max_val
state.norm_factor = norm_factor
state.unit = unit
state.outfile = outfile
widget_control, ev.top, set_uvalue=state

; Sets window to the appropriate draw widget.
widget_control, state.draw2, get_value=winid
wset, winid

call_procedure,'reset', ev

return
end

---

pro OpenNO2MRalamb, ev

; Set default variables and widget values for NO2 Mixing Ratio at Pressure (mb).
specie_type = 41
surf_type = 2
max_val = 9.9999999999999e-1
norm_factor=1e9 ; Will give ppb.
unit = '(ppb)'
surf = 70
range = 10
surf_unit = 'longitude degrees'
y_unit = 3
x_unit = 1
outfile = 'temp'
widget_control, ev.top, get_uvalue=state
parent = ev.top

; Gets information from the user about the file to be opened.
call_procedure, 'getinfo', nummonth, surf, header, surf_unit, surf_type, range, cancel=cancel, parent=parent

; Reads the data and creates an output file.
call_procedure,'month_read', specie_type, surf_type, nummonth, surf, header, range, outfile, norm_factor, unit, surf_unit, y_unit, max_val

; Sets the file name for passing.
state.specie_type = specie_type
state.surf_type = surf_type
state.max_val = max_val
state.norm_factor = norm_factor
state.unit = unit
state.outfile = outfile
widget_control, ev.top, set_uvalue=state

; Sets window to the appropriate draw widget
widget_control, state.draw2, get_value=winid
wset, winid

call_procedure,'reset', ev

return
end

--

pro OpenNO2MRalaK, ev

; Set default variables and widget values for NO2 Mixing Ratio at Potential Temperature.
specie_type = 42
surf_type = 2
max_val = 9.9999999999999e-1
norm_factor=1e9 ; Will give ppb.
unit = '(ppb)'
surf = 70
range = 10
surf_unit = 'longitude degrees'
y_unit = 4
x_unit = 1
outfile = 'temp'
widget_control, ev.top, get_uvalue=state
parent = ev.top

; Gets information from the user about the file to be opened.
call_procedure, 'getinfo', nummonth, surf, header, surf_unit, surf_type, range, cancel=cancel, parent=parent

; Reads the data and creates an output file.
call_procedure,'month_read', specie_type, surf_type, nummonth, surf, header, range, outfile, norm_factor, unit, surf_unit, y_unit, max_val

; Sets the file name for passing.
state.specie_type = specie_type
state.surf_type = surf_type
state.max_val = max_val
state.norm_factor = norm_factor
state.unit = unit
state.outfile = outfile
widget_control, ev.top, set_uvalue=state

; Sets window to the appropriate draw widget
widget_control, state.draw2, get_value=winid
wset, winid

call_procedure,'reset', ev

return
end
pro OpenNO2MRalokm, ev

; Set default variables and widget values for NO2 Mixing Ratio @ km

specie_type = 43
surf_type = 3
max_val = 9.9999999999999e-1
norm_factor=1e9 ; Will give ppb.
unit = '(ppb)'
surf = 40
range = 5
surf_unit = 'latitude degrees'
y_unit = 2
x_unit = 1
outfile = 'temp'
widget_control, ev.top, get_uvalue=state
parent = ev.top

; Gets information from the user about the file to be opened.
call_procedure, 'getinfo', nummonth, surf, header, surf_unit, surf_type, range, cancel=cancel, parent=parent

; Reads the data and creates output file.
call_procedure, 'month_read', specie_type, surf_type, nummonth, surf, header, range, outfile, norm_factor, unit, surf_unit, y_unit, max_val

; Sets the file name for passing.
state.specie_type = specie_type
state.surf_type = surf_type
state.max_val = max_val
state.norm_factor = norm_factor
state.unit = unit
state.outfile = outfile
widget_control, ev.top, set_uvalue=state

; Sets window to the appropriate draw widget
widget_control, state.draw2, get_value=winid
wset, winid

call_procedure, 'reset', ev

return
end

pro OpenNO2MRalomb, ev

; Set default variables and widget values for NO2 Mixing Ratio @ mb.

specie_type = 44
surf_type = 3
max_val = 9.9999999999999e-1
norm_factor=1e9 ; Will give ppb.
unit = '(ppb)'
surf = 40
range = 5
surf_unit = 'latitude degrees'
y_unit = 3
x_unit = 1
outfile = 'temp'
widget_control, ev.top, get_uvalue=state
parent = ev.top

;Gets information from the user about the file to be opened.
call_procedure, 'getinfo', nummonth, surf, header, surf_unit, surf_type, range, cancel=cancel, parent=parent

;Reads the data and creates an output file.
call_procedure, 'month_read', specie_type, surf_type, nummonth, surf, header, range, outfile, norm_factor, unit, surf_unit, y_unit, max_val

;Sets the file name for passing.
state.specie_type = specie_type
state.surf_type = surf_type
state.max_val = max_val
state.norm_factor = norm_factor
state.unit = unit
state.outfile = outfile
widget_control, ev.top, set_uvalue=state

;Sets window to the appropriate draw widget
widget_control, state.draw2, get_value=winid
wset, winid

call_procedure, 'reset', ev

return
end

--;------------------------------------------------------------------------------
--

pro OpenNO2MRalOK, ev

;Set default variables and widget values for NO2 Mixing Ratio @ Potential Temperature.
specie_type = 45
surf_type = 3
max_val = 9.9999999999999e-1
norm_factor = 1e9 ;Will give ppb.
unit = '(ppb)'
surf = 40
range = 5
surf_unit = 'latitude degrees'
y_unit = 4
x_unit = 1
outfile = 'temp'
widget_control, ev.top, get_uvalue=state
parent = ev.top

;Gets information from the user about the file to be opened.
call_procedure, 'getinfo', nummonth, surf, header, surf_unit, surf_type, range, cancel=cancel, parent=parent

;Reads the data and creates an output file.
call_procedure, 'month_read', specie_type, surf_type, nummonth, surf, header, range, outfile, norm_factor, unit, surf_unit, y_unit, max_val
pro Open03MR11km, ev

