(NASA-CR-176612) A LABORATORY INVESTIGATION N86-23436 OF THE VARIABILITY OF CLOUD REFLECTED RADIANCE FIELDS Final Technical Report (Colorado State Univ.) 72 p EC A04/MF A01 Unclas CSCL 20F G3/74 05745

FINAL TECHNICAL REPORT

FOR

NASA Grant NAG5-387

entitled

A Laboratory Investigation of the Variability

of Cloud Reflected Radiance Fields

Principal Investigator: Thomas B. McKee

Co-Investigator: Stephen K. Cox

ŧ.

Department of Atmospheric Science Colorado State University Fort Collins, Colorado 80523

ł

FINAL TECHNICAL REPORT

· • ~

\ ~•

J

TABLE OF CONTENTS

		Page
1.0	Design and construction of a laboratory apparatus (CFOS) to simulate the interaction of cloud fields with visible radiation A. The Source B. The Cloud Field Assembly C. Sensor Array D. Data Display/Collection Station	1 1 4 5 5
2.0	<pre>Verification of CFOS by comparing experimental results from it with calculations performed with a Monte Carlo radiative transfer model A. Selection of Suitable Materials for Cloud Simulation B. The Optical Depth of Simulated Clouds C. Retrieval of Basic Finite Cloud Features</pre>	7 7 10 11
3.0	Development of a Software Library to Process, Reduce and Display CFOS Data for use in Research Studies Introduction Part I A. Laboratory Procedures B. Section 1 1. Source Alignment C. Section 2 1. Calibration 2. A Typical Data Collection Session Part II References	14 15 15 15 17 17 20 23
4.0	Boges 24-33 removed	
5.0	Publications and Reports	38
6.0	Statement on Inventions	39
	APPENDIX - Data Reduction and Analysis Programs	

Data Reduction and Analysis Programs for the Cloud Field Optical Simulator

.

.

۰ ،

. '

40

FINAL TECHNICAL REPORT

5

During the term of support by NASA of this research program, we have successfully developed a new approach to determining the radiative properties of complex cloud fields. This innovative research began as a unique, untried concept and has matured into a verified, useful technique. The accomplishments of this research are highlighted below. Following the highlights are brief explanations of each accomplishment.

Accomplishments:

- o Design and construction of a laboratory apparatus (CFOS) to simulate the interaction of cloud fields with visible radiation.
- Verification of CFOS by comparing experimental results from it with calculations performed with a Monte Carlo radiative transfer model.
- o Development of a software library to process, reduce and display CFOS data for use in research studies.
- o Utilization of CFOS to study the reflected radiance patterns from simulated cloud fields.
- 1.0 Design and construction of a laboratory apparatus (CFOS) to simulate the interaction of cloud fields with visible radiation.

The CFOS apparatus is designed to measure the simulated reflection of shortwave radiation by optically thick clouds. The CFOS basically consists of a light source, a target cloud field, an array of radiation detectors and a data display/collection system. Fig. 1 shows a schematic of the CFOS which is housed in a 10 m X 10 m dark room at the Department of Atmospheric Science at Colorado State University. Each of the components which comprise the CFOS has been selected or designed to simulate as closely as possible the actual interaction of visible solar radiation with real clouds and to perform measurements on the simulation analogous to the real world case. Each aspect of the CFOS is described below along the rationale used in selecting various options in the components design.

A. The Source

In simulating the interaction between the visible solar irradiance and clouds it is desirable to duplicate as closely as possible three characteristics of the natural source. First, the source should possess, to the extent possible, a visible spectrum of a 5700 K blackbody radiator. Second, the beam irradiance should be uniform across the area of the cloud field, and third, the beam should be parallel. Because the cost of constructing a solar simulator approaching the above description would have been prohibitive, efforts were focused on achieving the latter two characteristics for the following reasons. First, theoretically, the spectral distribution of the incident radiation is important only in relation to the microphysical properties of the cloud; i.e. scattering

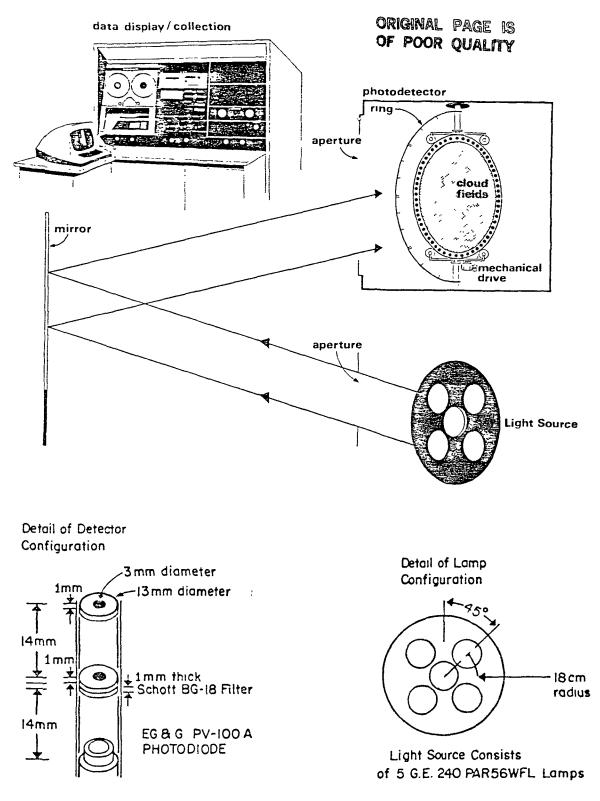


Figure 1. A schematic drawing of the Cloud Field Optical Simulator (CFOS) designed to simulate the interaction of visible solar radiation with optically thick clouds.

Э

properties at a wavelength λ are determined only as a function of the ratio λ/r , and where r is the radius of the droplet. Since simulated clouds used in the CFOS are not composed of droplets (much less the specific droplet distributions measured in real clouds) and in view of the considerations given above, achieving the proper spectral response was given a lower priority and emphasis was given to designing a source which fulfilled the remaining criteria. Maintaining the proper spatial characteristics of the beam, as specified in the second and third criteria listed above, assures that the effects of cloud geometry are accurately taken into account. Doing so, even at the expense of achieving less than optimum spectral characteristics, is consistent with recent findings concerning the importance of cloud geometry. To these ends it was found that an array of low voltage display lamps provided illumination with the best spatial uniformity over the target cloud The low voltage design of the lamps allows small filament field. assemblies to be precisely placed at the focal points of accurately The result is a smooth illumination curve which molded reflectors. decreases slowly (7% in the first 4°) as a function of the angle from the beam axis of each lamp. Use of an array of overlapping beams, each aimed at a different section of the cloud field, results in an irradiance uniform to within $\pm 3\%$ of the mean value in the plane of the cloud field. The source was placed behind a circular aperture 0.5 m in diameter to shield the cloud field from stray light and to constrain the beam to within 3° of its axis, thus assuring nearly parallel light. The beam is reflected by a large plane mirror in order to allow enough distance (20 m) for the nearly parallel beam to diverge to a cross section sufficient to illuminate the entire target area ($\sim 3 \text{ m}^2$). Although the source output is reasonably constant in time, it is monitored by a wide field-of-view detector near the cloud field so that the effects due to even small variations may be accounted for in the analysis.

B. The cloud field assembly

The target cloud field assembly consists of the simulated clouds and the hardware necessary to support and orient the clouds with respect to the incoming radiation and the detectors. The assembly is contained in a separate 4 m X 4 m X 4 m black box in the laboratory room. The types of materials used to construct the simulated clouds are discussed in Sections 3a-c. As shown in Fig. 1, the target cloud field is mounted in a circular area ~2 m in diameter. The incoming radiation enters through a large aperture in one face of the box. The target cloud field is oriented in a vertical plane and has two rotational degrees of freedom. The first of these allows rotation about the vertical axis of the cloud field and simulates changing solar zenith angle. The second_rotation is about a horizontal axis through the center of and perpendicular to the plane of the cloud field which allows simulation of a change in solar azimuth angle. Each of these rotations is driven by a separate motor and may be controlled at the data display station. The rotations are monitored to the nearest degree through the use of optical encoders and Any sun-cloud geometry of interest may be associated logic circuitry. easily simulated in the CFOS as a result of this design.

C. Sensor array

In order to examine the relationship between the summative and component properties of radiation reflected from the simulated clouds it is necessary to sample the radiation field from a number of angular viewing coordinates. The placement of the CFOS sensors with respect to the cloud field may be seen in Fig. 1. Fifteen sensors are mounted on a semi-circular ring whose ends are attached to the cloud field apparatus at points above and below the cloud field on its vertical diameter which serves as an axis of rotation for the ring. The sensors are spaced at increments of 10° of arc along the ring, beginning at the center of the ring and proceeding toward its ends. This sensor configuration permits a density of angular sampling of the reflected radiation which is more than adequate to establish the relationships between the desired quantities.

Each sensor consists of a high-quality silicon photodiode with a built-in high-gain operational amplifier circuit. The diodes are mounted in small cylindrical enclosures each of which contains a spectral filter and two circular diaphragms. The diaphragms limit the field of view of each photodiode to 7.5° half-angle. The relative spectral responses of the detectors with and without the optical filters are shown in Fig. 2. The filtered spectral response corresponds closely to that of the human eve. Thus, features visually observed should be evident also in the measurements. The field of view of the detectors is such that the center detector resolves a circular area 0.5 m in diameter when viewing the cloud field at the nadir. By using the relationships between the optical and geometric properties of simulated and real clouds (see Sections 3a-c) it is possible to associate the CFOS sensor configuration with that of a real world sensor 100 km above the earth's surface with a nadir ground resolution of 25 km.

D. Data display/collection station

One of the advantages of a laboratory investigation of the radiative properties of clouds lies in the ability to observe an unchanging cloud This feature is field from a variety of angular coordinates. fullv appreciated by observing the changes in the various detector voltages as the "sun-cloud-sensor" geometry changes. The output of each sensor including the source monitor may be read from digital voltmeters at the data display/collection station. An array of light-emitting diode bar the voltage outputs of all 15 graph displays indicates diodes simultaneously, giving an instantaneous sample of the radiance patterns. The simulated solar zenith and azimuth angles and the angle of rotation of the detector ring are controlled from and monitored at the display station.

In order to examine the structure of the radiance patterns and to detect changes in the field or image as the clouds' geometric properties are changed it is necessary to assemble all measurements into a single representation of the reflected radiance pattern. This is accomplished in two stages by the CFOS. First, the data are recorded using an Apple II microcomputer as a smart data collection device. Various parameters such as sampling rates and the numbers of measurements included in average readings may be programmed into the data collection process. Second, the data from the floppy diskette in the Apple II are transferred

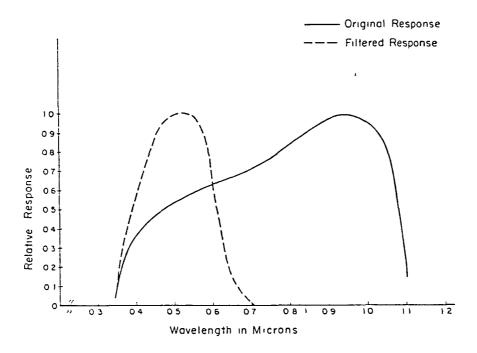


Figure 2. The relative spectral responses of the detectors used in the CFOS with and without optical filters.

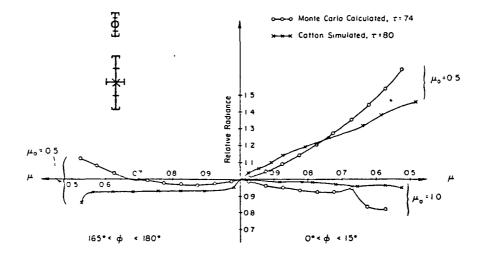


Figure 3. A comparison of the relative radiances reflected into the principal plane by cotton-simulated clouds (measured by the CFOS) to those calculated using a Monte Carlo model for water clouds. Comparisons are shown for solar zenith angles of 60° and 0°. (Only one of the symmetric branches is shown in the 0° case). Note that the uncertainty in observed and modeled relative radiances are a function of the observation zenith angle. The error brackets shown are maximum values typical at $\mu = 0.55$. Uncertainties near $\mu = 1.0$ are about half these maximum values and are indicated by the error bars.

1

Ì

to an Apple III microcomputer where they are processed. The processing is relatively simple; measurements are rotated into a nadir-relative azimuth angle coordinate system, voltages are divided by relative sensitivities, effects caused by variations in the source are removed, the reflected radiances are integrated over the lower hemisphere to obtain a flux density, and various graphical displays are generated. The total time of the processing of the data is ~15 min. Thus, experiments may be repeated for slight perturbations in the cloud field geometry and changes in the radiance field may be appreciated within a short time. Also, data and displays from the radiance patterns may be saved on diskette files for later viewing and comparison.

The CFOS apparatus described above should provide insight into the composition of wide field of view satellite measurements and images. It offers an interactive setting in which cloudy scenes may be created, observed visually, and whose relative radiance fields may be measured quantitatively. The next section describes the verification of the CFOS and in doing so furthers the appreciation of the similitude between the CFOS and the real world.

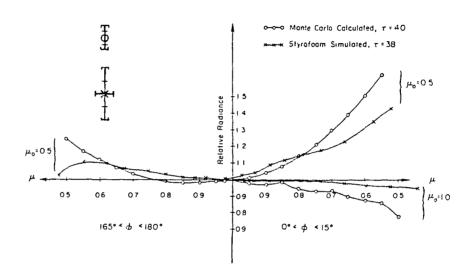
2.0 Verification of CFOS by comparing experimental results from it with calculations performed with a Monte Carlo radiative transfer model.

The previous sections have described a laboratory device designed to measure the simulated radiative properties of clouds of a realistic shape. In the sections which follow the properties of the simulated clouds and the relationship of their scattering properties to those of simulated water clouds are discussed. The verification of the CFOS is based not on analogies between the microphysical properties of real and simulated clouds, but rather on comparisons of observable radiative properties.

A. Selection of suitable materials for cloud simulation

The validity of measurements obtained from the CFOS depends, almost entirely, on the measurable radiative properties of the simulated clouds. Several materials were examined in a search for one which adequately simulates the visible reflective properties of optically thick clouds. The criteria which were examined in the selection process were first, the behavior of the radiances reflected into the principal plane by a horizontally semi-infinite cloud, and second, the visual appearance of the simulated clouds and cloud fields. Based on these criteria, two materials emerged as superior to all others tested; they are surgical quality sterilized cotton and decorative billet (DB) styrofoam which is marketed by Dow Chemical under product code #81568.

It should be emphasized that the manner in which light interacts on the microphysical scale with the materials selected may differ considerably from the classical picture of independent Mie scattering in a spherical polydispersion. For example, the surgical cotton used in the experiments consists of long fibers of mainly cellulose from 10 to 25 μ m in diameter. The mean index of refraction of cellulose is 1.55 in the mid-visible. The DB styrofoam is a polystyrene extrusion. It contains no pigments or other suspensions and has a mean cell dimension of 1.9 mm. The index of refraction of polystyrene is 1.59-1.60 in the visible.



,

. .

.

~

Figure 4. As in Fig. 3, but for styrofoam-simulated clouds.

- -

1

1

. ·

ł

ORIGINAL PAGE IS OF POOR QUALITY

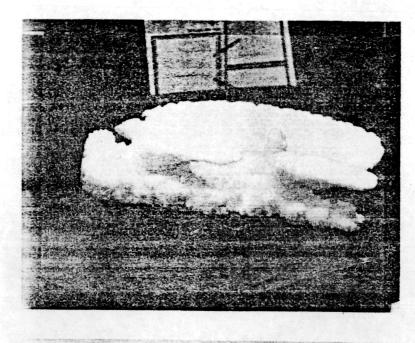




Figure 5. Photographs of a styrofoam-simulated cloud system. The bottom photograph is an enlargement of the first showing the detail of the area between the simulated cumulonimbus clouds. Polystyrene is a transparent plastic. The white appearance of styrofoam results from multiple reflections of the incident light from the many facets which surround the individual cells. Thus, it would be difficult to draw an analogy between the local scattering process in water clouds and the multiple reflection process in styrofoam. Moreover, recent studies have shown that cloud shape may dominate microphysical scattering as the most important factor affecting the radiance pattern. Also, it is doubtful that any material which closely duplicates the scattering process in water clouds would possess an extinction coefficient great enough to permit simulation of optically thick clouds in a laboratory The goal of the CFOS experiment is to determine if it is setting. possible to simulate the observable properties of optically thick clouds of a realistic shape and not necessarily to duplicate the exact scattering process on the microphysical scale. Thus the determination of which materials are best qualified as simulation materials is based on comparison of observable optical properties of the simulation materials with those predicted by radiative transfer models of real water clouds. Such comparisons have been made for "horizontally infinite" and cubic finite cloud shapes.

Figures 3 and 4 show comparisons between the radiances reflected into the principal plane by horizontally infinite cotton and styrofoam simulated clouds compared with theoretical curves derived from a Monte Carlo radiative transfer calculation. The model was run for a C.1 (Deirmendjian, 1969) droplet distribution with an absorption for a wavelength of 0.7 μ m and for solar zenith angles with cosines of $\mu_{0} = 1.0$ The radiances have been normalized to the value at the and $\mu_{2} = 0.5$. zenith and are displayed as a function of the cosine of the zenith angle (μ) and the relative azimuth angle ϕ into which they are reflected. Scattering into the forward direction $(0^{\circ} \leq \phi \leq 15^{\circ})$ is depicted in the right halves of the figures and backscatter (165° $\leq \phi \leq$ 180°) is indicated in the left halves. The materials are almost equivalent in satisfying the first criterion. The styrofoam-simulated clouds display a slightly more realistic behavior in the backscatter direction.

Both materials do well in simulating the visual appearance of real clouds. Fig. 5 shows photographs of styrofoam-simulated clouds of a realistic shape. If we add a third criterion, the ease of working with the materials, styrofoam is preferable for the following reasons. First, styrofoam is rigid and will maintain a constant ratio of geometric to optical depth, and the shape of simulated clouds will be retained regardless of orientation. Second, the simulated styrofoam clouds are easily placed and maneuvered in a cloud field and may be categorized and stored for use in other cloud scenes. Finally styrofoam clouds are easily made into regular shapes i.e., cubes, cylinders, spheres, etc., so that their radiation properties may be compared with theory.

B. The optical depth of simulated clouds

-

In order to relate the reflective properties of simulated clouds to real water clouds it is necessary to have an accurate estimate of the optical depth of the simulated clouds. One means of doing so is based on the bulk radiative properties of a 'horizontally-infinite' sheet of the cloud material at 0° zenith. Specifically, theory predicts that the ratio of the spectral reflectance R_{λ} to the spectral transmittance T_{λ} of a semi-infinite cloud over a non-reflecting surface is nearly a linear function of optical depth (see, e.g., Coakley and Chylek, 1975; Stephens, 1978). Fig. 6 shows a plot of the ratio of R/T generated from the parameterization of Stephens (1978) for water clouds in the visible portion of the spectrum. The solid curve shown in the figure is the result of a linear regression of the form $R/T = \tau(\ln\tau + 8.307)/153.149$, which is nearly linear for $10 < \tau < 200$. Also shown is the ratio $(R_{\lambda}/T_{\lambda})$ calculated using an Eddington model for various microphysical distributions and a few results of the R_{λ}/T_{λ} ratio from Monte Carlo calculations. The nearly linear dependence between R/T and τ , the visible optical depth, is apparent.

An equivalent visible optical depth (τ_e) may be assigned to the CFOS cloud material by measurement of the ratio of R/T for a sheet of the Once τ may be material with a large ratio of horizontal to vertical dimension. is established for a large slab of styrofoam several clouds may "sculptured" from the slab while maintaining in each the vertical dimension of the original slab. The procedure requires an additional stop in the case of cotton since the vertical structure of the original "slab" (surgical cotton is available in 12" X 60" sheets) cannot be maintained while forming clouds of a realistic shape. However, it was found that the mass of the material in a vertical column of unit cross section is also related to the ratio of the R/T in a nearly linear manner (see Fig. 7). Thus, for a cloud simulated from surgical cotton on approximate visible optical depth may be assigned by weighing the cloud and measuring its cross-sectional area to determine the area mass density, then using the R/T line as a transfer function to obtain τ_{a} .

C. Retrieval of basic finite cloud features

с.

A crucial test of the CFOS is the ability to measure the reflected radiances of finite clouds. Figs. 8 and 9 show comparisons between radiances reflected into the principal plane by finite clouds as measured on the CFOS and the same quantities predicted by the theoretical Monte Carlo model described in McKee and Cox (1976). The radiances in each case have been normalized by the radiance measured or calculated at the zenith. The CFOS profiles have been retrieved from measurements over a field of simulated (styrofoam) cubic clouds cut from a slab of material whose R/T ratio corresponded to an equivalent vertical optical depth τ_{ρ} = 76. The simulation clouds were placed at the centers of adjacent squares of sides 5w, where w is the dimension of the finite cubic cloud. This arrangement resulted in a true fractional cloud cover f = 0.04. The cloud rows were aligned along two mutually perpendicular axes, one of which formed the line of intersection of the principal plane with the surface. Figs. 8 and 9 show measured retrievals. The first (applicable only for observation of the cloud field in the direction of the cloud rows) assumes that as the observation zenith angle (θ) increases, the solid angle of the observed cloud field relative to the underlying surface increases by a factor of $1 + \tan\theta$, resulting in a modified fractional cloud cover f' given by

 $f' = \begin{cases} f(1 + \tan\theta), & \theta < \theta_{\max} \\ f_{\max} = f(1 + \tan\theta_{\max}), & \theta > \theta_{\max} \end{cases}$

In the above, F_{max} is the fractional cloud cover derived as the tops and sides of the cubic clouds maximally obscure the inter-cloud spacing. Note, in the present case, for observations taken in the principal plane

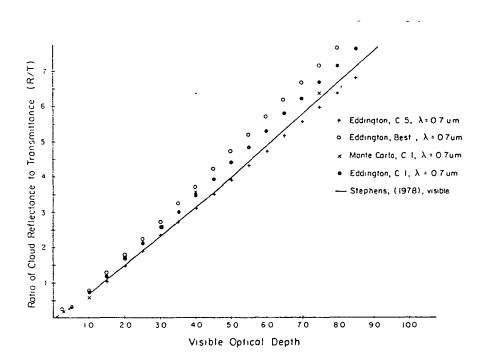


Figure 6. The ratio of reflectance to transmittance for horizontally infinite clouds plotted as a function of optical depth in the visible region of the spectrum for a solar zenith angle of 0°. Values of the ratio from the Eddington and Monte Carlo models are valid at 0.7 μ m, values from Stephens (1978) are representative in the visible ($\lambda \leq 0.75 \ \mu$ m).

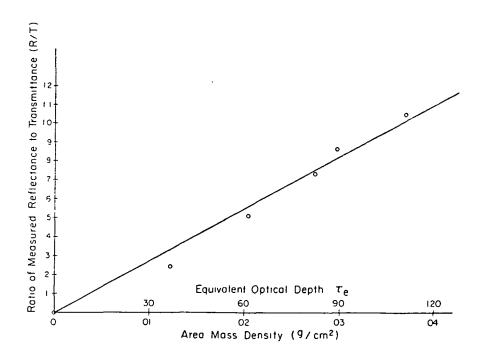


Figure 7. The ratio of reflectance to transmittance for cotton simulated "horizontally infinite" clouds plotted as a function of the area mass density of the material which is used as a transfer function to obtain the equivalent optical depth of simulated clouds.

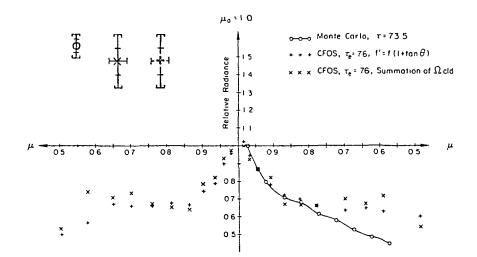


Figure 8. A comparison between calculated and simulated radiances reflected from finite cubic clouds into the principal plane for a solar zenith angle of 0° using styrofoam as the cloud simulation material. (Only one of the symmetric btanches is shown for the modeled results.) Note that the uncertainty in observed and modeled relative radiances are a function of the observation zenith angle. The error brackets shown are maximum values typical at $\mu = 0.55$. Uncertainties near $\mu = 1.0$ are about half these maximum values and are indicated by the error bars.

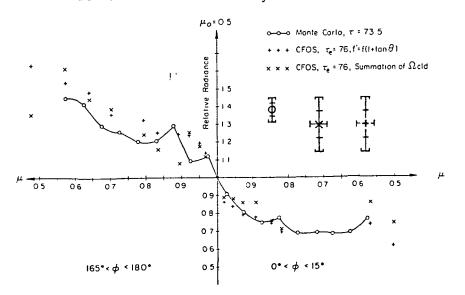


Figure 9. As in Fig. 8, but for a solar zenith angle of 60° .

1

(parallel to the row directions), $f_{max} = 0.20$ and $\theta_{max} = 76^{\circ}$, which is larger than the zenith angle of any of the observations depicted below, so that the first line in the equation above applies. The second treatment utilized the exact geometry of the cloud field and the CFOS detectors, counted the clouds in the field of view, and calculated the total solid angle subtended by the clouds and their shadows. In this interpretaiton the radiance measurement (N) is given as

$$N = N_{cld} \cdot \Omega_{cld} + N_{cir} \cdot \Omega_{cir} + 0 \cdot \Omega_{sdw}$$

where the subscripts cld, clr, and sdw represent cloud, clear and shadow, respectively, and Ω is the fractional solid angle subtended by each target component. It was assumed that there was no radiance contribution from the shadow regions. The clear measurements were made of the surface on which the clouds were mounted in the absence of the clouds. The albedo of the surface was 0.02. The second treatment resulted in a "noisier" curve because a single cloud was either considered completely within or exterior to the field of view. Nevertheless, smoothed versions of the curves are in good agreement. The apparent disagreement between the curves for the $0\,^{\rm o}$ solar zenith case at large observation zenith angles is principally from two factors. First, the styrofoam material is least faithful in its reproduction of the reflected radiance of real clouds at the larger observation angles as evidenced in the comparisons for horizontally infinite clouds in Fig. 4. Second, in the Monte Carlo model, for a 0° solar zenith angle, there is no radiation incident on the vertical side walls of the cubic clouds. However, in the laboratory, the incident radiation is not parallel in the strictest sense. Thus, over the extended cloud field, some incident radiation falls on the vertical walls of some of the simulated clouds. This results in relatively brighter side walls in the simulated case which contribute greatly to the radiance field at larger observation zeniths.

It should be noted that the retrieval of the finite cloud reflected radiances described above represents a rigorous test of the CFOS concept. The low surface albedo (0.02) combined with the extremely small fractional cloud cover (0.04) resulted in reflected radiances at the lowest bound of the domain for which the CFOS was designed. Larger clouds, smaller cloud spacing and more realistic simulated surfaces will all tend to increase the radiance signal. In addition, the above experiment represents the retrieval radiances reflected from only part of the scene. Measurements of total scene radiances are of a more stable nature.

3.0 Development of a software library to process, reduce and display CFOS data for use in research studies.

Introduction

1

This manual was written in order to provide a transfer of established methodology used in the operation of the Cloud Field Optical Simulator (CFOS) to interested users of the device. Throughout this document it is assumed that the reader is familiar with the basic design and purpose of the CFOS. If this is not the case the reader is referred to a publication Davis, Cox and McKee (1983), which will provide sufficient backround

information and which may be found in Appendix A. This manual is divided into two parts. Part one is a description of the methodology of data collection. In part one the reader will find a discussion of alignment of the CFOS, calibration of the sensors, and the normal procedure which has been developed to collect meaningful data. Part two is a discussion of data processing. The main thrust of part two focuses on how to proceed from the raw data to an array of bi-directional reflectance data. This. of course, is not the only product for which the CFOS was designed but the basic methods are demonstrated in obtaining this type of data. Part two necessarily discusses some of the application software which has been written for the CFOS although additional software exists for particular tasks. All the software is listed in Appendix B along with a brief statement of its purpose. Finally, it must be noted that all of procedures associated with the CFOS have been in a constant state of flux. CFOS itself has always been in part the object of the ongoing research effort. Thus, especially in using the applications software, some user familiarity with the code must be established. CFOS is not now, nor in all probability will ever become a black-box laboratory device.

I. PART I

A. Laboratory procedures

Part I is divided into two sections. Section one presents suggestions, advice and procedures to ensure that the basic laboratory device is aligned for data collection. Certain care must be taken before any data is collected especially if there has been a significant down period or if it is discovered that the device has been moved or altered as may happen for instance if items not related to CFOS have been moved in or out of the basement annex. Section two discusses the calibration and method of data collection which has been found to provide the best results to date. It should be stressed at the outset that calibration should be considered part of the data collection process since it has been found that the calibration coefficients are not constants. In all of part one it is assumed that the reader has been briefed on the proper way to power up the laboratory and on the functions of the various controls accessed at the data display station.

B. Section 1

1. Source alignment

The source may need to be realigned periodically because of the reasons mentioned above. The source alignment consists of adjustment of the relative position and orientation of the light source itself and the mirror and establishing the zero degree position of the cloud field ring all of which are interdependent. An iterative procedure has been developed which seems to work reasonably well; however, it is somewhat time consuming. One begins by ensuring that the normal to the cloud field ring is pointing in the approximate direction of the light source. Then by adjusting the position of the array of lamps so that its lateral positioning behind the aperture appears symmetric when viewed by an observer standing on either side of the cloud field ring. In other words, if you can see all the lamps except for part of one of the lower lamps when standing on one side of the cloud field ring, then if you move to the other side of the ring you should be able to see all of the lamps except for a similar portion of the other lower lamp. The position and orientation of the mirror may also need adjustment in order to accomplish this. It may take a few to several adjustments obtain the desired symmetric alignment.

Next, the true zero zenith angle must be set. To do so it is first necessary to establish the center of the cloud field with respect to the direction of the incoming beam. An aluminium bar has been constructed for this purpose. It is fitted with cylindrical feet on each end which may be inserted into the holes in the cloud field ring. A small hole has been drilled in the middle of the bar through which the source light may pass to form a small image of the lamp source on the cloud field backround. The image marks the center of the cloud field with respect to the incoming beam. Next, an alignment photodiode which is mounted in a circular magnetic support is placed on the cloudfield backround at the center point. The photodiode is connected to an operational amplifier circuit and thus requires a supply votage of +/- 15 volts. The output of the device may be read using a digital voltmeter. By examining the output of the device for changes in the simulated solar zenith angle about the one may establish the center of initial orientation. the response pattern. This point marks the true zero of the solar zenith angle regardless of the reading on the data display panel meter. The zero readout may be reset once the optical zero is established. It should be pointed out that near the zero of the solar zenith angle there will be little change in the output of the device due to the nature of the cosine response. Thus one would be well advised to look for symmetric points at larger angles about the zero in solar zenith.

After the optical zero zenith angle is established the next step in the general alignment procedure is to check the spatial homogeneity of the incident irradiance field. The magnetically held diode may be used to check the homogeneity of the incident radiance field. By moving the device about to different positions on the cloud field and comparing the output voltage at the various points homogeneity may be established. If the incident pattern is not homogeneous then the orientations of the individual lamps must be must be adjusted relative to each other. This may be a time consuming process depending on how non-homogeneous the field is and on how large the region is where homogeneity is desired. It is convenient to employ a second digital voltmeter to monitor the output of the test diode. The second dvm should be placed near the lamp source so that it can be read at the source. Then while adjusting the individual lamps with the test diode placed in a region of particularly high or low irradiance the effect of the re-aiming of the individual lamp may be monitored. The dvm located near the interior of the CFOS is convenient to monitor changes in the test diode output as the diode is moved about on the cloud field. Two items should be noted while checking the homogeneity of the incident beam. First, the test diode circuit outputs a dark current voltage which must be subtracted from the readings before establishing the relative magnitude of the incident irradiance. Second. the reorientation of the individual lamps changes to some extent the optical zero zenith angle. If in the process of smoothing the incident light one upsets the optical zero the preceding step should be repeated.

The next item in this section concerns the cleanliness of the glass surfaces in the CFOS. The large mirror will need cleaning from time to time and the frequency of the cleaning will be obvious. Also, the photodiode glass covers and the glass optical filters housed within each collimating can should be cleaned periodically, especially after significant down time. When this is done the individual diodes invariably become misaligned and uncalibrated. Recalibration will be covered in section 2 of part 1. To re-align each diode a simple flashlight device has been construced which may be mounted over the exterior of each diode can and which projects a small spot of light toward the center of the cloud field backround. The device is powered by any 4.5 volt d.c. source. It is helpful to mount a white piece of paper or cardboard at the center of the cloud backround and to turn off the main lights since the projected spot of light is rather dim. The center of the cloud field may be established on the white reflector as explained above using the large aluminium bar. In this manner each diode's field of view may be centered at the center of the cloud field after the glass surfaces have been cleaned.

The final item to be discussed in this section concerns the alignment of the detector arc. This is one of the simplest of the procedures. The optical zero of the detector ring is established at the position where the shadow of the detector ring falls on the center of the cloud field. Actually, there are five shadows since there are five lamps, but it is fairly obvious where one should place the detector arc zero point. The readout may be reset to zero at this point if desired but this is not necessary if the offset is programmed into the software.

C. Section 2

This section presents a discussion of procedures used more on a daily basis or even more often to ensure quality data. These methods pertain to the actual process of collecting the data and maintaining calibration. It is easiest to begin with the data collection device--the Apple II plus computer and the data logging program. After turning the computer on, with the disk labeled "cfos prodos" inserted, the logging program is initiated by typing "run calib." This program will prompt the user to insert a properly formatted data disk and to select the number of data scans to be included in each measurement. In an actual data collection session 30 data scans have usually been used. However, for merely observing the diode outputs a smaller number is more convenient. The program then displays the output of each of the diodes and the relevant angle settings. Nothing else will happen until the user presses a "control p" which initiates a write to the disk at the end of the current scanning sequence. Data may be taken in this manner for as many different geometries as desired. When it is desired to end the recording session the user must press the "escape" key which will terminate the file. This is the basic way used to collect the data. Small adjustments to the basic process and specific cautions will be found below as they pertain to collection of bi-directional reflectance data, calibration etc.

1. Calibration

In all the applications for which CFOS was constructed only the relative sensitivities need be determined. Even so, it has been found that constant checks must be made on the diode relative sensitivities since - they may change significantly even with the temperature excursions

induced by the heating system in the basement annex. Thus what follows may seem like overkill, but it has been found that only by continually updating the sensitivities can one expect to obtain results valid to within a few percent.

Each diode circuit has a very high amplification factor which causes a significant dark current signal. It is mainly this compontent of the signal which is temperature sensitive. In order to "predict" the magnitude of the dark current signal, (which is impossible to monitor in an experiment with light incident on the diodes), a separate diode circuit identical to the others has been masked off so that no light may enter the diode can. Note that it is important to ensure that the back of the collimator can is also masked off since it has been observed that sufficient light may enter the can from the backside and cause erroneous results. The purpose of this diode is to put out only a dark current signal which will respond to temperature changes and which may be used to infer the behavior of the dark current signals in the remaining diodes. Simple linear regression has been found to provide predictions of the required dark current signals which are highly correlated to the actual measured valued. (Correlation coefficients greater than 0.99 are not uncommon.) The regression relations should be re-calculated periodically using the following procedure.

It is desirable to collect the regression data over a period of time when the temperature extremes in the CFOS laboratory are similar to those encountered during the data collection session. Thus it may be desirable to collect the data over the weekend before a series of measurements will be made or if the outside ambient temperature has changed drastically to collect a new set overnight. By modifying the data logging program slightly the system may be placed in a continuous logging mode and serveral hundred scans may be recorded from which the regression data may be generated.

The modification consists of inserting the line,

"1516 GOSUB 600"

Depending on the amount of time the program is left to record data, a very large may be generated. The software which processes this data is described in Part II. During the time these data are being collected it is necessary that the curtains on CFOS remain closed and is would be preferable if the main overhead lighting remain off.

