

# Making Earth Science Data Records for Use in Research Environments (MEASURES) Projects Data and Services at the GES DISC B. Vollmer<sup>1</sup> (Bruce.E.Vollmer@nasa.gov), D. Ostrenga<sup>1,2</sup>, A. Savtchenko<sup>1,3</sup>, J. Johnson,<sup>1,3</sup> J. Wei<sup>1,2</sup>, W. Teng<sup>1,3</sup> and I. Gerasimov<sup>1,2</sup>

### **Overview of MEaSUREs at the GES DISC**

NASA's Earth Science Program is dedicated to advancing Earth remote sensing and pioneering the scientific use of satellite measurements to improve human understanding of our home planet. Through the MEaSUREs Program, NASA is continuing its commitment to expand understanding of the Earth system using consistent data records. Emphasis is on linking together multiple data sources to form coherent time-series, and facilitating the use of extensive data in the development of comprehensive Earth system models.

A primary focus of the MEaSUREs Program is the creation of Earth System Data Records (ESDRs). An ESDR is defined as a unified and coherent set of observations of a given parameter of the Earth system, which is optimized to meet specific requirements for addressing science questions. These records are critical for understanding Earth System processes; for the assessment of variability, long-term trends, and change in the Earth System; and for providing input and validation means to modeling efforts. Seven MEaSUREs projects will be archived and distributed through services at the Goddard Earth Sciences Data and Information Services Center (GES DISC).

### **MEaSUREs Projects at the GES DISC**

≻Reprocessing and Goddard Satellite-based Surface Turbulent Fluxes (GSSTF) Data Set for Global Water and Energy Cycle Research; PI: Chung-Lin Shie

Creating a Long Term Multi-Sensor Ozone Data Record; PI: Richard McPeters Consistent Long-Term Aerosol Data Records over Land and Ocean from SeaWiFS; PI: Christina Hsu

GOZCARDS: Global Ozone Chemistry and Related Trace Gas Data Records for the Stratosphere; PI: Lucien Froidevaux

Earth Surface and Atmosphere Reflectivity Since 1979 from Multiple Satellites (TOMS, SBUV, SBUV-2, OMI, SeaWiFS, NPP, and NPOESS); PI: Jay Herman

A Multi-Sensor Water Vapor Climate Data Record Using Cloud Classification; PI: Eric Fetzer

>Developing Consistent Earth System Data Records for the Global Terrestrial Water Cycle; PI: Eric Wood

### **MEaSUREs Information Portal**

The MEaSUREs Portal (http://disc.sci.gsfc.nasa.gov/measures) is a Web interface that compiles all the information available on each MEaSUREs project serviced through the GES DISC. The portal is an easy-to-navigate Web interface offering the following: documentation