; Set default variables and widget values for O3 Mixing Ratios at Kilometers
; (km).
specie_type = 64
surf_type = 1
max_val = 9.9999999999999e-1
norm_factor=le6 ; Will give ppm for the mixing ratio.
unit = '(ppm)'
surf = 14.5
surf_unit = 'km'
y_unit = 1
x_unit = 1
outfile = 'temp'
widget_control, ev.top, get_uvalue=state
parent = ev.top

; Gets information from the user about the file to be opened.
call_procedure, 'getinfo', nummonth, surf, header, surf_unit, surf_type, range, cancel=cancel, parent=parent

; Reads the data and creates an output file.
call_procedure, 'month_read', specie_type, surf_type, nummonth, surf, header, range, outfile, norm_factor, unit, surf_unit, y_unit, max_val

; Sets the file name for passing.
state.specie_type = specie_type
state.surf_type = surf_type
state.max_val = max_val
state.norm_factor = norm_factor
state.unit = unit
state.outfile = outfile
widget_control, ev.top, set_uvalue=state

; Sets window to the appropriate draw widget
widget_control, state.draw2, get_value=winid
wset, winid

call_procedure, 'reset', ev

return
end
pro OpenO3MRlmb, ev

; Set default variables and widget values for O3 Mixing Ratios at Pressure (mb).

specie_type = 65
surf_type = 1
max_val = 9.9999999999999e-1
norm_factor=1e6 ; Will give ppm for the mixing ratio.
unit = '(ppm)'
surf = 144
surf_unit = 'mb'
y_unit = 1
x_unit = 1
outfile = 'temp'
widget_control, ev.top, get_uvalue=state
parent = ev.top

; Gets information from the user about the file to be opened.
call_procedure, 'getinfo', nummonth, surf, header, surf_unit, surf_type,
range, cancel=cancel, parent=parent

; Reads the data and creates an output file.
call_procedure, 'month_read', specie_type, surf_type, nummonth, surf, header,
range, outfile, norm_factor, unit, surf_unit, y_unit, max_val

; Sets the file name for passing.
state.specie_type = specie_type
state.surf_type = surf_type
state.max_val = max_val
state.norm_factor = norm_factor
state.unit = unit
state.outfile = outfile
widget_control, ev.top, set_uvalue=state

; Sets window to the appropriate draw widget
widget_control, state.draw2, get_value=winid
wset, winid