Once the regression data have been collected the relative sensitivities may be determined. These numbers also change and must be continually updated. In fact, below in the description of a typical data collection session note that a calibration update is performed before each scene measurement. To obtain the relative calibration coefficients an isotropic reflector is used. It has been found that ordinary polyurethane foam provides a surface which is nearly istropic out to observation angles of nearly 60 degrees when illuminated at normal incidence. It is convenient to use magnets to mount the foam on the cloud field backround since it must be mounted and removed frequently. With the foam in place the reflected signal from all the lamps is too large for the highly sensitive detectors. In order to circumvent this problem a separate power supply has been connected only to the center lamp of the light source. A circuit breaker is provided to ensure that the output of this power supply may be isolated at all times from the AC supply which normally operates the source.

Thus using only the center lamp one may collect data and record it on a disk file which may be analyzed to obtain the relative sensitivities. It is advisable to set the detector arc angle at about 10 to 15 degrees in order to displace the shadow it casts as far as possible from the center of the foam. The software to produce the diode sensitivities is described in Part II.

2. A typical data collection session

To begin a typical data collection session it is assumed that the regression data have been collected and that the relative sensitivities are known fairly well. What is described here is a procedure which when followed will produce data with standard deviations of a few percent of their respective mean values.

Although dark current data have already been collected best results will be obtained if this information is updated prior to each experiment. To do so the CFOS curtains are closed and a data file is written with all lights off. This file need consist of only 10 to 20 records each containing 30 or so scans. While this data is being collected the lights should remain off and none of the motor controls should be activated since the motors and switches may introduce noise into the diode signals. End the file with the usual escape sequence.

Next leaving the main AC power off the center lamp of the source array is activated by powering up the separate DC supply. The circuit breaker switch at the lamp source must also be turned on. Open the curtains and mount the calibration foam so that it is as much in the center of the cloud field support as possible. Offset the detector arc angle to about 15 degrees so that the shadow will not be in the field of the detectors. Write a file of about 10 scans to establish current calibration coefficients. End the file with the escape sequence.

Now the system is ready for data collection. Turn off the center lamp supply and open the circuit breaker. Turn on the main lamp switch. It is best to let the source lamps heat up as their output will fall considerably in the first 5 minutes or so. Variation in source strength is accounted for in the data reduction software but a constant source is best. Remove the foam calibration reflector and mount the cloud field target. It is easiest if the cloud field is premounted on a separate backround so that it may be rapidly mounted and removed. Normally bi-directional reflectance data is collected by scanning the detector arc through plus and minus 60 degrees with the cloud field set at the desired zenith angle. It is best to confine the total target to within about 9 inches of the center in order to avoid errors intoduced by changes in the solid angle subtended by cloud elements as the detectors are rotated. So beginning with the detector arc offset at 60 degrees from the center, on a new data file, record a data scan. Then proceed every 10 degrees in detector arc across the reflectance field. The data record which is being averaged while the arc is moved should be not be recorded since moving the arc will introduce noise into the data. Only the next record during which no arc movement has occurred should be recorded. After some practice it is possible to move the arc while the computer is writing to disk in which case the next record may be used. If, after the "control p" sequence has been entered, it is desired to inhibit the write to disk, press any key on the Apple II keyboard and the current record will not be

written to disk. This happens occasionally if doors are opened or in some cases people may need to walk across the path of the incident beam. These records should be discarded. It often happens that moving the arc will cause some change in the zenith angle setting in which case the zenith angle should be adjusted to the desired value. When all the data have been collected for a particular scene the file should be ended with the escape sequence. For best results the same scene should be repeated as many as four times to assure the quality of the data. (This should yield results with standard deviations of less than 2% of the mean values.) Each time the experiment is repeated the dark current and sensitivities should be redone as explained above.

At the end of the session the curtains should be closed, the computer turned off and the lamps should be turned off. However, the power to the main control panel should be left on. It has been found that the stability of the entire system is highest if the amplifier circuits are constantly powered up. The data disk should be removed and saved for processing, which is the subject of Part II below.

II. PART II

In part two the software which has been developed for the processing of bi-direcional reflectance data is described. Additional software exists and is listed in Appendix B. Only a mention of the particular use of this latter software will be given since it is unlikely that a new user will have need for these routines without some modification. As mentioned in the introduction, it is assumed that the user will become familiar with the software. Many will require some user interaction. All of the programs which are discussed below are found on the Davong system hard disk under volume prefix /area1 or .H1 or on the CFOS software backup diskette included with this manual.

We begin by assuming the user has completed a session in the CFOS laboratory and has written a data disk containing a file for establishing the dark current regression coefficients, one for updating the coefficients, a file containing relative calibration data and one or more files containing data for analysis of bi-directional reflectance data. All of the files written by the Apple II in the CFOS laboratory have a file name of the type D.mmddyy.hhmm, where mm is the two digit designator of the month, dd designates the day of the month yy the year, hh the hour on a 24 hour clock and mm the minute when the file was written. For example, the last dark current regression data recorded is listed on the first page of the Appendix B as D.082484.1348.

The first task is to run the regression program which will establish the initial regression coefficients between the masked diode and the remaining detectors. Run the program called "CFOSREG". It will prompt you for the name of the file containing the regression data. It expects to find the file on device .d2. After the file name is input the reqression coefficients will be calculated and written to a file on the Davong system hard disk called "/area1/cfos.cal/coeff". As the data is processed the values of the slope, intercept and regression coefficients will be written to the screen. If the file contains a large amount of data the processing may take several minutes to a half hour. Once the regression coefficients have been calculated it is a good idea to transfer the raw data file to the hard disk for temporary storage in case the file containing the coefficients is lost as has been done with the file d.082484.1348.

The program above is utilized only occasionally after a new regression is needed for whatever reason. More often the file "/area1/cfos.cal/coeff" will already exist on the hard disk and these coefficients will need to be updated. This is the task of the program called "/area1/cfos.cal/cfosdark" using the data collected just prior to the relative sensitivity measurement described in Part I. This program also prompts for the name of the data input file which it expects to find on device .d2. The program uses the regression coefficients which it then writes to a file called "/area1/cfos.cal/coeff" and simply updates the offset coefficients which it normally repeated for each new bi-directional reflectance data set prior to running the relative calibration program described next.

Now the program "/area1/cfos.cal/cfossens" is run to process the relative sensitivity measurements. The user is asked for the name of the data file which it expects to find on device .d2 after which the contents of "/area1/cfos.cal/cfoscoeff" and "/area1/cfos.cal/adjust" are used along with the current data file to establish sensitivities relative to diode #8. These values are written to a file "/area1/cfos.cal/sensiv".

The preliminaries out of the way it is now possible to process meaningful bi-directional reflectance data. This is the task of the program "/areal/cfos.bdr/cfosbdr" which expects to find the raw data in subdirectory "/area1/cfos.back/". Iſ several bi-directional the reflectance files have been collected it is convenient to use the filer to transfer these files to the hard disk prior to the data processing session. The present routine uses the data in the files "/area1/cfos.cal/adjust", "/area1/cfos.cal/coeff". and "/area1/cfos.cal/sensiv" along with the present raw data to establish the normalized bi-directional data set. Normally the regime of detector arc angles is limited to +/- 60 degrees in these data. The program terminates by writing to a file in the subdirectory "/area1/cfos.bdr/" concatenated with the current raw data file name. The bi-directional field, the number of detector arc angle scans, the normalizing flux density and the minimum and maximum of the field are also written to the file for later use.

This completes the main processing for bi-directional reflectance data. However, now that the field has been established it is fairly common to continue the process further to obtain a denser interpolated field which may be plotted or used for error analysis, for example. So continuing along the data processing chain of events one may run the program "/area1/cfos.interp/cfosinterp" which performs а weighted interpolation on the normalized bi-directional reflectance data. The weighting is based on the inverse of the angular distance between the point at which the interpolation is desired and a neighborhood around this point which may be changed to include all of the normalized data points or just a surrounding few. The running time is highly dependent on the number of points used in the interpolation. The program prompts for the number of nadir and azimuthal points at which interpolated results are desired as well as the input data file name. This latter file name should be the concatenated portion of the normalized data which was written by "/area1/cfos.bdr/cfosbdr" to the subdirectory "/areal/cfos.bdr/". This is of course just the "d.mmddyy.hhmm" designator of the original raw data. The product of this program is an interpolated field which is written to а file under the subdirectory

"/areal/cfos.plot/" concatenated with the "d.mmddyy.hhmm" designator of the original data.

One final product of this line of processing is a polar plot of the bi-directional reflectance data. Such a plot is the product of a program "/area1/cfos.plot/cfosplot". This program utilizes the HP 7470A plotter to produce the drawing. The input data set is the product of the previous interpolation program and is requested by the program. Another use of the interpolated field is variance estimation. It is desirable from time to time to analyze the variance in the bi-directional reflectance data for the same scene measured several times or the variance among sets of data for slightly different scenes. This type of analysis is the object of the program "/area1/cfosste" which prompts for first the number of interpolated data fields and then the name of each one. Again, it is assumed that the interpolated fields are to be found in under the subdirectory "/area1/cfos.plot/" with concatenations of the raw data file names to be input by the user. The program presently assumes that 144 interpolated data points are available for each scene in a 12 by 12 array over the azimuth and nadir regime. The poduct is the standard error at each grid point and an average standard error for all grid points. This program was used to establish the basic precision of the bi-directional reflectance analysis which has been outlined in this manual.

This completes the description of the software needed to obtain bi-directional reflectance information. There are several other programs listed in Appendix B. What follows is a very brief description of the remaining software.

"/area1/cfos.cal/cfoscal" was the predecessor to the current sensitivity procedure. It assumed the dark current coefficients were constants and were entered in DATA statements within the program.

"/area1/cfos/cldareadist" is a simple algorithm which implements a cloud field statistical model given by Planck.

"/area1/cfos/clddist1" is a simple algorithm which implements the cloud field distribution program by Hozumi.

"/area1/cfos/cfosmovie" was used to provide a "movie" type graphical display of bi-directional reflectance fields. The input files to this program were previously generated fotofiles and are assumed to exist on device .h1.

"/areal/cfos/cfosfin" was used to produce graphical displays on the monitor and a pricipal plane graph on the silentype of bi-directional reflectance patterns for finite cloud fields.

"/area1/cfos/cfosback" was originally used experimentally to adjust for the backround reflectance pattern but was not found to be useful.

"/area1/cfos/cfosoff" was used to analyze the effect of displacing a single cloud or a small field clouds from the center of the CFOS cloud field support.

1

"/area1/plot.pack/myplot", "/area1/plot.pack/myplot1", and "/area1/plot.pack/hp.text" were prototype plotting routines from which the cfos plotting routines were patterned.

"/area1/plot.pack/rectterp" and "/area1/plot.pack/recplot" are routines analagous to their cfosinterp and cfos.plot counterparts(described above) and were used originally to interpolate and plot the radiance patterns exiting modeled and measured finite cubic clouds.

References

ł

- Coakley, J. A., and P. Chy'lek, 1975: The two stream approximation in radiative transfer: Including the angle of the incident radiation. J. Atmos. Sci., 32, 409-418.
- Davis, J. M., S. K. Cox, and T. B. McKee, 1983: Design and verification of a cloud field optical simulator. J. Appl. Meteor., 22, 947-958.
- Deirmendjian, D., 1969: Electromagnetic Scattering on Spherical Poly-dispersions. Elsevier, 290 pp.
- Stephens, G. L., 1978: Radiation profiles in extended water clouds. II: Parameterization schemes. J. Atmos. Sci., 35, 2123-2132.

List of Figure Legends

.

.

Figure 1. A photograph of the radiance pattern from an optically thick cubic cloud under normal irradiation as simulated in the CFOS.

Figure 2. Contours of relative radiance (measured) exiting the side of a simulated cubic cloud irradiated at normal incidence.

Figure 3. Contours of relative radiance (calculated) exiting the side of a modeled cubic cloud irradiated at normal incidence.

MER 24-33 THENTIONALLY BLANK

PRECEDING PAGE BLANK NOT FILMED

24-33

ч **н**

•

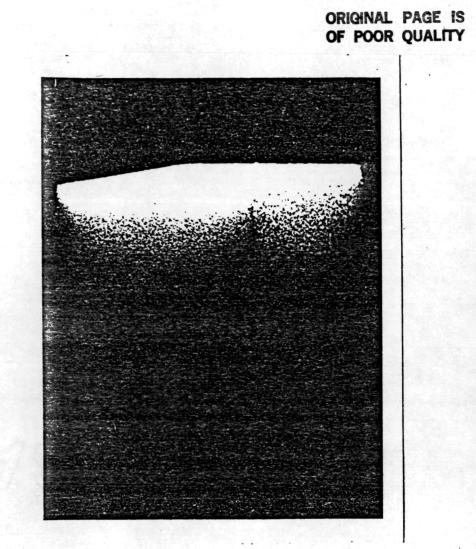


Figure 1

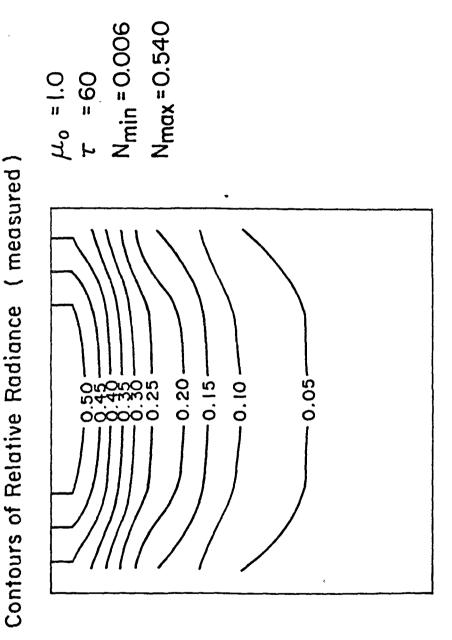
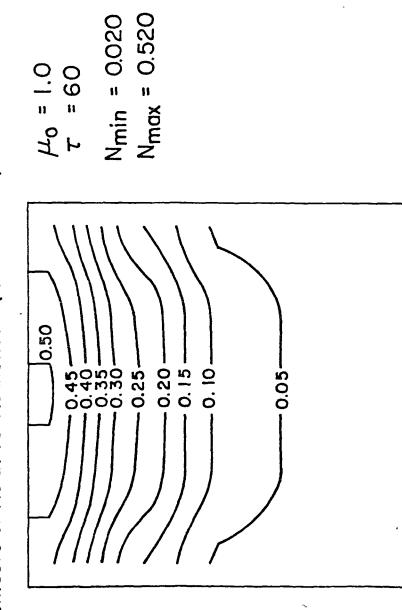


Figure 2

---,

•

. 14



Contours of Relative Radiance (calculated)

ı t Figure 3

---,

¢

, -

÷.

5.0 Publications and Reports

1

,

- McKee, T. B., J. M. Davis, and S. K. Cox. Design and Verification of a Cloud Field Optical Simulator. Published in Preprint of the Fourth Conference on Atmospheric Radiation, Toronto, Ontario, Canada, June 16-18, 1981.
- Davis, J. M., S. K. Cox, and T. B. McKee, 1983: Design and verification of a cloud field optical simulator. J. Appl. Meteor., 22, 947-958.
- Davis, J. M., S. K. Cox, and T. B. McKee. The role of finite clouds in scenes scharacterized by forward scattering bi-directional reflectances. International Radiation Symposium '84, August 21-29, 1984.
- Davis, J. M. and S. K. Cox, 1986: Additional confirmation of the validity of laboratory simulation of cloud radiances. Accepted for publication in J. Climate and Appl. Meteor., February, 1986.

6.0. Statement on Inventions

~

ł

• •

There were no patentable inventions made during the performance of this work.

.

r

APPENDIX

ა

.

Data Reduction and Analysis

Programs for the Cloud Field Optical Simulator

10 REM PROGRAM CFOS PRINT" CFOS CALIBRATION PROGRAM" 20 DIM A\$(15) 30 DIM VALUE (500,20) 40 DIM DC(19) 57 DIM SLOP(15), OFFS(15), SENS(15) 70 75 DATA -633.57,66,195,-357,-240,-52,-59,21,-1,-84, -221,-192,-182,307 DATA 1.3758,0.811,0.839,0.694,1.486,1.049,1.149,0.78,.85,0.89,1.05,1.13,1 80 .215.1.041.0.597 FOR H=1 TO 15 100 READ OFFS(1) 110 NEXT F 120 FOR k=1 TO 15 130 140 READ SLOP(1.) NEXT F. 155 DTRD=3.14159/180. 190 OPEN#1 AS INPUT, ".D2/D.091784.1247" 250 251 T≢="TEST.DARK" B#="" 260 INFUT#1,1;B\$ 280 370 NS=VAL(B\$) 380 PRINT NS 400 FOR K=1 TO NS B事="" 410 420 INFUT#1,K+1;B\$ 430 POS1=1 435 FOR J=1 TO 20 440 SPACE=POS1 450 POS2=INSTR(B\$," ",SPACE) 460 NOC=POS2-POS1 470 VALUE(N,J)=VAL(MID\$(B\$,POS1,NOC)) 480 P0S1=P0S2+1 490 FRINT VALUE(K, J) 500 NEXT J 510 NEXT K 520 FOR L=1 TO NS 530 FOR J=1 TO 15 540 SENS(J)=SENS(J)+(VAL(K,J)*SLOP(J)+OFFS(J))/NS 550 NEXT J 560 NEXT K 570 FOR 1=1 TO 15 580 SENS(J)=SENS(J)/SENS(8) 590 NEXT I. 600 OPEN#4 AS OUTPUT, ".SILENTYPE" 610 OUTFUT#4 620 FOR 1=1 TO 15 PRINT SENS(F) 630 640 NEXT E 650 END

ł

REM PROGRAM CFOS 10 PRINT" CFDS DARK CURRENT UPDATE PROGRAM" 20DIM A\$(15),VALUE(100,20) 30 40 DIM SLOP(15), OFFS(15) 50 PRINT"INPUT FILE NAME OF DARK CURRENT UPDATE RUN" INPUT D\$ 60 OPEN#1 AS INPUT, "/AREA1/CFOS.CAL/COEFF" 250 FOR J=1 TO 15 260 270 READ#1, J; SLOP(J), OFFS(J) 280 NEXT J 290 OPEN#2 AS INPUT, ".D2/"+D\$ ₽ŧ="" 300 310 INPUT#2,1;NS 320 NS=NS-2 380 PRINT NS 400 FOR 1=1 TO NS B‡="" 410 420 INPUT#2,K+1;B\$ 430 POS1=1 435 FOR J=1 TO 20 44O SPACE=POS1 450 POS2=INSTR(B\$," ",SPACE) 460 NOC=P052-P051 470 VALUE(K, J) = VAL(MID#(B#, POS1, NOC)) 480 POS1=POS2+1 490 FRINT VALUE(K,J) 500 NEXT J 510 NEXT K FOR J=1 TO 15 520 530 DIFF=0 540 FOR K=1 TO NS 550 DIFF=DIFF+(VALUE(K,16)*SLOP(J)+OFFS(J)-VALUE(K,J))/NS 560 NEXT K 570 OFFS(J)=OFFS(J)-DIFF PRINT DIFF 575 580 NEXT J 600 OPEN#5 AS OUTFUT, "/AREA1/CFOS.CAL/ADJUST" 610 FOR J=1 TO 15 620 WRITE#5, J: OFFS(J) 630 NEXT J 640 CLOSE 650 END

10 REM PROGRAM CEOS CFOS DARK CURRECT OFFSET PROGRAM" 20PRINT" DIM A\$(15) 30 40 DIM VALUE(650,20) DIM SLOP(15), OFFS(15) 50 PRINT"INPUT THE NAME OF THE DATA INPUT FILE" 100 INPUT D# 110 120 DTRD=3.14159/180. 150 OPEN#1 AS INPUT, "/.D2/"+D\$ B≢="" 160 180 INFUT#1,1:B# 190 DTRD=3.14159/180. 270 NS=VAL(B\$) 280 PRINT NS 200 FOR K=1 TO NS B\$="" 310 320 INFUT#1, F+1; B# 330 POS1=1 335 FOR J=1 TO 20 340 SPACE=POS1 350 POS2=INSTR(B\$," ",SPACE) 360 NOC=POS2-POS1 370 VALUE(F,J)=VAL(MID\$(B\$,POS1,NOC)) 380 P051=P052+1 390 PRINT VALUE(K,J) 400 NEXT J 410 NEXT E 415 FOR J=1 TO 15 420 N=Ö 430 SX=0 440 SY=0 450 SXX=0 460 SYY=0 470 SXY=0 480 FOR K=1 TO NS 490 N=N+1500 X = VALUE(K, 16)510 Y=VALUE(K.J) 520 SXY=SXY+X*Y 530 SX=SX+X 540 SY=SY+Y 550 SXX=SXX+X*X 560 SYY=SYY+Y*Y 570 NEXT K 580 BETA1 = (N*SXY-SX*SY) / (N*SXX-SX*SX)610 BETAO=SY/N-BETA1*SX/N 620 PRINT BETA1, BETAO 630 R=(N*SXY-SX*SY)/SDR((N*SXX-SX*SX)*(N*SYY-SY*SY)) 640 PRINT R 650 SLOP(J)=BETA1 660 OFFS(J)=BETAO 670 NEXT J 680 OPEN#3 AS OUTPUT, "/AREA1/CFOS.CAL/COEFF" 690 FOR J=1 TO 15 700 WRITE#3,J;SLOP(J),OFFS(J) 710 NEXT J 720 CLOSE 730 END

l

•

.

10REM PROGRAM CFOS FRINT" CFOS CALIBRATON PROGRAM" 20 30 DIM A#(15),VALUE(100,20) DIM SLOP(15), OFFS(15), COFFS(15), SENS(15) 40 PRINT"INPUT FILE NAME OF DARK CURRENT CALIBRATON RUN" 50 INPUT D\$ <u>50</u> OPEN#1 AS INPUT, "/AREA1/CFOS.CAL/COEFF" 150 FOR J=1 TO 15 160 READ#1,J;SLOP(J),OFFS(J) 170 NEXT J 180OPEN#2 AS INPUT, "/AREA1/CFDS.CAL/ADJUST" 200 FOR J=1 TO 15 210 220 READ#2, J; COFFS(J) 230 NEXT J 240 PRINT" CURRENT DARK CURRENT OFFSET UPDATE VALUES" FOR J=1 TO 15 250PRINT COFFS(J) 260 270 NEXT J 280CLOSE#2 290 OPEN#2 AS INPUT,".D2/"+D\$ 300 B\$="" 310 INPUT#2,1;NS 320 NS=NS-2 380 PRINT NS 400 FOR k=1 TO NS B‡="" 410 420 INPUT#2,K+1;B# 430 POS1=1 435 FOR J=1 TO 20 440 SPACE≠POS1 450 POS2=INSTR(B#," ",SPACE) 460 NOC=POS2-POS1 470 VALUE(K,J)=VAL(MID\$(B\$,POS1,NOC)) 480 POS1=POS2+1 490 PRINT VALUE(K,J) 500 NEXT J 510 NEXT K FOR J=1 TO 15 520 530 SENS(J) = 0, 540FOR K=1 TO NS 550 SENS(J) = SENS(J) + (VALUE(K,J) - VALUE(K,16) + SLOP(J) - COFFS(J)) / NS560 NEXT E 570 FRINT SENS(J) 575 NEXT J 580 FOR J=1 TO 7 590 SENS(J) = SENS(J) / SENS(8)600 SENS(J+8) = SENS(J+8) / SENS(8)610 NEXT J 620 SENS(8) = 1625 OPEN#5 AS OUTPUT, "/AREA1/CFOS.CAL/SENSIV" 630 FOR J=1 TO 15 640 WRITE#5,J:SENS(J) 650 NEXT J 660 CLOSE 670 OPEN#1 AS OUTPUT, ".SILENTYPE" 680 FOR J=1 TO 15 69Û PRINT#1SENS(J) 700 NEXT J 710 CLOSE 720 END

}

- 10 PRINT"ENTER THE TOTAL CLOUD COVER" 20 INPUT ST
- 30 PRINT"ENTER THE CHI PARAMETER"
- 40 INPUT CHI

,

.

- 50 PRINT"ENTER THE DIAMETER LIMITS D1 AND D2" 60 INFUT D1.D2
- 60 INFUT D1,D270 PRINT"ENTER THE EXPONENT ALPHA"
- 80 INPUT ALPHA
- 100 D1A=D1*ALPHA
- 110 DZA=D2*ALFHA
- 120 A=-(ST/(2*CHI)*(EXP(-D2A)*(D2A^2+2*D2A+2)-EXP(-D1A)*(D1A^2+2*D1A+2)))

ι,

- 130 PRINT D1, D2, A
- 140 END

10 20 25 110 120 130 135 140 150 160 170 175	<pre>REM CLOUD DISTRIBUTION PROGRAM A LA HQZUMI DIM D(SO),N(SO),A(SO),V(SO) OPEN#1 AS OUTPUT.".PRINTER" FOR M=5 TO 95 STEP 10 A=124*EXP(-4.7*M*.01) B=4.5*EXP(-3.5*M*.01) ASUM=0 FOR I=1 TO 20 D1=I*0.50+0.50 D2=I*0.50 N(I)=A/B*(EXP(-B*D1)-EXP(-B*D2))*40 DB1=D1*B</pre>
176 180	DB2=D2*B A(I)=3.14159*A/(4*B^3)*(EXP(-DB1)*(DB1*DB1+2*DB1+2)-EXP(-DB2)*(DB2
180	B2+2*DB2+2))/100
190	ASUM=ASUM+A(I)
280	PRINT#1M,D1,D2,N(I),A(I)
290	NEXT I
295	PRINT#1ASUM: PRINT#1: PRINT#1
200	NEXT M
310	END

•

.

•

-

1510 INVOLE".D1/BGRAF.INV"	
ACOA DEDEDEM INITEDACIY	
1520 PERFORM INITGRAFIX	
15I0 PERFORM GRAFIXMODE(%1,%1)	
1540 PERFORM FILLPORT	
1550 PERFORM GLOAD.".H1/FOAM.60DEGGRAF"	
1560 PERFORM GRAFIXON	
1570 PERFORM GRAFIXMODE(%1,%2)	
1580 PERFORM GLOAD.".H1/FOAM.30DEGGRAF"	
1590 PERFORM GRAFIXON	
1600 PERFORM GRAFIXMODE(%1,%1)	
1605 PERFORM INITGRAFIX	
1610 PERFORM GLOAD.".H1/FOAM.ODEGGRAF"	
1620 PERFORM GRAFIXON	
1625 FOR k=1 TO 1000:PERFORM GRAFIXON:NEXT	к
1630 PERFORM GRAFIXMODE(%1,%2)	
1640 PERFORM GLOAD.".H1/FOAM.60DEGPLOT"	
1650 PERFORM GRAFIXON	
1660 PERFORM GRAFIXMODE(%1,%2)	
1670 PERFORM GLOAD.".H1/FOAM.JODEGPLOT"	
1680 PERFORM GRAFIXON	
1670 PERFORM GRAFIXMODE(%1,%1)	
1700 PERFORM GLOAD.".H1/FOAM.ODEGPLOT"	
1710 PERFORM GRAFIXON	
1720 FOR k=1 TO 1000:PERFORM GRAFIXON:NEXT	ĸ
1730 GOTO 1540	
1740 END	

•

.

,

:

, ,

.

REM PROGRAM CFOS 10PRINT" CFOS DATA REDUCTION PROGRAM" 20 30 PRINT: FRINT: FRINT" THE DIODE SENSITIVITIES USED IN THIS FROGRAM ARE" 40 DIM DIANG(15), SENS(15), DC(19), NADANG(500), RAZANG(500), VOLT(500) DIM DID(19), ANG(3), NR(36), NRN(36), MEAS(500,2) 50 55 DIM A\$(15) DATA 20,30,40,50,60,70,80,90,100,110,120,130,140,150,160 60 DATA 1.,1.06,.88,.94,.84,.95,1.18,.79,.94,1.03,.86,.98,.98,1.06,1.04 70 DATA 1098,125,477,852,427,573,314,338,193,652,185,503,73,220,287,25,3 75 FOR I=1 TO 15 80 90 READ DIANG(I) NEXT I 100 110 FOR I=1 TO 15 120 READ SENS(I) 130 NEXT I PRINT" DIODE NUMBER DIODE ANGLE DIODE SENSITIVITY" 140 143 NF = 8150 FOR I=1 TO 15 PRINT USING 170; I, DIANG(I), SENS(I) 160 170 IMAGE 10X,2#,14X,3#,16X,1#.2# 180 NEXT I DTRD=3.14159/180. 190 200REM DEFINE ARCOS FUNCTION 210 DEF FN ACOS(X) = ATN(SQR(1-X*X)/X) 220 L=0 225 AVZEN=0 250 OPEN#1 AS INPUT, ".D2/BACKZ60" 251 T#="FOAM" 255 FOR LL=1 TO 2 260 B\$="" FOR I=1 TO 15 270 280 GET#1:A\$(I) 290 IF A#(I)=CHR\$(13) THEN 280 IF A\$(I)=CHR\$(10) THEN 340 300 310 IF A\$(I)=CHR\$(32) THEN 340 320 NEXT I 340 FOR K=1 TO I 350 B\$=B\$+A\$(K) 360 NEXT K 370 NS=VAL(B≱) PRINT NS 380 400 FOR K=1 TO NS 410 B\$="" 420 FOR J=1 TO 18 430 B*="" 440 FOR I=1 TO 15 450 GET#1:A\$(I) 460 IF A\$(I)=CHR\$(13) THEN 450 470 IF A\$(I)=CHR\$(32) THEN 500 480 IF A\$(I)=CHR\$(10) THEN 500 490 NEXT I 500 FOR M=1 TO I

510BI=BI+AI(M)520 NEXT M 530 DIO(J) = VAL(B\$)535 DIO(J) = (DIO(J) - DC(J)) / 1000.540 IF K=1 THEN REF=DIO(18) 545 NEXT J 550 FOR J=1 TO 3 560 B=""

΄,

GET#1: A = (1) 530 IF $A \neq (I) = CHR \neq (13)$ THEN 580 A-9 590 IF A\$(I)=CHR\$(32) THEN 630 600-IF A#(I)=CHR#(10) THEN 630 610 NEXT I 620 FOR M=1 TO I 630 B\$=B\$+A\$(M) 640 NEXT M 650 $ANG(J) = VAL(B \pm)$ 66O NEXT J 665 FOR I=1 TO 15 670 ALFHA=ANG(2)-ANG(1)680 X=SIN(DIANG(I)*DTRD)*COS(ALFHA*DTRD) 690 NAD = FN ACOS(X)695 L=L+1700-NADANG(L)=NAD 705 COMP=(DIANG(I)-90)*DTRD 710 DEN=(SIN(NADANG(L))*SIN(ALPHA*DTRD)) 720 IF DEN=0. THEN 750 730 X=(COS(COMP)-COS(NADANG(L))*COS(ALPHA*DTRD))/DEN 740 750 IF DEN=0. THEN X=.00001 IF DIANG(I)<90. THEN X=-X 760 IF NADANG(L) >,000001 THEN 775:ELSE X=1.0 770 775 IF X:1. THEN X=1. IF X - 1. THEN X = -1. 776 RAZANG(L) = FN ACOS(X)780 IF ALPHA.O. THEN RAZANG(L)=RAZANG(L)+180*DTRD 790 IF RAZANG(L)<0. THEN RAZANG(L)=360.*DTRD+RAZANG(L) 800 MEAS(L,LL)=DIO(I)/SENS(I)*REF/DIO(18) 811 VOLT(L) = MEAS(L, 2) - MEAS(L, 1)812 FRINT L, NADANG(L)/DTRD, RAZANG(L)/DTRD, VOLT(L) 815 820 NEXT I 830 PRINT: PRINT AVZEN=AVZEN+ANG(1)/NS 835 NEXT 1. 840 841 CLOSE#1 842 IF LL=2 THEN 850 843 OPEN#1 AS INPUT, ".D2/FIN60.Z60CUBE" 844 L=0:AVZEN=0. NEXT LL 845 850 NMEAS=L 860 **GOSUB** 1200 900 REM SUBROUTINE INTERP 910 DELTA=30+DTRD 920 SUMF=0.:SUMW=0. 930 FOR I=1 TO NMEAS 940 Z = NADANG(I) : A = RAZANG(I)950 IF ABS(Z-ZINT) >DELTA THEN 1040 960 IF ABS(A-AINT)>DELTA THEN 1040 970 THETA=COS(Z)*COS(ZINT)+SIN(Z)*SIN(ZINT)*COS(A-AINT) 980 IF THETADO. THEN 1000:ELSE 1000 **9**90 THETA= FN ACOS(THETA) 1000 GOSUB 1100 1010 SUMW=SUMW+W 1020 SUMF=SUMF+W*VOLT(I) 1040NEXT I 1100 REM SUBROUTINE WEIGHT 1120 WGHT=1.E+06 IF THETA'.0001 THEN 1140:ELSE 1150 1170 1140 W=WGHT:RETURN 1150 WGHT=DELTA/THETA 1160 W=WGHT:RETURN 1200 REM SUBROUTINE MAX-----MIN 1210 MAX=01220 MTN=100

a vary of the open and the mail IF NADANG(I) 60*DTRD THEN 1260 4237 1240 IF VOLT(I) MAX THEN MAX=VOLT(I) A-10 1250 IF VOLT(I) MIN THEN MIN=VOLT(I) NEXT I 1260 FRINT MIN, MAX 1265 REM SUBROUTINE INTEGRATE RADIANCES 1300 1310 SUM=0.:TOTNUM=0 ORIGINAL PAGE IS FOR J=1 TO 35 1315 DE POOR QUALITY 1320 NR(J) = 0: NRN(J) = 01325 NEXT J NINC=90*DTRD/36. 1330 FOR I=1 TO NMEAS 1335 J=INT(NADANG(I)/NINC)+1 13401345 NR(J) = NR(J) + VOLT(I)1350NRN(J) = NRN(J) + 1NEXT I 1355 FOR I=1 TO 36 1360IF NRN(I)=0 THEN 13951365 1370 ANG=(2*I-1)/2*NINC 1375 SUM=SUM+NR(I)/NRN(I)*COS(ANG)*SIN(ANG)*NINC 1380 TOTNUM=TOTNUM+NRN(I) 1390 NINC=90.*DTRD/36.:GOTO 1400 1395 NINC=NINC+NINC 1400 NEXT I 1410 FLUXUF=3.14159+2*SUM 1420 PRINT FLUXUP 1430 STOP 1435 OPEN#5 AS OUTPUT, ".SILENTYPE" 1436 OUTPUT#5 1437 FOR Y=8 TO 375 STEP 15 VOLT(F) = (MEAS(K, 2) - MEAS(K, 1) * (1-F*(1+TAN(NADANG(K)))))/F/(1+TAN(NADAN 1438 G(K))) 1439 PRINT MEAS(k,1),MEAS(K,2),VOLT(K),NADANG(K)/DTRD,(1-COS(NADANG(F))) 1440 NEXT K 1441 PRINT: PRINT 1445 END 1500 OPEN#2,".GRAFIX" 1510INVOKE".D1/BGRAF.INV" 1520 PERFORM INITGRAFIX 1530 PERFORM GRAFIXMODE(%1,%1) 1540 PERFORM FILLPORT 1550RAD=60 1560 GOSUB 1880 1570 PERFORM PENCOLOR(%15) 1580NPOINTS=72 1590 PERFORM GRAFIXON 1600 FOR K=1 TO 3 1610 X1=F*SO*DTRD 1620 R=RAD*SIN(X1) 1630 PERFORM MOVETO(%(R*140/192*2+140),%96) 1640 FOR I=1 TO 365 STEP 5 1650 X=R*COS(I*DTRD)*140/192+70:X=2*X 1660 Y=R*SIN(I*DTRD)*192/140+96 1670 PERFORM LINETO(%X,%Y) 1680 NEXT I 1690 NEXT E 1700 ANGINC=JO*DTRD 1710 PERFORM MOVETO(%140,%96) 1720 FOR I=1 TO 12 1730 ANG=ANGINC*I 1740 X=RAD*COS(ANG)*140/192+70:X=2*X 1750Y=RAD*SIN(ANG)*192/140+96 1760 FERFORM LINETO(%X,%Y) 1770 PERFORM MOVETO(%140,%96) 1720 NEYT T

المستحك ليتبيدها فالتباريك والإستامين والحارج بالالت مراج 4790 PERFORM MOVETO(%230,%98) 1795 PRINT#2; "180" PERFORM MOVETO(%10,%188) 1800 A-11 PRINT#2 USING 1804; AVZEN 1802 IMAGE "Z=",##. 1804 PERFORM MOVETO (%180,%188) 1806 PRINT#2 USING 1810; FLUXUP 1808 IMAGE "F=", #. ## 1810 FERFORM MOVETO(%10,%8) 1812 PRINT#2 USING 1816;MIN 1814 IMAGE "MIN=",#.# 1816 FERFORM MOVETO(%180,%8) 1818 FRINT#2 USING 1822; MAX 1820 1822 IMAGE "MAX=",#.# 1825 FERFORM MOVETO(%126,%188) 1830 PRINT#2; "90" 1840 PERFORM MOVETO (%30,%98) 1850 PRINT#2:"0" PERFORM MOVETO(%120,%8) 1860 PRINT#2:"270" 1870 1875 GOTO 3000 PERFORM GRAFIXON 1880 1885 PERFORM INITGRAFIX 1890 PERFORM XFROPTION(%0) COLINC=(MAX-MIN)/10. 1895 1900 FOR F=1 TO NMEAS 1905 IF NADANG(K)>60*DTRD THEN 2025 1910 R=-RAD+SIN(NADANG(E)) X=R+COS(RAZANG(K))*140/192+70:X=X*2 1920 1925 XS=3*COS(NADANG(K))+1:XS=XS*2 1930 Y=R*SIN(RAZANG(K))*192/140+95 1935 YS=6*COS(NADANG(K))+3 1940 IF COLING=0. THEN COLOR=10:ELSE COLOR=(VOLT(K)-MIN)/COLING 1950 COLOR=INT(COLOR) PERFORM FILLCOLOR(%COLOR) 1960 1970 R=X+XS 1980 L=X-XS 1990 T=Y+YS 2000 B=Y-YS 2010 PERFORM VIEWPORT(%L,%R,%B,%T) 2020 PERFORM FILLPORT 2025 NEXT K 2030 PERFORM INITGRAFIX 2040 RETURN 2050 END 3000 REM SUBROUTINE PRINCIPAL PLANE RADIANCE GRAPH 3010 REM FIND THE MAX AND MIN VOLT IN THE PRINCIPAL PLANE 3020 MAX=0.:MIN=100. 3030 FOR I=8 TO(NS-1)*15+8 STEP 15 3040 IF VOLT(I) > MAX THEN MAX=VOLT(I) 3050 IF VOLT(I) < MIN THEN MIN=VOLT(I) 3060 NEXT I 3070 FRINT MAX, MIN 3100REM SET XSCALE AND XINC 3110 XRANGE=NADANG(8)+NADANG((NS-1)*15+8) 3120 XRANGE=XRANGE/DTRD 3130 XRANGE=INT((XRANGE/2+10)/10) 3140 XINC=40 3150 REM SET YSCALE AND YINC 3155 MID=INT((NS+1)/2) 3160 FOR I=8 TO(NS-1)*15+8 STEP 15 3170 IF NADANG(I) <8 * DTRD THEN NORM=VOLT(I) 3180 NEXT I 3185 J=0 3190 FOR 1=8 TO(NG-1)+15+8 STEP 15

3210 NR(J)=VOLT(I)/NORM 3220 NEXT I 3230 MAX=MAX/NORM:MIN=MIN/NORM A-12 . 3240 REM SET YRANGE AND YINC 3250 YINC = 15YRANGE=MAX-MIN 3260 3265 PERFORM GRAFIXMODE (%2,%2) FERFORM GRAFIXON 3270 PERFORM FILLPORT 3275 PERFORM MOVETO(%280,%30) 3280 3290 PERFORM MOVEREL (%-3,%3) 3310 PERFORM MOVETO(%280,%30) 3320 FERFORM MOVEREL (%0,%-10) ANG=0 3330 PRINT#2ANG 3340 FOR K=-1 TO 1 STEP 2 3350 3360 FOR I=1 TO XRANGE 3370 XR=280+K + I + 40: YR=30 3380 PERFORM MOVETO(%XR-1,%YR+3) PRINT#2;"I" 3400 3410 PERFORM MOVETO(%XR,%YR) 3420 PERFORM MOVEREL (%-3,%-10) 3430 $ANG=I \times 10$ 3440 FRINT#2:ANG 3450 NEXT I 3470 NEXT N LL=280-XRANGE*40 3490 3500 LR=280+XRANGE*40 3510 PERFORM MOVETO(%LL,%30) 3520 PERFORM LINETO(%LR,%30) 3530 PERFORM MOVETO(%280,%30) 3540 FOR J=1 TO 3 XR=280:YR=30+J*50 3550 3560 PERFORM MOVETO(%XR-3,%YR+2) PRINT#2; "-" 3570 3575 PERFORM MOVETO (%XR,%YR) 3580 PERFORM MOVEREL (%10,%0) 3590 FRINT#2;J 3600 NEXT J 3610 PERFORM MOVETO(%XR,%YR) 3620 PERFORM LINETO(%280.%30) 3622 PERFORM MOVETO(%280,%30) 3625 J=0:L=0 3630 FOR I=8 TO(NS-1)*15+8 STEP 15 3635 IF VOLT(I)=0 THEN 3710 3640 k=1 3645 J=J+13650 IF RAZANG(I) :5*DTRD THEN K=-1 3660 X=280+1.+NADANG(I)/DTRD+4 3670 Y=NR(J)*50+30 3675 FRINT NR(J), NADANG(I) / DTRD, RAZANG(I) / DTRD, X, Y 3680 X = INT(X)3690 Y = INT(Y)3695 IF ABS(X-509)<3 THEN 3710 3700 IF L=0 THEN PERFORM MOVETO(%X,%Y):ELSE PERFORM LINETO(%X,%Y) 3701 L=L+13705 PERFORM DOTAT (%X,%Y) 3710 NEXT I PERFORM MOVETO(%100,%180) 3720 3730 FRINT#2 USING 3740;T\$ 3740 IN THE PRINCIPAL PLANE FOR ",1 IMAGE "RELATIVE RADIANCES 0A 3750 PERFORM MOVETO(%40,%170) 3760 PRINT#2 USING 3770; AVZEN 3770 IMAGE "SOLAR TENITH ANGLE= ".##.. "DEG"

3790. 3800	PRINT#2"ANTI-SOLAR SIDE" PERFORM MOVETD(%400,%10)	
5810	PRINT#2"SOLAR SIDE"	A-13
3820	PERFORM MOVETO(%240,%10)	
2820	FRINT#2"NADIR ANGLE"	
3840	END	
11438	<pre>VOLT(k) = (MEAS(k, 2) - MEAS(K, 1)</pre>)*(1-F*(1+TAN(NADANG(K))))/(F*(1+TAN(NADAN
	G(K))))	

,

1

.

,

.

REM PROGRAM CFOS 10 PRINT" CFOS CALIBRATION PROGRAM" 20DIM DIANG(50) 40 45 DIM DARK (500) 50DIM DID(40), ANG(3), NR(36), NRN(36) 55 DIM AF(15) DIM VALUE(500,20) 56 DIM DC(19) 57 DIM SENS(10,16) 58 DATA 20,30,40,50,60,70,80,90,100,110,120,130,140,150,160 60 70 DATA 1.00,.91,1.07,.98,.99,.96,1.2,1.09,1.03,1.23,.89,1.02,1.10,.88,.96 DIM BDR(50) 75 DTRD=3.14159/180. 190 REM DEFINE ARCOS FUNCTION 200 210 DEF FN ACOS(X) = ATN(SQR(1-X*X)/X) 220 L≡Ŭ 225 AVZEN=0 250OFEN#1 AS INPUT, "/AREA1/CFOS.BACK/D.071684.1244" T≢="TEST.DARK" 251 B\$="" 260 280 INPUT#1,1;8≢ NS=VAL(B\$) 370 375 NS=NS-2 PRINT NS 380 400 FOR Y=1 TO NS 410 B‡="" INPUT#1,K+1;B\$ 420 430 POS1=1 435 FOR J=1 TO 20 440 SPACE=POS1 450 POS2=INSTR(B#," ",SPACE) 460 NOC=POS2-POS1 VALUE(K,J)=VAL(MID\$(B\$,POS1,NOC)) 470 480 POS1=POS2+1 490 PRINT VALUE(K,J) 500 NEXT J 510 NEXT K 520 REF=VALUE(1,17) 530 NS2=NS/2 540 FOR J=1 TO NS 550 VALUE(J,8)=VALUE(J,8)*REF/VALUE(J,17) 560 DARk (J) = VALUE (J, 9) *0.761652+163.5 580 NEXT J 600 F=.01 610 FOR J=1 TO NS 620 DIANG(J) = VALUE(J, 19)630 IF DIANG(J) <0. THEN DIANG(J)=360.-DIANG(J) 640 PRINT DIANG(J) 650 NEXT J 660 FOR J=1 TO NS 670 DIANG(J) = ((DIANG(J) + VALUE(J, 18)) - 360) * DTRD680 DIANG(J) = ABS(DIANG(J))685 SINE=ABS(SIN(DIANG(J))) 686 COSE=ABS(COS(DIANG(J))) 690 DIO(J) = (VALUE(J, 8) - DARK(J))700 NEXT J 701 DIO(7) = (DIO(8) + DIO(6))/2.710 FOR J=1 TO NS 720 PRINT DIO(J)/DIO(7),DIANG(J)/DTRD 730 NEXT J 740 SUM=0.

```
1 WIX 1 ** L 1 U 11 U
142
755
        SINE=ABS(SIN(DIANG(F)))
                                            A-15
        COSE = ABS(COS(DIANG(1)))
756
        SUM=SUM+DIO(k)+COSE+SINE+10+DTRD+1+3.14159
760
        NEXT E
780
      SOLANG=(1.0-COS(DIANG(1)))*2.0*3.14159
790
      OFEN#2 AS OUTFUT, ".SILENTYPE"
795
796
      OUTFUT#2
      FOR 1=1 TO NS
800
        BDR(K)=DIO(K)*3.14159/SUM
810
        PRINT BDR(K), COS(DIANG(K))
820
        NEXT K
830
840
      END
      NMEAS=L
850
900
      FOR N=1 TO 5
910
        FOR J=1 TO 18
          DC(J) = DC(J) + VALUE(K, J) / 5
920
930
          NEXT J
940
        NEXT K
      FOR K=1 TO 19
950
        PRINT DC(K)
960
        NEXT E
970
1000
       FOR N=6 TO NS
1010
         J = (K-5) - 15 * INT ((K-5) / 15)
         IF J=0 THEN J=16
1020
1030
         I = INT((K-6)/15)+1
         REF=VALUE(5+I,1)
1040
1042
         SENS(I,J) = (VALUE(K,J) - DC(J))/REF*VALUE(I+5,18)/VALUE(K,18)
         PRINT I, J, K, VALUE(k, J), SENS(I, J)
1050
         NEXT K
1060
1100
       END
1200
       FOR I=1 TO 4:FOR J=2 TO 16:SENS(I,J)=SENS(I,J)/SENS(I,1):NEXT J:NEXT I
       FOR I=1 TO 5:FOR J=1 TO 16:PRINT SENS(I,J):NEXT J:NEXT I
1210
1300
       OPEN#3 AS OUTPUT, ".SILENTYPE"
1310
       OUTPUT#3
1320
       FOR J=1 TO 16
         PRINT SENS(1,J), SENS(2,J), SENS(3,J), SENS(4,J), SENS(5,J)
1330
1340
         NEXT J
```

REM PROGRAM CFOS

```
CFOS CALIBRATION PROGRAM"
     PRINT"
20
     DIM DIANG(50)
40
45
     DIM DARK (500)
     DIM DID(40), ANG(3), NR(36), NRN(36)
50
55
     DIM A$(15)
56
     DIM VALUE (500,20)
     DIM DC(19)
57
     DIM SENS(10,16)
58
60
     DATA 20,30,40,50,60,70,80,90,100,110,120,130,140,150,160
70
     DATA 1.00,.91,1.07,.98,.99,.96,1.2,1.09,1.03,1.23,.89,1.02,1.10,.88,.96
     DIM BDR(50)
75
      DTRD=3.14159/180.
190
200
      REM DEFINE ARCOS FUNCTION
240
      DEF FN ACOS(X) = ATN(SQR(1-X*X)/X)
220
      L=0
225
      AVZEN=0
250
      OPEN#1 AS INPUT, "/AREA1/CFOS.OFF/D.071984.0826"
      T#="TEST.DAR!"
251
      B$=""
260
280
      INPUT#1,1:B$
370
      NS=VAL(B$)
      NS=NS-2
375
380
      FRINT NS
400
      FOR K=1 TO NS
         B‡=""
410
420
         INPUT#1,K+1;B$
430
         P0S1=1
        FOR J=1 TO 20
435
440
           SPACE=POS1
           FOS2=INSTR(B$," ",SPACE)
450
460
           NOC=F0S2-F0S1
470
           VALUE(K, J)=VAL(MID$(B$, POS1, NOC))
480
           POS1=POS2+1
490
           PRINT VALUE(K,J)
500
           NEXT J
510
        NEXT K
520
      REF=VALUE(1,17)
530
      NS2=NS/2
540
      FOR J=1 TO NS
550
         VALUE (J, 8) = VALUE (J, 8) * REF / VALUE (J, 17)
560
         DARk (J) = VALUE (J, 9) *0.871844+47.374
580
        NEXT J
600
      F=.01
610
      FOR J=1 TO NS
620
         DIANG(J) = VALUE(J, 19)
630
         IF DIANG(J) (0. THEN DIANG(J)=360.-DIANG(J)
        FRINT DIANG(J)
640
650
         NEXT J
660
      FOR J=1 TO NS
670
         DIANG(J) = ((DIANG(J) + VALUE(J, 1B)) - 360) * DTRD
680
         DIANG(J)=ABS(DIANG(J))
         SINE=ABS(SIN(DIANG(J)))
685
686
         COSE=ABS(COS(DIANG(J)))
690
         DIO(J) = (VALUE(J, B) - DARE(J))
700
         NEXT J
701
      DIO(7) = (DIO(6) + DIO(8))/2.
710
      FOR J=1 TO NS
720
         PRINT DIO(J)/DIO(7), DIANG(J)/DTRD
730
        NEXT J
740
      SHM=0.
```

```
755
       SINE=ABS(SIN(DIANG(k)))
                                           A-17
        COSE=ABS(COS(DIANG(k)))
755
        SUM=SUM+DID().)*COSE*SINE*10*DTRD*1*3.14159
760
        NEXT F
780
790
      SOLANG=(1.0-COS(DIANG(1)))*2.0*3.14159
      OPEN#2 AS OUTPUT, ".SILENTYPE"
795
      OUTPUT#2
796
      FOR K=1 TO NS
800-
810
        BDR(k)=DID(k)*3.14159/SUM
        PRINT BDR(N),COS(DIANG(N))
820
        NEXT K
830
840
      END
      NMEAS=L
850
      FOR K=1 TO 5
900
        FOR J=1 TO 18
910
920
          DC(J) = DC(J) + VALUE(K, J) / 5
930
          NEXT J
        NEXT K
940
      FOR K=1 TO 19
950
960
        PRINT DC(K)
        NEXT K
970
1000
       FOR K=6 TO NS
         J = (k - 5) - 15 + INT((K - 5) / 15)
1010
         IF J=0 THEN J=16
1020
1030
         I = INT((K-6)/15)+1
1040
         REF=VALUE(5+I,1)
         SENS(I,J) = (VALUE(K,J) - DC(J))/REF*VALUE(I+5,18)/VALUE(K,18)
1042
         PRINT I,J,K,VALUE(K,J),SENS(I,J)
1050
         NEXT E
1060
       END
1100
       FOR I=1 TO 4:FOR J=2 TO 16:SENS(I,J)=SENS(I,J)/SENS(I,1):NEXT J:NEXT I
1200
1210
       FOR I=1 TO 5:FOR J=1 TO 16:PRINT SENS(I,J):NEXT J:NEXT I
       OPEN#3 AS OUTPUT, ".SILENTYPE"
1300
       OUTPUT#3
1310
1320
       FOR J=1 TO 16
         FRINT SENS(1,J), SENS(2,J), SENS(3,J), SENS(4,J), SENS(5,J)
1330
1340
         NEXT J
```

, ,

```
10
     REM PROGRAM CFOS
20
     PRINT"
                     CFOS BI-DIRECTIONAL REFLECTANCE PROGRAM
                                                                    11
     DIM DIANG(15), SENS(15), COFFS(15), NR(50), NRN(50)
40
     DIM DAR* (20,15), DIO (20,17), BDR (20,15), OFFS (15), SLOP (15)
45
     DIM ANG(20,3), NAD(20,15), AZI(20,15)
50
     DATA 20,30,40,50,60,70,80,90,100,110,120,130,140,150,160
60
80
     FOR I=1 TO 15
       READ DIANG(I)
90
        NEXT I
100
      OPEN#1 AS INFUT, "/AREA1/CFOS.CAL/COEFF"
110
      OPEN#2 AS INPUT, "/AREA1/CFOS.CAL/ADJUST"
120
      OPEN#3 AS INPUT, "/AREA1/CFOS.CAL/SENSIV"
130
140
      FOR J=1 TO 15
         READ#1, J; SLOP(J), OFFS(J)
150
        READ#2, J; COFFS(J)
160
170
         READ#3, J:SENS(J)
         OFFS(J)=COFFS(J)
180
190
         NEXT J
200
      CLOSE
205
      DTRD=3.14159/180.
210
      REM DEFINE ARCOS FUNCTION
      DEF FN ACOS(X) = ATN(SOR(1-X*X)/X)
215
      PRINT" INPUT DATA FILE NAME "
220
225
       INPUT DE
250
      OPEN#1 AS INPUT. "/AREA1/CFOS.BACK/"+D#
260
      ₽$≈""
280
       INFUT#1.1;B$
370
      NS=VAL(B$)
375
      NS=NS-2
      PRINT NS
380
400
      FOR K=1 TO NS
        B$=""
410
420
         INPUT#1,K+1;B$
430
         POS1=1
435
         FOR J=1 TO 17
440
           SPACE=POS1
445
           POS2=INSTR(B#," ",SPACE)
450
           NOC=POS2-POS1
455
           DIO(K,J) = VAL(MID \neq (B \neq , POS1, NOC))
460
           POS1=POS2+1
465
           PRINT DIO(K,J)
           NEXT J
470
475
         FOR J=18 TO 20
480
           SPACE=POS1
485
           POS2=INSTR(B$," ",SPACE)
490
           NOC=POS2-POS1
495
           ANG(K, J-17)=VAL(MID\ddagger(B\ddagger, POS1, NOC))
500
           POS1=POS2+1
505
           PRINT ANG(K, J-17)
510
           NEXT J
515
         NEXT P
520
      REF=DIO(1,17)
530
      NS2=NS/2
540
      FOR J=1 TO NS
545
         FOR K=1 TO 15
           DARK(J,K)=DIO(J,16)*SLOP(K)+OFFS(K)
550
560
           DIO(J,k) = (DIO(J,k) - DARk(J,k)) / SENS(k)
570
           DIO(J,K) = DIO(J,K) * REF/DIO(J,17)
590
           NEXT K
600
        NEXT J
610
       FOR J=1 TO NS
```

```
ما با بلغان الاستان والعادي فيتحرون الارتيار ما بالا بالمحادة المحافظة والارتبار المالي الداري المحاف المادة ا
.....
         ANG(J,2) = -ANG(J,2)
.635
640
        PRINT ANG(J.2)
                                                              ORIGINAL PAGE IS
        FOR +=1 TO 15
650
                                             A-19
                                                              OF POOR QUALITY
           ALFHA=ANG(J,2)-ANG(J,1)
086
           X=SIN(DIANG())*DTRD)*COS(ALFHA*DTRD)
690
           NAD(J,k) = FN ACOS(X)
700
           COMF = (DIANG(k) - 90) * DTRD
710
           DEN=(SIN(NAD(J,K))*SIN(ALPHA*DTRD))
720
           IF DEN=0. THEN 750
730
740
           X=(COS(COMF)-COS(NAD(J,K))*COS(ALPHA*DTRD))/DEN
750
           IF DEN=0. THEN X=0.00001
           IF DIANG(\flat) < 90. THEN X=-X
760
           IF NAD(J, 1) 0.00001 THEN 775:ELSE X=1.0
770
775
           IF X 1. THEN X=1.
           IF X<-1. THEN X=-1.0
776
           AZI(J, I) = FN ACOS(X)
780
           IF ALPHAKO.0 THEN AZI(J,K)=AZI(J,K)+180.0*DTRD
790
           IF AZI(J,F)<0. THEN AZI(J,K)=360.0*DTRD+AZI(J,K)
800
810
           PRINT J,K,NAD(J,K)/DTRD,AZI(J,K)/DTRD,DIO(J,K)
820
           NEXT F
830
         NEXT J
840
       SUM=0
850
       TOTNUM=0
860
       FOR J=1 TO 36
870
         NR(J)=0
880
         NRN(J)=0
900
         NEXT J
910
      NINC=90*DTRD/36.
920
      FOR J=1 TO 13
930
         FOR F=1 TO 15
940
           I = INT(NAD(J,K)/NINC) + 1
950
           NR(I) = NR(I) + DIO(J,K)
960
           NRN(I) = NRN(I) + 1
970
           NEXT K.
980
        NEXT J
        FOR I=1 TO 36
1000
1010
          IF NRN(I)=0 THEN 1070
1020
          ANG=(2*I-1)/2*NINC
1030
          SUM=SUM+NR(I)/NRN(I)*COS(ANG)*SIN(ANG)*NINC
1040
          TOTNUM=TOTNUM+NRN(I)
1050
          NINC=90.*DTRD/36.
1060
          GOTO 1090
1070
          NINC=NINC+NINC
1090
          NEXT I
1100
        FLUXUP=3.14159*SUM*2.
1110
        PRINT"UPWARD FLUX DENSITY"; FLUXUP
1120
        MAX=0
1130
        MIN=90
1140
        FOR J=1 TO 13
1150
          FOR K=1 TO 15
1160
             IF NAD(J,K) >MAX THEN MAX=NAD(J,K)
1170
             IF NAD(J,K) < MIN THEN MIN=NAD(J,K)
1180
            NEXT K
1190
          NEXT J
1200
        FRINT MIN, MAX
1210
        SOLANG=2.0*3.14159*(1.-COS(MAX))
1220
        FRACSA=SOLANG/(2.*3.14159)
1230
        FRINT SOLANG, FRACSA
1700
        FOR J=1 TO 13
1310
          FOR F=1 TO 15
1320
            BDR(J,K)=DIO(J,K)*3.14159/FLUXUP
1330
            PRINT J,K,NAD(J,K)/DTRD,AZI(J,K)/DTRD,BDR(J,K)
1340
            NEXT K
1350
          NEXT J
1740
        MAY=0
```

```
. -
       .
           - -
1375
       [ = 1
1780
       FOR J=1 TO 13
                                        A-20
         FOR +=1 TO 15
1390
            IF BDR(J, k) MAX THEN MAX=BDR(J, k)
1400
           IF BDR(J,F) MIN THEN MIN=BDR(J,K)
1410
           NEXT K
1420
         NEXT J
1430
       PRINT MIN, MAX
1440
       OPEN#3 AS OUTPUT, "/AREA1/CFOS.BDR/"+D$
1460
1470
       WRITE#3,1;NS,FLUXUP,MIN,MAX
       I = 1
1475
       FOR J=1 TO NS
1480
         FOR F=1 TO 15
1470
1500
            I = I + 1
           WRITE#3,I;J,K,NAD(J,K),AZI(J,K),BDR(J,K)
1510
           NEXT Y
1520
1530
         NEXT J
1540
       CLOSE
       END
1550
```

•

٦

. . . .

1	HOME
5	X0=0.0:Y0=0.0:X1=6:Y1=4
10	DIM V(11), SCALEX(21), SCALEY(21), XNUM(21), YNUM(21)
15	DIM XG(200),YG(200),BDN(6,12),BDA(2,12),BD(30),NA(14)
80	FOR I=1 TO 10
90	F1X=1500:F1Y=1500
95	X0=0.0:Y0=0.0:X1=5:Y1=4
100	
110	
115 120	•
125	
150	
200	
201	
202	
203	P1X#=CONV#(P1X):P2X#=CONV#(P2X):P1Y#=CONV#(P1Y):P2Y#=CONV#(P2Y):
204	
205	
206	
207	
208	
210 211	
212	
210	
214	
215	
215	DELTAY=(Y1-Y0)/NDIVY
217	SCALEX(1) = x0: SCALEY(1) = Y0
218	
219	
220	
221 225	
220	
227	
228	
230	
231	
232	
233	
234	
235	
236	
237	
239 240	
240	
245	
246	
247	
248	PRINT#9:"PA":XO#:".":YO#:":"PD:PA":X1#:".":YO#:":"PU:"
249	PRINT#9; "PA"; XO\$; ", "; YO\$; "; "; "PD; PA"; XO\$; ", "; Y1\$; "; "FU; "
250	PRINT#9; "TL1.0,0.0; PA"; XO\$; ", "YO\$; "; "
251	
252	
253 254	
255	
256	
	· · · · · · · · · · · · · · · · · · ·

```
REM LOCATION IS THE LOWER LEFT HAND CORNER
261 .
        REM DIRUN, DIRISE: SET DIRECTION . 1,0 FOR HORIZONTAL
262
                                                                         A-22
263
        REM SAW, SAH SET WIDTH AND HEIGHT IN CM.
        IF SAW=0 THEN SAW=0.1:SAH=0.15
264
266
        AXX#=CONV#(AXX):AYY#=CONV#(AYY):AXNUM#=CONV#(AXNUM)
        PRINT#9;"SI";CONV$(SAW);",";CONV$(SAH);";"
267
        PRINT#9; "FA"; AXX$; ", "; AYY$; "; LB"; AXNUM$; CHR$(3)
268
269
        RETURN
270
        REM SUBROUTINE TO FLOT TEXT TXT$ AT LOCATION TXX, TYY
        REM LOCATION IS THE LOWER LEFT HAND CORNER
271
272
        REM DIRUN, DIRISE; SET DIRECTION . 1,0 FOR HORIZONTAL
        REM SAW, SAH SET WIDTH AND HEIGHT IN CM.
273
274
        IF SAW=0 THEN SAW=0.1:SAH=0.15
275
        TXX==CONV=(TXX):TYY==CONV=(TYY)
277
        PRINT#9;"SI";CONV#(SAW);",";CONV#(SAH);";"
278
        PRINT#9; "DI"; CONV$ (DIRUN); ", "; CONV$ (DIRISE); "; ": FOR M=1 TO 999: NEXT M
279
        PRINT#9:"PA";TXX#:",";TYY#:";LB";TXT#:CHR#(3)
280
        RETURN
        REM SUBROUTINE TO CENTER DIGITS ON X AXIS
281
282
        NUMDIGIT=LEN(CONV$(AXNUM))
283
        AXX=AXX-(NUMDIGIT*SAW)/2/2.54
284
        RETURN
        REM SUBROUTINE TO CENTER DIGITS ON Y AXIS
285
286
        AYY=AYY-SAH/2/2.54:RETURN
287
        REM PLOT A CURVE OF NP POINTS IN XG,YG
        XP = (XG(1) - XNUM(5)) * DX : YP = (YG(1) - YNUM(1)) * DY
288
        SYM2==CONV=(XP)+","+CONV=(YP)
289
290
        PRINT#9; "PU: PA"; SYM2#; "; PD; "
291
        FOR IPLOT=2 TO NP
           XF=(XG(IFLOT)-XNUM(5))*DX:FOR D=1 TO 200:NEXT D
292
293
           YF=(YG(IFLOT)-YNUM(1))*DY
294
           SYM2#=CONV#(XP)+","+CONV#(YP)
295
           PRINT#9; "PA"; SYM2#; "; ":NEXT IFLOT
296
        PRINT#9; "PU;"
297
        RETURN
299
        RETURN
        REM SUBROUTINE TO GET ERRORS ON HP
300
301
        PRINT#9;CHR$(27);".E;"
302
        PRINT#9; "DE; ": INPUT#9; ERROR$: PRINT ERROR$
303
        RETURN
500
        GOSUB 200
510
        GOSUB 245
520
        FOR I=1 TO 11
525
           XNUM(I) = (I-1) * 0.10
530
           NEXT I
535
        FOR I=2 TO 10
540
           XNUM(I+10)=1.1-I*.1
545
          NEXT I
550
        FOR I=1 TO 6
560
           YNUM(I) = (I-1) *.50
570
         . NEXT I
575
        SAW=.10*2.54:SAH=.10*2.54
580
        AXX=SCALEX(2)
590
        AYY=-.15*2.54
600
        FOR I=1 TO NDIVX-1
610
          AXNUM=XNUM(I+5)
620
           GOSUB 281
625
          FOR J=1 TO 100:NEXT J
630
          GOSUB 260
640
          AXX=SCALEX(I+2)
650
          NEXT I
660
        DX = (X1 - X0) / (XNUM(NDIVX+1) - XNUM(1))
665
        DXH=DX
680
        TXT = "COSINE OF THE OBSERVATION ZENITH"
690
        NUMI ET=I FN (TXT$)
```

فعشها فاستناقه العالية بالاستقادة

4 * * * *

	م است. است. است. ۱۳ Min Amin at La g ⊥ a	
	TYY=3+2.54	
720	GOSUB 270	A-23
725	DY = (Y1 - Y0) / (YNUM (NDIVY+1) - YNUM (1))	
726 730	AXX=2*2.54:AYY=0 For I=1 to ndivy+1	
730	AXNUM=YNUM(I)	
740 750	GOSUB 285	
760	FOR J=1 TO 200:NEXT J	
770	GOSUB 260	
775	FOR J=1 TO 200:NEXT J	
780	AYY=SCALEY(I+1)	
790	NEXT I	original page is
800	TXT#="NORMALIZED RADIANCE"	OF POOR QUALITY
810 820	TXX=-0.35*2.54 DIRUN=0.	-
830	DIRISE=1	
840	NUMLET=LEN(TXT\$)	
850	TYY=Y1/2NUMLET*SAW/2/2.54	
855	FOR J=1 TO 800:NEXT J	
860	GOSUB 270	
870	FOR I=1 TO NDIVX+1	
880	XNUM(I) = (I-1) * 0.1	
870 800	NEXT I FOR F=1 TO NP	
900 910	PRINT K	
920	INPUT BD(K)	
930	NEXT F	
940	FOR K=1 TO NP	
950	REM PRINT K:INPUT XG(K)	
960	YG(E) = BD(k)	
970	PRINT XG(K),YG(K)	
980 885	NEXT K	
985 990	DX=5. Gosub 287	
	SYM≢="X"	
	W=.2:H=.2	
1010	FOR K=1 TO NP	
1020	X = (XG(K) - XNUM(5)) * DX	
1000	Y = (YG(k) - YNUM(1)) * DY	
1040	FOR J=1 TO 400:NEXT J	•
1045	GOSUB 225	
1050 1060	GOSUB 230 NEXT K	
1070	END	
1100	TXT≇="OCEAN BDR IN THE PRINCIPAL PLANE"	
1105	DIRUN=1.0:DIRISE=0:SYM≸="":GOSUB 225	
1120	TXX=1.25	
1130	TYY=5	
1140	GOSUB 270	
1145		
$1150 \\ 1160$	TXX=1.5 TYY=4.5	
1170	SAW=.075*2.54:SAH=0.075*2.54	
1180	TXT $= 0 - COSINE OF THE SOLAR ZENITH = 0.1$	
1190	GOSUB 270	
1195	END	
1200	TYY=4.25	
1210	TXT $=$ "X - COSINE OF THE SOLAR ZENITH = 0.	5 "
1220	GOSUB 270 END	
1225 1230	TYY=4.0	
1240	TXT\$="0 - 0.2 CLOUD COVER"	
1250	GOSUB 270	
1260	END	

.