call_procedure, 'reset', ev

return
end
```
norm_factor=le6 ;Will give ppm for the mixing ratio.
unit = ' (ppm)'
surf = 700.0
surf_unit = 'Potential Temperature'
y_unit = 1
x_unit = 1
outfile = 'temp'
```

```
;Gets information from the user about the file to be opened.
call_procedure, 'getinfo', nummonth, surf, header, surf_unit, surf_type,
range, cancel=cancel, parent=parent
```

```
;Reads the data and creates and output file.
call_procedure, 'month_read', specie_type, surf_type, nummonth, surf, header,
range, outfile, norm_factor, unit, surf_unit, y_unit, max_val
```

```
;Sets the file name for passing.
state.specie_type = specie_type
state.surf_type = surf_type
state.max_val = max_val
state.norm_factor = norm_factor
state.unit = unit
state.outfile = outfile
```

```
;Sets window to the appropriate draw widget.
widget_control, ev.top, set_uvalue=state
```

```
```
```
; Reads the data and creates an output file.
call_procedure, 'month_read', specie_type, surf_type, nummonth, surf, header, range, outfile, norm_factor, unit, surf_unit, y_unit, max_val

; Sets the file name for passing.
state.specie_type = specie_type
state.surf_type = surf_type
state.max_val = max_val
state.norm_factor = norm_factor
state.unit = unit
state.outfile = outfile
widget_control, ev.top, set_uvalue = state

; Sets window to the appropriate draw widget
widget_control, state.draw2, get_value = winid
wset, winid

call_procedure, 'reset', ev

return
end

--

pro OpenO3MRalamb, ev

; Set default variables and widget values for O3 Mixing Ratios at Pressure (mb)

specie_type = 68
surf_type = 2
max_val = 9.99999999999999e-1
norm_factor = 1e6 ; Will give ppm for the mixing ratio.
unit = '('ppm')'
surf = 70
range = 10
surf_unit = 'longitude degrees'
y_unit = 3
x_unit = 1
outfile = 'temp'
widget_control, ev.top, get_uvalue = state
parent = ev.top

; Gets information from the user about the file to be opened.
call_procedure, 'getinfo', nummonth, surf, header, surf_unit, surf_type, range, cancel = cancel, parent = parent

; Reads the data and creates an output file.
call_procedure, 'month_read', specie_type, surf_type, nummonth, surf, header, range, outfile, norm_factor, unit, surf_unit, y_unit, max_val

; Sets the file name for passing.
state.specie_type = specie_type
state.surf_type = surf_type
state.max_val = max_val
state.norm_factor = norm_factor
state.unit = unit
state.outfile = outfile
widget_control, ev.top, set_uvalue = state
pro OpenO3MRalaK, ev

; Set default variables and widget values for O3 Mixing Ratios at Potential Temperature.
specie_type = 69
surf_type = 2
max_val = 9.999999999e-1
norm_factor = 1e6 ; Will give ppm for the mixing ratio.
unit = '(ppm)'
surf = 70
range = 10
surf_unit = 'longitude degrees'
y_unit = 4
x_unit = 1
outfile = 'temp'

widget_control, ev.top, get_uvalue=state
parent = ev.top

; Gets information from the user about the file to be opened.
call_procedure, 'getinfo', nummonth, surf, header, surf_unit, surf_type, range, cancel=cancel, parent=parent

; Reads the data and creates an output file.
call_procedure, 'month_read', specie_type, surf_type, nummonth, surf, header, range, outfile, norm_factor, unit, surf_unit, y_unit, max_val

; Sets the file name for passing.
state.specie_type = specie_type
state.surf_type = surf_type
state.max_val = max_val
state.norm_factor = norm_factor
state.unit = unit
state.outfile = outfile

widget_control, ev.top, set_uvalue=state

; Sets window to the appropriate draw widget
widget_control, state.draw2, get_value=winid
wset, winid

call_procedure, 'reset', ev

return
end
pro OpenO3MRelokm, ev

;Set default variables and widget values for O3 Mixing Ratios at Kilometers (km).
specie_type = 70
surf_type = 3
max_val = 9.9999999999999e-1
norm_factor=1e6 ;Will give ppm for the mixing ratio.
unit = '(ppm)'
surf = 40
range = 5
surf_unit = 'latitude degrees'
y_unit = 2
x_unit = 1
outfile = 'temp'
widget_control, ev.top, get_uvalue=state
parent = ev.top

;Gets information from the user about the file to be opened.
call_procedure, 'getinfo', nummonth, surf, header, surf_unit, surf_type,
range, cancel=cancel, parent=parent

;Reads the data and creates and output file.
call_procedure,'month_read', specie_type, surf_type, nummonth, surf, header,
range, outfile, norm_factor, unit, surf_unit, y_unit, max_val

;Sets the file name for passing.
state.specie_type = specie_type
state.surf_type = surf_type
state.max_val = max_val
state.norm_factor = norm_factor
state.unit = unit
state.outfile = outfile
widget_control, ev.top, set_uvalue=state

;Sets window to the appropriate draw widget
widget_control, state.draw2, get_value=winid
wset, winid

call_procedure,'reset', ev

return
end

--

pro OpenO3MRelomb, ev

;Set default variables and widget values for O3 Mixing Ratios at Pressure (mb).
specie_type = 71
surf_type = 3
max_val = 9.9999999999999e-1
norm_factor=1e6 ;Will give ppm for the mixing ratio.
unit = '(ppm)'
surf = 40
range = 5
surf_unit = 'latitude degrees'
y_unit = 3
x_unit = 1
outfile = 'temp'
widget_control, ev.top, get_uvalue=state
parent = ev.top

; Gets information from the user about the file to be opened.
call_procedure, 'getinfo', nummonth, surf, header, surf_unit, surf_type, range, cancel=cancel, parent=parent

; Reads the data and creates and output file.
call_procedure, 'month_read', specie_type, surf_type, nummonth, surf, header, range, outfile, norm_factor, unit, surf_unit, y_unit, max_val

; Sets the file name for passing.
state.specie_type = specie_type
state.surf_type = surf_type
state.max_val = max_val
state.norm_factor = norm_factor
state.unit = unit
state.outfile = outfile
widget_control, ev.top, set_uvalue=state

; Sets window to the appropriate draw widget
widget_control, state.draw2, get_value=winid
wset, winid

call_procedure, 'reset', ev
return
end

---

pro Open03MRaloK, ev

; Set default variables and widget values for O3 Mixing Ratios at Potential Temperature.
specie_type = 72
surf_type = 3
max_val = 9.9999999999999e-1
norm_factor=1e6 ; Will give ppm for the mixing ratio.
unit = '(ppm)'
surf = 40
range = 5
surf_unit = 'latitude degrees'
y_unit = 4
x_unit = 1
outfile = 'temp'
widget_control, ev.top, get_uvalue=state
parent = ev.top

; Gets information from the user about the file to be opened.
call_procedure, 'getinfo', nummonth, surf, header, surf_unit, surf_type, range, cancel=cancel, parent=parent

; Reads the data and creates and output file.
call_procedure, 'month_read', specie_type, surf_type, nummonth, surf, header, range, outfile, norm_factor, unit, surf_unit, y_unit, max_val

; Sets the file name for passing.
state.specie_type = specie_type
state.surf_type = surf_type
state.max_val = max_val
state.norm_factor = norm_factor
state.unit = unit
state.outfile = outfile
widget_control, ev.top, set_uvalue=state

;Sets window to the appropriate draw widget
widget_control, state.draw2, get_value=winid
wset, winid

call_procedure, 'reset', ev

return
end

 pro reset, ev

widget_control, ev.top, get_uvalue=state