ĩ

A-24

•

•

t

<pre>1 HOME 5</pre>		A-24
 S V0=0, 0:Y0=0, 0:Y1=4;Y1=4 DIM V(1), SCALEX(21), SCALEY(21), XNUM(21), YNUM(21) DIM V(1), SCALEX(21), SCALEY(21), SD(30), NA(14) FOR 1= T0 10 FOR 1= T0 10 Y0=0, 0:Y0=0: 0:X1=4;Y1=4 X1=150, 0:X1=4;Y1=4 Y1=150, 0:X1=4;Y1=4 Y1=150, 0:X1=4;Y1=4 Y1=150, 0:X1=4;Y1=4 Y1=150, 0:X1=4;Y1=4 Y1=150, 0:X1=4;Y1=4 Y1=150, 0:X1=4;Y1=150, 0:Y1=150, 0:	1	LOME
<pre>10 DIN V(11).SCALEX(21).SCALEX(21).SDA(2,12).VNUM(21) 10 DIN V6(200).YS(200).BDN(6,12).BDA(2,12).BD(50).NA(14) 10 FOR I=1 TO 10 10 NUTV=15:ND=24:DIRUN=1.0:DIRISE=0. 110 NUTV=15:ND=24:DIRUN=1.0:DIRISE=0. 110 NUTV=15:ND=24:DIRUN=1.0:DIRISE=0. 120 SAU=.1+2.54:SAH=.13+2.54 120 ORENDU SCALEX(1)=V0 120 FENHP(::TAS:SAH=.13+2.54 120 ORENDU SCALEX(1)=V0 121 DFENHP(::TAS:SAH=.13+2.54 122 PRINTH=9:(FFE(27):".IS2::17:":FRINTH9:(FRK*(27):".Nt19:":"IN:" 123 PIX=CONV4:F(X):PIX=CONV4:F(Y):PIX=F(Y) 125 FIEDJ=PIX="""""""""""""""""""""""""""""""""""</pre>		
<pre>15 DIM Y0(C000,Y0(C001,RDN(6,12),BDA(2,12),BD(30),NA(14) 96 FOR t-1 TO 10 97 PLX=1500(PLY=1500 97 Y0(PLY=1500(PLY=1500) 97 Y0(PLY=1500(PLY=1500) 97 Y0(PLY=1500(PLY=16)) 98 Y0(PLY=1500(PLY=16)) 99 Y0(PLY=1500(PLY=16)) 90 Y0(PLY=1500(PLY=16)) 91 Y1(PLY=1500(PLY=16)) 92 Y0(PLY=1500(PLY=16)) 93 Y0(PLY=1500(PLY=16)) 94 Y1(PLY=1500(PLY=16)) 95 Y1(PLY=1500(PLY=16)) 96 Y1(PLY=1500(PLY=16)) 97 Y1(PLY=1500(PLY=16)) 97 Y1(PLY=1500(PLY=16)) 97 Y1(PLY=1500(PLY=16)) 98 Y1(PLY=1500(PLY=16)) 98 Y1(PLY=1500(PLY=16)) 99 Y1(PLY=1500(PLY=16)) 99 Y1(PLY=1500(PLY=16)) 90 Y1(PLY=1500(PLY=16)) 91 Y1(PLY=1500(PLY=16)) 92 Y1(PLY=1500(PLY=16)) 93 Y1(PLY=1500(PLY=16)) 94 Y1(PLY=1500(PLY=16)) 95 Y1(PLY=1500(PLY=16)) 96 Y1(PLY=1500(PLY=16)) 97 Y1(PLY=1500(PLY=16)) 96 Y1(PLY=1500(PLY=16)) 97 Y1(PLDI=PLY=16)) 97 Y1(PLDI=PLI=PLI=PLI=PLI=PLI=PLI=PLI=PLI=PLI=PL</pre>		
<pre>60 FOR 1=1 TO 10 71 F11500:P1Y=1500 75 X0=0.0:Y0=0.0:X1=4:Y1=4 75 X0=0.0:Y0=0.0:X1=4:Y1=4 75 Y1=0:Y1=0:Y1=0:Y1=0:Y1=0:Y1=0:Y1=0:Y1=0:</pre>		
<pre>50 50 50 50 50 50 50 50 50 50 50 50 50 5</pre>	15	
<pre>95</pre>	80	
 100 MUNATC: NUMAX: B0:YMAX=3.0 101 NDVX-12:NYDIX=5:NY=24:DIRUN=1.0:DIRISE=0. 115 DTRD=5.14157/180 102 GAM=.142:54:SAH=.13*2.54 103 GAM=.142:54:SAH=.13*2.54 104 GAM=.142:54:SAH=.13*2.54 105 ENO 105 ENO 105 PENH9,".RSC22" 107 PENH9,".RSC22" 108 PENH74:54:SAH=.13*2.54 109 OPENH9,".RSC22" 118 PENH74:54:SAH=.13*2.54 119 PENH74:54:SAH=.13*2.54 119 PENH74:54:SAH=.13*2.54 1118 PENH74:54:SAH=.13*2.54 11100 PENH7	90	P1X=1500:P1Y=1500
 NDIVX=12:NYDIV=S:NP=24:DIRUN=1.0;DIRIS=0. DIVX=12:NYDIV=S:NP=24:DIRUN=1.0;DIRIS=0. GAM=,12:S4:SAH=,13+2.54 GOSUB 500 REM INITIALIZE PLOTER DPNHP, ".RSC22" PRINT#9:CHRR(C7):".I32:17:":FRINT#9;CHR8(C7):P2Y=CDNV8(P1Y):P2Y=CDNV8(P2Y): PZX=PIX+(X1-X0)*1010:P2Y=P1Y+(Y1+Y0)*1010 FX =CONV8(P1X):P2X#=CONV8(P2X):P1Y#=CONV8(P1Y):P2Y#=CONV8(P2Y): PZX=PIX+(X1-X0)*1010:P2Y=P1Y+(Y1+Y0)*1010 FX 0=X1 THEN P1X=500:P2X:1000:P1Y=400H24(P1Y):P2Y#=CONV4(P2Y): PZX=PIX+(X1-X0)*1010:P2Y#=CONV8(P2X):P1Y#=CONV8(P1Y):P2Y#=CONV4(P2Y): PZX=PIX+(X1-X0)*1010:P2Y#=CONV8(P1Y):P2Y#=CONV4(P2Y): PZX=CONV4(P1X):P2X#=CONV8(P2X):P1Y#=CONV4(P1Y):P2Y#=CONV4(P2Y): PZX=THEN, "#1":P1";PTELD1:"" PRINT#9;"TP";PTELD1:"" REM SOALEX.SCALEY=SCALED DATA FOR TIC MARKS REM SOALEX.SCALEY=SCALED DATA FOR TIC MARKS REM SOALEX.SCALEY=SCALED DATA FOR TIC MARKS DELTAY=(11-X0)/NDIVX DELTAY=(11-X0)/NDIVX DELTAY=(11-X0)/NDIVX DELTAY=(11-X0)/NDIVX DELTAY=(11-X0)/NDIVX DELTAY=(11-X0)/NDIVX SCALEX(SUB=1 TO NDIVY:SCALEX(ISUB+1)=SCALEX(ISUB)+DELTAX:NEXT DCALEX(X0)-","*CONV#(N) PRINT#9;"SI":SVM14;"SM#;SVM4:":" PRINT#9;"SI":SVM14;"SM#;SVM4:":" PRINT#9;"SI":SVM14;"SM#;SVM4:":" PRINT#9;"SI":SVM14;"SM#;SVM4:":" PRINT#9;"SI":SVM14;"SM#;SVM4:":" PRINT#9;"SI":SVM14;"SM#;SVM4:":" PRINT#9;"SI":SVM14;"SM#;SVM4:":" PRINT#9;"FINT#9;"FUNE FPD=0 THEN PRINT#9;"PU:"::ELSE PRINT#9;"FD;": FEURA PRINT#9;"SI":SVM14;"SM#;SVM4:":" PRINT#9;"FUN:" PRINT#9;"FUN:" PRINT#9;"FUN:" PRINT#9;"FUN:" FRINT#9;"FUN:" PRINT#9;"FUN:" FRINT#9	95	xo=0.0:Y0=0.0:X1=6:Y1=4
 NDIVX=12:NYDIV=S:NP=24:DIRUN=1.0;DIRIS=0. DIVX=12:NYDIV=S:NP=24:DIRUN=1.0;DIRIS=0. GAM=,12:S4:SAH=,13+2.54 GOSUB 500 REM INITIALIZE PLOTER DPNHP, ".RSC22" PRINT#9:CHRR(C7):".I32:17:":FRINT#9;CHR8(C7):P2Y=CDNV8(P1Y):P2Y=CDNV8(P2Y): PZX=PIX+(X1-X0)*1010:P2Y=P1Y+(Y1+Y0)*1010 FX =CONV8(P1X):P2X#=CONV8(P2X):P1Y#=CONV8(P1Y):P2Y#=CONV8(P2Y): PZX=PIX+(X1-X0)*1010:P2Y=P1Y+(Y1+Y0)*1010 FX 0=X1 THEN P1X=500:P2X:1000:P1Y=400H24(P1Y):P2Y#=CONV4(P2Y): PZX=PIX+(X1-X0)*1010:P2Y#=CONV8(P2X):P1Y#=CONV8(P1Y):P2Y#=CONV4(P2Y): PZX=PIX+(X1-X0)*1010:P2Y#=CONV8(P1Y):P2Y#=CONV4(P2Y): PZX=CONV4(P1X):P2X#=CONV8(P2X):P1Y#=CONV4(P1Y):P2Y#=CONV4(P2Y): PZX=THEN, "#1":P1";PTELD1:"" PRINT#9;"TP";PTELD1:"" REM SOALEX.SCALEY=SCALED DATA FOR TIC MARKS REM SOALEX.SCALEY=SCALED DATA FOR TIC MARKS REM SOALEX.SCALEY=SCALED DATA FOR TIC MARKS DELTAY=(11-X0)/NDIVX DELTAY=(11-X0)/NDIVX DELTAY=(11-X0)/NDIVX DELTAY=(11-X0)/NDIVX DELTAY=(11-X0)/NDIVX DELTAY=(11-X0)/NDIVX SCALEX(SUB=1 TO NDIVY:SCALEX(ISUB+1)=SCALEX(ISUB)+DELTAX:NEXT DCALEX(X0)-","*CONV#(N) PRINT#9;"SI":SVM14;"SM#;SVM4:":" PRINT#9;"SI":SVM14;"SM#;SVM4:":" PRINT#9;"SI":SVM14;"SM#;SVM4:":" PRINT#9;"SI":SVM14;"SM#;SVM4:":" PRINT#9;"SI":SVM14;"SM#;SVM4:":" PRINT#9;"SI":SVM14;"SM#;SVM4:":" PRINT#9;"SI":SVM14;"SM#;SVM4:":" PRINT#9;"FINT#9;"FUNE FPD=0 THEN PRINT#9;"PU:"::ELSE PRINT#9;"FD;": FEURA PRINT#9;"SI":SVM14;"SM#;SVM4:":" PRINT#9;"FUN:" PRINT#9;"FUN:" PRINT#9;"FUN:" PRINT#9;"FUN:" FRINT#9;"FUN:" PRINT#9;"FUN:" FRINT#9	100	XMIN=0; YMIN=0, ; XMAX=180; YMAX=3,0
<pre>115 DTRD=7.14159/180 120 GAM=1*2.54:SAH=.13*2.54 121 DECEMPTION OF A DE</pre>		
<pre>100 GAUE.1*2.54.GAUE.13*2.54 105 GBUB 500 106 END 107 END 108 END 109 END 109 FENH9,".RSC22" 100 PENH9,".RSC22" 101 PENH9,".RSC22" 102 PRINTH9;CHR8(C7):".I32::17:";PRINTH9;CHR8(27):PY4*CONV#(PY):P2Y*EONV#(P2Y): 103 PENH9;CHR8(C7):P2X*EONV#(P2X):PY4*CONV#(P1Y):P2Y*EONV#(P2Y): 104 P2X*PIX+(X1-X0)*1010;P2Y*E1Y+(Y1-Y0)*1010 105 IF X0*X1 THEN P1X*S0):P2X*1000;P1Y*EONV#(P1Y):P2Y*EONV#(P2Y): 107 PFIELD#:1**","*P1Y*F","*P2Y** 108 PRINT#9;"IP":PFIELDI;":" 108 REN SUBROUTINE TO SCALE AXISES 109 REN NDIVX.NDIVY=NUMBER OF DIVISIONS ON AXISES 114 REN X0,X1,Y0,Y1 DEFINE STARTING AND ENDING PUNTS IN INCHES 114 REN X0,X1,Y0,Y1 DEFINE STARTING AND ENDING PUNTS IN INCHES 114 REN NDIVX.NDIVY=NUMBER OF DIVISIONS ON AXISES 115 DELTAX*(11-X0)/NDIVX 116 DELTAY*(11-X0)/NDIVX 116 DELTAY*(11-X0)/NDIVX 116 DELTAY*(11-X0)/NDIVX 116 DELTAY*(11-X0)/NDIVX 117 SCALEX(15UB+1)=SCALEY(ISUB)+DELTAX:NEXT 117 FOR ISUB=1 TO NDIVY:SCALEY(ISUB+1)=SCALEY(ISUB)+DELTAX:NEXT 119 FOR ISUB=1 TO NDIVY:SCALEY(ISUB+1)=SCALEY(ISUB)+DELTAX:NEXT 120 SC#=CONV#(X0)*(","*CONV#(N) 121 PRINT#9;"EI":SYMI#;"SM";SYM#;":" 122 REM SUBROUTINE TO SET SYMBOL MODE 123 REM DBORO FOR FEN UP: PD=1 FOR PEN DONN: LINETELIME TYPE(0-4) 124 PRINT#9;"EI":SYMI#;"SM";SYM#;":" 125 REM SUBROUTINE TO SET SYMBOL MODE 126 SYMI#CONV#(U): PD=1 FOR PEN DONN: LINETELIME TYPE(0-4) 127 PRINT#9;"EI":SYMI#;"SM";SYM#;":" 128 RETURN 129 FOR PD=0 THEN PRINT#9;"PD: PD=1 FOR PEN DONN: LINETELIME TYPE(0-4) 120 REM LINEL= LENSTH (PERCENT OF DIST. BETWEEN P1 AND P2) 123 IF PD=0 THEN FINIT#9;"CIU";":LESE FRINT#9;"FD;": 124 PP=0 GDR FEN UP: PD=1 FOR PEN DONN: LINETELIME TYPE(0-4) 125 REM PD=0 THEN FINIT#9;"CU:";:ELSE FRINT#9;"FD;": 124 IF CONV#(X1):Y1#=CONV#(X1):Y1#=CONV#(Y1) 125 REM PD=0 THEN FINIT#9;"CU:";:ELSE FRINT#9;"FD;": 125 PRINT#9;"CI:";":SCALE#YCONV#(X1):Y1#=CONV#(Y1) 125 PRINT#9;"PD: PD: PO: PONY#(Y1):Y1#=CONV#(Y1) 125 PRINT#9;"PD: PO: PONY#(Y1):Y1#=CONV#(Y1):Y1#=CONV#(Y1) 125 PRINT</pre>		•
125 GGUB 500 150 ED 151 CHD 152 CHD 153 FINT#9(IREX127);".132(:17:";PRINT#9(CHR#(27);".N:19;";"IN;" 154 CHNT#9(IREX127);".132(:17:";PRINT#9(CHR#(27);".N:19;";"IN;" 155 FINT#9(IREX127);P2X#=CONV#(P2X):F1Y#=CONV#(P1Y);P2Y#=CONV#(P2Y); 154 CONV#(P1X):F2X#=CONV#(P2X):F1Y#=CONV#(P1Y):P2Y#=CONV#(P2Y); 155 FIX=CONV#(P1X):F2X#=CONV#(P2X):F1Y#=CONV#(P1Y):P2Y#=CONV#(P2Y); 156 FIX=CONV#(P1X):F2X#=CONV#(P2X):F1Y#=CONV#(P1Y):P2Y#=CONV#(P2Y); 157 FIX=CONV#(P1X):F2X#=CONV#(P2X):F1Y#=CONV#(P1Y):P2Y#=CONV#(P2Y); 156 FIX=CONV#(P1X):P2Y#=CONV#(P2X):F1Y#=CONV#(P1Y):P2Y#=CONV#(P2Y); 157 FIX=CONV#(P1X):P2Y#=CONV#(P2X):F1Y#=CONV#(P1Y):P2Y#=CONV#(P2Y); 158 FR FIX=CONV#(P1X):P2Y#=CONV#(P2X):F1Y#=CONV#(P1Y):P2Y#=CONV#(P2Y); 159 FIX=CONV#(P1X):P2Y#=CONV#(P2X):F2Y#=CONV#(P2Y); F2 150 FIX=CONV#(P1X):P2Y#=CONV#(P2X):F2Y#=CONV#(P2Y); 157 FIX=CONV#(P1X):P2Y#=CONV#(P1X):F2Y#=CONV#(P2X):F2Y#=CONV#(P2X); 157 F1X=CONV#(P1X):P1Y#=CONV#(P1X):F2Y#=CONV#(P1X):F2#=CONV#(P1X):F2#=CONV#(P1X):F2#=CONV#(P1X):F2#=CONV#(P1X):F2#=CONV#(P1X):F2#=CONV#(P1X):F2#=CONV#(P1X):F2#=CONV#(P1X):F2#=CONV#(P1X):F2#=CONV#(P1X):F1#=F2#F1# 157		
 END END CON RET INITIALIZE PLOTER OPENH9,".RS232" PRINT#9:CHR#(27):".I32::17:":FRINT#9:CHR#(27):".N:19:":"IN:" PRINT#9:CHR#(27):".I32::17:":FRINT#9:CHR#(27):P2Y#=CONV#(P2Y): PRINT#9:CHR#(27):".I32::17:":FRINT#9:CHR#(27):P2Y#=CONV#(P2Y): P2X=FIX:(XI=XO)*IOI0:P2Y=P1V+(YI=Y0)*IOI0 FIX J=CONV#(P1X):P2Y#=CONV#(P2X):P1Y#=CONV#(P1Y):P2Y#=CONV#(P2Y): P2X=FIX:"."P1Y#*".""P2Y#="Chromoscale" P1XI=CONV#(P1X):P2Y#=CONV#(P2X):P1Y#=CONV#(P1Y):P2Y#=CONV#(P2Y) P2X=FIX:"."P1Y#*".""P2X#="Chromoscale" P1XI=CONV#(P1X):P2Y#=CONV#(P2X):P1Y#=CONV#(P1Y):P2Y#=CONV#(P2Y) P2X=CONV#(P1X:P1X#=""Chromoscale" P2X=FILD:#1:"" REM SUBROUTINE TO SCALE AXISES REM SCALEX.SCALEY=SCALED DATA FOR TIC MARKS REM SCALEX.SCALEY=SCALED DATA FOR TIC MARKS P2X=FILD:#1:#0101VX D2LTAX:(1:40)/NDIVX D2LTAX:(1:40)/NDIVX D2LTAX:(1:40)/NDIVX D2LTAX:(1:40)/NDIVX D2LTAX:(1:40)/NDIVX D2LTAX:(1:40)/NDIVX D2LTAX:(1:40)/NDIVX D2LTAX:(1:40)/NDIVX:SCALEX(ISUB+1)=SCALEY(ISUB)+DELTAY:NEXT D2D: CAUSX:(0)+", "+CONV4(I)+", "+CONV4(V0)+", "+CONV4(Y1) P21 FOR ISUB=1 TO NDIVY:SCALEX(ISUB+1)=SCALEX(ISUB)+DELTAY:NEXT D3D: CALEX(ISUB+1) TIC NDIVX:SCALEX(ISUB+1)=SCALEX(ISUB)+DELTAY:NEXT P24 FOR SUBROUTINE DEST SYMBOL MDDE P24= CONV#(W)+", "+CONV#(I)+", "+CONV#(V0)+", "+CONV#(I) P21 FINI#9:"SCH:EXET TO NDIVY:SCALEX(ISUB) P22 REM UNE:NE, TICNY#", "CONV#(V):SYMBA AT LOCATION X,Y REM PD=0 FOR PEN UP: PD=1 FOR PEN DOWN:LINET=LINE TYPE(0-4) REM PD=0 FOR PEN UP: PD=1 FOR PEN DOWN:LINET=LINE TYPE(0-4)<td></td><td></td>		
200 REM_INITIALIZE PLOTER 201 OPENN9,".RS232" 202 PRINT#9:CHR5(27):".J32::17:":PRINT#9:CHR*(27):".N:19:":"IN:" 203 PRINT#9:CHR5(27):".J32::17:":PRINT#9:CHR*(27):".N:19:":"IN:" 204 P2X=F1X:(L=X):F1X=CDNV2(F2X):F1Y*=CDNV4(F1Y):F2Y=CDNV4(F2Y): 204 P2X=F1X:(L=X):F1X=F0:F1X:F1:":F1X=F1X=F1X:F1:":F1X=F0:F1X=F1:		
 DFENAP,".RST2P" PFINT#9:CHRS(C7):".IS2::I7:":FRINT#9:CHR*(27):".N:I9:":"IN:" P1X#=CONV&(P1X):P2X#=CONV*(P2X):P1Y#=CONV&(P1Y):P2Y#=CONV#(P2Y): P2X=F1X+(X1-X0)*1010;P2Y#=F1Y+(Y1-Y0)*1010 FX 0=X1 THEN P1X=S00:P2X+D000;P1Y#=CONV#(P1Y):P2Y#=CONV#(P2Y): P1X#=CONV#(P1X):P2X#=CONV#(P2X):P1Y#=CONV#(P1Y):P2Y#=CONV#(P2Y) P1X#=CONV#(P1X):P2X#=CONV#(P2X):P1Y#=CONV#(P1Y):P2Y#=CONV#(P2Y) P1X#=CONV#(P1X):P2X#=CONV#(P2X):P1Y#=CONV#(P1Y):P2Y#=CONV#(P2Y) P1X#=CONV#(P1X):P2X#=CONV#(P2X):P1Y#=CONV#(P1Y):P2Y#=CONV#(P2Y) P1X#=CONV#(P1X):P2X#=CONV#(P2X):P1Y#=CONV#(P1Y):P2Y#=CONV#(P2Y) P1X#=CONV#(P1X):P2X#=CONV#(P2X):P1Y#=CONV#(P1Y):P2Y#=CONV#(P2Y) P1X#=CONV#(P1X:P1X#=V1#P2X#=""""""""""""""""""""""""""""""""""""		_
<pre>PRINT#9;CHR#(27);".ISJ:17:"FRINT#9;CHR#(27):".N:19:"IN!" PIX=CONV#(PIX):PZX=CONV#(PZX):PIY=CONV#(PIY):P2Y=CONV#(PZY): PZ=PIX+(X1-X0)*I010:PZY=PIY+(Y1-Y0)*L010 DS IF X0=X1 THEN PIX=500:PZX=10000:PIY=600:PZY=7500 PIX=CONVI(FIX):PZX=CONVE(PZX):PIY=600:PZY=7500 PIELDJ=PIXI-","+PIY+","+PZX=TCONVE(PZX):PIY=CONVF(PIY):PZY=CONVF(PZY) PIELDJ=PIXI-","+PIY+","+PZX=T","+PZY= PINT#9;"IP":PFIELDI:"" PINT#9;"IP":PFIELDI:"" PINT#0;"IP":PFIELDI:"" PINT#0;"IP":PFIELDI:"" PINT#0;"IP":PFIELDI:"" PINT#0;"IP":PFIELDI:"" PINT#0;"IP":PFIELDI:"" PINT#0;"IP":PFIELDI:"" PINT#0;"IP":PFIELDI:"" PINT#0;"IP":PFIELDI:"" PINT#0;"IP":PFIELDI:"" PINT#0;"IP":PFIELDI:"" PINT#0;"IP":PFIELDI:"" PINT#0;"IP":PFIELDI:"" PINT#0;"IP":PFIELDI:"" PINT#0;"IP":"PINT#0;"IP":"" PINT#0;"IP":"" PINT#0;"IP":"" PINT#0;"IP":""" PINT#0;"IP":""" PINT#0;"SC:"SCALEY(ISUB+1)=SCALEY(ISUB)+DELTAY:NEXT PINT#0;"SC:"SCALEY(ISUB+1)=SCALEY(ISUB)+DELTAY:NEXT PINT#0;"SC:"SCALEY":"":"ETURN PINT#0;"SC:"SCALEY":"":"ETURN PINT#0;"SC:"SCALEY":"":"ETURN PINT#0;"SC:"SCALEY":"":""" PINT#0;"SC:"SCALEY":"":"ETURN PINT#0;"SC:"SCALEY":"":"ETURN PINT#0;"SC:"SCALEY":"":"ELSE PRINT#0;"PD:": PINT#0;"SC:"SCALEY":"":"ELSE PRINT#0;"PD:": PINT#0;"PINT#0;"PD:":":"ELSE PRINT#0;"PD:": PINT#0;"PINT#0;"PI:":":"ELSE PRINT#0;"PD:": PINT#0;"PINT#0;"PI:":":""" PINT#0;"PINT#0;"PI:":":""" PINT#0;"PINT#0;"PI:":":""" PINT#0;"PINT#0;"PI:":":"" PINT#0;"PINT#0;"PI:":":"" PINT#0;"PINT#0;"PI:":":"" PINT#0;"PINT#0;"PI:":":"" PINT#0;"PINT#0;"PI:":":"" PINT#0;"PI:":":"" PINT#0;"PINT#0;"PI:":":"" PINT#0;"PI:":":""" PINT#0;"PI:":":"" PINT#0;"PI:":":"" PINT#0;"PI:":":"" PINT#0;"PI:":":"" PINT#0;"PI:":":"" PINT#0;"PI:":":"" PINT#0;"PI:":":"" PINT#0;"PI:":":"" PINT#0;"PI:":":"" PINT#0;"PI:":":"" PINT#0;"PI:":":"" PINT#0;"PI:"::::::::::::::::::::::::::::::::::</pre>	200	
<pre>203 P1Xt=CDNV\$(P1X):P2Xt=CDNV\$(P2Y):P1Yt=CDNV\$(P1Y):P2Yt=CDNV\$(P2Y): 204 P2X=P1Xt(1-x0)*1010:P2Y=P1Yt+(Y1-Y0)*1010 205 IF X0=X1 THEN F1X=500:P2Y=F10000;P1Y=600:P2Y=7500 206 P1Xt=CDNV\$(P1X):P2Xt=CDNV\$(P2Y):P1Y=CDNV\$(P1Y):P2Yt=CDNV\$(P2Y) 207 P1ELD1=P1Xt+","+P1Yt+","+P2Xt+","+P2Yt 208 PRINT#9;"IP":P1ELD1;":" 200 REM SUBROUTINE TO SCALE AXISES 211 REM X0,X1,Y0,Y1 DEFINE STARTING AND ENDING POINTS IN INCHES 212 REM XNIN.XMAX,YMIN.YMAX ARE THE MAX AND MIN VALUE ON AXISES 213 REM X0,X1,Y0,Y1 DEFINE STARTING AND ENDING POINTS IN INCHES 214 REM NOIVX.NDIYY=NUMBER DF DIVISIONS ON AXISES 215 DELTAX=(1+X0)/NDIYX 216 DELTAY=(1+X0)/NDIYX 217 SCALEX(1)=40:SCALEY(1)=Y0 218 FOR ISUB=1 TO NDIVY:SCALEY(ISUB+1)=SCALEY(ISUB)+DELTAY:NEXT 219 FOR ISUB=1 TO NDIVY:SCALEY(ISUB+1)=SCALEX(ISUB)+DELTAX:NEXT 210 SC4=CDNV4(X0)+","+CONV4(Y)+","+CONV4(Y0)+","+CONV4(Y1) 218 PRINT#9;"SC1:SC4:"":RETURN 225 REM SUBROUTINE TO SET SYMBOL MODE 226 SYM11=CONV4(W)+","+CONV4(W) 227 PRINT#9;"S1'N1\$!"SYM1\$!"SYM1\$!"!" 238 RETURN 230 REM THIS SUBROUTINE PLOTS SYMBOL SYM\$ AT LOCATION X,Y 231 REM DD=0 FOR PEN UP: PD=1 FOR PEN DOWN: LINET=LINE TYPE(0-4) 232 REM LINEL= LENGTH (PERCENT OF DIST. BETWEEN P1 AND P2) 233 IF PD=0 THEN PRINT#9!"YU:"::ELSE PRINT#9;"PD:": 244 IF PD=0 GOT 02:39 245 IF LINEL=0 THEN LINEL=4 246 LIT=CONV4(X):*","+CONV4(Y):SYMB\$=SYM\$ 247 M21=CONV4(X):*","+CONV4(Y):SYMB\$=SYM\$ 248 REM PLOT AXIS 244 RETURN 249 PRINT#9;"L1:_LT:";" 241 RETURN 244 RETURN 245 REM PLOT AXIS 244 PRINT#9;"PD:": 245 REM PLOT AXIS 246 PRINT#9;"PD:": 247 X0:=CONV4(X0):Y0:=CONV4(Y):SYMB\$=SYM\$ 248 REM PLOT AXIS 244 PRINT#9;"PA";SVM2\$!";"PD:PA";X1\$\$\$\$\$\$\$\$\$\$ 244 RETURN 245 REM PLOT AXIS 245 PRINT#9;"PD:YA:Y0:\$</pre>	201	DPEN#9,".RS232"
<pre>203 P1Xt=CDNV\$(P1X):P2Xt=CDNV\$(P2Y):P1Yt=CDNV\$(P1Y):P2Yt=CDNV\$(P2Y): 204 P2X=P1Xt(1-x0)*1010:P2Y=P1Yt+(Y1-Y0)*1010 205 IF X0=X1 THEN F1X=500:P2Y=F10000;P1Y=600:P2Y=7500 206 P1Xt=CDNV\$(P1X):P2Xt=CDNV\$(P2Y):P1Y=CDNV\$(P1Y):P2Yt=CDNV\$(P2Y) 207 P1ELD1=P1Xt+","+P1Yt+","+P2Xt+","+P2Yt 208 PRINT#9;"IP":P1ELD1;":" 200 REM SUBROUTINE TO SCALE AXISES 211 REM X0,X1,Y0,Y1 DEFINE STARTING AND ENDING POINTS IN INCHES 212 REM XNIN.XMAX,YMIN.YMAX ARE THE MAX AND MIN VALUE ON AXISES 213 REM X0,X1,Y0,Y1 DEFINE STARTING AND ENDING POINTS IN INCHES 214 REM NOIVX.NDIYY=NUMBER DF DIVISIONS ON AXISES 215 DELTAX=(1+X0)/NDIYX 216 DELTAY=(1+X0)/NDIYX 217 SCALEX(1)=40:SCALEY(1)=Y0 218 FOR ISUB=1 TO NDIVY:SCALEY(ISUB+1)=SCALEY(ISUB)+DELTAY:NEXT 219 FOR ISUB=1 TO NDIVY:SCALEY(ISUB+1)=SCALEX(ISUB)+DELTAX:NEXT 210 SC4=CDNV4(X0)+","+CONV4(Y)+","+CONV4(Y0)+","+CONV4(Y1) 218 PRINT#9;"SC1:SC4:"":RETURN 225 REM SUBROUTINE TO SET SYMBOL MODE 226 SYM11=CONV4(W)+","+CONV4(W) 227 PRINT#9;"S1'N1\$!"SYM1\$!"SYM1\$!"!" 238 RETURN 230 REM THIS SUBROUTINE PLOTS SYMBOL SYM\$ AT LOCATION X,Y 231 REM DD=0 FOR PEN UP: PD=1 FOR PEN DOWN: LINET=LINE TYPE(0-4) 232 REM LINEL= LENGTH (PERCENT OF DIST. BETWEEN P1 AND P2) 233 IF PD=0 THEN PRINT#9!"YU:"::ELSE PRINT#9;"PD:": 244 IF PD=0 GOT 02:39 245 IF LINEL=0 THEN LINEL=4 246 LIT=CONV4(X):*","+CONV4(Y):SYMB\$=SYM\$ 247 M21=CONV4(X):*","+CONV4(Y):SYMB\$=SYM\$ 248 REM PLOT AXIS 244 RETURN 249 PRINT#9;"L1:_LT:";" 241 RETURN 244 RETURN 245 REM PLOT AXIS 244 PRINT#9;"PD:": 245 REM PLOT AXIS 246 PRINT#9;"PD:": 247 X0:=CONV4(X0):Y0:=CONV4(Y):SYMB\$=SYM\$ 248 REM PLOT AXIS 244 PRINT#9;"PA";SVM2\$!";"PD:PA";X1\$\$\$\$\$\$\$\$\$\$ 244 RETURN 245 REM PLOT AXIS 245 PRINT#9;"PD:YA:Y0:\$</pre>	202	PRINT#9;CHR\$(27);".I32;;17:":PRINT#9;CHR\$(27);".N;19;";"IN;"
<pre>204 P2X=P1X+(X1-X0)+1010;P2Y=P1Y+(Y1-Y0)*1010 205 IF X0=X1 THEN P1X=500;P2Y=f0000;P1Y=600;P2Y=f500 206 P1X1=CDNV1(P1X):P2X1=CDNV1(P1Y):P2Y1=CDNV1(P2Y) 207 FFIELDI=F1X1+*,"+F1Y5*","+P2X1=CDNV1(P1Y):P2Y1=CDNV1(P2Y) 208 PRINT#9;"IP*;FFIELDI:";" 210 REM SUBROUTINE TO SCALE AXISES 211 REM X0,X1,Y0,Y1 DEFINE STARTING AND ENDING POINTS IN INCHES 212 REM X01X,Y0,Y1 DEFINE STARTING AND ENDING POINTS IN INCHES 213 REM SCALEX,SCALEY=SCALED DATA FOR TIC MARKS 214 REM NDIVX.NDIVY=NUMBER OF DIVISIONS ON AXISES 215 DELTAX=(Y1-X0)/NDIVX 216 DELTAY=(Y1-Y0)/NDIVY 217 SCALEX(1)=(0):SCALEY(1)=Y0 218 FOR ISUB=1 TO NDIVY:SCALEX(ISUB+1)=SCALEY(ISUB)+DELTAY:NEXT 219 FOR ISUB=1 TO NDIVY:SCALEX(ISUB+1)=SCALEY(ISUB)+DELTAY:NEXT 219 FOR ISUB=1 TO NDIVY:SCALEX(ISUB+1)=SCALEY(ISUB)+DELTAY:NEXT 210 SCA=CONV2(X0)+*,"+CONV2(Y1)+*,"+CONV4(Y0)+*,"+CONV4(Y1) 211 PRINT#9;"SC1:SC3:",":RTENN 225 REM SUBROUTINE TO SET SYMBOL MODE 226 SYM1=CONV2(U)+*,"+CONV2(U) 237 PRINT#9;"SI":SYM11;"SM";SYM11;" 238 RETURN 239 REM THIS SUBROUTINE PLOTS SYMBOL SYM\$ AT LOCATION X,Y 231 REM PD=0 FOR PEN UP; PD=1 FOR PEN DUWM; LINET=LINE TYPE(0-4) 235 IF D=0 THEN PRINT#9;"PU;";:ELSE PRINT#9;"PD;"; 234 IF PD=0 GOR PEN UP; PD=1 FOR PEN DUWM; LINET=LINE TYPE(0-4) 235 IF LINEL= ENGTH (PERCEND PD IST. BETWEEN F1 AND P2) 235 IF LINEL=0 THEN LINEL=4 236 LT3=CONV3(X)+*,"+CONV3(LINEL) 237 PRINT#9;"PA";SYM21;": 239 SYM21=CONV3(X)+*,"+CONV3(LINEL) 237 PRINT#9;"PA";SYM21;": 239 SYM21=CONV3(X)+*,"+CONV3(LINEL) 237 PRINT#9;"PA";SYM21;": 239 SYM21=CONV3(X)+*,"+CONV3(LINEL) 237 PRINT#9;"PA";SYM21;": 239 SYM21=CONV3(X)+*,"+CONV3(LINEL) 237 PRINT#9;"PA";SYM21;": 239 SYM21=CONV3(X)+*,"+CONV3(LINEL) 237 PRINT#9;"PA";SYM21;": 230 REM FLOT AXIS 234 IF CDN AXIS 235 PRINT#9;"PA";SYM21;": 235 PRINT#9;"PA";SOM21;": 236 PRINT#9;"PA";SOM21;": 237 PRINT#9;"PA";SOM21;": 238 PRINT#9;"PA";SOM21;": 239 PRINT#9;"PA";SOM21;": 230 PRINT#9;"PA";SOM21;": 230 PRINT#9;"PA";SOM21;": 231 PRINT#9;"PA";SOM21;": 232 PRINT#9;"PA";SOM21;": 233 PRINT#9;"PA";SOM22;": 234 IF CONV3(X): 235 PRINT#9;"PA";SOM22;": 235</pre>		
<pre>105 IF X0=X1 THEN P1X=500;P2X=10000;P1Y=600;P2Y=7500 106 P1X=CONV#(P1X):P2X=CONV#(P1Y):P2Y=CONV#(P2Y) 107 PFIELD=P1XI+","+P1Y=","+P2X#+","+P2Y# 108 REM SUBCOUTINE TO SCALE AXISES 109 REMIT#9;"IP":FFIELDE:";" 100 REM SUBROUTINE TO SCALE AXISES 101 REM X0,X1,Y0,Y1 DEFINE STARTING AND ENDING POINTS IN INCHES 102 REM XMIN,XMAX,YMIN,YMAX ARE THE MAX AND MIN VALUE ON AXISES 103 REM SCALEX.SCALEY=SCALED DATA FOR TIC MARKS 104 REM NDIVX.NDIVY=NUMBER OF DIVISIONS ON AXISES 105 DELTAY=(X1-X0)/NDIVX 104 DELTAY=(X1-X0)/NDIVX 104 DELTAY=(X1-X0)/NDIVX 105 REM SUBSE1 TO NDIVY:SCALEY(ISUB+1)=SCALEY(ISUB)+DELTAY:NEXT 107 SCALEX(1)=(0:SCALEY(I)=Y0 108 CFCCNV\$(X0)+","+CONV\$(X1)+","+CONV\$(Y0)+","+CONV\$(Y1) 107 SCALEX(I)=(0:SCALEY(I)=Y0 108 CFCCNV\$(X0)+","+CONV\$(X1)+","+CONV\$(Y0)+","+CONV\$(Y1) 109 CF=CONV\$(X0)+","+CONV\$(X1)+","+CONV\$(Y0)+","+CONV\$(Y1) 109 CF=CONV\$(W)+","+CONV\$(H) 100 CF=CONV\$(W)+","+CONV\$(H) 100 REM THIS SUBROUTINE PLOTS SYMBOL SYM\$ AT LOCATION X,Y 104 RETURN 105 REM THIS SUBROUTINE PLOTS SYMBOL SYM\$ AT LOCATION X,Y 105 REM THIS SUBROUTINE PLOTS SYMBOL SYM\$ AT LOCATION X,Y 106 RETURN 107 PRINT#9;"SI";ISMI#;"SM";SYM#;";" 108 RETURN 109 OGTO 229 109 THEN PRINT#9;"PU;";:ELSE PRINT#9;"PD;"; 109 OFTO 259 109 OFTO 259 109 CTHEN PRINT#9;"PU;";:ELSE PRINT#9;"PD;"; 100 REM THES LENSTH (PERCENT OF DIST. BETWEEN P1 AND P2) 107 SYM2#=CONV#(LINEL=4 100 FOR PEN UP; PD=1 FOR PEN DOWN; LINET=LINE TYPE(0-4) 107 PRINT#9;"C1";LT#;";" 109 SYM2#=CONV#(V);SYMB#=SYM\$ 109 PRINT#9;"FA";SVM2#;";" 109 SYM2#=CONV#(X);Y,*ECONV#(Y);SYMB#=SYM\$ 100 PRINT#9;"FA";SVM2#;";" 101 REM PLOT AXIS 100 PRINT#9;"FA";X0#;";"PD;PA";X0#;";"PD;PA";X0#;";"PU;" 102 PRINT#9;"FA";X0#;";"PD;PA";X0#;";"PU;" 103 FEN PLOT AXIS 104 PRINT#9;"FA";X0#;";"PD;PA";X0#;";"PU;" 104 PRINT#9;"FA";X0#;";"PU;PA";X0#;";"PU;PU;" 105 FRINT#9;"FA";X0#;";"PO;PA";X0#;";"PU;PU;"PU;"PU;"PU;"PU;"PU;"PU;"PU;"P</pre>		
 206 P1X1=CDNV4(P1X):P2X5=CDNV4(P2X):P1YECDNV4(P1Y):P2Y5=CDNV4(P2Y) 207 PFIELD3=P1X1+","+P1Y5+","+P2X5+","+P2Y5 208 PFINT89;"1P":PFIELD1:"," 201 REM SUBROUTINE TO SCALE AXISES 211 REM X0,X1,Y0,Y1 DEFINE STARTING AND ENDING POINTS IN INCHES 212 REM XMIN,XMAX,YMIN,YMAX ARE THE MAX AND MIN VALUE ON AXISES 213 REM SCALEX.SCALEY=SCALED DATA FOR TIC MARKS 214 REM NDIVX,NDIVY=NUMBER OF DIVISIONS ON AXISES 215 DELTAX=(X1-X0)/NDIVX 216 DELTAY=(Y1-Y0)/NDIVX 217 SCALEX(1)=(0:SCALEY(1)=Y0 218 FOR ISUB=1 TO NDIVY:SCALEX(ISUB+1)=SCALEY(ISUB)+DELTAY:NEXT 219 FOR ISUB=1 TO NDIVX:SCALEX(ISUB+1)=SCALEX(ISUB)+DELTAX:NEXT 220 SC5=CDNV5(X0)+","+CONV5(X1)+","+CONV5(Y0)+","+CONV5(Y1) 221 PRINT89;"SC":SC5:":":RETURN 222 REM SUBROUTINE TO SET SYMBOL MODE 223 SYM1=CONV5(W)+","+CONV5(H) 224 RETURN 225 REM SUBROUTINE TO SET SYMBOL SYM5 AT LOCATION X,Y 226 RETURN 227 PRINT89;"SI":SYMI5;"SN";SVM5:";" 228 RETURN 229 RETURN 220 RETURN 230 RET THIS SUBROUTINE PLOTS SYMBOL SYM5 AT LOCATION X,Y 231 REM PD=0 FOR PEN UP; PD=1 FOR PEN DOWN; LINET=LINE TYPE(0-4) 232 REM LINEL= LENGTH (PERCENT OF DIST. BETWEEN P1 AND P2) 233 IF PD=0 GOTO 229 234 IF PD=0 GOTO 229 235 IF LINEL=0 THEN LINEL=4 234 LIF PD=0 GOTO 230 235 SIM2:CONV5(V):SYME#=SYM# 244 LINEL= LENGTH (PERCENT OF DIST. BETWEEN P1 AND P2) 235 IF LINEL=0 THEN LINEL=4 236 LI*=CONV5(LINET)+", "+CONV5(LINEL) 237 PRINT89; "LT":LT#:"; "''':SYM5#:"; "E''''''':SYM5#:"; "'''''''''''''''''''''''''''''''''''		
 PFIELDJ=PIXF*, "+PIY5*", "+P2X5*", "+P2Y5 PRINT#9; "IP"; FFIELDJ;";" REM SUBROUTINE TO SCALE AXISES REM X0,X1,V0,Y1 DEFINE STARTING AND ENDING POINTS IN INCHES REM XNIN,XMAX,YMIN,YMAX ARE THE MAX AND MIN VALUE ON AXISES REM XNIN,XMAX,YMIN,YMAX ARE THE MAX AND MIN VALUE ON AXISES REM NDIVX,NDIVY=NUMBER OF DIVISIONS ON AXISES DELTAY=(Y1-Y0)/NDIVY DELTAY=(Y1-Y0)/NDIVY SCALEX(1)=A0:SCALEY(1)=Y0 FOR ISUB=1 TO NDIVY:SCALEY(1SUB+1)=SCALEY(ISUB)+DELTAY:NEXT SCALEX(1)=A0:SCALEY(1)=Y0 FOR ISUB=1 TO NDIVY:SCALEY(ISUB+1)=SCALEX(ISUB)+DELTAY:NEXT SCALEX(1)=A0:SCALEY(1)=Y0 FOR ISUB=1 TO NDIVY:SCALEY(1)=SCALEX(ISUB)+DELTAY:NEXT SCALEX(1)=A0:SCALEY(1)=Y0 FOR ISUB=1 TO NDIVY:SCALEY(1)=SCALEX(ISUB)+DELTAY:NEXT SCALEX(1)=A0:SCALEY(1)=Y0 FOR ISUB=1 TO NDIVY:SCALEY(1)=SCALEX(ISUB)+DELTAY:NEXT SCALEX(4))+", "+CONV4(X1)+", "+CONV4(0)+", "+CONV4(Y1) PRINT#9; "SI";SYMI\$; "SM";SYM\$;";" REM SUBROUTINE TO SET SYMBOL SYM\$ AT LOCATION X,Y REM THIS SUBROUTINE PLOTS SYMBOL SYM\$ AT LOCATION X,Y REM THIS SUBROUTINE PLOTS SYMBOL SYM\$ AT LOCATION X,Y REM THIS SUBROUTINE PLOTS SYMBOL SYM\$ AT LOCATION X,Y REM PLOT FOR PEN DOWN; LINET=LINE TYPE(0-4) F PD=0 GOTO 239 F F D=0 GOTO 239 IF LINEL= LENGTH (PERCENT OF DIST. BETWEEN P1 AND P2) IF PD=0 GOTO 239 SYM12=CONV4(1):P', "+CONV4(LINEL) PRINT#9; "LT"; LT7; ";" SYM24=CONV4(I):SYMB\$=SYM\$ PRINT#9; "LT"; LT7; ";" SYM24=CONV4(X):Y0\$=CONV4(Y):SYMB\$=SYM\$ PRINT#9; "PA";SYM2\$;";" REM PLOT AXIS PRINT#9; "PA";SYM2\$;";" YO\$;";" FUNT#9; "FA";X0\$;", ";YO\$;";" FUNT#9; "FA";X0\$;", ";YO\$;";" FUN		
<pre>208 PRINT#9:"IP":PFIELD#:":" 210 REM SUBROUTINE TO SCALE AXISES 211 REM X0,X1,Y0,Y1 DEFINE STARTING AND ENDING POINTS IN INCHES 212 REM XMIN.XMAX,YMIN.YMAX ARE THE MAX AND MIN VALUE ON AXISES 213 REM SCALEX.SCALEY=SCALED DATA FOR TIC MARKS 214 REM NDIVX.NDIVY=NUMBER OF DIVISIONS ON AXISES 215 DELTAX=(X1-X0)/NDIVX 216 DELTAY=(Y1-Y0)/NDIVX 217 SCALEX(1)=<0.SCALEY(1)=Y0 218 FOR ISUB=1 TO NDIVY:SCALEY(ISUB+1)=SCALEY(ISUB)+DELTAY:NEXT 219 FOR ISUB=1 TO NDIVY:SCALEY(ISUB+1)=SCALEX(ISUB)+DELTAX:NEXT 220 SCJ=CONVJ(X0)+","+CONVJ(X1)+","+CONVJ(Y0)+","+CONVJ(Y1) 227 PRINT#9;"SC":SCS:;":"RETURN 225 REM SUBROUTINE TO SET SYMBOL MODE 226 SYM1#=CONVJ()+","+CONVJ(H) 227 PRINT#9;"SC":SCS:;":"RETURN 228 RETURN 229 REM THIS SUBROUTINE PLOTS SYMBOL SYM# AT LOCATION X,Y 231 REM PD=0 FOR PEN UP; PD=1 FOR PEN DDMN: LINET=LINE TYPE(0-4) 232 REM LINEL= LENGTH (PERCENT OF DIST. BETWEEN P1 AND P2) 233 IF PD=0 FOR PEN UP; PD=1 FOR PEN DDMN: LINET=LINE TYPE(0-4) 234 IF PD=0 GOTO 239 235 IF LINEL= LENGTH (PERCENT OF DIST. BETWEEN P1 AND P2) 235 REM THIS SUBROUTINE PLOTS SYMBOL SYM# AT LOCATION X,Y 231 REM THO: SUBROUTINE PLOTS SYMBOL SYM# AT LOCATION X,Y 233 REM THIS SUBROUTINE PLOTS SYMBOL SYM# AT LOCATION X,Y 234 REM LINEL= LENGTH (PERCENT OF DIST. BETWEEN P1 AND P2) 235 IF PD=0 GOTO 237 236 REM THIS SUBROUTINE Y: ":ELSE PRINT#9;"PD;"; 236 REM THAS:" 237 PRINT#9;"P1";"LIT::::::::::::::::::::::::::::::::::::</pre>		
<pre>210 REM SUBROUTINE TO SCALE AXISES 211 REM X0,X1,Y0,Y1 DEFINE STARTING AND ENDING POINTS IN INCHES 212 REM XMIN.XMAX,YNIN,YMAX ARE THE MAX AND MIN VALUE ON AXISES 213 REM SCALEX.SCALEY=SCALED DATA FOR TIC MARK'S 214 REM NDIVX.NDIVY=NUMBER OF DIVISIONS ON AXISES 215 DELTAX=(X1-X0)/NDIVX 216 DELTAX=(X1-X0)/NDIVY 217 SCALEX(1)=X0;SCALEY(1)=Y0 218 FOR ISUB=1 TO NDIVY;SCALEY(ISUB+1)=SCALEY(ISUB)+DELTAY:NEXT 219 FOR ISUB=1 TO NDIVY;SCALEX(ISUB+1)=SCALEX(ISUB)+DELTAY:NEXT 210 SC#=CONV#(X0)+","+CONV#(X1)+","+CONV#(V0)+","+CONV#(Y1) 221 PRINT#9;"SC";SC#;":"RETURN 225 REM SUBROUTINE TO SET SYMBOL MODE 226 SYM1=CONV#(W)+","+CONV#(H) 227 PRINT#9;"SI";SYM1#;"SM";SYM8;";" 238 RETURN 230 REM THIS SUBROUTINE PLOTS SYMBOL SYM# AT LOCATION X,Y 231 REM PD=0 FOR PEN UP; PD=1 FOR PEN DDWN; LINET=LINE TYPE(0-4) 235 IF PD=0 THEN PRINT#9;"PU;"::ELSE PRINT#9;"PD;"; 234 IF PD=0 GOTO 239 235 IF LINEL= CENSINT (ETONV#(LINEL) 235 PRINT#9;"UT";LT#;";" 236 RETURN 237 SYM2#=CONV#(X)+","+CONV#(UINEL) 237 PRINT#9;"UT";LT#;";" 238 RETURN 239 SYM2#=CONV#(X)+","+CONV#(V);SYMB#=SYM# 240 PRINT#9;"PU;" 254 IF PD=0 THEN LINEL=4 255 IF LINEL=0 THEN LINEL=4 256 LT#=CONV#(X)+","+CONV#(UN);SYMB#=SYM# 240 PRINT#9;"PAT;SYM2#;";" 244 RETURN 245 REM PLOT AXIS 246 PRINT#9;"PAT;SYM2#;";" 257 SYM2#=CONV#(X)+","+CONV#(Y);X1#=CONV#(X1):Y1#=CONV#(Y1) 248 RETURN 244 PRINT#9;"PAT;SYM2#;";" 250 PRINT#9;"PAT;SYM2#;";" 251 FOR ISUB=1 TO NDIVX+1;SCALE##CONV#(X1):Y1#=CONV#(Y1) 252 PRINT#9;"PAT;SCALE#;","Y0#;";";"PD;PAT;X1#;","Y0#;T";";"PU;" 253 PRINT#9;"PAT;SCALE#;","Y0#;";";"PI;PAT;Y1#;TID 254 PRINT#9;"PAT;SCALE#;","Y0#;";";"PI;PAT;Y1#;TTT 255 PRINT#9;"PAT;SCALE##CONV#(SCALE#CINV#(SCALE#CINU#) 255 PRINT#9;"TL1.0,0.0;PAT;SCALE##CONV#(SCALE#CINU#) 255 PRINT#9;"TL1.0,0.0;PAT;SCALE##CONV#(SCALE#CINU#) 255 PRINT#9;"TL1.0,0.0;PAT;SCALE##CONV#(SCALE#CINU#) 254 POR ISUB=1 TO NDIVX+1:SCALE##CONV#(SCALE#CINU#) 255 PRINT#9;"TDAT;SCALE##CONV#(SCALE#CINU#) 255 PRINT#9;"TDAT;SCALE##CONV#(SCALE#CINU#) 255 PRINT#9;"TDAT;SCALE##CONV#(SCALE#CINU#) 255 PRINT#9;"TAT;SCALE##CONV#;SCALE#</pre>		
<pre>211 REM X0,X1,Y0,Y1 DEFINE STARTING AND ENDING FOINTS IN INCHES 212 REM XMIN.XMAX,YMIN,YMAX ARE THE MAX AND MIN VALUE ON AXISES 213 REM SCALEX,SCALEY=SCALED DATA FOR TIC MARK'S 214 REM NDIVX.NDIVY=NUMBER OF DIVISIONS ON AXISES 215 DELTAX=(X1-X0)/NDIVX 216 DELTAY=(Y1-Y0)/NDIVY 217 SCALEX(1)=<0:SCALEY(1)=Y0 218 FOR ISUB=1 TO NDIVY:SCALEY(ISUB+1)=SCALEY(ISUB)+DELTAY:NEXT 219 FOR ISUB=1 TO NDIVY:SCALEY(ISUB+1)=SCALEX(ISUB)+DELTAX:NEXT 220 SC\$=CONV\$(X0)+","+CONV\$(Y1)+","+CONV\$(Y0)+","+CONV\$(Y1) 221 PRINT#9''SC";SC\$*:"':RETURN 225 REM SUBROUTINE TO SET SYMBOL MODE 226 SYM1=CONV\$(W)+","+CONV\$(H) 227 PRINT#9''SC";SC\$*:"'RETURN 230 REM THIS SUBROUTINE TO SET SYMBOL SYM\$ AT LOCATION X,Y 231 REM DD=0 FOR PEN UP; PD=1 FOR PEN DDWN; LINET=LINE TYPE(0-4) 232 IF PD=0 THEN PRINT#9;"PU;";:ELSE PRINT#9;"PD;"; 234 IF PD=0 GOTO 239 235 IF LINEL= LENGTH (PERCENT OF DIST. BETWEEN P1 AND P2) 233 IF PD=0 THEN PRINT#9;"PU;";:ELSE PRINT#9;"PD;"; 234 IF PD=0 GOTO 239 235 IF LINEL=0 THEN LINEL=4 236 LI\$=CONV\$(LNET)+","+CONV\$(LINEL) 237 SYM2==CONV\$(LNET)+","+CONV\$(Y);SYMB\$=SYM\$ 240 PRINT#9;"PA";SYM2\$;";" 241 RETURN 243 REM FLOT AXIS 244 PRINT#9;"PA";Y0\$;";";"PD;PA";X1\$;",";Y0\$;";";"PU;" 244 RETURN 245 REM FLOT AXIS 246 PRINT#9;"PA";X0\$;",";Y0\$;";";"PD;PA";X0\$;",";Y0\$;";";"PU;" 247 SYM2==CONV\$(X0):Y0\$=CONV\$(Y0):X1\$=CONV\$(X1):Y1\$=CONV\$(Y1) 248 PRINT#9;"PA";X0\$;",";Y0\$;";";"PD;PA";X0\$;",";Y0\$;";";"PU;" 250 PRINT#9;"PA";SCALE\$;",";Y0\$;";";TO\$;",";Y0\$;";";"PU;" 251 FOR ISUB=1 TO NDIVY+1:SCALE\$=CONV\$(SCALEX(ISUB)) 252 PRINT#9;"PA";SCALE\$;",";Y0\$;";";TO\$;";"TO IO:NEXT I:NEXT ISUB 253 PRINT#9;"PA";X0\$;",";SCALE\$;",";Y0\$;";";"FOR I=1 TO 100:NEXT I:NEXT ISUB 254 FOR ISUB=1 TO NDIVY+1:SCALE\$=CONV\$(SCALEY(ISUB)) 255 PRINT#9;"PA";X0\$;",";SCALE\$#CONV\$(SCALEY(ISUB)) 255 PRINT#9;"PA";X0\$;",";SCALE\$#CONV\$(SCALEY(ISUB)) 255 PRINT#9;"PA";X0\$;",";SCALE\$#CONV\$(SCALEY(ISUB)) 255 PRINT#9;"PA";X0\$;",";SCALE\$#CONV\$(SCALEY(ISUB)) 255 PRINT#9;"PA";X0\$;",";SCALE\$#CONV\$(SCALEY(ISUB)) 255 PRINT#9;"PA";X0\$;",";SCALE\$#CONV\$(SCALEY(ISUB)) 255 PRINT#9;"PA";X0\$;",";SCA</pre>	208	
<pre>212 REM XMIN,XMAX,YMIN,YMAX ARE THE MAX AND MIN VALUE ON AXISES 213 REM SCALEX,SCALEY=SCALED DATA FOR TIC MARKS 214 REM NDIVX,NDIVY=NUMBER OF DIVISIONS ON AXISES 215 DELTAX=(X1-X0)/NDIVY 216 DELTAY=(Y1-Y0)/NDIVY 217 SCALEX(1)=/0 SCALEY(ISUB+1)=SCALEY(ISUB)+DELTAY:NEXT 219 FOR ISUB=1 TO NDIVY:SCALEX(ISUB+1)=SCALEY(ISUB)+DELTAY:NEXT 220 SC#=CONV#(X0)+","+CONV#(X1)+","+CONV#(Y0)+","+CONV#(Y1) 221 PRINT#9;"SC";SC#;":":RETURN 225 REM SUBROUTINE TO SET SYMBOL MODE 226 SYM1#=CONV#(W)+","+CONV#(H) 227 PRINT#9;"SI";SYM1#;"SM";SYM#;":" 228 RETURN 230 REM THIS SUBROUTINE PLOTS SYMBOL SYM# AT LOCATION X,Y 231 REM PDO FOR PEN UP; PD=1 FOR PEN DOWN; LINET=LINE TYPE(0-4) 232 REM LINEL= LENGTH (PERCENT OF DIST. BETWEEN P1 AND P2) 233 IF PD=0 THEN PRINT#9;"PU;"::ELSE PRINT#9;"PD;": 234 IF PD=0 GOTD 2:9 235 IF LINEL=0 THEN LINEL=4 236 LI#=CONV#(X)+","+CONV#(LINEL) 237 PRINT#9;"FA";SYM2#;";" 239 SYM2#=CONV#(X)+","+CONV#(Y0);X1#=CONV#(X1);Y1#=CONV#(Y1) 240 PRINT#9;"PA";SYM2#;";" 240 PRINT#9;"FA";SYM2#;";" 254 IF ART YLSE CONV#(Y0);X1#=CONV#(X1);Y1#=CONV#(Y1) 245 REM PLOT AXIS 246 PRINT#9;"FA";SYM2#;";" 257 SYND#=CONV#(X)+","+CONV#(Y0);X1#=CONV#(X1);Y1#=CONV#(Y1) 258 PRINT#9;"PA";SCHE#;";" 259 SYND#=CONV#(X0);Y0#=CONV#(Y0);X1#=CONV#(X1);Y1#=CONV#(Y1) 248 PRINT#9;"FA";SCHE#;";"PD;PA";X0#;";"Y0#;";"FU;" 250 PRINT#9;"FA";SCHE#;";"Y0#;";"PD;PA";X0#;";";Y1#;";"FU;" 250 PRINT#9;"FA";SCHE#=CONV#(SCALE#/(ISUB)) 252 PRINT#9;"TL1.0,0.0;PA";X0#;","Y0#;";" 254 FOR ISUB=1 TO NDIV#+1;SCALE#=CONV#(SCALE¥(ISUB)) 255 PRINT#9;"TL1.0,0.0;PA";X0#;","Y0#;";" 254 FOR ISUB=1 TO NDIV#+1;SCALE#=CONV#(SCALE¥(ISUB)) 255 PRINT#9;"TO NDIV#+1;SCALE#=CONV#(SCALE¥(ISUB)) 255 PRINT#9;"TL1.0,0.0;PA";X0#;","Y0#;";" 254 FOR ISUB=1 TO NDIV#+1;SCALE#=CONV#(SCALE¥(ISUB)) 255 PRINT#9;"TL1.0,0.0;PA";X0#;","Y0#;";" 254 FOR ISUB=1 TO NDIV#+1;SCALE#=CONV#(SCALE¥(ISUB)) 255 PRINT#9;"TL1.0,0.0;PA";X0#;","Y0#;";"FOR I=1 TO 100:NEXT I:NEXT ISUB 255 PRINT#9;"TL1.0,0.0;PA";X0#;","Y0#;";"FOR I=1 TO 100:NEXT I:NEXT ISUB 255 PRINT#9;"TL1.0,0.0;PA";X0#;","Y0#;";"FOR I=1 TO 100:NE</pre>	210	REM SUBROUTINE TO SCALE AXISES
<pre>213 REM SCALEX.SCALEY=SCALED DATA FOR TIC MARK'S 214 REM NDIVX.NDIVY=NUMBER OF DIVISIONS ON AXISES 215 DELTAX=(x1-X0)/NDIVX 216 DELTAY=(y1-Y0)/NDIVY 217 SCALEX(1)=(0:SCALEY(I)=Y0 218 FOR ISUB=1 TO NDIVY:SCALEY(ISUB+1)=SCALEY(ISUB)+DELTAY:NEXT 219 FOR ISUB=1 TO NDIVY:SCALEY(ISUB+1)=SCALEX(ISUB)+DELTAY:NEXT 220 SC*=CONV\$(X0)+", "+CONV\$(Y1)+","+CONV\$(Y0)+","+CONV\$(Y1) 221 PRINT#9;"SC";SC*;":"RETURN 225 REM SUBROUTINE TO SET SYMBOL MODE 224 SYM1#=CONV\$(W)+","+CONV\$(H) 227 PRINT#9;"SI";SYM1#;"SM";SYM#:";" 228 RETURN 230 REM THIS SUBROUTINE PLOTS SYMBOL SYM# AT LOCATION X,Y 231 REM PD=0 FOR PEN UP; PD=1 FOR PEN DOWN; LINET=LINE TYPE(0-4) 232 REM LINEL= LENGTH (PERCENT OF DIST. BETWEEN P1 AND P2) 233 IF PD=0 THEN PFINT#9;"PU;";:ELSE PRINT#9;"PD;"; 234 IF PD=0 GOTO 229 235 IF LINEL=0 THEN LINEL=4 236 LIT#=CONV\$(I)+","+CONV\$(I)NEL] 237 PRINT#9;"LT";LT#;";" 239 SYM1#=CONV\$(Y0);SYM#=SYM# 240 PRINT#9;"F0;";"+CONV\$(Y0);SYM#=SYM# 241 RETURN 243 REM PLOT AXIS 244 PRINT#9;"F0;";"0\$;";""PI;PA";X0#;";"FU;" 247 Y0#=CONV\$(X)+","+CONV\$(Y0);X1#=CONV\$(X1):Y1#=CONV\$(Y1) 258 REM FLOT AXIS 249 PRINT#9;"F0;";"254 E#:","Y0#;";";F0;"";"F0;"" 250 PRINT#9;"F0;";00#;";";"PD;PA";X0#;",";Y0#;";";F0;"" 251 FOR ISUB=1 TO NDIVX:SCALE#CONV\$(SCALEX(ISUB)) 252 PRINT#9;"F0;";254 E#:CONV\$(SCALEX(ISUB)) 253 PRINT#9;"F0;";254 E#:CONV\$(SCALEX(ISUB)) 254 PROF ISUB=1 TO NDIVX+1:SCALE#=CONV\$(SCALEX(ISUB)) 255 PRINT#9;"F0;";254 E#:","Y0#;";";F0;";"F0;";"EXT ISUB 255 PRINT#9;"F0;";254 E#:","Y0#;";";F0;";";F0;";";F0;";";F0;";";F0;";";F0;";";F0;";";F0;";";F0;";";F0;";";F0;";";F0;";";F0;";";F0;";";F0;";";F0;";";F0;";";F0;";";F0;";F0;";";F0;";";F0;";";F0;";";F0;";";F0;";";F0;";";F0;";";F0;";";F0;";F0;";";F0;";";F0;";";F0;";F0;";";F0;";F0;";";F0;";";F0;";";F0;";";F0;";";F0;";";F0;";";F0;";";F0;";";F0;";";F0;";";F0;";";F0;";F0;";";F0;";";F0;";";F0;";";F0;";";F0;";";F0;";";F0;";F0;";";F0;";";F0;";";F0;";";F0;";";F0;";";F0;";";F0;";";F0;";";F0;";";F0;";F0;";";F0;";F0;";";F0;";F0;";";F0;";";F0;";F0;";F0;";F0;";F0;";F0;";F0;";F0;";F0;";F0;";F0;";";F0;";F0;";F0;";F0</pre>	211	REM X0,X1,Y0,Y1 DEFINE STARTING AND ENDING POINTS IN INCHES
<pre>213 REM SCALEX.SCALEY=SCALED DATA FOR TIC MARK'S 214 REM NDIVX.NDIVY=NUMBER OF DIVISIONS ON AXISES 215 DELTAX=(x1-X0)/NDIVX 216 DELTAY=(y1-Y0)/NDIVY 217 SCALEX(1)=(0:SCALEY(I)=Y0 218 FOR ISUB=1 TO NDIVY:SCALEY(ISUB+1)=SCALEY(ISUB)+DELTAY:NEXT 219 FOR ISUB=1 TO NDIVY:SCALEY(ISUB+1)=SCALEX(ISUB)+DELTAY:NEXT 220 SC*=CONV\$(X0)+", "+CONV\$(Y1)+","+CONV\$(Y0)+","+CONV\$(Y1) 221 PRINT#9;"SC";SC*;":"RETURN 225 REM SUBROUTINE TO SET SYMBOL MODE 224 SYM1#=CONV\$(W)+","+CONV\$(H) 227 PRINT#9;"SI";SYM1#;"SM";SYM#:";" 228 RETURN 230 REM THIS SUBROUTINE PLOTS SYMBOL SYM# AT LOCATION X,Y 231 REM PD=0 FOR PEN UP; PD=1 FOR PEN DOWN; LINET=LINE TYPE(0-4) 232 REM LINEL= LENGTH (PERCENT OF DIST. BETWEEN P1 AND P2) 233 IF PD=0 THEN PFINT#9;"PU;";:ELSE PRINT#9;"PD;"; 234 IF PD=0 GOTO 229 235 IF LINEL=0 THEN LINEL=4 236 LIT#=CONV\$(I)+","+CONV\$(I)NEL] 237 PRINT#9;"LT";LT#;";" 239 SYM1#=CONV\$(Y0);SYM#=SYM# 240 PRINT#9;"F0;";"+CONV\$(Y0);SYM#=SYM# 241 RETURN 243 REM PLOT AXIS 244 PRINT#9;"F0;";"0\$;";""PI;PA";X0#;";"FU;" 247 Y0#=CONV\$(X)+","+CONV\$(Y0);X1#=CONV\$(X1):Y1#=CONV\$(Y1) 258 REM FLOT AXIS 249 PRINT#9;"F0;";"254 E#:","Y0#;";";F0;"";"F0;"" 250 PRINT#9;"F0;";00#;";";"PD;PA";X0#;",";Y0#;";";F0;"" 251 FOR ISUB=1 TO NDIVX:SCALE#CONV\$(SCALEX(ISUB)) 252 PRINT#9;"F0;";254 E#:CONV\$(SCALEX(ISUB)) 253 PRINT#9;"F0;";254 E#:CONV\$(SCALEX(ISUB)) 254 PROF ISUB=1 TO NDIVX+1:SCALE#=CONV\$(SCALEX(ISUB)) 255 PRINT#9;"F0;";254 E#:","Y0#;";";F0;";"F0;";"EXT ISUB 255 PRINT#9;"F0;";254 E#:","Y0#;";";F0;";";F0;";";F0;";";F0;";";F0;";";F0;";";F0;";";F0;";";F0;";";F0;";";F0;";";F0;";";F0;";";F0;";";F0;";";F0;";";F0;";";F0;";";F0;";F0;";";F0;";";F0;";";F0;";";F0;";";F0;";";F0;";";F0;";";F0;";";F0;";F0;";";F0;";";F0;";";F0;";F0;";";F0;";F0;";";F0;";";F0;";";F0;";";F0;";";F0;";";F0;";";F0;";";F0;";";F0;";";F0;";";F0;";";F0;";F0;";";F0;";";F0;";";F0;";";F0;";";F0;";";F0;";";F0;";F0;";";F0;";";F0;";";F0;";";F0;";";F0;";";F0;";";F0;";";F0;";";F0;";";F0;";F0;";";F0;";F0;";";F0;";F0;";";F0;";";F0;";F0;";F0;";F0;";F0;";F0;";F0;";F0;";F0;";F0;";F0;";";F0;";F0;";F0;";F0</pre>	212	
<pre>214 REM NDIVX.NDIVY=NUMBER OF DIVISIONS ON AXISES 215 DELTAX=(x1-X0)/NDIVX 217 SCALEX(1)=X0:SCALEY(1)=Y0 218 FOR ISUB=1 TO NDIVY:SCALEY(ISUB+1)=SCALEY(ISUB)+DELTAX:NEXT 219 FOR ISUB=1 TO NDIVY:SCALEY(ISUB+1)=SCALEX(ISUB)+DELTAX:NEXT 220 SC#=CONV#(X0)+","+CONV#(X1)+","+CONV#(Y0)+","+CONV#(Y1) 221 PRINT#9:"SC";SC#;":RETURN 225 REM SUBROUTINE TO SET SYMBOL MODE 226 SYM1#=CONV#(W)+","+CONV#(H) 227 PRINT#9:"SI";SYM1#;"SM";SYM#;":" 228 RETURN 230 REM THIS SUBROUTINE PLOTS SYMBOL SYM# AT LOCATION X,Y 231 REM PD=0 FOR PEN UP; PD=1 FOR PEN DUMN; LINET=LINE TYPE(0-4) 232 REM LINE=LENGTH (PECENT OF DIST. BETWEEN P1 AND P2) 233 IF PD=0 THEN PRINT#9;"PU:"::ELSE PRINT#9;"FD;": 234 IF FD=0 GOTG 239 235 IF LINE=0 THEN LINEL=4 236 LT#=CONV#(LINET)+","+CONV#(LINEL) 237 FRINT#9;"PA";SYM2#;":" 240 PRINT#9;"PA";SYM2#;":" 241 RETURN 245 REM FLOT AXIS 246 PRINT#9;"PU:" 247 YO#=CONV#(Y0):X1#=CONV#(X1):Y1#=CONV#(Y1) 248 PRINT#9;"PA";X0#;";"Y0#;":"PD;PA";X0#;";"FU;";"FU;" 250 PRINT#9;"PA";X0#;","Y0#;";"TOR I=1 TO 100:NEXT I:NEXT ISUB 253 PRINT#9;"TL:0,0,0;PA";X0#;","Y0#;";"FOR I=1 TO 100:NEXT I:NEXT ISUB 255 PRINT#9;"PA";X0#;","SCALE#;";"FOR I=1 TO 100:NEXT I:NEXT ISUB 255 PRINT#9;"PA";X0#;",";SCALE#;",";YO#;";"FOR I=1 TO 100:NEXT I:NEXT ISUB 255 PRINT#9;"PA";SCALE#;",";SCALE#==CONV#(SCALE#;";FOR I=1 TO 100:NEXT I:NEXT ISUB 255 PRINT#9;"PA";SCALE#;",";SCALE#;";YT;";FOR I=1 TO 100:NEXT I:NEXT ISUB 255 PRINT#9;"PA";SCALE#;",</pre>		•
<pre>215 DELTAX=(X1-X0)/NDIVX 216 DELTAY=(Y1-Y0)/NDIVY 217 SCALEX(1)=X0:SCALEY(1)=Y0 218 FOR ISUB=1 TO NDIVY:SCALEX(ISUB+1)=SCALEX(ISUB)+DELTAY:NEXT 219 FOR ISUB=1 TO NDIVY:SCALEX(ISUB+1)=SCALEX(ISUB)+DELTAY:NEXT 210 SC4=CONV\$(X0)+","+CONV\$(X1)+","+CONV\$(Y0)+","+CONV\$(Y1) 221 PRINT#9:"SC";SC\$:";"RETURN 225 REM SUBROUTINE TO SET SYMBOL MODE 226 SYM14=CONV\$(W)+","+CONV\$(H) 227 PRINT#9:"SI";SYM1\$;"SM";SYM\$;";" 228 RETURN 230 REM THIS SUBROUTINE PLOTS SYMBOL SYM\$ AT LOCATION X,Y 231 REM PD=0 FOR PEN UP; PD=1 FOR PEN DOWN; LINET=LINE TYPE(0-4) 232 IF PD=0 THEN PRINT#9:"PU;";ELSE PRINT#9;"FD;"; 234 IF PD=0 GOTO 239 235 IF LINEL= LENGTH (PERCENT OF DIST. BETWEEN P1 AND P2) 235 IF LINEL=0 THEN PRINT#9;"PU;";ELSE PRINT#9;"FD;"; 234 IF PD=0 GOTO 239 235 IF LINEL=0 THEN LINEL=4 236 LT4=CONV\$(LINET)+","+CONV\$(LINEL) 237 PRINT#9;"UT";LT4;";" 239 SYM24=CONV4(X)+","+CONV4(LINEL) 237 PRINT#9;"PA";SYM2\$;";" 240 PRINT#9;"PA";SYM2\$;";" 241 RETURN 245 REM PLOT AXIS 246 PRINT#9;"PA";SYM2\$;";" 241 RETURN 245 REM PLOT AXIS 246 PRINT#9;"PA";SYM2\$;";" 247 X04=CONV4(X0);Y04=CONV4(Y0);X14=CONV4(X1);Y14=CONV4(Y1) 248 PRINT#9;"PA";X04;",";Y04;";";PD;PA";X04;",";Y04;";";"PU;" 250 PRINT#9;"PA";X04;",";Y04;";";"PD;PA";X04;",";Y14;";";"PU;" 251 FOR ISUB=1 TO NDIVX+1:SCALE4=CONV4(SCALEX(ISUB)) 252 PRINT#9;"TL1.0,0.0;PA";X04;","Y04;";XT";"FOR I=1 TO 100:NEXT I:NEXT ISUB 253 PRINT#9;"TL1.0,0.0;PA";X04;","Y04;";XT";"FOR I=1 TO 100:NEXT I:NEXT ISUB 254 FOR ISUB=1 TO NDIVY+1:SCALE4=CONV4(SCALEY(ISUB)) 255 PRINT#9;"TL1.0,0.0;PA";X04;","Y04;";XT";"FOR I=1 TO 100:NEXT I:NEXT ISUB 255 PRINT#9;"TL1.0,</pre>		
<pre>214 DELTAY=(Y1-Y0)/NDIVY 217 SCALEX(1)=X0:SCALEY(1)=Y0 218 FOR ISUB=1 TO NDIVY:SCALEY(ISUB+1)=SCALEY(ISUB)+DELTAY:NEXT 219 FOR ISUB=1 TO NDIVY:SCALEX(ISUB+1)=SCALEX(ISUB)+DELTAX:NEXT 220 SC#=CONV#(X0)+","+CONV#(X1)+","+CONV#(Y0)+","+CONV#(Y1) 221 PRINT#9:"SC";SC#;":"RETURN 225 REM SUBROUTINE TO SET SYMBOL MODE 226 SYM1#=CONV#(W)+","+CONV#(H) 227 PRINT#9;"SI";SYM1#;"SM";SYM#;";" 228 RETURN 230 REM THIS SUBROUTINE PLOTS SYMBOL SYM# AT LOCATION X,Y 231 REM FD=0 FOR PEN UP; PD=1 FOR PEN DOWN; LINET=LINE TYPE(0-4) 232 REM LINEL= LENGTH (FERCENT OF DIST. BETWEEN F1 AND P2) 233 IF FD=0 THEN PRINT#9;"PU;";:ELSE PRINT#9;"PD;"; 234 IF PD=0 GOTO 239 235 IF LINEL=0 THEN LINEL=4 236 LT#=CONV#(LINET)+","+CONV#(LINEL) 237 PRINT#9;"LT";LT#;";" 239 SYM2#=CONV#(X0):Y0#=CONV#(Y):SYMB#=SYM# 240 PRINT#9;"PA";SVM2#;";" 241 RETURN 245 REM FLOT AXIS 246 PRINT#9;"PA";SVM2#;";"PD;PA";X1#=CONV#(X1):Y1#=CONV#(Y1) 247 X0#=CONV#(X0):Y0#=CONV#(Y0):X1#=CONV#(X1):Y1#=CONV#(Y1) 249 PRINT#9;"PA";X0#;","Y0#;";"PD;PA";X0#;","Y0#;";"PU;" 240 PRINT#9;"PA";X0#;","Y0#;";"PD;PA";X0#;","Y1#;";"PU;" 241 RETURN 245 REM FLOT AXIS 246 PRINT#9;"PA";X0#;","Y0#;";"PD;PA";X0#;","Y1#;";"PU;" 247 CONV#(X0):Y0#=CONV#(Y0):X1#=CONV#(X1):Y1#=CONV#(Y1) 248 PRINT#9;"PA";X0#;","Y0#;";"PD;PA";X0#;","Y1#;";"PU;" 250 PRINT#9;"PA";X0#;","Y0#;";"FOR I=1 TO 100:NEXT I:NEXT ISUB 253 PRINT#9;"PA";X0#;",";SCALE#;","Y0#;";"FOR I=1 TO 100:NEXT I:NEXT ISUB 254 POR ISUB=1 TO NDIVY+1:SCALE#=CONV#(SCALEY(ISUB)) 255 PRINT#9;"PA";X0#;",";SCALE#;",";Y0#;";"FOR I=1 TO 100:NEXT I:NEXT ISUB 255 PRINT#9;"PA";X0#;",";SCALE#;",";Y0#;";"FOR I=1 TO 100:NEXT I:NEXT ISUB 255 PRINT#9;"PA";X0#;",";SCALE#;",";Y0#;";"FOR I=1 TO 100:NEXT I:NEXT ISUB 255 PRINT#9;"PA";X0#;",";SCALE#;";"FOR I=1 TO 100:NEXT I:NEXT ISUB 255 PRINT#9;"PA";X0</pre>		
<pre>217 SCALEX(1)=X0:SCALEY(1)=Y0 218 FOR ISUB=1 TO NDIVY:SCALEY(ISUB+1)=SCALEY(ISUB)+DELTAY:NEXT 219 FOR ISUB=1 TO NDIVY:SCALEX(ISUB+1)=SCALEX(ISUB)+DELTAX:NEXT 220 SC\$=CONV\$(X0)+","+CONV\$(X1)+","+CONV\$(Y0)+","+CONV\$(Y1) 221 PRINT#9:"SC";SC\$;":":RETURN 225 REM SUBROUTINE TO SET SYMBOL MODE 226 SYM14=CONV\$(W)+","+CONV\$(H) 227 PRINT#9:"SI";SYM1\$;"SM";SYM\$;";" 228 RETURN 230 REM THIS SUBROUTINE PLOTS SYMBOL SYM\$ AT LOCATION X,Y 231 REM PD=0 FOR PEN UP; PD=1 FOR PEN DOWN; LINET=LINE TYPE(0-4) 232 REM LINEL= LENGTH (PERCENT OF DIST. BETWEEN P1 AND P2) 233 IF PD=0 THEN PRINT#9;"PU;";:ELSE PRINT#9;"PD;"; 234 IF PD=0 GOTO 239 235 IF LINEL=0 THEN LINEL=4 236 LT#=CONV\$(LINET)+","+CONV\$(LINEL) 237 PRINT#9;"LT";LT\$;"" 239 SYM2#=CONV\$(X)+","+CONV\$(LINEL) 239 SYM2#=CONV\$(X)+","+CONV\$(V);SYMB\$=SYM\$ 240 PRINT#9;"LT";LT\$;"" 244 RETURN 245 REM FLOT AXIS 245 REM FLOT AXIS 246 PRINT#9;"PA";X0\$;","Y0\$;";"" 247 X0\$=CONV\$(X0):Y0\$=CONV\$(Y0):X1\$=CONV\$(X1):Y1\$=CONV\$(Y1) 248 PRINT#9;"PA";X0\$;","Y0\$;";"" 249 PRINT#9;"PA";X0\$;","Y0\$;";"" 250 PRINT#9;"PA";X0\$;","Y0\$;";"" 251 FOR ISUB=1 TO NDIVX+1:SCALE\$=CONV\$(SCALEX(ISUB)) 252 PRINT#9;"PA";SCALE\$;","Y0\$;";"" 254 FOR ISUB=1 TO NDIVY+1:SCALE\$=CONV\$(SCALEY(ISUB)) 255 PRINT#9;"PA";X0\$;",";SCALE\$;";"FOR I=1 TO 100:NEXT I:NEXT ISUB 255 PRINT#9;"PA";X0\$;",";SCALE\$;";";FOR I=1 TO 100:NEXT I:NEXT ISUB 255 PRINT#9;"PA";X0\$;",";SCALE\$;";"</pre>		
<pre>218 FOR ISUB=1 TO NDIVY:SCALEY(ISUB+1)=SCALEY(ISUB)+DELTAY:NEXT 219 FOR ISUB=1 TO NDIVY:SCALEX(ISUB+1)=SCALEX(ISUB)+DELTAY:NEXT 220 SC#=CONV\$(X)+","+CONV\$(I)+","+CONV\$(Y))+","+CONV\$(Y1) 221 PRINT#9;"SC";SC\$;";"RETURN 225 REM SUBROUTINE TO SET SYMBOL MODE 226 SYM1\$=CONV\$(W)+","+CONV\$(H) 227 PRINT#9;"SI";SYM1\$;"SYM1\$;";" 228 RETURN 230 REM THIS SUBROUTINE PLOTS SYMBOL SYM\$ AT LOCATION X,Y 231 REM PD=0 FOR PEN UP; PD=1 FOR PEN DOWN; LINET=LINE TYPE(0-4) 232 REM LINEL= LENGTH (PERCENT OF DIST. BETWEEN P1 AND P2) 233 IF PD=0 THEN PRINT#9;"PU;";:ELSE PRINT#9;"PD;"; 234 IF PD=0 GOTO 279 235 IF LINEL=0 THEN LINEL=4 236 LT\$=CONV\$(LINET)+","+CONV\$(LINEL) 237 PRINT#9;"LT1\$;"" 240 PRINT#9;"PA";SYM2\$;";" 241 RETURN 245 REM PLOT AXIS 246 PRINT#9;"PA";SVM2\$;";"PD;PA";X1\$;",";Y0\$;";";"FU;" 247 X0\$=CONV\$(X0);Y0\$=CONV\$(Y0);X1\$=CONV\$(X1);Y1\$=CONV\$(Y1) 248 PRINT#9;"PA";X0\$;",";Y0\$;";"PD;PA";X1\$;",";Y1\$;";"PU;" 250 PRINT#9;"PA";SCALE\$;","Y0\$;";"TO;Y0\$;";""PU;" 251 PON ISUB=1 TO NDIVY+1:SCALE\$=CONV\$(SCALEX(ISUB)) 252 PRINT#9;"PA";SCALE\$;","Y0\$;";XT;":FOR I=1 TO 100:NEXT I:NEXT ISUB 253 PRINT#9;"PA";X0\$;",";Y0\$;";"FOR I=1 TO 100:NEXT I:NEXT ISUB 254 PRINT#9;"PA";X0\$;",";Y0\$;";"FOR I=1 TO 100:NEXT I:NEXT ISUB 255 PRINT#9;"PA";X0\$;",";Y0\$;";"FOR I=1 TO 100:NEXT I:NEXT ISUB 255 PRINT#9;"PA";X0\$;",";Y0\$;";"FOR I=1 TO 100:NEXT I:NEXT ISUB 255 PRINT#9;"PA";X0\$;",";Y0\$;";";"FOR I=1 TO 100:NEXT I:NEXT ISUB 255 PRINT#9;"PA";X0\$;",";SCALE\$;",";Y0\$;";"FOR I=1 TO 100:NEXT I:NEXT ISUB 255 PRINT#9;"PA";X0\$;",";SCALE\$;",";Y0\$;";"FOR I=1 TO 100:NEXT I:NEXT ISUB 255 PRINT#9;"PA";X0\$;",";SCALE\$;",";Y0\$;";"FOR I=1 TO 100:NEXT I:NEXT ISUB 255 PRINT#9;"CALE\$;",";Y0\$;";";"FOR I=1 TO 100:NEXT I:NEXT ISUB 255 PRINT#9;"TA:N;Y0\$;"</pre>		
<pre>219 FOR ISUB=1 TO NDIVX:SCALEX(ISUB+1)=SCALEX(ISUB)+DELTAX:NEXT 220 SC#=CONV#(X0)+","+CONV#(X1)+","+CONV#(Y0)+","+CONV#(Y1) 221 PRINT#9;"SC";SC#;":"RETURN 225 REM SUBROUTINE TO SET SYMBOL MODE 226 SYM1#=CONV#(W)+","+CONV#(H) 227 PRINT#9;"SI";SYM1#;"SM";SYM#;";" 228 RETURN 230 REM THIS SUBROUTINE PLOTS SYMBOL SYM# AT LOCATION X,Y 231 REM PD=0 FOR PEN UP; PD=1 FOR PEN DOWN; LINET=LINE TYPE(0-4) 232 REM LINEL= LENGTH (FERCENT OF DIST. BETWEEN P1 AND P2) 233 IF PD=0 THEN PRINT#9;"PU;";:ELSE PRINT#9;"PD;"; 234 IF PD=0 GOTO 279 235 IF LINEL=0 THEN LINEL=4 236 LT#=CONV#(LINET)+","+CONV#(LINEL) 237 PRINT#9;"LT";LT#;";" 239 SYM2#=CONV#(X)+","+CONV#(UINEL) 239 SYM2#=CONV#(X)+","+CONV#(V):SYMB#=SYM# 240 PRINT#9;"PU;" 241 RETURN 245 REM PLOT AXIS 246 PRINT#9;"PU;" 247 X0#=CONV#(X0):Y0#=CONV#(Y0):X1#=CONV#(X1):Y1#=CONV#(Y1) 248 PRINT#9;"PA";X0#;","Y0#;";"PD;PA";X0#;","Y1#;";";"PU;" 249 PRINT#9;"PA";X0#=CONV#(Y0):X1#=CONV#(X1):Y1#=CONV#(Y1) 248 PRINT#9;"PA";X0#=CONV#(Y0):X1#=CONV#(X1):Y1#=CONV#(Y1) 249 PRINT#9;"PA";X0#=CONV#(Y0):X1#=CONV#(X1):Y1#=CONV#[Y1] 240 PRINT#9;"PA";X0#=CONV#;","Y0#;";""FD;FA";X0#;";";"PU;" 240 PRINT#9;"PA";X0#=CONV#(Y0):X1#=CONV#(X1):Y1#=CONV#[Y1] 241 RETURN 245 REM FLOT AXIS 246 PRINT#9;"PA";X0#=CONV#(Y0):X1#=CONV#(X1):Y1#=CONV#[Y1] 249 PRINT#9;"PA";X0#:","Y0#;";""FD;FA";X0#;";";PU;" 240 PRINT#9;"PA";X0#:","Y0#;";""FD;FA";X0#;";";"FU;" 250 PRINT#9;"PA";X0#:","Y0#;";"TD:FA";X0#;";";"FU;" 250 PRINT#9;"PA";X0#:","Y0#;";" 251 FOR ISUB=1 TO NDIVX+1:SCALE#=CONV#(SCALEX(ISUB)) 252 PRINT#9;"PA";X0#;",";Y0#;";" 254 FOR ISUB=1 TO NDIVX+1:SCALE#;",";Y0#;";" 255 PRINT#9;"PA";X0#;",";SCALE#;",";Y0#;";" 254 FOR ISUB=1 TO NDIVX+1:SCALE#;",";Y0#;";" 255 PRINT#9;"PA";X0#;",";SCALE#;",";Y0#;";" 256 PRINT#9;"PA";X0#;",";SCALE#;",";Y0#;";" 257 PRINT#9;"PA";X0#;",";SCALE#;",";Y0#;";" 258 PRINT#9;"PA";X0#;",";SCALE#;",";Y0#;";" 259 PRINT#9;"PA";X0#;",";SCALE#;",";Y0#;";" 250 PRINT#9;"PA";X0#;",";SCALE#;",";Y0#;";"FOR I=1 TO 100:NEXT I:NEXT ISUB 250 PRINT#9;"PA";X0#;",";SCALE#;",";Y0#;";"FOR I=1 TO 100:NEXT I:NEXT IS</pre>		·
 220 SC#=CONV#(X0)+","+CONV#(X1)+","+CONV#(Y0)+","+CONV#(Y1) 221 PRINT#9;"SC";SC#;":"RETURN 225 REM SUBROUTINE TO SET SYMBOL MODE 226 SYM1#=CONV#(W)+","+CONV#(H) 227 PRINT#9;"SI";SYM1#;"SM";SYM#;";" 228 RETURN 230 REM THIS SUBROUTINE PLOTS SYMBOL SYM# AT LOCATION X,Y 231 REM PD=O FOR PEN UP; PD=1 FOR PEN DOWN; LINET=LINE TYPE(0-4) 232 REM LINEL= LENGTH (PERCENT OF DIST. BETWEEN P1 AND P2) 233 IF FD=0 THEN PRINT#9;"PU;";ELSE PRINT#9;"PD;"; 234 IF PD=0 GOTO 239 235 IF LINEL=0 THEN LINEL=4 236 LT#=CONV#(LINET)+","+CONV#(LINEL) 237 PRINT#9;"LT";LT#;";" 239 SYM2#=CONV#(V0):X1#=CONV#(X1):Y1#=CONV#(Y1) 240 PRINT#9;"PU;" 241 RETURN 245 REM FLOT AXIS 246 PRINT#9;"PA";X0#;",";Y0#;";"PD;PA";X0#;",";Y0#;";";"FU;" 247 X0#=CONV#(X0):Y0#=CONV#(Y0):X1#=CONV#(X1):Y1#=CONV#(Y1) 248 PRINT#9;"PA";X0#;",";Y0#;";"PD;PA";X0#;",";Y1#;";"PU;" 250 PRINT#9;"PA";X0#;",";Y0#;";"PD;PA";X0#;",";Y1#;";"PU;" 250 PRINT#9;"PA";X0#;",";Y0#;";"FOR I=1 TD 100:NEXT I:NEXT ISUB 250 PRINT#9;"PA";X0#;",";SCALE#;";YT;":FOR I=1 TO 100:NEXT I:NEXT ISUB 		
<pre>221 PRINT#9; "SC"; SC\$; "; ":RETURN 225 REM SUBROUTINE TO SET SYMBOL MODE 226 SYM1#=CONV\$(W)+", "+CONV\$(H) 227 PRINT#9; "SI"; SYM1\$; "SM"; SYM\$; "; " 228 RETURN 230 REM THIS SUBROUTINE PLOTS SYMBOL SYM\$ AT LOCATION X,Y 231 REM PD=0 FOR PEN UP; PD=1 FOR FEN DOWN; LINET=LINE TYPE(0-4) 232 REM LINEL= LENGTH (PERCENT OF DIST. BETWEEN P1 AND P2) 233 IF PD=0 THEN PRINT#9; "PU; ";:ELSE PRINT#9; "PD; "; 234 IF PD=0 GOTO 239 235 IF LINEL=0 THEN LINEL=4 236 LT\$=CONV\$(LINET)+", "+CONV\$(LINEL) 237 PRINT#9; "LT";LT\$; ": 239 SYM2=CONV\$(X)+", "+CONV\$(Y):SYMB\$=SYM\$ 240 PRINT#9; "PA";SYM2\$; "; " 241 RETURN 245 REM PLOT AXIS 246 PRINT#9; "PA";SVM2\$; "; "PD;PA";X0\$; ", "Y0\$; "; "FU;" 247 X0\$=CONV\$(X0):Y0\$=CONV\$(Y0):X1\$=CONV\$(X1):Y1\$=CONV\$(Y1) 248 PRINT#9; "PA";X0\$; ", ";Y0\$; "; "PD;PA";X0\$; ", "Y1\$;"; "PU;" 249 PRINT#9; "PA";X0\$; ", ";Y0\$; "; "PD;PA";X0\$; ", "Y1\$;"; "PU;" 250 PRINT#9; "PA";X0\$; ", ";Y0\$; "; "PD;PA";X0\$; ", "Y1\$;"; "PU;" 251 FOR ISUB=1 TO NDIVX+1:SCALE\$=CONV\$(SCALEX(ISUB)) 252 PRINT#9; "PA";X0\$; ", ";Y0\$; "; "Y0\$;";" 254 FOR ISUB=1 TO NDIVX+1:SCALE\$=CONV\$(SCALEX(ISUB)) 255 PRINT#9; "PA";X0\$; ", ";Y0\$;";"FOR I=1 TO 100:NEXT I:NEXT ISUB 255 PRINT#9; "PA";X0\$;", ";SCALE\$;";YT;":FOR I=1 TO 100:NEXT I:NEXT ISUB 255 PRINT#9; "P</pre>	219	FOR ISUB=1 TO NDIVX:SCALEX(ISUB+1)=SCALEX(ISUB)+DELTAX:NEXT