parent = ev.top

 ;Sets window to the appropriate draw widget
 widget_control, state.draw2, get_value=winid
 wset, winid

 ;Plots the raw data.
 call_procedure, 'plot_points', state.outfile, state.surf_type, state.
 levels, x_axis_max, x_axis_min, y_axis_max, y_axis_min

 ;Sets window to the appropriate draw widget
 widget_control, state.draw, get_value=winid
 wset, winid

 ;Grids the data and draws a cellfilled contour.
 call_procedure, 'Grid_Smooth_Map', state.outfile, state.lat_step, state.
 lon_step, state.smooth_pass, state.levels, x_axis_max, x_axis_min, y_axis_max,
 y_axis_min

 state.x_axis_max = x_axis_max
 state.x_axis_min = x_axis_min
 state.y_axis_max = y_axis_max
 state.y_axis_min = y_axis_min

 widget_control, ev.top, set_uvalue=state

 ;Sets window to the appropriate draw widget
 ; widget_control, state.draw2, get_value=winid
 ; wset, winid

 ;Plots the raw data.
 ; call_procedure, 'plot_points', state.outfile

 ;Sets window to the appropriate draw widget
 ; widget_control, state.draw, get_value=winid
wset, winid
; Grids the data and draws a cellfilled contour.
; call_procedure, 'Grid_Smooth_Map', state.outfile

return
end

pro Color_Table, ev
    CALL_Procedure, 'xloadct'

return
end

pro WidgetDone, ev
    Widget_Control, ev.top, /destroy

return
end

pro Process_Gif, ev
; This event is responsible for creating a GIF file
thisfile = dialog_pickfile(/write, file='DATA.gif')
if thisfile eq '' then return

    Widget_Control, ev.top, Get_UValue=state, /No_Copy
    WSet, state.winid
    thisImage = TVRD()
    TVLCT, r, g, b, /Get
    Write_GIF, thisFile, thisImage, r, g, b
    Widget_Control, ev.top, Set_UValue=state, /No_Copy

END

pro Process_JPEG, ev
; This event handler is responsible for creating a JPEG file.
thisFile = Dialog Pickfile(/Write, File='DATA.jpg')
IF thisFile EQ '' THEN RETURN

    Widget_Control, ev.top, Get_UValue=state, /No_Copy
    WSet, state.winid
thisImage = TVRD()
TVLCT, r, g, b, /Get

; Create 24-bit color image.

image24 = BytArr(3, state.xsize, state.ysize)
image24(0,*,*) = r(thisImage)
image24(1,*,*) = g(thisImage)
image24(2,*,*) = b(thisImage)

; Write file. Normal image quality in this lossy format.
Write_JPEG, thisFile, image24, True=1, Quality=75
Widget_Control, ev.top, Set_UValue=state, /No_Copy
END

-----------------------------------------------

PRO Postscript_Save, ev
filename = Dialog_Pickfile(/Write, File='DATA.ps')
IF filename EQ '' THEN RETURN

; Get the screen dump of the current graphics window.
screenDump = TVRD()

; Open a PostScript file and dump it.
thisDevice = !D.NAME
SET_PLOT, 'PS'

; Make a PostScript window with the same aspect ratio as the current display window. Use color PostScript if the COLOR keyword is set.
;;;;; aspect = PSWINDOW()
DEVICE, FILENAME=filename, XSIZE=aspect.xsize, YSIZE=aspect.ysize, $
XOFFSET=aspect.xoffset, YOFFSET=aspect.yoffset, COLOR=KEYWORD_SET(color)

; Display the screen dump. Fill up the window.
TV, screenDump, XSIZE=!D.X_SIZE, YSIZE=!D.Y_SIZE
DEVICE, /CLOSE_FILE
SET_PLOT, thisDevice
END

-----------------------------------------------

pro ReadSage_EVENT ,ev
widget_control, ev.top, get_uvalue=state

; What type of event was it?
wtype = tag_names(ev, /struct)

;Slider Widget
if(wtype eq 'WIDGET_DRAW') then begin
dx = ev.x
dy = ev.y

xyd = convert_coord(dx,dy, /device, /to_normal)

xd = xyd(0,0)
yd = xyd(1,0)

xyid = widget_info(ev.top, find_by_uname = 'xy')

loc = string(FORMAT='(f7.1,f7.1)',xd,yd)

widget_control, xyid, set_value=loc
endif

if(wtype eq 'WIDGET_BUTTON') then begin
    widget_control, ev.id, get_value=typ
    case typ of
        'Done': widget_control,/destroy,ev.top
    endcase
endif

if(wtype eq 'WIDGET_FSLIDER') then begin
    levels = state.levels
    step = ev.value/10.0
    for j = 0, i0 do begin
        levels(j) = j*step
    endfor
    widget_control, state.draw2, get_value=winid
    wset, winid
    call_procedure, 'plot_points', state.outfile, state.surf_type, levels,
    state.x_axis_max, state.x_axis_min, state.y_axis_max, state.y_axis_min
    widget_control, state.draw, get_value=winid
    wset, winid
    call_procedure, 'Grid_Smooth_Map', state.outfile, state.lat_step, state.
lon_step, state.smooth_pass, levels, state.x_axis_max, state.x_axis_min,
state.y_axis_max, state.y_axis_min

    state.levels = levels

    widget_control, ev.top, set_uvalue = state
endif
returnend

;---------------------------------------------
--
pro ReadSage

device, pseudo=8, retain=2
!p.background = 0

; Set dialog in the middle of the screen
device, get_screen_size = screensize
xcenter = fix(screensize[0] / 2.0)
ycenter = fix(screensize[1] / 2.0)

base = widget_base( mbar=bar, title = 'SAGE Data Surface Plate Visualization',
ysize=screensize[1], xsize=screensize[0], /row, /tlb_size_events)

; Creates FILE menu button
menul = widget_button(bar, value='File', /menu)
    button1 = widget_button(menul, value='New Window', /menu)
    button2 = widget_button(menul, value='Open g2p V5.931', /menu)

; Aerosol Menu
    but1 = widget_button(button2, value='Aerosol 1000 nm', /menu)
        but11 = widget_button(but1, value='Vs latitude & longitude', /menu)
            but111 = widget_button(but11, value='At altitude in km',
                event_pro='OpenA100011km')
            but112 = widget_button(but11, value='At altitude in mb',
                event_pro='OpenA100011mb')
            but113 = widget_button(but11, value='At altitude in Potential Temperature',
                event_pro='OpenA100011K')
        but12 = widget_button(but1, value='Vs altitude & latitude', /menu)
            but121 = widget_button(but12, value='Vs altitude & longitude', /menu)
                but1211 = widget_button(but121, value='At altitude in km',
                    event_pro='OpenA100011Km')
                but1212 = widget_button(but121, value='At altitude in mb',
                    event_pro='OpenA100011mb')
                but1213 = widget_button(but121, value='At altitude in Potential Temperature',
                    event_pro='OpenA10001aK')
            but122 = widget_button(but12, value='Altitude in km',
                event_pro='OpenA1000alakm')
            but123 = widget_button(but12, value='Altitude in mb',
                event_pro='OpenA1000alamb')
                but1231 = widget_button(but123, value='At altitude in Potential Temperature',
                    event_pro='OpenA1000aloK')
but2 = widget_button(button2, value='Aerosol 525 nm', /menu)
but21 = widget_button(but2, value='Vs altitude & latitude', /menu)
but211 = widget_button(but21, value='At altitude in km', event_pro='OpenA52511km')
but212 = widget_button(but21, value='At altitude in mb', event_pro='OpenA52511mb')
but213 = widget_button(but21, value='At altitude in Potential Temperature', event_pro='OpenA52511K')
but22 = widget_button(but2, value='Vs altitude & latitude', /menu)
but221 = widget_button(but22, value='At altitude in km', event_pro='OpenA525alakm')