<pre>225 REM SUBROUTINE TO SET SYMBOL MODE 226 SYM1#=CONV#(W)+","+CONV#(H) 227 PRINT#9;"SI";SYM1#;"SYM#;";" 228 RETURN 230 REM THIS SUBROUTINE PLOTS SYMBOL SYM# AT LOCATION X,Y 231 REM PD=0 FOR PEN UP; PD=1 FOR PEN DOWN; LINET=LINE TYPE(0-4) 232 REM LINEL= LENGTH (PERCENT OF DIST. BETWEEN P1 AND P2) 233 IF PD=0 THEN PEINT#9;"PU;";:ELSE PRINT#9;"PD;"; 234 IF PD=0 GOTO 239 235 IF LINEL=0 THEN LINEL=4 236 LT#=CONV#(LINE)+","+CONV#(LINEL) 237 PRINT#9;"LT";'T*" 240 PRINT#9;"PA";SYM2#;";" 241 RETURN 245 REM FLOT AXIS 246 PRINT#9;"PA";SYM2#;";" 247 X0#=CONV#(X0);Y0#=CONV#(Y0);X1#=CONV#(X1);Y1#=CONV#(Y1) 248 PRINT#9;"PA";X0#;",";Y0#;";";"PD;PA";X0#;",";Y0#;";";"PU;" 249 PRINT#9;"PA";X0#;",";Y0#;";";"PD;PA";X0#;",";Y1#;";";"PU;" 249 PRINT#9;"PA";X0#;",";Y0#;";";"PD;PA";X0#;",";Y1#;";";"PU;" 249 PRINT#9;"PA";SCALE#=CONV#(SCALEX(ISUB)) 251 FOR ISUB=1 TO NDIVX+1:SCALE#=CONV#(SCALEY(ISUB)) 252 PRINT#9;"PA";X0#;",";SCALE#;";YT;":FOR I=1 TO 100:NEXT I:NEXT ISUB 253 PRINT#9;"PA";X0#;",";SCALE#;";YT;":FOR I=1 TO 100:NEXT I:NEXT ISUB</pre>	220	SC\$=CONV\$(X0)+","+CONV\$(X1)+","+CONV\$(Y0)+","+CONV\$(Y1)
<pre>225 REM SUBROUTINE TO SET SYMBOL MODE 226 SYM1#=CONV#(W)+","+CONV#(H) 227 PRINT#9;"SI";SYM1#;"SYM#;";" 228 RETURN 230 REM THIS SUBROUTINE PLOTS SYMBOL SYM# AT LOCATION X,Y 231 REM PD=0 FOR PEN UP; PD=1 FOR PEN DOWN; LINET=LINE TYPE(0-4) 232 REM LINEL= LENGTH (PERCENT OF DIST. BETWEEN P1 AND P2) 233 IF PD=0 THEN PEINT#9;"PU;";:ELSE PRINT#9;"PD;"; 234 IF PD=0 GOTO 239 235 IF LINEL=0 THEN LINEL=4 236 LT#=CONV#(LINE)+","+CONV#(LINEL) 237 PRINT#9;"LT";'T*" 240 PRINT#9;"PA";SYM2#;";" 241 RETURN 245 REM FLOT AXIS 246 PRINT#9;"PA";SYM2#;";" 247 X0#=CONV#(X0);Y0#=CONV#(Y0);X1#=CONV#(X1);Y1#=CONV#(Y1) 248 PRINT#9;"PA";X0#;",";Y0#;";";"PD;PA";X0#;",";Y0#;";";"PU;" 249 PRINT#9;"PA";X0#;",";Y0#;";";"PD;PA";X0#;",";Y1#;";";"PU;" 249 PRINT#9;"PA";X0#;",";Y0#;";";"PD;PA";X0#;",";Y1#;";";"PU;" 249 PRINT#9;"PA";SCALE#=CONV#(SCALEX(ISUB)) 251 FOR ISUB=1 TO NDIVX+1:SCALE#=CONV#(SCALEY(ISUB)) 252 PRINT#9;"PA";X0#;",";SCALE#;";YT;":FOR I=1 TO 100:NEXT I:NEXT ISUB 253 PRINT#9;"PA";X0#;",";SCALE#;";YT;":FOR I=1 TO 100:NEXT I:NEXT ISUB</pre>	221	PRINT#9: "SC"; SC#: ": RETURN
 226 SYM1#=CONV#(W) +", "+CONV#(H) 227 PRINT#9;"SI";SYM1#;"SM";SYM#;";" 228 RETURN 230 REM THIS SUBROUTINE PLOTS SYMBOL SYM# AT LOCATION X,Y 231 REM PD=0 FOR PEN UP; PD=1 FOR PEN DOWN; LINET=LINE TYPE(0-4) 232 REM LINEL= LENGTH (PERCENT OF DIST. BETWEEN P1 AND P2) 233 IF PD=0 THEN PRINT#9;"PU;";:ELSE PRINT#9;"PD;"; 234 IF PD=0 GOTO 239 235 IF LINEL=0 THEN LINEL=4 236 LT#=CONV#(LINET)+","+CONV#(LINEL) 237 PRINT#9;"P4";SYM2#;";" 240 PRINT#9;"P4";SYM2#;";" 241 RETURN 245 REM PLOT AXIS 246 PRINT#9;"P4";X0#;","Y0#;";";"PD;PA";X0#;",";Y0#;";";"PU;" 247 X0#=CONV#(X0):Y0#=CONV#(Y0):X1#=CONV#(X1):Y1#=CONV#(Y1) 248 PRINT#9;"P4";X0#;","Y0#;";";"PD;PA";X0#;",";Y0#;";";"PU;" 249 PRINT#9;"P4";X0#;","Y0#;";";"P1P;PA";X0#;",";Y1#;";"PU;" 250 PRINT#9;"P4";X0#;","Y0#;";";"P0:PA";X0#;",";Y1#;";"PU;" 251 FOR ISUB=1 TO NDIVX+1:SCALE#=CONV#(SCALEX(ISUB)) 252 PRINT#9;"PA";S0#LE#;","Y0#;";"FOR I=1 TO 100:NEXT I:NEXT ISUB 253 PRINT#9;"PA";X0#;",";SCALE#;";YT;":FOR I=1 TO 100:NEXT I:NEXT ISUB 		
<pre>227 PRINT#9;"SI";SYM1\$;"SM";SYM\$;";" 228 RETURN 230 REM THIS SUBROUTINE PLOTS SYMBOL SYM\$ AT LOCATION X,Y 231 REM PD=0 FOR PEN UP; PD=1 FOR PEN DOWN; LINET=LINE TYPE(0-4) 232 REM LINEL= LENGTH (PERCENT OF DIST. BETWEEN P1 AND P2) 233 IF PD=0 THEN PRINT#9;"PU;";:ELSE PRINT#9;"PD;"; 234 IF PD=0 GOTO 239 235 IF LINEL=0 THEN LINEL=4 236 LT#=CONV\$(LINET)+","+CONV\$(LINEL) 237 PRINT#9;"LT";LT#;";" 239 SYM2#=CONV\$(X)+","+CONV\$(Y):SYMB#=SYM\$ 240 PRINT#9;"PU;" 241 RETURN 245 REM PLOT AXIS 246 PRINT#9;"PU;" 247 X0#=CONV#(X0):Y0#=CONV#(Y0):X1#=CONV#(X1):Y1#=CONV#(Y1) 248 PRINT#9;"PA";SVM2#;";"PD;PA";X0#;","Y0#;";";"PU;" 249 PRINT#9;"PA";X0#;","Y0#;";"PI;PA";X0#;","Y0#;";";"PU;" 250 PRINT#9;"PA";X0#;","Y0#;";";"FD;PA";X0#;",";Y1#;";"PU;" 251 FOR ISUB=1 TO NDIVX+1:SCALE#=CONV#(SCALEX(ISUB)) 252 PRINT#9;"PA";X0#;",";SCALE#;";YT;":FOR I=1 TO 100:NEXT I:NEXT ISUB 253 PRINT#9;"PA";X0#;",";SCALE#;";YT;":FOR I=1 TO 100:NEXT I:NEXT ISUB 254 PRINT#9;"PA";X0#;",";SCALE#;";YT;":FOR I=1 TO 100:NEXT I:NEXT ISUB 255 PRINT#9;"PA";X0#;",";SCALE#;";YT;":FOR I=1</pre>		
228 RETURN 230 REM THIS SUBROUTINE PLOTS SYMBOL SYM# AT LOCATION X,Y 231 REM PD=0 FOR PEN UP; PD=1 FOR PEN DOWN; LINET=LINE TYPE(0-4) 232 REM LINEL= LENGTH (PERCENT OF DIST. BETWEEN P1 AND P2) 233 IF PD=0 THEN PRINT#9; "PU; ";:ELSE PRINT#9; "PD;"; 234 IF PD=0 GOTO 239 235 IF LINEL=0 THEN LINEL=4 236 LT#=CONV#(LINET)+", "+CONV#(LINEL) 237 PRINT#9; "LT"; LT#; "; " 239 SYM2#=CONV#(X)+", "+CONV#(V): SYMB#=SYM# 240 PRINT#9; "PA"; SYM2#; "; " 241 RETURN 245 REM FLOT AXIS 246 PRINT#9; "PA"; SO#: ", "; YO#; "; "; "PD; PA"; XI#: ", "; YO#; "; "; "FU; " 247 X0#=CONV#(X0): Y0#=CONV#(Y0): X1#=CONV#(X1): Y1#=CONV#(Y1) 248 REM FLOT AXIS 244 PRINT#9; "PA"; XO#: ", "; YO#; "; "; "PD; PA"; XO#; ", "; YO#; "; "; "FU; " 247 X0#=CONV#(X0): Y0#=CONV#(Y0): X1#=CONV#(X1): Y1#=CONV#(Y1) 248 REM FLOT AXIS 249 PRINT#9; "PA"; XO#: ", "; YO#; "; "; "PD; PA"; XO#; ", "; YO#; "; "; "FU; " 249 PRINT#9; "PA"; SO#: ", "; YO#; "; "; "PD; PA"; XO#; ", "; YU#; "; "; "FU; " 249 PRINT#9; "PA";		
 REM THIS SUBROUTINE PLOTS SYMBOL SYM# AT LOCATION X,Y REM PD=0 FOR PEN UP; PD=1 FOR PEN DOWN; LINET=LINE TYPE(0-4) REM LINEL= LENGTH (PERCENT OF DIST. BETWEEN P1 AND P2) IF PD=0 THEN PRINT#9; "PU; ";:ELSE PRINT#9; "PD;"; IF D=0 THEN LINEL=4 LT#=CONV#(LINET)+", "+CONV#(LINEL) PRINT#9; "LT";LT#; "; " SYM2#=CONV#(X)+", "+CONV#(V):SYMB#=SYM# PRINT#9; "PU; "; SYM2#; "; " REM PLOT AXIS PRINT#9; "PU; "; YO#; "; "PD;PA";XO#; ", "YO#; "; "PU; " PRINT#9; "FA";SCALE#=CONV#(SCALEX(ISUB)) PRINT#9; "FA";SCALE#=CONV#(SCALEY(ISUB)) PRINT#9; "FA";XO#; ", "; SCALE#; "; YT; ":FOR I=1 TO 100:NEXT I:NEXT ISUB 		
<pre>231 REM PD=0 FOR PEN UP; PD=1 FOR PEN DOWN; LINET=LINE TYPE(0-4) 232 REM LINEL= LENGTH (PERCENT OF DIST. BETWEEN P1 AND P2) 233 IF PD=0 THEN PRINT#9; "PU; ";:ELSE PRINT#9; "PD; "; 234 IF PD=0 GOTO 239 235 IF LINEL=0 THEN LINEL=4 236 LT#=CONV#(LINET)+", "+CONV#(LINEL) 237 PRINT#9; "LT";LT#; "; 239 SYM2#=CONV#(X)+", "+CONV#(V):SYMB#=SYM# 240 PRINT#9; "PA";SYM2#; "; 241 RETURN 245 REM PLOT AXIS 246 PRINT#9; "PA";XO#; ", ";YO#; "; "PD;PA";XI#; ", ";YO#; "; "FU;" 247 XO#=CONV#(X0):YO#=CONV#(Y0):XI#=CONV#(X1):YI#=CONV#(Y1) 248 PRINT#9; "PA";XO#; ", ";YO#; "; "PD;PA";XI#; ", ";YO#; "; "FU;" 249 PRINT#9; "PA";XO#; ", ";YO#; "; "PD;PA";XI#; ", ";YO#; "; "FU;" 250 PRINT#9; "PA";XO#; ", ";YO#; "; "FOR I=1 TO 100:NEXT I:NEXT ISUB 253 PRINT#9; "PA";XO#; ", ";SCALE#; "; YT; ":FOR I=1 TO 100:NEXT I:NEXT ISUB 254 PRINT#9; "PA";XO#; ", ";SCALE#; "; YT; ":FOR I=1 TO 100:NEXT I:NEXT ISUB 255 PRINT#9; "PA";XO#; ", ";SCALE#; "; YT; ":FOR I=1 TO 100:NEXT I:NEXT ISUB 255 PRINT#9; "PA";XO#; ", ";SCALE#; "; YT; ":FOR I=1 TO 100:NEXT I:NEXT ISUB 255 PRINT#9; "PA";XO#; ", ";SCALE#; "; YT; ":FOR I=1 TO 100:NEXT I:NEXT ISUB 255 PRINT#9; "PA";XO#; ", ";SCALE#; "; YT; ":FOR I=1 TO 100:NEXT I:NEXT ISUB 255 PRINT#9; "PA";XO#; ", ";SCALE#; "; YT; ":FOR I=1 TO 100:NEXT I:NEXT ISUB 255 PRINT#9; "PA";XO#; ", ";SCALE#; "; YT; ":FOR I=1 TO 100:NEXT I:NEXT ISUB 255 PRINT#9; "PA";XO#; ", ";SCALE#; "; YT; ":FOR I=1 TO 100:NEXT I:NEXT ISUB 255 PRINT#9; "PA";XO#; ", ";SCALE#; "; YT; ":FOR I=1 TO 100:NEXT I:NEXT ISUB 255 PRINT#9; "PA";XO#; ", ";SCALE#; "; YT; ":FOR I=1 TO 100:NEXT I:NEXT ISUB 255 PRINT#9; "PA";XO#; ", ";SCALE#; "; YT; ":FOR I=1 TO 100:NEXT I:NEXT ISUB 255 PRINT#9; "PA";XO#; ", ";SCALE#; "; YT; ":FOR I=1 TO 100:NEXT I:NEXT ISUB 255 PRINT#9; "PA";XO#; ", ";SCALE#; "; YT; ":FOR I=1 TO 100:NEXT I:NEXT ISUB 255 PRINT#9; "PA";XO#; ", ";SCALE#; "; YT; ":FOR I=1 TO 100:NEXT I:NEXT ISUB 255 PRINT#9; "PA";XO#; ", ";SCALE#; "; YT; ":FOR I=1 TO 100:NEXT I:NEXT ISUB 255 PRINT#9; "PA";XO#; ", ";SCALE#; "; YT; ":FOR I=1 TO 100:NEXT I:NEXT ISUB 255</pre>		
<pre>232 REM LINEL= LENGTH (PERCENT OF DIST. BETWEEN P1 AND P2) 233 IF PD=0 THEN PRINT#9; "PU; ";:ELSE PRINT#9; "PD; "; 234 IF PD=0 GOTO 239 235 IF LINEL=0 THEN LINEL=4 236 LT#=CONV#(LINET)+", "+CONV#(LINEL) 237 PRINT#9; "LT"; LT#; "; 239 SYM2#=CONV#(X)+", "+CONV#(Y):SYMB#=SYM# 240 PRINT#9; "FA";SYM2#; "; 241 RETURN 245 REM PLOT AXIS 246 PRINT#9; "PU; " 247 X0#=CONV#(X0):Y0#=CONV#(Y0):X1#=CONV#(X1):Y1#=CONV#(Y1) 248 PRINT#9; "PU; " 249 PRINT#9; "PA";X0#; ", ";Y0#; "; "PD;PA";X1#; ", ";Y0#; "; ";"FU;" 249 PRINT#9; "PA";X0#; ", ";Y0#; "; "PD;PA";X0#; ", ";Y1#; "; "FU;" 249 PRINT#9; "PA";X0#; ", ";Y0#; "; "PD;PA";X0#; ", ";Y1#; "; "FU;" 250 PRINT#9; "TL1.0,0.0;PA";X0#; ", "Y0#; "; " 251 FOR ISUB=1 TO NDIVX+1:SCALE#=CONV#(SCALEX(ISUB)) 252 PRINT#9; "PA";SCALE#; ", "Y0#; "; " 254 PRINT#9; "PA";SCALE#=CONV#(SCALEY(ISUB)) 255 PRINT#9; "PA";X0#; ", ";SCALE#=CONV#(SCALEY(ISUB)) 255 PRINT#9; "PA";X0#; ", ";SCALE#; ";YT; ":FOR I=1 TO 100:NEXT I:NEXT ISUB 255 PRINT#9; "PA";X0#; ", ";SCALE#=CONV#(SCALEY(ISUB)) 255 PRINT#9; "PA";X0#; ", ";SCALE#; ", "Y1#; ": "FOR I=1 TO 100:NEXT I:NEXT ISUB</pre>		
<pre>233 IF PD=0 THEN PRINT#9; "PU; ";:ELSE PRINT#9; "PD; "; 234 IF PD=0 GOTG 239 235 IF LINEL=0 THEN LINEL=4 236 LT#=CONV#(LINET)+", "+CONV#(LINEL) 237 PRINT#9; "LT*; ";" 239 SYM2#=CONV#(X)+", "+CONV#(Y):SYMB#=SYM# 240 PRINT#9; "PA";SYM2#; ";" 241 RETURN 245 REM PLOT AXIS 246 PRINT#9; "PU; " 247 X0#=CONV#(X0):Y0#=CONV#(Y0):X1#=CONV#(X1):Y1#=CONV#(Y1) 248 PRINT#9; "PA";X0#; ", ";Y0#; ";" "PD;PA";X1#; ", ";Y0#; ";" "PU; " 249 PRINT#9; "PA";X0#; ", ";Y0#; ";" "PD;PA";X1#; ", ";Y0#; ";" "PU; " 249 PRINT#9; "PA";X0#; ", ";Y0#; ";" "PD;PA";X0#; ", ";Y1#; ";" "PU; " 250 PRINT#9; "TL1.0,0.0;PA";X0#; ", "Y0#; ";" 251 FOR ISUB=1 TO NDIVX+1:SCALE#=CONV#(SCALEX(ISUB)) 252 PRINT#9; "TL1.0,0.0;PA";X0#; ", "Y0#; ";" 254 FOR ISUB=1 TO NDIVX+1:SCALE#=CONV#(SCALEY(ISUB)) 255 PRINT#9; "PA";X0#; ", ";SCALE#; ";YT;":FOR I=1 TO 100:NEXT I:NEXT ISUB 255 PRINT#9; "PA";X0#; ", ";SCALE#; ";YT;":FOR I=1 TO 100:NEXT I:NEXT ISUB</pre>		
<pre>234 IF PD=0 G0T0 239 235 IF LINEL=0 THEN LINEL=4 236 LT#=CONV#(LINET)+","+CONV#(LINEL) 237 PRINT#9;"LT";LT#;";" 239 SYM2#=CONV#(X)+","+CONV#(Y):SYMB#=SYM# 240 PRINT#9;"FA";SYM2#;";" 241 RETURN 245 REM PLOT AXIS 246 PRINT#9;"PU;" 247 X0#=CONV#(X0):Y0#=CONV#(Y0):X1#=CONV#(X1):Y1#=CONV#(Y1) 248 PRINT#9;"PA";X0#;",";Y0#;";"PD;PA";X1#;",";Y0#;";";"FU;" 249 PRINT#9;"PA";X0#;",";Y0#;";"PD;PA";X1#;",";Y0#;";";"FU;" 249 PRINT#9;"PA";X0#;",";Y0#;";"PD;PA";X1#;",";Y1#;";"FU;" 250 PRINT#9;"TL1.0,0.0;PA";X0#;","Y0#;";" 251 FOR ISUB=1 TO NDIVX+1:SCALE#=CONV#(SCALEX(ISUB)) 252 PRINT#9;"PA";SCALE#;",";Y0#;";" 254 FOR ISUB=1 TO NDIVY+1:SCALE#=CONV#(SCALEY(ISUB)) 255 PRINT#9;"PA";X0#;",";SCALE#;";YT;":FOR I=1 TO 100:NEXT I:NEXT ISUB</pre>		
<pre>235 IF LINEL=0 THEN LINEL=4 236 LT#=CONV#(LINET)+","+CONV#(LINEL) 237 PRINT#9;"LT";LT#;";" 239 SYM2#=CONV#(X)+","+CONV#(Y):SYMB#=SYM# 240 PRINT#9;"PA";SYM2#;";" 241 RETURN 245 REM FLOT AXIS 246 PRINT#9;"PU;" 247 X0#=CONV#(X0):Y0#=CONV#(Y0):X1#=CONV#(X1):Y1#=CONV#(Y1) 248 PRINT#9;"PA";X0#;",";Y0#;";";"PD;PA";X1#;",";Y0#;";";"FU;" 249 PRINT#9;"PA";X0#;",";Y0#;";";"PD;PA";X1#;",";Y0#;";";"FU;" 249 PRINT#9;"PA";X0#;",";Y0#;";";"PD;PA";X1#;",";Y0#;";";"FU;" 250 PRINT#9;"TL1.0,0.0;PA";X0#;","Y0#;";" 251 FOR ISUB=1 TO NDIVX+1:SCALE#=CONV#(SCALEX(ISUB)) 252 PRINT#9;"TL1.0,0.0;PA";X0#;","Y0#;";" 254 FOR ISUB=1 TO NDIVY+1:SCALE#=CONV#(SCALEY(ISUB)) 255 PRINT#9;"PA";X0#;",";SCALE#;";YT;":FOR I=1 TO 100:NEXT I:NEXT ISUB</pre>		
<pre>236 LT#=CONV#(LINET)+","+CONV#(LINEL) 237 PRINT#9;"LT";LT#;";" 239 SYM2#=CONV#(X)+","+CONV#(Y):SYMB#=SYM# 240 PRINT#9;"PA";SYM2#;";" 241 RETURN 245 REM FLOT AXIS 246 PRINT#9;"FU;" 247 X0#=CONV#(X0):Y0#=CONV#(Y0):X1#=CONV#(X1):Y1#=CONV#(Y1) 248 PRINT#9;"PA";X0#;",";Y0#;";"PD;PA";X1#;",";Y0#;";";"FU;" 249 PRINT#9;"PA";X0#;",";Y0#;";"PD;PA";X1#;",";Y0#;";";"FU;" 249 PRINT#9;"FA";X0#;",";Y0#;";"FD;PA";X0#;",";Y1#;";";"FU;" 250 PRINT#9;"TL1.0,0.0;PA";X0#;","Y0#;";" 251 FOR ISUB=1 TO NDIVX+1:SCALE#=CONV#(SCALEX(ISUB)) 252 PRINT#9;"TL1.0,0.0;PA";X0#;","Y0#;";" 254 FOR ISUB=1 TO NDIVY+1:SCALE#=CONV#(SCALEY(ISUB)) 255 PRINT#9;"PA";X0#;",";SCALE#;";YT;":FOR I=1 TO 100:NEXT I:NEXT ISUB</pre>	234	IF PD=0 GOTO 239
<pre>237 FRINT#9:"LT":LT#:"" 239 SYM2#=CONV#(X)+","+CONV#(Y):SYMB#=SYM# 240 FRINT#9:"FA":SYM2#:":" 241 RETURN 245 REM FLOT AXIS 246 PRINT#9:"FU:" 247 X0#=CONV#(X0):Y0#=CONV#(Y0):X1#=CONV#(X1):Y1#=CONV#(Y1) 248 FRINT#9:"FA":X0#:",":Y0#:":"FD:PA":X1#:",":Y0#:":";"FU:" 249 PRINT#9:"FA":X0#:",":Y0#:":"FD:PA":X0#:",":Y1#:":";"FU:" 250 PRINT#9:"TL1.0,0.0:FA":X0#:","Y0#:":" 251 FOR ISUB=1 TO NDIVX+1:SCALE#=CONV#(SCALEX(ISUB)) 252 PRINT#9:"FA":SCALE#:",":Y0#:":"FOR I=1 TO 100:NEXT I:NEXT ISUB 253 PRINT#9:"FA":X0#:",":SCALE#=CONV#(SCALEY(ISUB)) 254 FOR ISUB=1 TO NDIVY+1:SCALE#=CONV#(SCALEY(ISUB)) 255 PRINT#9:"FA":X0#:",":SCALE#:":"FOR I=1 TO 100:NEXT I:NEXT ISUB</pre>	235	IF LINEL=0 THEN LINEL=4
<pre>237 FRINT#9:"LT":LT:"" 239 SYM2#=CONV#(X)+","+CONV#(Y):SYMB#=SYM# 240 FRINT#9:"FA":SYM2#:":" 241 RETURN 245 REM FLOT AXIS 246 PRINT#9:"FU:" 247 X0#=CONV#(X0):Y0#=CONV#(Y0):X1#=CONV#(X1):Y1#=CONV#(Y1) 248 FRINT#9:"FA":X0#:",":Y0#:":"FD:PA":X1#:",":Y0#:":";"FU:" 249 PRINT#9:"FA":X0#:",":Y0#:":"FD:PA":X0#:",":Y1#:":";"FU:" 250 PRINT#9:"TL1.0,0.0:FA":X0#:","Y0#:":" 251 FOR ISUB=1 TO NDIVX+1:SCALE#=CONV#(SCALEX(ISUB)) 252 PRINT#9:"FA":SCALE#:",":Y0#:":" 254 FOR ISUB=1 TO NDIVY+1:SCALE#=CONV#(SCALEY(ISUB)) 255 PRINT#9:"FA":X0#:",":SCALE#:":YT:":FOR I=1 TO 100:NEXT I:NEXT ISUB</pre>	236	LT#=CONV#(LINET)+","+CONV#(LINEL)
<pre>239 SYM2#=CONV#(X)+","+CONV#(Y):SYMB#=SYM# 240 PRINT#9;"PA";SYM2#;";" 241 RETURN 245 REM PLOT AXIS 246 PRINT#9;"PU;" 247 X0#=CONV#(X0):Y0#=CONV#(Y0):X1#=CONV#(X1):Y1#=CONV#(Y1) 248 PRINT#9;"PA";X0#;",";Y0#;";"PD;PA";X1#;",";Y0#;";";"FU;" 249 PRINT#9;"PA";X0#;",";Y0#;";":"PD;PA";X0#;",";Y1#;";";"PU;" 250 PRINT#9;"PA";X0#;",";Y0#;";","Y0#;";" 251 FOR ISUB=1 TO NDIVX+1:SCALE#=CONV#(SCALEX(ISUB)) 252 PRINT#9;"PA";SCALE#;",";Y0#;";":FOR I=1 TO 100:NEXT I:NEXT ISUB 253 PRINT#9;"TL1.0,0.0;PA";X0#;","Y0#;";" 254 FOR ISUB=1 TO NDIVY+1:SCALE#=CONV#(SCALEY(ISUB)) 255 PRINT#9;"PA";X0#;",";SCALE#;";YT;":FOR I=1 TO 100:NEXT I:NEXT ISUB</pre>	237	
 240 FRINT#9; "FA"; SYM2\$; "; " 241 RETURN 245 REM FLOT AXIS 246 FRINT#9; "FU; " 247 X0\$=CONV\$(X0):Y0\$=CONV\$(Y0):X1\$=CONV\$(X1):Y1\$=CONV\$(Y1) 248 FRINT#9; "FA";X0\$; ", ";Y0\$; "; "; "FD;FA";X1\$; ", ";Y0\$; "; "; "FU; " 249 PRINT#9; "FA";X0\$; ", ";Y0\$; "; ", "Y0\$; "; " 250 PRINT#9; "TL1.0,0.0;FA";X0\$; ", "Y0\$; "; " 251 FOR ISUB=1 TO NDIVX+1:SCALE\$=CONV\$(SCALEX(ISUB)) 252 PRINT#9; "FA";SCALE\$; ", ";Y0\$; "; "FOR I=1 TO 100:NEXT I:NEXT ISUB 253 PRINT#9; "FA";X0\$; ", ";SCALE\$=CONV\$(SCALEY(ISUB)) 254 FOR ISUB=1 TO NDIVY+1:SCALE\$=CONV\$(SCALEY(ISUB)) 255 PRINT#9; "FA";X0\$; ", ";SCALE\$; ";YT; ":FOR I=1 TO 100:NEXT I:NEXT ISUB 		
<pre>241 RETURN 245 REM PLOT AXIS 246 PRINT#9;"PU;" 247 X0\$=CONV\$(X0):Y0\$=CONV\$(Y0):X1\$=CONV\$(X1):Y1\$=CONV\$(Y1) 248 PRINT#9;"PA":X0\$;",":Y0\$;";"PD;PA":X1\$;",":Y0\$;";"FU;" 249 PRINT#9;"PA":X0\$;",":Y0\$;":":"PD;PA":X0\$;",":Y1\$;":";"PU;" 250 PRINT#9;"TL1.0,0.0;PA":X0\$;","Y0\$;";" 251 FOR ISUB=1 TO NDIVX+1:SCALE\$=CONV\$(SCALEX(ISUB)) 252 PRINT#9;"PA":SCALE\$:",":Y0\$;":XT;":FOR I=1 TO 100:NEXT I:NEXT ISUB 253 PRINT#9;"TL1.0,0.0;PA":X0\$;","Y0\$;":" 254 FOR ISUB=1 TO NDIVY+1:SCALE\$=CONV\$(SCALEY(ISUB)) 255 PRINT#9;"PA":X0\$;",":SCALE\$:";Y1;":FOR I=1 TO 100:NEXT I:NEXT ISUB</pre>		
<pre>245 REM PLOT AXIS 246 PRINT#9; "PU;" 247 X0#=CONV#(X0):Y0#=CONV#(Y0):X1#=CONV#(X1):Y1#=CONV#(Y1) 248 PRINT#9; "PA":X0#; ", ":Y0#; "; "PD;PA":X1#; ", ":Y0#; "; "PU;" 249 PRINT#9; "PA":X0#; ", ":Y0#; "; ":PD;PA":X0#; ", ":Y1#; "; "PU;" 250 PRINT#9; "TL1.0,0.0;PA":X0#; ", "Y0#;";" 251 FOR ISUB=1 TO NDIVX+1:SCALE#=CONV#(SCALEX(ISUB)) 252 PRINT#9; "PA":SCALE#; ", ":Y0#; ":XT; ":FOR I=1 TO 100:NEXT I:NEXT ISUB 253 PRINT#9; "TL1.0,0.0;PA":X0#; ", "Y0#;";" 254 FOR ISUB=1 TO NDIVY+1:SCALE#=CONV#(SCALEY(ISUB)) 255 PRINT#9; "PA":X0#; ", ":SCALE#:"; "FOR I=1 TO 100:NEXT I:NEXT ISUB</pre>		
<pre>246 PRINT#9: "PU: " 247 X0\$=CONV\$(X0):Y0\$=CONV\$(Y0):X1\$=CONV\$(X1):Y1\$=CONV\$(Y1) 248 PRINT#9: "PA":X0\$: ", ":Y0\$: ": "PD:PA":X1\$: ", ":Y0\$: ": "; "PU:" 249 PRINT#9: "PA":X0\$: ", ":Y0\$: ": "PD:PA":X0\$: ", ":Y1\$: ": "PU:" 250 PRINT#9: "TL1.0,0.0:PA":X0\$: ", "Y0\$:":" 251 FOR ISUB=1 TO NDIVX+1:SCALE\$=CONV\$(SCALEX(ISUB)) 252 PRINT#9: "PA":SCALE\$: ", ":Y0\$: ":XT; ":FOR I=1 TO 100:NEXT I:NEXT ISUB 253 PRINT#9: "TL1.0,0.0:PA":X0\$: ", "Y0\$:":" 254 FOR ISUB=1 TO NDIVY+1:SCALE\$=CONV\$(SCALEY(ISUB)) 255 PRINT#9: "PA":X0\$: ", ":SCALE\$:":" 254 FOR ISUB=1 TO NDIVY+1:SCALE\$:" 255 PRINT#9: "PA":X0\$: ", ":SCALE\$:":" 256 PRINT#9: "PA":X0\$: ", ":SCALE\$:":" 257 PRINT#9: "TL1.0,0.0:PA":X0\$:":" 258 PRINT#9: "TL1.0,0.0:PA":X0\$:"" 259 PRINT#9: "TL1.0,0.0:PA":X0\$:"" 250 PRINT#0: "PA":X0\$:"" 250 PRINT#0: "PRINT#0: "PA":X0\$:"" 250 PRINT#0: "PRINT#0: "PA":X0\$:"" 250 PRINT#0: "PA":X0\$:"" 250 PRINT#0: "PA":X0\$:"" 25</pre>		
<pre>247 X0\$=CONV\$(X0):Y0\$=CONV\$(Y0):X1\$=CONV\$(X1):Y1\$=CONV\$(Y1) 248 PRINT#9;"PA":X0\$:",":Y0\$:":"PD:PA":X1\$:",":Y0\$:":";"FU:" 249 PRINT#9;"PA":X0\$:",":Y0\$:":"PD:PA":X0\$:",":Y1\$:":"PU;" 250 PRINT#9;"TL1.0,0.0:PA":X0\$:","Y0\$:":" 251 FOR ISUB=1 TO NDIVX+1:SCALE\$=CONV\$(SCALEX(ISUB)) 252 PRINT#9:"PA":SCALE\$:",":Y0\$:":XT;":FOR I=1 TO 100:NEXT I:NEXT ISUB 253 PRINT#9:"TL1.0,0.0:PA":X0\$:","Y0\$:":" 254 FOR ISUB=1 TO NDIVY+1:SCALE\$=CONV\$(SCALEY(ISUB)) 255 PRINT#9:"PA":X0\$:",":SCALE\$:":YT:":FOR I=1 TO 100:NEXT I:NEXT ISUB</pre>		
<pre>248 FRINT#9: "FA": XO\$: ", ":YO\$: ": "FD:FA": X1\$: ", ":YO\$: ": "; "FU:" 249 FRINT#9: "FA": XO\$: ", ":YO\$: ": "FD:FA": XO\$: ", ":Y1\$: ": "; "FU:" 250 PRINT#9: "TL1.0,0.0:FA": XO\$: ", "YO\$: ": 251 FOR ISUB=1 TO NDIVX+1: SCALE\$=CONV\$(SCALEX(ISUB)) 252 FRINT#9: "FA": SCALE\$: ", ":YO\$: ": XT: ":FOR I=1 TO 100:NEXT I:NEXT ISUB 253 PRINT#9: "TL1.0,0.0:FA": XO\$: ", "YO\$:":" 254 FOR ISUB=1 TO NDIVY+1: SCALE\$=CONV\$(SCALEY(ISUB)) 255 PRINT#9: "FA": XO\$: ", ":SCALE\$:", "YO\$: ":"</pre>		
<pre>249 PRINT#9: "PA":XO\$: ", ":YO\$: ": "PD:PA":XO\$: ", ":Y1\$: ": "PU;" 250 PRINT#9: "TL1.0,0.0:PA":XO\$: ", "YO\$: ";" 251 FOR ISUB=1 TO NDIVX+1:SCALE\$=CONV\$(SCALEX(ISUB)) 252 PRINT#9: "PA":SCALE\$: ", ":YO\$: ": XT; ":FOR I=1 TO 100:NEXT I:NEXT ISUB 253 PRINT#9: "TL1.0,0.0:PA":XO\$: ", "YO\$: ":" 254 FOR ISUB=1 TO NDIVY+1:SCALE\$=CONV\$(SCALEY(ISUB)) 255 PRINT#9: "PA":XO\$: ", ":SCALE\$: ":YT: ":FOR I=1 TO 100:NEXT I:NEXT ISUB</pre>		
250 PRINT#9; "TL1.0,0.0; PA"; XO\$; ", "YO\$; "; " 251 FOR ISUB=1 TO NDIVX+1:SCALE\$=CONV\$(SCALEX(ISUB)) 252 PRINT#9; "PA"; SCALE\$; ", "; YO\$; "; XT; ":FOR I=1 TO 100:NEXT I:NEXT ISUB 253 PRINT#9; "TL1.0,0.0; PA"; XO\$; ", "YO\$; "; " 254 FOR ISUB=1 TO NDIVY+1:SCALE\$=CONV\$(SCALEY(ISUB)) 255 PRINT#9; "PA"; XO\$; ", "; SCALE\$; "; YT; ":FOR I=1 TO 100:NEXT I:NEXT ISUB		
250 PRINT#9; "TL1.0,0.0; PA"; XO\$; ", "YO\$; "; " 251 FOR ISUB=1 TO NDIVX+1:SCALE\$=CONV\$(SCALEX(ISUB)) 252 PRINT#9; "PA"; SCALE\$; ", "; YO\$; "; XT; ":FOR I=1 TO 100:NEXT I:NEXT ISUB 253 PRINT#9; "TL1.0,0.0; PA"; XO\$; ", "YO\$; "; " 254 FOR ISUB=1 TO NDIVY+1:SCALE\$=CONV\$(SCALEY(ISUB)) 255 PRINT#9; "PA"; XO\$; ", "; SCALE\$; "; YT; ":FOR I=1 TO 100:NEXT I:NEXT ISUB	249	PRINT#9;"FA";XO\$;",";YO\$;";";"PD;FA";XO\$;",";Y1\$;";"PU;"
251 FOR ISUB=1 TO NDIVX+1:SCALE#=CONV#(SCALEX(ISUB)) 252 PRINT#9; "PA";SCALE#;",";YO#;";XT;":FOR I=1 TO 100:NEXT I:NEXT ISUB 253 PRINT#9; "TL1.0,0.0;PA";XO#;","YO#;";" 254 FOR ISUB=1 TO NDIVY+1:SCALE#=CONV#(SCALEY(ISUB)) 255 PRINT#9;"PA";XO#;",";SCALE#;";YT;":FOR I=1 TO 100:NEXT I:NEXT ISUB	250	PRINT#9; "TL1.0,0.0; PA"; X0#; ", "Y0#; "; "
252 PRINT#9: "PA": SCALE\$: ", "; YO\$: "; XT; ": FOR I=1 TO 100: NEXT I: NEXT ISUB 253 PRINT#9: "TL1.0,0.0; PA": XO\$: ", "YO\$; "; " 254 FOR ISUB=1 TO NDIVY+1: SCALE\$=CONV\$(SCALEY(ISUB)) 255 PRINT#9: "PA": XO\$: ", "; SCALE\$: "; YT; ": FOR I=1 TO 100: NEXT I: NEXT ISUB		
253 PRINT#9;"TL1.0,0.0;PA";X0\$;","Y0\$;";" 254 FOR ISUB=1 TO NDIVY+1:SCALE\$=CONV\$(SCALEY(ISUB)) 255 PRINT#9;"PA";X0\$;",";SCALE\$;";YT;":FOR I=1 TO 100:NEXT I:NEXT ISUB		
254FOR ISUB=1 TO NDIVY+1:SCALE#=CONV#(SCALEY(ISUB))255PRINT#9;"PA";XO#;",";SCALE#;";YT;":FOR I=1 TO 100:NEXT I:NEXT ISUB		
255 PRINT#9;"PA";XO\$;",";SCALE\$;";YT;":FOR I=1 TO 100:NEXT I:NEXT ISUB		
256 RETURN		·
	- 56	

```
,261
        REM LOCATION IS THE LOWER LEFT HAND CORNER
        REM DIRUN, DIRISE; SET DIRECTION . 1,0 FOR HORIZONTAL
262
                                                                           A-25
263
        REM SAW, SAH SET WIDTH AND HEIGHT IN CM.
         IF SAW=0 THEN SAW=0.1:SAH=0.15
264
        AXX == CONV = (AXX) : AYY == CONV = (AYY) : AXNUM == CONV = (AXNUM)
266
        FRINT#9;"SI";CONV$(SAW);",";CONV$(SAH);";"
267
        FRINT#9; "FA"; AXX#; ", "; AYY#; "; LB"; AXNUM#; CHR#(3)
268
269
        RETURN
        REM SUBROUTINE TO FLOT TEXT TXT$ AT LOCATION TXX, TYY
270
        REM LOCATION IS THE LOWER LEFT HAND CORNER
271
        REM DIRUN, DIRISE; SET DIRECTION . 1,0 FOR HORIZONTAL
272
273
        REM SAW, SAH SET WIDTH AND HEIGHT IN CM.
         IF SAW=0 THEN SAW=0.1:SAH=0.15
274
276
         TXX=CONV=(TXX):TYY=CONV=(TYY)
        PRINT#9;"SI";CONV$(SAW);",";CONV$(SAH);";"
277
        PRINT#9; "DI"; CONV$ (DIRUN); ", "; CONV$ (DIRISE); "; ": FOR M=1 TO 999: NEXT M
278
         PRINT#9;"PA";TXX#;",";TYY#;";LB";TXT#;CHR#(3)
279
280
        RETURN
        REM SUBROUTINE TO CENTER DIGITS ON X AXIS
281
        NUMDIGIT=LEN(CONV$(AXNUM))
282
283
         AXX=AXX~(NUMDIGIT*SAW)/2/2.54
284
        RETURN
285
        REM SUBROUTINE TO CENTER DIGITS ON Y AXIS
286
         AYY=AYY-SAH/2/2.54:RETURN
287
         REM PLOT A CURVE OF NP POINTS IN XG,YG
288
         XF = (XG(1) - XNUM(5)) * DX : YF = (YG(1) - YNUM(1)) * DY
         SYM2#=CONV#(XP)+","+CONV#(YP)
289
290
        FRINT#9; "FU; FA"; SYM2#; "; PD; "
291
         FOR IFLOT=2 TO NP
           XP=(XG(IPLOT)-XNUM(5))*DX:FOR D=1 TO 200:NEXT D
292
293
           YP = (YG(IPLOT) - YNUM(1)) * DY
294
           SYM2#=CONV#(XP)+","+CONV#(YP)
           PRINT#9; "PA"; SYM2#; "; ":NEXT IPLOT
295
296
         PRINT#9:"FU:"
297
        RETURN
299
         RETURN
300
         REM SUBROUTINE TO GET ERRORS ON HP
\overline{301}
         PRINT#9:CHR$(27);".E;"
302
        PRINT#9; "OE; ": INPUT#9; ERROR$: PRINT ERROR$
303
         RETURN
500
         GOSUB 200
510
         GOSUB 245
520
         FOR I=1 TO 11
525
           XNUM(I) = (I-1) * 0.10
530
           NEXT I
535
        FOR I=2 TO 10
540
           XNUM(I+10)=1.1-I*.1
545
           NEXT I
550
        FOR I=1 TO 6
560
           YNUM(I) = (I-1) *.50
570
           NEXT I
575
        SAW=.10*2.54:SAH=.10*2.54
580
        AXX=SCALEX(2)
590
        AYY=-.15*2.54
600
        FOR I=1 TO NDIVX-1
610
           AXNUM=XNUM(I+5)
620
           GOSUB 281
625
           FOR J=1 TO 100:NEXT J
630
           GOSUB 260
640
           AXX=SCALEX(I+2)
650
           NEXT I
660
        DX = (X1 - XO) / (XNUM(NDIVX+1) - XNUM(1))
680
         TXT = "COSINE OF THE OBSERVATION ZENITH"
690
        NUMLET=LEN(TXT$)
700
        TXX=X1/2.-NUMLET*SAW/2/2.54-0.30
```

9 * * * *

.720 .	GOSUB 270
725	DY = (Y1 - Y0) / (YNUM(NDIVY + 1) - YNUM(1))
726	AXX=2*2.54:AYY=0
730	FOR $I=1$ TO NDIVY+1
740	
750	GOSUB 285
750	FOR J=1 TO 200:NEXT J
770	GOSUB 260
775	FOR J=1 TO 200:NEXT J
780	AYY=SCALEY(I+1)
790	NEXT I
800	TXT#="NORMALIZED RADIANCE"
810	TXX=-0.35*2.54
820	DIRUN=0.
830	DIRISE=1
840	NUMLET=LEN(TXT\$)
850	TYY=Y1/2NUMLET*SAW/2/2.54
855	FOR $J=1$ TO 800:NEXT J
860	GOSUB 270
870	FOR I=1 TO NDIVX+1
880	
	XNUM(I) = (I-1) * 0.1
890	NEXT I
900	FOR N=1 TO NP
910	PRINT I.
920	REM INFUT BD(K)
930	NEXT N
940	FOR K=1 TO NP
950	XG(K)=1.+COS((-57.5+5*K)*DTRD)
960	YG (E) ≈BD (E)
970	PRINT XG(K),YG(K)
980	NEXT K
985	DX=DX*NDIVX/NF
990	GOSUB 287
1000	SYM=="X"
1005	W=.2:H=.2
1010	FOR K=1 TO NP
1020	X = (XG(F) - XNUM(5)) * DX
1030	Y = (YG(k) - YNUM(1)) * DY
1040	FOR $J=1$ TO 400:NEXT J
1045	GOSUB 225
1050	GOSUB 230
1060	NEXT K
1070	END
1100	TXT#="CFOS BDR IN THE PRINCIPAL PLANE"
1105	
1120	DIRUN=1.0:DIRISE=0:SYM\$="":GOSUB 225
	TXX=1.25
1130	TYY=5
1140	GOSUB 270
1145	END
1150	TXX=1.5
1160	· TYY=4.5
1170	SAW=.075*2.54:SAH=0.075*2.54
1180	TXT≸=" COSINE OF SOLAR ZEN = 1.0"
1190	GOSUB 270
1195	END
1200	TYY=4.25
1210	TXT≸="X - CLEAR SURFACE"
1220	GOSUB 270
1230	TYY=4.0
1240	TXT≢="0 - 0.2 CLOUD COVER"
1250	END

. A-26

.

.

REM PROGRAM CFOS 10 20 PRINT" CFOS BI-DIRECTIONAL REFLECTANCE FLOT FROGRAM" 45 DIM RAD(10,10), RDN(30,30) DIM NXP(10,10),NYP(10,10),NXD(30),NYD(30) 50 DATA 2.5,7.5,12.5,17.5,22.5,27.5,32.5,37.5,42.5,47.5,52.5,57.5 60 DATA 15,45,75,105,135,165,195,225,255,285,315,345 70 75 FI=3.14159: FOVR2=PI/2 FRINT"ENTER THE NUMBER OF X DATA POINTS AVAILABLE" 80 85 INFUT NFX 9Ō FRINT"ENTER THE NUMBER OF Y DATA FOINTS AVAILABLE" 95 INFUT NFY 100 FOR J=1 TO 30 FOR 1=1 TO 30 110 120 RDN(J, F) = 0.NEXT K 150 NEXT J 160 FRINT"ENTER THE NUMBER OF X INTERPOLTION POINTS" 165 167 INPUT NX 170 FOR J=1 TO NX-1 190 NXD(J) = 60/NX * J200 NEXT J 216 FRINT"ENTER THE NUMBER OF Y INTERPOLATION POINTS" INFUT NY 217 220 FOR J=1 TO NY-1 230NYD(J) = 60/NY * J240 NEXT J 250 PRINT"ENTER THE RADIANCE DATA AS X POS Y POS RAD(X,Y)" 260 FOR J=1 TO NFX 270 FOR K=1 TO NPY 280 INPUT NXP(J,K),NYP(J,K),RAD(J,K) 290 NEXT K 300 NEXT J 400 GOSUB 1000 500 REM SUBROUTINE TO CALCULATE WEIGHT 510DELTA=60/12 520 IF THETA; DELTA GOTO 570 530 WGHT=1.0E+06 540 IF THETA:0.001 THEN RETURN 550 WGHT=DELTA/THETA 560 RETURN 570 WGHT=0. 580 IF (THETA-DELTA) >= DELTA THEN RETURN 590 WGHT=2.0-THETA/DELTA 600 RETURN 700 REM SUBROUTINE TO INTERPOLATE IN BDR ARRAY 710 SUMF=0. 720 SUMW=0. 730 FOR M=1 TO NEX 740 FOR N=1 TO NEY XI = NXF'(M,N)750 760 YI=NYP(M,N) 770 THETA=SOR((XI-XPRM)^2+(YI-YPRM)^2) ' GOSUB 500 800 810 W=WGHT 820 SUMW=SUMW+W 820 SUMF=SUMF+W*RAD(M,N) 840 NEXT N 850 NEXT M 86Ō INTERP=0. 870 IF SUMW =0. THEN RETURN INTERP=SUMF/SUMW 880

```
- - -- - - - - - -
      بديشة بالسبدين
1000 . REM CALCULATE RAD VALUES AT REGULAR ARRAY POINTS
     FOR J=1 TO NX-1
1010
         FOR F=1 TO NY-1
1020
                                                                 A-28
1030
           XFRM=NXD(J)
            YFRM=NYD(F)
1040
           GOSUB 700
1320
           RDN(J,F) = INTERP
1330
           FRINT RDN(J,E)
1340
            NEXT K
1350
1360
         NEXT J
       OPEN#4 AS OUTPUT, "/AREA1/CFOS.PLOT/"+"STYRO"
1400
       MIN=99999
1410
       MAX=0
1420
       FOR J=1 TO NX-1
1430
1440
         FOR K=1 TO NY-1
            IF RDN(J,K)<MIN THEN MIN=RDN(J,K)
1450
            IF RDN(J,K) > MAX THEN MAX=RDN(J,K)
1460
1470
            NEXT K
1480
         NEXT J
       PRINT"MIN AND MAX OF INTERPOLATED FIELD ",MIN,MAX
1485
1490
       WRITE#4,1;NX-1,NY-1,MIN,MAX
       I = 1
1495
       FOR J=1 TO NX-1
1500
         FOR K=1 TO NY-1
1510
1520
            I = I + 1
            WRITE#4,I;NXD(J),NYD(K),RDN(J,K)
1530
            PRINT NXD(J),NYD(K),RDN(J,K)
1535
1540
            NEXT K
1550
         NEXT J
1560
       CLOSE
1570
       END
```

```
DIM X(30),Y(30),XG(360),YG(360),RDN(30,30),ZLEV(20)
20
     DIM R(6), XNUM(12), YNUM(12), NXD(30), NYD(30)
40
     DTRD=3.14159/180.
50
     DIM YM(JO),Z(JO,JO)
60
     DATA 0,30,40,90,120,150,180,210,240,270,300,330
7Ō
     FOR I=1 TO 12
80
        NEXT I
100
      NLEV=10
110
      NINCR=.05
115
      GOSUB 1000
120
      GOSUB 1600
130
200
      REM INITIALIZE PLOTER
      OPEN#9,".RS232"
201
202
      FRINT#9;CHR#(27);".I32;:17:":FRINT#9;CHR#(27);".N:19:":"IN:"
203
      P1X$=CONV$(P1X):P2X$=CONV$(P2X):P1Y$=CONV$(P1Y):P2Y$=CONV$(P2Y):
204
      P2X=P1X+(X1-X0)*1010:P2Y=P1Y+(Y1-Y0)*1010
      IF X0=X1 THEN F1X=500:F2X=10000:F1Y=600:P2Y=7500
205
      F1X#=CONV#(F1X):F2X#=CONV#(F2X):F1Y#=CONV#(F1Y):F2Y#=CONV#(F2Y)
206
      PFIELD#=P1X#+","+P1Y#+","+P2X#+","+P2Y#
207
      FRINT#9;"IF";FFIELD#;";"
208
      GOSUB 220: RETURN
209
      REM SUBROUTINE TO SCALE AXISES
210
      REM X0,X1,Y0,Y1 DEFINE STARTING AND ENDING POINTS IN INCHES
211
      REM XMIN, XMAX, YMIN, YMAX ARE THE MAX AND MIN VALUE ON AXISES
212
      REM SCALEX, SCALEY=SCALED DATA FOR TIC MARKS
213
214
      REM NDIVX,NDIVY=NUMBER OF DIVISIONS ON AXISES
215
      DELTAX=(X1-X0)/NDIVX
216
      DELTAY=(Y1-Y0)/NDIVY
      SCALEX(1)=X0:SCALEY(1)=Y0
217
218
      FOR ISUB=1 TO NDIVY:SCALEY(ISUB+1)=SCALEY(ISUB)+DELTAY:NEXT
219
      FOR ISUB=1 TO NDIVX:SCALEX(ISUB+1)=SCALEX(ISUB)+DELTAX:NEXT
220
      SC#=CONV#(X0)+","+CONV#(X1)+","+CONV#(Y0)+","+CONV#(Y1)
221
      FRINT#9; "SC"; SC$; "; ":RETURN
225
      REM SUBROUTINE TO SET SYMBOL MODE
225
      SYM1 = CONV = (W) + ", "+CONV = (H)
227
      PRINT#9;"SI";SYM1#;"SM";SYM#;";"
228
      RETURN
270
      REM THIS SUBROUTINE PLOTS SYMBOL SYM≢ AT LOCATION X,Y
231
      REM FD=0 FOR FEN UP; FD=1 FOR PEN DOWN; LINET=LINE TYPE(0-4)
272
      REM LINEL= LENGTH (FERCENT OF DIST. BETWEEN P1 AND P2)
      IF PD=0 THEN PRINT#9; "PU; "; ELSE PRINT#9; "PD; ";
233
234
      IF PD=0 G0TO 239
235
      IF LINEL=0 THEN LINEL=4
236
      LT==CONV=(LINET)+","+CONV=(LINEL)
237
      FRINT#9:"LT":LT#:":"
239
      SYM2#=CONV#(X)+","+CONV#(Y):SYMB#=SYM#
240
      FRINT#9: "PA": SYM2:: ": "
241
      RETURN
245
      REM PLOT AXIS
246
      FRINT#9; "FU; "
247
      XO = CONV = (XO) : YO = CONV = (YO) : X1 = CONV = (X1) : Y1 = CONV = (Y1)
248
      PRINT#9; "PA"; X0#; ", "; Y0#; "; "PD; PA"; X1#; ", "; Y0#; "; "PU; "
249
      FRINT#9; "FA"; XO$; ", "; YO$; "; "; "PD; PA"; XO$; ", "; Y1$; "; "PU; "
250
      PRINT#9;"TL1.0,0.0;FA";XO#;","YO#;";"
251
      FOR ISUB=1 TO NDIVX+1:SCALE$=CONV$(SCALEX(ISUB))
252
        PRINT#9; "PA"; SCALE$; ", "; YO$; "; XT; ":NEXT
253
      PRINT#9;"TL1.0,0.0;PA";XO$;","YO$;";"
254
      FOR ISUB=1 TO NDIVY+1:SCALE#=CONV#(SCALEY(ISUB))
255
        PRINT#9; "PA"; XO$; ", "; SCALE$; "; YT; ": NEXT
256
      RETURN
      REM SUBROUTINE TO FLOT NUMBER AXNUM AT LOCATION AXX, AYY
260
```

```
, REM DIRUN, DIRISE: SET DIRECTION . 1,0 FOR HORIZONTAL
207
263
      REM SAW, SAH SET WIDTH AND HEIGHT IN CM.
                                                                A-30
264
      IF SAW=0 THEN SAW=0.1:SAH=0.15
266
      AXX==CONV=(AXX):AYY==CONV=(AYY):AXNUM==CONV=(AXNUM)
      PRINT#9; "SI"; CONV$ (SAW); ", "; CONV$ (SAH); "; "
267
      FRINT#9: "PA": AXX#: ", ": AYY#: ": LB": AXNUM#: CHR#(3)
268
269
      RETURN
      REM SUBROUTINE TO PLOT TEXT TXT# AT LOCATION TXX, TYY
270
      REM LOCATION IS THE LOWER LEFT HAND CORNER
271
272
      REM DIRUN, DIRISE; SET DIRECTION . 1,0 FOR HORIZONTAL
273
      REM SAW, SAH SET WIDTH AND HEIGHT IN CM.
274
      IF SAW=0 THEN SAW=0.1:SAH=0.15
275
      FRINT#9; "FU;"
276
      TXX = CONV = (TXX) : TYY = CONV = (TYY)
      FRINT#9;"SI";CONV$(SAW);",";CONV$(SAH);";"
277
      PRINT#9; "DI"; CONV$ (DIRUN); ", "; CONV$ (DIRISE); "; "
278
      FRINT#9;"FA";TXX$;",";TYY$;";LB";TXT$;CHR$(3)
279
280
      RETURN
281
      REM SUBROUTINE TO CENTER DIGITS ON X AXIS
      NUMDIGIT=LEN(CONV$(AXNUM))
282
      AXX=AXX-(NUMDIGIT*SAW)/2/2.54
283
284
      RETURN
      REM SUBROUTINE TO CENTER DIGITS ON Y AXIS
285
286
      AYY=AYY-SAH/2/2.54:RETURN
      REM PLOT A CURVE OF NP POINTS IN XG,YG
287
288
      XP = XG(O) : YP = YG(O)
289
      SYM2==CONV=(XP)+","+CONV=(YP)
290
      PRINT#9: "PU: PA": SYM25: ": PD: "
291
      FOR IPLOT=1 TO NP
292
        XP=XG(IFLOT)
293
        YP=YG(IFLOT)
294
        SYM2 = CONV = (XP) + ", "+CONV = (YP)
295
        PRINT#9; "PA"; SYM2$; "; PD; ":NEXT IPLOT
296
      FRINT#9;"PU;"
297
      RETURN
299
      RETURN
300
      REM SUBROUTINE TO GET ERRORS ON HP
301
      PRINT#9; CHR#(27); ".E;"
302 .
      PRINT#9; "OE; ": INPUT#9; ERROR$: PRINT ERROR$
303
      RETURN
400
      REM SUBROUTINE TO PUT AZIMUTH TIC MARKS
410
      TXT=""
420
      SAW=0.1:SAH=0.1
430
      DIRUN=CSIN
435
      IF ABS(DIRUN) (0.01 THEN DIRUN=0.
440
      DIRISE=SINE
445
      IF ABS(DIRISE)<0.01 THEN DIRISE=0
450
      TXX=XG(K):TYY=YG(k)
460
      GOSUB 270
470
      RETURN
1000
       REM INITIALIZE PLOTTER
1010
       P1X=1500
1020
       P1Y=1250
1030
       X0=0
1040
       Y0=0
1050
       X1=6
1060
       Y1=6
1070
       SAW=0.1*2.54
1080
       SAH=0.13*2.54
1090
       CX=3.0
1100
       CY=3.0
1110
       XMIN=0.0
1120
       XMAX=6.0
1130
       YMIN=0.00
1140
       YMAX=6.
```

```
.11.50
        w = 1
        1-1=1
1170
        GOSUB 225
1180
        REM FLOT BOUNDARY
1200
        XNUM(1) = 0: YNUM(1) = 0
1205
        DX=1:DY=1:NP=5
1205
        XG(1) = -2 + CX : YG(1) = -2 + CY
1210
1220
        XG(2) = +2+CX; YG(2) = YG(1)
        XG(3) = XG(2) : YG(3) = +2+CY
1230
1240
        XG(4) = XG(1) : YG(4) = YG(3)
1250
        XG(5) = XG(1) : YG(5) = YG(1)
        PRINT#9: "PU"
1255
        FOR K=1 TO NF
 1260
1270
           XP = XG(k): YP = YG(K)
 1280
           SYM2#=CONV#(XP)+","+CONV#(YP)
           FRINT#9; "FA"; SYM2#; "; FD; FA; "
1290
           NEXT K
 1295
        SAW=.25:SAH=.25
 1390
        TXT = "TAU = 60.0"
 1400
        TXX=2.25:TYY=CY-2.25
 1410
        DIRUN=1.0:DIRISE=0.0
 1415
        GOSUB 270
 1420
        TXT = "TAU = 0.0"
 1425
        TXX=2.25:TYY=CY+2.25
 1430
 1440
        GOSUB 270
        FOR P=1 TO 100:NEXT P
 1510
 1530
        RETURN
        REM INFUT INTERPOLATED BDN FIELD
 1600
 1610
        PRINT"INFUT FILE NAME OF INTERPOLATED DATA"
 1620
         INFUT D#
         OPEN#2,"/AREA1/CFOS.PLOT/"+D#
 1630
 1640
         I = 1
 1650
         READ#2.1:NX,NY,MIN,MAX
 1455
        FRINT NX,NY,MIN,MAX
 1660
        FOR J=1 TO NX
 1670
           FOR K=1 TO NY
 1680
             I = I + 1
             READ#2, I; NXD(J), NYD(K), RDN(J,K)
 1670
 1700
             PRINT J,K,NXD(J),NYD(K),RDN(J,K)
 1710
             NEXT K
 1720
           NEXT J
        REM SET UP CONTOUR ARRAYS
 1730
 1800
        ZMIN=MIN
 1810
        ZMAX=MAX
 1820
        FOR J=1 TO NX
 1830
           FOR L=1 TO NY
 1840
             Z(J, L) = RDN(J, K)
 1850
             NEXT K
 1860
           NEXT J
 1870
        NXF=NX:NXF1=NX-1
 1880
        NYP=NY:NYP1=NY-1
 1910
        FOR N=1 TO NLEV
 1920
           ZLEV(N)=INT(ZMIN*100)/100+N*NINCR
 1925
           NEXT N
 1950
        GOSUB 4900
 4900
        IDUB=0
 4910
        DELTAT=4/NYP1
 4920
        DELTAR=4/NXP1
 5000
        FOR I=1 TO NYP1
 5001
           TO = (I - 1) * DELTAT
 5002
           T1=T0+DELTAT
           FOR J=1 TO NXP1
 5003
 5004
             RO=(J-1)*DELTAR
 5005
             R1=R0+DELTAR
5004
             H1 = 7(.1.1)
```