but222 = widget_button(but22, value='At altitude in mb', event_pro='OpenA525alamb')
but223 = widget_button(but22, value='At altitude in Potential Temperature', event_pro='OpenA525alaK')
but23 = widget_button(but2, value='Vs altitude & longitude', /menu)
but231 = widget_button(but23, value='At altitude in km', event_pro='OpenA525alokm')
but232 = widget_button(but23, value='At altitude in mb', event_pro='OpenA525alomb')
but233 = widget_button(but23, value='At altitude in Potential Temperature', event_pro='OpenA525aloK')
but3 = widget_button(button2, value='Aerosol 450 nm', /menu)
but31 = widget_button(but3, value='Vs altitude & longitude', /menu)
but311 = widget_button(but31, value='At altitude in km', event_pro='OpenA45011km')
but312 = widget_button(but31, value='At altitude in mb', event_pro='OpenA45011mb')
but313 = widget_button(but31, value='At altitude in Potential Temperature', event_pro='OpenA45011K')
but32 = widget_button(but3, value='Vs altitude & latitude', /menu)
but321 = widget_button(but32, value='At altitude in km', event_pro='OpenA450alakm')
but322 = widget_button(but32, value='At altitude in mb', event_pro='OpenA450alamb')
but323 = widget_button(but32, value='At altitude in Potential Temperature', event_pro='OpenA450alaK')
but33 = widget_button(but3, value='Vs altitude & longitude', /menu)
but331 = widget_button(but33, value='At altitude in km', event_pro='OpenA450alokm')
but332 = widget_button(but33, value='At altitude in mb', event_pro='OpenA450alomb')
but333 = widget_button(but33, value='At altitude in Potential Temperature', event_pro='OpenA450aloK')
but4 = widget_button(button2, value='Aerosol 385 nm', /menu)
but41 = widget_button(but4, value='Vs altitude & longitude', /menu)
but411 = widget_button(but41, value='At altitude in km', event_pro='OpenA38511km')
but412 = widget_button(but41, value='At altitude in mb', event_pro='OpenA38511mb')
but413 = widget_button(but41, value='At altitude in Potential Temperature', event_pro='OpenA38511K')
but42 = widget_button(but4, value='Vs altitude & latitude', /menu)
but421 = widget_button(but42, value='Altitude in km',
event_pro='OpenA385alakm')
but422 = widget_button(but42, value='Altitude in mb',
event_pro='OpenA385alamb')
but423 = widget_button(but42, value='Altitude in Potential Temperature',
event_pro='OpenA385alaK')

but43 = widget_button(but4, value='Vs altitude & longitude', /menu)
but431 = widget_button(but43, value='Altitude in km',
event_pro='OpenA385alokm')
but432 = widget_button(but43, value='Altitude in mb',
event_pro='OpenA385alomb')
but433 = widget_button(but43, value='Altitude in Potential Temperature',

; NO2 Menu
but2 = widget_button(button2, value='NO2 Mixing Ratio', /menu)
but21 = widget_button(but2, value='Vs latitude & longitude', /menu)
but211 = widget_button(but21, value='At altitude in km',
event_pro='OpenNO2MRllkm')
but212 = widget_button(but21, value='At altitude in mb',
event_pro='OpenNO2MRllmb')
but213 = widget_button(but21, value='At altitude in Potential Temperature',
    event_pro='OpenNO2MRllaK')
but22 = widget_button(but2, value='Vs altitude & latitude', /menu)
but221 = widget_button(but22, value='Altitude in km',
event_pro='OpenNO2MRalakm')
but222 = widget_button(but22, value='Altitude in mb',
event_pro='OpenNO2MRalamb')
but223 = widget_button(but22, value='Altitude in Potential Temperature',
    event_pro='OpenNO2MRalaK')

; Ozone Menu
but3 = widget_button(button2, value='Ozone Mixing Ratio', /menu)
but31 = widget_button(but3, value='Vs latitude & longitude', /menu)
but311 = widget_button(but31, value='At altitude in km',
event_pro='OpenO3MRllkm')
but312 = widget_button(but31, value='At altitude in mb',
event_pro='OpenO3MRllmb')
but313 = widget_button(but31, value='At altitude in Potential Temperature',
    event_pro='OpenO3MRllaK')
but32 = widget_button(but3, value='Vs altitude & latitude', /menu)
but321 = widget_button(but32, value='Altitude in km',
event_pro='OpenO3MRalakm')
but322 = widget_button(but32, value='Altitude in mb',
event_pro='OpenO3MRalamb')
but323 = widget_button(but32, value='Altitude in Potential Temperature',
    event_pro='OpenO3MRalaK')
but33 = widget_button(but3, value='Vs altitude & longitude', /menu)
    but331 = widget_button(but33, value='Altitude in km',
                        event_pro='OpenO3MRalokm')
    but332 = widget_button(but33, value='Altitude in mb',
                        event_pro='OpenO3MRalomb')
    but333 = widget_button(but33, value='Altitude in Potential Temperature',
                        event_pro='OpenO3MRaloK')

; Water Vapor menu
; but4 = widget_button(button2, value='Water Vapor', /menu)
; but41 = widget_button(but4, value='Mixing Ratio', /menu)
; but411 = widget_button(but41, value='Vs latitude & longitude', /menu)
    but4111 = widget_button(but411, value='Altitude in km',
                           event_pro='OpenH2OMRllkm')
    but4112 = widget_button(but411, value='Altitude in mb',
                           event_pro='OpenH2OMRllmb')
    but4113 = widget_button(but411, value='Altitude in K',
                           event_pro='OpenH2OMRllK')

; but412 = widget_button(but41, value='Vs altitude & latitude', /menu)
    but4121 = widget_button(but412, value='Altitude in km',
                           event_pro='OpenH2OMRalakm')
    but4122 = widget_button(but412, value='Altitude in mb',
                           event_pro='OpenH2OMRalamb')
    but4123 = widget_button(but412, value='Altitude in K',
                           event_pro='OpenH2OMRalaK')

; but413 = widget_button(but41, value='Vs altitude & latitude', /menu)
    but4131 = widget_button(but413, value='Altitude in km',
                           event_pro='OpenH2OMRALokm')
    but4132 = widget_button(but413, value='Altitude in mb',
                           event_pro='OpenH2OMRALomb')
    but4133 = widget_button(but413, value='Altitude in K',
                           event_pro='OpenH2OMRALoK')

button3 = widget_button(menu1, value='Open Specie File', event_pro='Specie_file')
button4 = widget_button(menu1, value='Close', event_pro='three')
button6 = widget_button(menu1, value='Save Plates As', /menu)
    but1 = widget_button(button6, value='GIF File', event_pro='Process_gif')
    but1 = widget_button(button6, value='JPEG File', event_pro='Process_jpeg')
    but1 = widget_button(button6, value='PostScript File', event_pro='Postscript_save')
; button22 = widget_button(menu1, value='Print', /separator)
    button6 = widget_button(menu1, value='Quit', /separator)
    button6 = widget_button(menu1, value='WidgetDone')

; Manipulation Options
Man_baseID = widget_base(base, /column, /frame)
label = widget_label(Man_baseID, value='Options')
label = widget_label(Man_baseID, value=' ')  
lb20 = widget_Button(Man_baseID, value='Color Table', event_pro='Color_Table')
Grid_butID = widget_Button(Man_baseID, value='Regrid and Smooth', event_pro='regrid')
scale_butID = widget_button(Man_baseID, value= 'Rescale Axes', event_pro= 'rescale')