.

```
م و د الد مسر م
5008
            H_{J=Z}(J+1,I+1)
5009
            H4=Z(J,I+1)
                                                                   A-32
            REM IF I = NYP1 THEN H_3=Z(J+1,1)
5010
            REM IF I = NYF1 THEN H4=Z(J,1)
5011
5012
            FOR 1=1 TO NLEV
              ZLEV=ZLEV()
5013
5014
              IF H1>=ZLEV GOTO 5023
              IF H2 =ZLEV GOTO 5019
5015
5015
              IF H3/=ZLEV GOTO 5020
              IF H4-ZLEV GOTO 5030
5017
5018
              GOTO 5100
5019
              IF H3 ZLEV GOTO 5021:ELSE GOTO 5022
              IF H4-ZLEV GOTO 5031:ELSE GOTO 5032
5020
              IF H4.ZLEV GOTO 5033:ELSE GOTO 5034
5021
5022
              IF H4 ZLEV GOTO 5035:ELSE GOTO 5036
              IF H2:=ZLEV GOTD 5026
5023
              IF H3 =ZLEV GOTO 5027
5024
              IF H4KZLEV GOTO 5036:ELSE GOTO 5035
5025
              IF HIKZLEV GOTO 5028:ELSE GOTO 5029
5026
5027
              IF H4KIZLEV GOTO 5037:ELSE GOTO 5033
5028
              IF H4KZLEV GOTO 5032:ELSE GOTO 5031
5029
              IF H4:=ZLEV GOTO 5090
              TA=T0+(H1-ZLEY)/(H1-H4)*DELTAT:TB=T1:RA=R0:RB=R0+(H4-ZLEV)/(H4-H3
5030
              )*DELTAR:GOTO 5080
5031
              TA=T0+(H2-ZLEV)/(H2-H3)*DELTAT:TB=T1:RA=R1:RB=R0+(H4-ZLEV)/(H4-H3
              )*DELTAR:GOTO 5080
              TA=T0+(H1-ZLEV)/(H1-H4)*DELTAT:TB=T0+(H2-ZLEV)/(H2-H3)*DELTAT:RA=
5032
              R0:RB=R1:GOTO 5080
5033
              TA=T0:TB=T0+(H2-ZLEV)/(H2-H3)*DELTAT:RA=R0+(H1-ZLEV)/(H1-H2)*DELT
              AR:RB=R1:IDUB=0:GOTO 5080
5034
              IDUB=1:GOTO 5030
              TA=T0:TB=T1:RA=R0+(H1-ZLEV)/(H1-H2)*DELTAR:RB=R0+(H4-ZLEV)/(H4-H3
5035
              )*DELTAR:GOTO 5080
              TA=T0:TB=T0+(H1-ZLEV)/(H1-H4)*DELTAT:RA=R0+(H1-ZLEV)/(H1-H2)*DELT
5006
              AR:RB=R0:IDUB=0:GOTO 5080
5037
              IDUB=-1:60T0 5031
5080
              XA=RA+1:XB=RB+1:YA=TA+1:YB=TB+1
5082
              XA$=CONV$(XA):XB$=CONV$(XB):YA$=CONV$(YA):YB$=CONV$(YB)
5083
              FRINT#9:"FU":XA#:","YA#:":FD":XB#:","YB#:":FU;"
5085
              IF IDUB=-1 THEN 5036
5086
              IF IDUB=1 THEN 5033
5090
              NEXT K
            NEXT J
5100
5200
          NEXT I
5250
        END
5300
        FOR J=1 TO NXP1
5310
          FOR K=1 TO NYP1
5320
            IF Z(J,K)=ZMIN THEN JMIN=J:KMIN=K
5330
            IF Z(J,K)=ZMAX THEN JMAX=J:KMAX=K
5340
            NEXT K
5350
          NEXT J
5360
        PRINT JMIN, KMIN, JMAX, KMAX
5365
        DIRUN=1:DIRISE=0
5370
        RMIN=(JMIN-1)*DELTAR
5380
        RMAX = (JMAX - 1) * DELTAR
5390
        TMIN=(EMIN-1)*DELTAT
5400
        TMAX=(*MAX-1)*DELTAT
5410
        XMIN=RMIN+1
· 5420
        XMAX = RMAX + 1
5430
        YMIN=TMIN+1
5440
        YMAX=TMAX+1
5450
        TXX=XMIN: TYY=YMIN: TXTF="L"
5460
        GOSUB 270
5470
        TXX=XMAX:TYY=YMAX:TXT="H"
5480
        GOGHE 070
```

(5500) 5510	TXX=0.30 TYY=50		A-33
	TXT\$="L = "+CONV\$(ZMIN)+"	H = "+CONV\$(ZMAX)+"	INTERVAL ≈ "+CONV\$(ZL
5530	EV(2)-ZLEV(1)) GDSUB 270		
5540	END		

A-34

- L 🔺 - L

```
DIM NA(30), AZ(30), XG(360), YG(360), BDN(30,30), ZLEV(20)
20
     DIM R(6),XNUM(12),YNUM(12)
40
     DTRD=3.14159/180.
50
60
     DIM AZM(30),Z(30,30)
70
     DATA 0,30,60,90,120,150,180,210,240,270,300,330
     FOR I=1 TO 12
80
        READ AZM(I)
90
         NEXT I
100
      NLEV=10
110
      NINCR=.50
115
120
      GDSUB 1000
      GOSUB 1600
130
      REM INITIALIZE PLOTER
200
      OPEN#9, ".RS232"
201
202
      PRINT#9;CHR#(27);".I32;;17:":PRINT#9;CHR#(27);".N:19;";"IN:"
203
      F1X4=CONV4(F1X):F2X4=CONV4(F2X):F1Y4=CONV4(F1Y):P2Y4=CONV4(F2Y):
      P2X=P1X+(X1-X0)*1010:P2Y=P1Y+(Y1-Y0)*1010
204
205
      IF X0=X1 THEN P1X=500:P2X=10000:P1Y=600:P2Y=7500
      P1X#=CONV#(P1X):P2X#=CONV#(P2X):P1Y#=CONV#(P1Y):P2Y#=CONV#(P2Y)
206
207
      PFIELD$=P1X$+","+P1Y$+","+P2X$+","+P2Y$
208
      PRINT#9;"IP";PFIELD#;";"
209
      GOSUB 220: RETURN
210
      REM SUBROUTINE TO SCALE AXISES
      REM X0,X1,Y0,Y1 DEFINE STARTING AND ENDING POINTS IN INCHES
211
212
      REM XMIN, XMAX, YMIN, YMAX ARE THE MAX AND MIN VALUE ON AXISES
213
      REM SCALEX, SCALEY=SCALED DATA FOR TIC MARKS
214
       REM NDIVX,NDIVY=NUMBER OF DIVISIONS ON AXISES
215
       DELTAX=(X1-X0)/NDIVX
215
       DELTAY=(Y1-Y0)/NDIVY
217
       SCALEX(1)=X0:SCALEY(1)=Y0
218
       FOR ISUB=1 TO NDIVY:SCALEY(ISUB+1)=SCALEY(ISUB)+DELTAY:NEXT
219
      FOR ISUB=1 TO NDIVX:SCALEX(ISUB+1)=SCALEX(ISUB)+DELTAX:NEXT
220
       SC#=CONV#(X0)+","+CONV#(X1)+","+CONV#(Y0)+","+CONV#(Y1)
221
      FRINT#9: "SC": SC#: ": ": RETURN
225
       REM SUBROUTINE TO SET SYMBOL MODE
226
       SYM1 = CONV = (W) + ", " + CONV = (H)
227
       FRINT#9;"SI";SYM15;"SM";SYM5;";"
228
       RETURN
230
       REM THIS SUBROUTINE PLOTS SYMBOL SYM# AT LOCATION X,Y
231
      REM PD=0 FOR PEN UP; PD=1 FOR PEN DOWN; LINET=LINE TYPE(0-4)
232
       REM LINEL= LENGTH (PERCENT OF DIST. BETWEEN P1 AND P2)
233
       IF PD=0 THEN PRINT#9; "PU; ";:ELSE PRINT#9; "PD; ";
234
       IF PD=0 GOTO 239
235
       IF LINEL=0 THEN LINEL=4
236
       LT#=CONV#(LINET)+","+CONV#(LINEL)
237
       FRINT#9;"LT";LT#;";"
239
       SYM21=CONV$(X)+","+CONV$(Y):SYMB5=SYM5
240
      PRINT#9: "PA": SYM2#: ":"
241
       RETURN
245
      REM FLOT AXIS
246
       PRINT#9; "PU;"
247
       X \bigcirc = CONV = (X \bigcirc) : Y \bigcirc = CONV = (Y \bigcirc) : X \land = CONV = (X \land) : Y \land = CONV = (Y \land)
248
      PRINT#9; "PA"; XO$; ", "; YO$; "; "PD; PA"; X1$; ", "; YO$; "; "PU; "
       PRINT#9; "PA"; XO#; ", "; YO#; "; "PD; PA"; XO#; ", "; Y1#; "; "PU; "
249
250
      PRINT#9; "TL1.0,0.0; PA"; X0$; ", "Y0$; "; "
251
       FOR ISUB=1 TO NDIVX+1:SCALE = CONV = (SCALEX (ISUB))
252
         PRINT#9; "PA"; SCALE$; ", "; YO$; "; XT; ": NEXT
253
       PRINT#9; "TL1.0,0.0; PA"; XO$; ", "YO$; "; "
254
      FOR ISUB=1 TO NDIVY+1:SCALE = CONV = (SCALEY(ISUB))
255
         PRINT#9; "PA"; XO#; ", "; SCALE#; "; YT; ": NEXT
256
      RETURN
```

THE REAGESTING SECTION TRADET DAMAGE DE COMPLEME DAALDES 261 REM LOCATION IS THE LOWER LEFT HAND CORNER 202 REM DIRUN, DIRISE; SET DIRECTION . 1,0 FOR HORIZONTAL A-35 263 REM SAW, SAH SET WIDTH AND HEIGHT IN CM. IF SAW=0 THEN SAW=0.1:SAH=0.15 264 AXX#=CONV#(AXX):AYY#=CONV#(AYY):AXNUM#=CONV#(AXNUM) 266 FRINT#9;"SI";CONV\$(SAW);",";CONV\$(SAH);";" 267 FRINT#9; "FA"; AXX \$; ", "; AYY \$; "; LB"; AXNUM \$; CHR \$ (3) 268 269 RETURN REM SUBROUTINE TO PLOT TEXT TXT\$ AT LOCATION TXX, TYY 270 REM LOCATION IS THE LOWER LEFT HAND CORNER 271 REM DIRUN, DIRISE; SET DIRECTION . 1,0 FOR HORIZONTAL 272 REM SAW, SAH SET WIDTH AND HEIGHT IN CM. 273 IF SAW=0 THEN SAW=0.1:SAH=0.15 274 275 FRINT#9; "FU: " 276 TXX=CONV=(TXX):TYY==CONV=(TYY) FRINT#9; "SI"; CONV\$ (SAW); ", "; CONV\$ (SAH); "; " 277 PRINT#9: "DI"; CONV\$ (DIRUN); ", "; CONV\$ (DIRISE): ":" $278 \cdot$ FRINT#9: "FA": TXX#; ", ": TYY#: "; LB": TXT#: CHR#(3) 279 280 RETURN 281 REM SUBROUTINE TO CENTER DIGITS ON X AXIS NUMDIGIT=LEN(CONV\$(AXNUM)) 282 283 AXX=AXX-(NUMDIGIT*SAW)/2/2.54 284 RETURN REM SUBROUTINE TO CENTER DIGITS ON Y AXIS 285 AYY=AYY-SAH/2/2.54:RETURN 286 287 REM PLOT A CURVE OF NP POINTS IN XG,YG 288 XP = XG(O): YP = YG(O)289 SYM21=CONV\$(XP)+","+CONV\$(YP) 290 FRINT#9: "FU: FA"; SYM2#; "; FD; " 291 FOR IPLOT=1 TO NP 292 XP=XG(IPLOT) 293 YP=YG(IPLOT) 294 SYM2==CONV=(XF)+","+CONV=(YP) 295 FRINT#9: "PA": SYM2#: ": PD: ": NEXT IPLOT 296 PRINT#9; "PU:" 297 RETURN 299 RETURN 200 REM SUBROUTINE TO GET ERRORS ON HP 301 PRINT#9:CHR\$(27):".E:" 302 PRINT#9: "OE: ": INPUT#9: ERROR#: PRINT ERROR# 303 RETURN 400 REM SUBROUTINE TO PUT AZIMUTH TIC MARKS ORIGINAL PAGE IS 410 TXT=" " 420 SAW=0.1:SAH=0.1 OF POOR QUALITY 430 DIRUN=CSIN 435 IF ABS(DIRUN)<0.01 THEN DIRUN=0. 440 DIRISE=SINE 445 IF ABS(DIRISE) (0.01 THEN DIRISE=0 450 TXX=XG(K):TYY=YG(K)460 GOSUB 270 470 RETURN 1000 REM INITIALIZE PLOTTER 1010F1X=1500 1020 P1Y=1250 1030 _X0=0 1040 YQ=0 1050 X1 = 61060 Y1 = 61070 SAW=0.1*2.54 SAH=0.13*2.54 1080 1090 CX=3.0 1100 CY=3.0 1110 XMIN=0.0 1120 XMAX=6.0 1170 VMTNLA AA

```
1150 .
       GOSUB 200
       W = 1
1160
1170
       H=1
       GOSUB 225
1180
1200
       REM FLOT BOUNDARY
       XNUM(1) = 0: YNUM(1) = 0
1205
      DX=1:DY=1:NP=360
1206
       FOR I=1 TO 6
1210
1220
         R(I) = I \neq 0.45
         FOR 1=0 TO 360 STEP 5
1230
1235
            CSIN=COS(+*DTRD):SINE=SIN(F*DTRD)
1240
            XG(h) = R(I) * CSIN + CX
1250
            YG(k) = R(I) * SINE + CY
            SYM2#=CONV#(XP)+","+CONV#(YP)
1265
1270
            XF = XG(K) : YF = YG(K)
            SYM2#=CONV#(XP)+","+CONV#(YP)
1280
            FRINT#9; "FU; PA"; SYM2#; "; FD; "
1290
            FOR P=1 TO 12
1300
              IF K=AZM(P) THEN GOSUB 400
1310
              NEXT P
1315
1330
            NEXT N
1340
          NEXT I
1350
       I=6
1560
       FOR K=0 TO 330 STEP 30
          SAW=.25:SAH=.25
1390
          TXT = "+CONV (K)
1400
1410 👘
          DIRUN=COS(K*DTRD)
1415
          IF ABS(DIRUN)<0.01 THEN DIRUN=0.
1420
          DIRISE=SIN(L+DTRD)
          IF ABS(DIRISE) <0.01 THEN DIRISE=0.
1425
1430
          TXX=R(6)*COS(E*DTRD)+CX
1440
          TYY=R(6)*SIN(k*DTRD)+CY
          IF 11=90 THEN 1500
1450
1455
          IF KV=270 THEN 1500
1460
          DIRISE=-DIRISE
1470
          DIRUN=-DIRUN
1480
          TXX=TXX+D*SAW*COS(K*DTRD)
1490
          TYY=TYY+3*SAH*SIN(K*DTRD)
1500
          PRINT F.TXX, TYY, DIRUN, DIRISE: GOSUB 270
1510
          FOR P=1 TO 100:NEXT P
1520
          NEXT F
1530
       RETURN
1600
        REM INPUT INTERPOLATED BDN FIELD
1610
        PRINT"INPUT FILE NAME OF INTERPOLATED DATA"
1620
        INFUT D≢
1630
        OPEN#2,"/AREA1/CFOS.FLOT/"+D$
1640
        I = 1
1650
        READ#2,1;NNAD,NAZM,FLUXUP,MIN,MAX
1655
       FRINT NNAD, NAZM, FLUXUP, MIN, MAX
1660
        FOR J=1 TO NNAD
1670
          FOR K=1 TO NAZM
1680
            I = I + 1
1690
            READ#2, I; NA(J), AZ(K), BDN(J, K)
            PRINT J, F, NA(J), AZ(K), BDN(J, K)
1700
1710
            NEXT K
1720
          NEXT J
1730
        REM SET UP CONTOUR ARRAYS
1800
        ZMIN=MIN
1810
        ZMAX=MAX
1820
       FOR J=1 TO NNAD
1830
          FOR 1=1 TO NAZM
1840
            Z(J,K) = BDN(J,K)
1850
            NEXT K
1860
          NEXT J
1870
        NRAD=NNAD:NRM1=NRAD-1
```

```
FOR N=1 TO NLEV
1210
1920
         ZLEV(N) = INT(ZM[N*10)/10+N*NINCR
                                                                A-37
1925
         NEXT N
       GOSUB 4900
1970
       IDUB=0
49<u>0</u>0
4910
       DELTAT=3.14159/(NTM1) #2
4920
       DELTAR=R(6)/(NRM1)
       FOR I=1 TO NTM1
5000
         TO=(I-1)*DELTAT
5001
         T1=T0+DELTAT
5002
         FOR J=1 TO NRM1
5003
5004
            RO=(J-1) * DELTAR
            R1=R0+DELTAR
5005
            H1=Z(J,I)
5006
5007
            H_{2}=Z(J+1,I)
            H_{J}=Z(J+1,I+1)
5008
5009
            H4=Z(J, I+1)
            IF I=NTM1 THEN H3=Z(J+1,1)
5010
            IF I=NTM1 THEN H4=Z(J,1)
5011
            FOR F=1 TO NLEY
5012
              ZLEV=ZLEV(K)
5013
5014
              IF H1>=ZLEV GOTO 5023
              IF H2.=ZLEV GOTO 5019
5015
              IF HD' =ZLEV GOTO 5020
5016
              IF H4%ZLEV GOTO 5030
5017
5018
              GOTO 5100
5019
              IF H3-ZLEV GOTO 5021:ELSE GOTO 5022
              IF H4-72LEV GOTO 5031:ELSE GOTO 5032
5020
              IF H4KZLEV GOTO 5033:ELSE GOTO 5034
5021
              IF H4 ZLEV GOTO 5035:ELSE GOTO 5036
5022
              IF H2;=ZLEV GOTO 5026
5023
5024
              IF HIVEZLEV GOTO 5027
5025
              IF H4<ZLEV GOTO 5036:ELSE GOTO 5035
              IF H3-ZLEV GOTO 5028:ELSE GOTO 5029
5026
              IF H4KZLEV GOTO 5037:ELSE GOTO 5033
5027
5028
              IF H4<ZLEV GOTO 5032:ELSE GOTO 5031
5029
              IF H4/=ZLEV GOTO 5090
5070
              TA=T0+(H1-ZLEV)/(H1-H4)*DELTAT:TB=T1:RA=R0:RB=R0+(H4-ZLEV)/(H4-H3
              )*DELTAR:GOTO 5080
              TA=T0+(H2-ZLEV)/(H2-H3)*DELTAT:TB=T1:RA=R1:RB=R0+(H4-ZLEV)/(H4-H3)
5031
              ) * DELTAR: GOTO 5080
5032
              TA=T0+(H1-ZLEV)/(H1-H4)*DELTAT:TB=T0+(H2-ZLEV)/(H2-H3)*DELTAT:RA=
              R0:RB=R1:GOTO 5080
5033
              TA=T0:TB=T0+(H2-ZLEV)/(H2-H3)*DELTAT:RA=R0+(H1-ZLEV)/(H1-H2)*DELT
              AR: RB=R1: IDUB=0: GOTO 5080
5034
              IDU8=1:GOTO 5030
5035
              TA=T0: TB=T1: RA=R0+ (H1-ZLEV) / (H1-H2) *DELTAR: RB=R0+ (H4-ZLEV) / (H4-H3
              )*DELTAR:GOTO 5080
5036
              TA=T0: TB=T0+ (H1-ZLEV) / (H1-H4) *DELTAT: RA=R0+ (H1-ZLEV) / (H1-H2) *DELT
              AR:RB=R0:IDUB=0:GDTO 5080
5037
              IDUB=-1:60T0 5031
5080
              XA=RA*COS(TA)+CX:XB=RB*COS(TB)+CX:YA=RA*SIN(TA)+CY:YB=RB*SIN(TB)+
              CY
5082
              XA=CONV=(XA):XB=CONV=(XB):YA=CONV=(YA):YB=CONV=(YB)
              PRINT#9; "PU"; XA$; ", "YA$; "; PD"; XB$; ", "YB$; "; PU; "
5083
5085
              IF IDUB=-1 THEN 5036
5086
              IF IDUB=1 THEN 5033
5090
              NEXT +
5100
            NEXT J
5200
         NEXT I
5250
       END
5300
       FOR J=1 TO NNAD
5310
         FOR K=1 TO NAZM
            IF Z(J, K) = ZMIN THEN JMIN=J: KMIN=K
5320
            IF Z(J,K)=ZMAX THEN JMAX=J:NMAX=K
5330
```

5050 5060 5065 5070 5080 5090 5400 5400 5420 5420 5440 5450 5460 5460 5460 5460 5460 546	NExT J PRINT JMIN, KMIN, JMAX, FMAX DIRUN=1: DIRISE=0 RMIN=(JMIN-1)*DELTAR RMAX=(JMAX-1)*DELTAR TMIN=(FMIN-1)*DELTAT TMAX=(FMAX-1)*DELTAT XMIN=RMIN*COS(TMIN)+CX XMAX=RMAX*COS(TMAX)+CX YMIN=RMIN*SIN(TMIN)+CY YMAX=RMAX*SIN(TMAX)+CY TXX=XMIN:TYY=YMIN:TXT#="L" GOSUB 270 TXX=XMAX:TYY=YMAX:TXT#="H" GOSUB 270 END TXX=0.30 TYY=50		A-38
5520	TXT≢="L = "+CONV\$(ZMIN)+"	H = "+CONV\$(ZMAX)+"	INTERVAL = "+CONV≉(ZL
5530 5540	EV(2)-ZLEV(1)) GOSUB 270 END		

.

REM PROGRAM CFOS 10 CFOS BI-DIRECTIONAL REFLECTANCE INTERP. PROGRAM" 20FRINT" 45 DIM BDR(13,15), BDN(30,30), NAN(30), AZIN(30) DIM NAD(13,15),AZI(13,15) 50 DATA 2.5,7.5,12.5,17.5,22.5,27.5,32.5,37.5,42.5,47.5,52.5,57.5 60 DATA 15,45,75,105,135,165,195,225,255,285,315,345 70 PI=3.14159:POVR2=PI/2 75 FOR J=1 TO 30 100 FOR F=1 TO CO 110 BDN(J, L) = 0. 120 NEXT N 150 160 NEXT J PRINT"ENTER THE NUMBER OF NAD INTERPOLTION FOINTS" 165 167 INPUT NNAD 170 FOR J=1 TO NNAD 190 NAN(J) = PI/J/NNAD*(J-1)200 NEXT J DTRD=3.14159/180. 205 210 DEF FN ACOS(X) = ATN(SOR(1-X*X)/X) DEF FN ACOS(X) = ATN(SQR($1-X \times X$)/X) 215216 PRINT"ENTER THE NUMBER OF AZIMUTHAL INTERPOLATION POINTS" 217 INPUT NAZM 220 FOR J=1 TO NAZM 230 $AZIN(J) = 2 \times PI/NAZM \times (J-1)$ 240 NEXT J 250PRINT" INFUT DATA FILE NAME " 260 INFUT D# OPEN#3 AS INPUT, "/AREA1/CFOS.BDR/"+D\$ 270 280 READ#3,1:NS,FLUXUP,MIN,MAX 290 I = 1300 FOR J=1 TO NS 310 FOR 1=1 TO 15 320 I = I + 1330 READ#3,I;J,K,NAD(J,K),AZI(J,K),BDR(J,K) 340 PRINT J, k, NAD(J, K), AZI(J, K), BDR(J, K) 350 NEXT K 360 NEXT J 370 PRINT" UPWARD FLUX DENSITY EQUALS ",FLUXUP 380 PRINT" MIN AND MAX VALUES OF BDR FUNCTION ",MIN,MAX 400 GOSUB 1000 500 REM SUBROUTINE TO CALCULATE WEIGHT 510DELTA=FI/6. 520 IF THETA/DELTA GOTO 570 530 WGHT=1.0E+06 540 IF THETA 0.001 THEN RETURN 550 WGHT=DELTA/THETA 560 RETURN 570 WGHT=0. 580 IF (THETA-DELTA) >= DELTA THEN RETURN 590 WGHT=2.0-THETA/DELTA 600 RETURN 700 REM SUBROUTINE TO INTERPOLATE IN BDR ARRAY 710 SUMF=0. 720 SUMW=0. 730 FOR M=JMIN TO JMAX 740 FOR N=FMIN TO KMAX 750 ZI = NAD(M,N)760 AI = AZI(M,N)THETA=COS(ZI)*COS(ZPRM)+SIN(ZI)*SIN(ZPRM)*COS(AI-APRM) 770 78<u>0</u> IF THETA (0. GOTO 840 790 THETA= FN ACOS (THETA)

800 60508 500 治10 W=WGHT A-40 820 SUMW=SUMW+W 830 SUMF=SUMF+W+BDR(M,N) 840 NEXT N 850 NEXT M INTERP=0. 860 IF SUMW = 0. THEN RETURN 870 INTERP=SUMF/SUMW 880 RETURN 900 REM CALCULATE BDR VALUES AT REGULAR ARRAY POINTS 1000 FOR J=1 TO NNAD 1010 FOR F=1 TO NAZM 1020 ZFRM=NAN(J) 1030 APRM=AZIN(K) 1040 REM FIND JMIN, JMAX, EMIN, EMAX TO LIMIT REGION OF INTERPOLATION 1050 SIND=SIN(ZFRM)*SIN(FI-AFRM) 1060 1070 COSD=SOR(1-SIND*SIND)*SGN(COS(AFRM)) 1075 COSA=COS(ZFRM)/COSD IF CD5A,=1.0 THEN COSA=1.0 10801085 IF COSA<=-1.0 THEN COSA=-1.0 A= FN ACOS(COSA) 1090 1100 D=ATN(SIND/COSD*SGN(COS(AFRM)))+FOVR2 AINC=INT(A/FI*18)+71120DINC=INT(D/FI*18)-1 1130 1150 JMIN=AINC-1 1160 JMAX=AINC+1 +MIN=DINC-1 1170 k.MAX=DINC+1 1180 1190 IF JMIN:=1 THEN 1230 1200 JMIN=JMIN+1 1210 GOTO 1190 1230 IF JMAX =13 THEN 1260 1240JMAX=JMAX-1 1250 GOTO 1230 IF KMIN =1 THEN 1290 1260 1270 **NMIN=KMIN+1** 1280 GOTO 1260 1290 IF KMAX4=15 THEN 1320 1300KMAX=KMAX-1 1310 GOTO 1290 1320 GOSUB 700 1330 BDN(J, k') = INTERF1340 PRINT BDN(J,K), JMIN, JMAX, KMIN, KMAX 1350 NEXT E 1360 NEXT J 1400 OPEN#4 AS OUTPUT, "/AREA1/CFO5.PLOT/"+D\$ 1410 MIN=99999 1420 MAX=0 1430 FOR J=1 TO NNAD 1440 FOR K=1 TO NAZM 1450 IF BDN(J,K)<MIN THEN MIN=BDN(J,K) 1460 IF BDN(J,K) DMAX THEN MAX=BDN(J,K) 1470 NEXT K 1480 NEXT J 1485 PRINT"MIN AND MAX OF INTERPOLATED FIELD ",MIN,MAX 1490 WRITE#4,1;NNAD,NAZM,FLUXUP,MIN,MAX 1495 I=11500 FOR J=1 TO NNAD 1510 FOR 1=1 TO NAZM 1520 I = I + 11530 WRITE#4, I; NAN(J), AZIN(K), BDN(J,K) PRINT NAN(J),AZIN(k),BDN(J,k) 1535 1540 NEXT F 1550 NEXT J

```
1570 END
```

A-41

```
REM CFOS BI-DIRECTIONAL REFLECTANCE STANDARD ERROR PROGRAM
10
20
     DIM N(30,12,12),NAN(12),AZIM(12)
30
     DIM NEAR(12,12), NSTD(12,12), SSN(12,12), SNS(12,12)
     DIM D$(30)
40
      PRINT"INFUT THE NUMBER OF INTERPOLATED DATA FILES TO USE"
100
      INFUT NUM
110
130
      FOR I=1 TO NUM
        PRINT"INPUT THE DATASET NAME FOR FILE NUMBER", I
140
150
        INFUT D $ (I)
        D$(I)="/AREA1/CFOS_FLOT/"+D$(I)
155
        NEXT I
160
200
      FOR I=1 TO NUM
210
        OPEN#2 AS INPUT, D$(I)
220
        FOUNT=1
        FOR J=1 TO 12
230
240
          FOR k=1 TO 12
250
             KOUNT=KOUNT+1
             READ#2,1;NNAD,NAZM,FLUXUF,MIN,MAX
255
260
             READ#2, FOUNT; NAN (J), AZIM (K), N(I, J, K)
270
             NEXT F
           NEXT J
280
290
        CLOSE#2
        NEXT I
300
310
      FOR J=1 TO 12
320
        FOR N=1 TO 12
330
           SSN(J,k)=0
340
           SNS(J,K)=0
           NBAR(J,K)=0
350
           NSTD(J, K) = 0
360
370
           NEXT K
380
        NEXT J
      FOR J=1 TO 12
400
410
        FOR 1.=1 TO 12
420
           FOR I=1 TO NUM
430
             SSN(J,K) = SSN(J,K) + N(I,J,K) + N(I,J,K)
440
             SNS(J,K) = SNS(J,K) + N(I,J,K)
450
             NBAR(J,K) = NBAR(J,K) + N(I,J,K) / NUM
460
             NEXT I
470
           SNS(J,K) = SNS(J,K) * SNS(J,K)
480
           NSTD(J,E) = SOR((SSN(J,K) - SNS(J,K) / NUM) / (NUM-1))
490
           NSTD(J,E)=NSTD(J,K)/NBAR(J,K)
500
           PRINT J,K,NSTD(J,K)*100
510
          NEXT K
520
        NEXT J
530
      AVGERR=0
540
      FOR J=1 TO 12
550
        FOR +=1 TO 12
560
           AVGERR=AVGERR+NSTD(J,K)*100/144
570
           NEXT K
58Q
        NEXT J
590
      PRINT"OVERALL STANDARD ERROR FOR BDR", AVGERR
600
      END
```