sliderID = cw_flslider(Man_baseID, Title = 'Colorbar Scale Maximum', value=10, maximum=100.0, /frame, /edit)

;Sections for drawing
Draw_BaseID = widget_base(base, /column, /frame)
windowx=screensize[0]*.75
windowy=screensize[1]*.42
; Draw Window for raw data
rbot3 = widget_base(Draw_baseID, /column, /frame)
draw2 = widget_draw(rbot3, xsize=windowx, ysize=windowy, /frame, /motion_events)
; Draw Window for gridded data
rbot2 = widget_base(Draw_baseID, /column, /frame)
draw = widget_draw(rbot2, xsize=windowx, ysize=windowy, /frame, /motion_events)
MapStuff_baseID = widget_base(rbot2,space=10,/row,/frame)
  but2 = widget_button(MapStuff_baseID, value='Reset', event_pro='reset')
  but3 = widget_button(MapStuff_baseID, value='Done')

rbot0 = widget_base(MapStuff_baseID,/row,/frame)
lbl0 = widget_label(rbot0, value='Location')
txt0 = widget_text( rbot0, value=' ', uname = 'xy')
InfoID = widget_base(MapStuff_baseID, /column)
  meID = widget_label(InfoID,value = 'Created by NSU ViSAGE Team', ysize = 10)
  NAPFID = widget_label(InfoID,value = 'Waldo J. Rodriguez, PI', ysize = 7)
  NSUID = widget_label(InfoID,value = 'Norfolk State University', ysize = 10)

; Realizes the Widget
widget_control, base, /realize

; Draws First map
widget_control, draw2, get_value=winid
WSET, winid
;MAP_SET, /CONTINENTS, /MERCATOR
MAP_SET, /MERCATOR
MAP_CONTINENTS, color=255
MAP_Grid, /Label, color=255

; Draws Second map
widget_control, draw, get_value=winid
WSET, winid
;MAP_SET, /CONTINENTS, /MERCATOR
MAP_SET, /MERCATOR
MAP_CONTINENTS, color=255
MAP_Grid, /Label, color=255

; State is utilize
state ={draw:draw, $
  draw2:draw2, $
winid: winid, $
 xsize: windowx, $
 ysize: windowy, $
 specie_type: 1,$
 surf_type: 1,$
 max_val: 9.99999e-1,$
 norm_factor: 1e6,$ ; for ppm
 unit: 'ppm',$
 outfile: ' ',$
 lat_step: 8.0,$
 lon_step: 10.0,$
 smooth_pass: 9,$
 levels: findgen(ll),$
 x_axis_max: 0,$
 x_axis_min: 0,$
 y_axis_max: 0,$
 y_axis_min: 0)

widget_control, base, set_uvalue = state
xmanager, 'ReadSage', base

return
d
pro reset, outfile, surf_type, levels, x_axis_max, x_axis_min, y_axis_max, y_axis_min, y_step, x_step, smooth_pass, cont_levels

widget_control, ev.top, get_uvalue=state
parent = ev.top

;Sets window to the appropriate draw widget
widget_control, state.draw2, get_value=winid
wset, winid

;Plots the raw data.
call_procedure, 'plot_points', state.outfile, state.surf_type, state.levels, x_axis_max, x_axis_min, y_axis_max, y_axis_min

;Sets window to the appropriate draw widget
widget_control, state.draw, get_value=winid
wset, winid

;Grids the data and draws a cellfilled contour.
call_procedure, 'Grid_Smooth_Map', state.outfile, state.lat_step, state.lon_step, state.smooth_pass, state.levels, x_axis_max, x_axis_min, y_axis_max, y_axis_min

state.x_axis_max = x_axis_max
state.x_axis_min = x_axis_min
state.y_axis_max = y_axis_max
state.y_axis_min = y_axis_min

widget_control, ev.top, set_uvalue=state

;Sets window to the appropriate draw widget
; widget_control, state.draw2, get_value=winid
; wset, winid

;Plots the raw data.
; call_procedure,'plot_points', state.outfile

;Sets window to the appropriate draw widget
; widget_control, state.draw, get_value=winid
; wset, winid

;Grids the data and draws a cellfilled contour.
; call_procedure, 'Grid_Smooth_Map', state.outfile

return
end
NAME: CW_FSLIDER

PURPOSE: The standard slider provided by the WIDGET_SLIDER() function is integer only. This compound widget provides a floating point slider.

CATEGORY: Compound widgets.

CALLING SEQUENCE: widget = CW_FSLIDER(Parent)

INPUTS: Parent: The ID of the parent widget.

KEYWORD PARAMETERS:

DRAG: Set this keyword to zero if events should only be generated when the mouse is released. If it is non-zero, events will be generated continuously when the slider is adjusted. Note: On slow systems, /DRAG performance can be inadequate. The default is DRAG=0.

EDIT: Set this keyword to make the slider label be editable. The default is EDIT=0.

FORMAT: Provides the format in which the slider value is displayed. This should be a format as accepted by the STRING procedure. The default is FORMAT=’(Gi3.6)’.

FRAME: Set this keyword to have a frame drawn around the widget. The default is FRAME=0.

MAXIMUM: The maximum value of the slider. The default is MAXIMUM=100.

MINIMUM: The minimum value of the slider. The default is MINIMUM=0.

SCROLL: Sets the SCROLL keyword to the WIDGET_SLIDER underlying this compound widget. Unlike WIDGET_SLIDER, the value given to SCROLL is taken in the floating units established by MAXIMUM and MINIMUM, and not in pixels.

SUPPRESS_VALUE: If true, the current slider value is not displayed. The default is SUPPRESS_VALUE=0.

TITLE: The title of slider. (The default is no title.)

UVALUE: The user value for the widget.

VALUE: The initial value of the slider

VERTICAL: If set, the slider will be oriented vertically. The default is horizontal.

XSIZE: For horizontal sliders, sets the length.

YSIZE: For vertical sliders, sets the height.

OUTPUTS: The ID of the created widget is returned.

SIDE EFFECTS: This widget generates event structures containing a field named value when its selection thumb is moved. This is a
; floating point value.
;
; PROCEDURE:
; WIDGET_CONTROL, id, SET_VALUE=value can be used to change the
; current value displayed by the widget.
; WIDGET_CONTROL, id, GET_VALUE=var can be used to obtain the current
; value displayed by the widget.
;
; MODIFICATION HISTORY:
; April 2, 1992, SMR and AB
; Based on the RGB code from XPALETTE.PRO, but extended to
; support color systems other than RGB.
; 5 January 1993, Mark Rivers, Brookhaven National Labs
; Added EDIT keyword.
; 7 April 1993, AB, Removed state caching.
; 28 July 1993, ACY, set_value: check labelid before setting text.
; 3 October 1995, AB, Added SCROLL keyword.
;

PRO fslider_set_value, id, value

; Set the value of both the slider and the label
ON_ERROR, 2 ;return to caller

stash = WIDGET_INFO(id, /CHILD)
WIDGET_CONTROL, stash, GET_UVALUE=state, /NO_COPY

WIDGET_CONTROL, state.slideid, $
SET_VALUE = 1000000. * $
(float(value) - state.bot) / (float(state.top) - state.bot)
IF (state.labelid NE 0) THEN $
WIDGET_CONTROL, state.labelid, $
SET_VALUE = STRING(FLOAT(value), format=state.format)

WIDGET_CONTROL, stash, SET_UVALUE=state, /NO_COPY
END

FUNCTION fslider_get_value, id

; Return the value of the slider
ON_ERROR, 2 ;return to caller

stash = WIDGET_INFO(id, /CHILD)
WIDGET_CONTROL, stash, GET_UVALUE=state, /NO_COPY

WIDGET_CONTROL, state.slideid, GET_VALUE = tmp
ret = ((tmp / 1000000.) * (float(state.top) - state.bot)) + state.bot

WIDGET_CONTROL, stash, SET_UVALUE=state, /NO_COPY
return, ret
END

;-------------------------------------------------------------

FUNCTION fslide_event, ev

FUNCTION fslide_event, ev
; Retrieve the structure from the child that contains the sub ids
parent=ev.handler
stash = WIDGET_INFO(parent, /CHILD)
WIDGET_CONTROL, stash, GET_UVALUE=state, /NO_COPY

; See which widget was adjusted, the slider or the label
if (ev.id eq state.slideid) then begin
; Get the non-adjusted value
WIDGET_CONTROL, state.slideid, GET_VALUE = nonadj
; Compute the floating point value
value = ((nonadj / 1000000.) * (float(state.top) - state.bot)) + state.bot
drag = ev.drag
; Update label
IF (state.labelid NE 0) THEN $
    WIDGET_CONTROL, state.labelid, $
      SET_VALUE=STRING(value, format=state.format)
endif else if (ev.id eq state.labelid) then begin
    WIDGET_CONTROL, state.labelid, GET_VALUE = tmp
    value = float(tmp[0])
    value = value > state.bot
    value = value < state.top
    ; Update the slider, set new value
    WIDGET_CONTROL, state.slideid, $
      SET_VALUE = 1000000. * $  
        (value - state.bot) / (float(state.top) - state.bot)
    drag = 0
    ; Update the label so it has desired format
    WIDGET_CONTROL, state.labelid, $
      SET_VALUE=STRING(value, format=state.format)
endif

WIDGET_CONTROL, stash, SET_UVALUE=state, /NO_COPY
RETURN, {WIDGET_FSLIDER, ID:parent, TOP: ev.top, HANDLER:0L, VALUE:value,
DRAG:drag }
END

FUNCTION cw_fslider, parent, $
  DRAG = drag, $
  EDIT = edit, $
  FRAME = frame, $
  MAXIMUM = max, $
  MINIMUM = min, $
  SCROLL = scroll, $
  SUPPRESS_VALUE = sup, $
  TITLE = title, $
  UVALUE = uval, $
  VALUE = val, $
  VERTICAL = vert, $
  XSIZE = xsize, $
  YSIZE = ysize, $
  FORMAT=format

IF (N_PARAMS() EQ 0) THEN MESSAGE, 'Incorrect number of arguments'
ON_ERROR, 2
: return to caller

; Defaults for keywords
IF NOT (KEYWORD_SET(drag)) THEN drag = 0
IF NOT (KEYWORD_SET(edit)) THEN edit = 0
IF NOT (KEYWORD_SET(frame)) THEN frame = 0
IF N_ELEMENTS(max) EQ 0 THEN max = 100.0
IF N_ELEMENTS(min) EQ 0 THEN min = 0.0
IF NOT (KEYWORD_SET(scroll)) THEN scroll = 10000 ELSE $
scroll = ABS(LONG((float(scroll) / (max - min)) * 1000000))
IF NOT (KEYWORD_SET(sup)) THEN sup = 0
IF NOT (KEYWORD_SET(title)) THEN title = ""
IF NOT (KEYWORD_SET(uval)) THEN uval = 0
IF NOT KEYWORD_SET(format) THEN format = '(G13.6)'

state = [slideid:0L, labelid:0L, top:max, bot:min, format:format ]

; Motif 1.1 and newer sliders react differently to XSIZE and YSIZE
; keywords than Motif 1.0 or OpenLook. These defs are for horizontal sliders
version = WIDGET_INFO(/version)
newer_motif = (version.style eq 'Motif') and (version.release ne 'i.0')

; The sizes of the parts depend on keywords and whether or not the
; float slider is vertical or horizontal
; these are display specific and known to be inherently evil
sld_thk = 16
chr_wid = 7
IF (KEYWORD_SET(vert)) THEN BEGIN
  if (newer_motif) then begin
    if (not KEYWORD_SET(xsize)) then xsize = 0
  endif else begin
    title_len = STRLEN(title) * chr_wid
    xsize = (sld_thk * 1.4) + title_len ; Take label into account
  endelse
  IF NOT (KEYWORD_SET(ysize)) THEN ysize = 100
  l_yoff = ysize / 2
ENDIF ELSE BEGIN
  vert = 0
  tmp = not keyword_set(xsize)
  if (newer_motif) then begin
    if (tmp) then xsize = 0
  IF NOT (KEYWORD_SET(ysize)) THEN ysize = 0
  endif else begin
    if (tmp) then xsize = 100
    IF (TITLE NE '') THEN sld_thk = sld_thk + 21
    ysize = sld_thk
  endifelse
  l_yoff = 0
ENDELS

if (vert) then begin
  mainbase = WIDGET_BASE(parent, FRAME = frame, /ROW)
  labelbase = WIDGET_BASE(mainbase)
endif else begin
  mainbase = WIDGET_BASE(parent, FRAME = frame, /COLUMN)
  labelbase = mainbase
endelse
WIDGET_CONTROL, mainbase, SET_UVALUE = uval, EVENT_FUNC = 'fslide_event',$
PRO_SET_VALUE='FSLIDER_SET_VALUE', $
FUNC_GET_VALUE='FSLIDER_GET_VALUE'

IF (sup EQ 0) THEN $
    ; Only build the label if suppress_value is FALSE
    state.labelid = WIDGET_TEXT(labelbase, YOFFSET = 1_yoff, $
        VALUE = STRING(FLOAT(val), format=state.format), $
        edit=edit) $
ELSE state.labelid = 0

    state.slideid = WIDGET_SLIDER(mainbase, $
        TITLE = TITLE, $
        XSIZE = xsize, $
        YSIZE = ysize, $
        /SUPPRESS_VALUE, $
        MINIMUM = 0, $
        MAXIMUM = 1000000, $
        VALUE = 1000000. * $(float(val) - state.bot) / $(float(state.top) - state.bot), $
        VERTICAL = vert, $
        DRAG=drag, $
        SCROLL=scroll)

WIDGET_CONTROL, WIDGET_INFO(mainbase, /CHILD), SET_UVALUE=state, /NO_COPY
RETURN, mainbase

END
function normal_scat, lon, lat, f, GS = gs, BOUNDS = bounds, NLON=nlon, $ NLAT = nlat, GOUT = gsout, BOUT = boundsout

; NAME:
; SPH_SCAT

; PURPOSE:
; Interpolate to a regular grid given scattered samples on the surface of a sphere.

; CATEGORY:
; Interpolation.

; CALLING SEQUENCE:
; Result = SPH_SCAT(lon, lat, f)

; INPUTS:
; lon = sample longitudes, a vector, in degrees. lon, lat, and f must have the same number of points.
; lat = sample latitudes, a vector, in degrees.
; f = data values measured at lon and lat. f(i) = sample value at lon(i), lat(i).

; KEYWORD PARAMETERS:
; GS: If present, GS must be a two-element vector [XS, YS], where XS is the spacing between grid points in longitude, and YS is the spacing in latitude. The default is based on the extents of lon and lat. If the grid starts at longitude Lonmin and ends at Lonmax, then the default horizontal spacing is (Lonmax - Lonmin)/(NX-l). YS is computed in the same way. The default grid size, if neither NX or NY are specified, is 26 by 26.
; BOUNDS: If present, BOUNDS must be a four element array containing the grid limits in longitude and latitude of the output grid: [Lonmin, Latmin, Lonmax, Latmax]. If not specified, the grid limits are set to the extent of lon and lat. Warning: to cover all longitudes, you must directly specify BOUNDS.
; NX: The output grid size in the longitude direction. NX need not be specified if the size can be inferred from GS and BOUNDS. The default value is 26.
; NY: The output grid size in the latitude direction. See NX.
; BOUT: the actual extent of the regular grid, arranged as in bounds. An optional output parameter.
; GOUT: The actual grid spacing, a two element optional output array.

; OUTPUTS:
; Result = regularly interpolated result.

; COMMON BLOCKS:
; None.

; SIDE EFFECTS:
; None.

; RESTRICTIONS:
; Timing. on a Sun SPARCstation LX producing a 36 x 36 output grid (1296 points), t is ~ .578 + .00368 * N + 2.39e-06 * N^2.
; For example:
; N 16 64 256 1024 4096
; Time .7 .8 1.6 6.6 56
; Output points are produced at a rate of approximately 2000 points per second.
PROCEDURE:

This routine is a convenience interface to the Spherical gridding and interpolation provided by TRIANGULATE and TRIGRID. The methods are based on the work of Robert Renka, Interpolation of Data on the Surface of a Sphere, Oak Ridge Natl Lab Technical Paper CSD-108. The procedure consists of generating a triangulation of the scattered data points, estimating the gradients with a local method, and then constructing a triangle based interpolant of the data and gradient estimates. The interpolant is C(1) continuous.

EXAMPLE:

Create 50 random longitudes and latitudes, make a function value, and then interpolate, obtaining a 360 x 360 array of 10 degree by 5 degree resolution that covers the sphere:

```plaintext
lon = randomu(seed, 50) * 360. -180. ;Make random scattered points
lat = randomu(seed, 50) * 180. -90.
z = sin(lat*!DTOR) ;Make a function to fit
c = cos(lat*!DTOR)
x = cos(lon*!DTOR) * c
y = sin(lon*!DTOR) * c
f = sin(x+y) * sin(x'*z) ;The dependent variable
```

Now, given lon, lat, and f, interpolate the data:

```plaintext
result = sph_scat(lon, lat, f, bounds=[0, -90, 350, 85], gs=[10,5])
```

MODIFICATION HISTORY:


```plaintext
n = n_elements(lon)
if n ne n_elements(lat) or n ne n_elements(f) then $
   message, 'lon, lat, and f must have the same number of elements'
if n le 3 then $
   message, 'Must have at least 3 points'
   Construct bounds if necessary
if n_elements(bounds) ne 4 then $
   boundsout = [ min(lon, max=lonmin), min(lat, max=latmin), lonmax, latmax]
else boundsout = bounds
   Get gs, nx, and ny.
   if n_elements(gs) ne 2 then begin
      if n_elements(nx) le 0 then nx = 10
      if n_elements(ny) le 0 then ny = 10
      gsout = [boundsout[2]-boundsout[0], boundsout[3]-boundsout[1]] / $
              float([nx-1, ny-1])
   endif else gsout = gs
   fcopy = f ;will be rearranged.
   TRIANGULATE, 1.0*lon, 1.0*lat, tr; FVALUE=fcopy
   return, TRIGRID(1.0*lon, 1.0*lat, fcopy, tr, gsout, boundsout)
end
```