| 💀 NASA Earth Data 🛛 Da           | ata Discovery 🗸 🛛 Data Centers 🗸 Community 🛪 Science Disciplines 🖌 Search EOSDIS 🗸   | ≻Data set d       |
|----------------------------------|--|-------------------|
| National Aerona<br>and Space Adm | utics Goddard Earth Sciences Data and Information Services Center  | ≻Data set a       |
| + ATMOS COMPOSITION              | + HYDROLOGY + A-TRAIN + AIRS + MODELING + MAIRS + MEASURES + PRECIPITATION   | ≻Latest nev       |
|                                  | MEaSUREs at GES DISC   | $\geq$ Tools to r |
| MEaSUREs at GES                  | Making Earth Science Data Records for Use in Research Environments   | > 10015 to 1      |
| DISC                             | You are here: <u>GES DISC Home</u> » <u>Measures</u> » <u>MEaSUREs Projects</u> » MEaSUREs Projects at the GES DISC  | LINKS to r        |
| » MEASURES PROJECTS              | MEASURES Projects at the GES DISC  | ➢Frequently       |
| + DOCUMENTATION                  | MEaSUREs Projects at the GES DISC  |                   |
| Additional Features              | Select a MEaSUREs program from the list and it will display the data information and access methods for the data products available by that program.   |                   |
| + Tools                          | Select Project:<br>Reprocessing and Goddard Satellite-based Surface Turbulent Fluxes (GSSTFb) Data Set for Global Water and Energy Cycle   |                   |
| + Links                          | <ul> <li>Research</li> <li>Creating a Long Term Multi-Sensor Ozone Data Record</li> </ul>  | Proje             |
| TINUS                            | <ul> <li>Consistent Long-Term Aerosol Data Records over Land and Ocean from SeaWIFS</li> <li>GOZCARDS: Global Ozone Chemistry and Related trace gas Data Records for the Stratosphere</li> </ul>   | IIOJC             |
|                                  | <ul> <li>Earth Surface and Atmosphere Reflectivity Since 1979 from Multiple Satellites (TOMS, SBUV, SBUV-2, OMI, SeaWIFS, NPP, and<br/>NPOESS)</li> </ul>  |                   |
|                                  | AMulti-Sensor Water Vapor Climate Data Record Using Cloud Classification     Developing Consistent Earth System Data Records for the global terrestrial water cycle  |                   |
|                                  | Project Information  |                   |
|                                  |  |                   |
|                                  | Energy Cycle Research  |                   |
|                                  | PI Name: Chung-Lin Shie  | Data se           |
|                                  | Project Description: The objective of this project is to continually produce a uniform data set of sea surface turbulent fluxes derived from remote sensing data and analysis that have been and continue to be useful for global energy and water flux research and   | D 1               |
|                                  | Energy and Water Cycle Study (NEWS) and World Climate Research Program (WCRP)/Global Energy and Water Experiment<br>(GEWEX), Model climate simulations show an enhanced hydrologic cycle, which must be corroborated with observations. The daily  | Readm             |
|                                  | temporal and one-degree spatial resolution of the product can be used to examining climate variability at these scales. Oceanic evaporation contributes to the net fresh water input to the oceans and drives the upper ocean density structure and consequently   | Dala              |
|                                  | the circulation of the oceans. On the other hand, the 12-hr temporal and a quarter degree spatial resolution of the product can be<br>used to studying the hurricane-ocean interaction of higher frequency scenario. Fully tested, these products can serve as a crucial<br>input for data assimilation of oceanic GCMs for forecasting. | Beni              |
|                                  | The original binary data can be found at: <u>ftp://meso-a.qsfc.nasa.qov/pub/shieftp/fluxdata</u> .   |                   |
|                                  | Formats: HDF-EOS 5 Readme Document: README for GSSTE2b   |                   |
|                                  | Science Behind the Data Document Science Background for the Reprocessing and Goddard Satellite-based Surface Turbulent   |                   |
|                                  | Fluxes (GSSTF2b) Data Set  |                   |
|                                  | Data Access Methods  |                   |
|                                  | Product: GSSTF.2b<br><u>GCMD DIF Document</u>  |                   |
|                                  | Long Name: Surface Turbulent Fluxes, 1x1 deg Daily Grid, Set1 and Set2<br>Mirador: http://mirador.gsfc.nasa.gov/cgi-bin/mirador/homepageAlt.pl?keyword=GSSTF   |                   |
|                                  | OPeNDAP:         http://measures.qsfc.nasa.qov/opendap/GSSTF/GSSTF.2b/contents.html           Direct FTP:         ftp://measures.qsfc.nasa.qov/data/s4pa/GSSTE/GSSTE.2b/   |                   |
|                                  | Product: GSSTE NCEP2h  |                   |
|                                  | <u>GCMD DIF Document</u>   |                   |
|                                  | Mirador: http://mirador.qsfc.nasa.qov/cqi-bin/mirador/homepaqeAlt.pl?keyword=GSSTF_NCEP  | Dr                |
|                                  | Direct FTP: <u>ftp://measures.qsfc.nasa.qov/data/s4pa/GSSTF/GSSTF_NCEP.2b/</u>   |                   |
|                                  | Product: GSSTF_F08.2b  | dat               |
|                                  | GCMD DIF Document Long Name: Surface Turbulent Fluxes, 1x1 deg Daily Grid, Satellite F08   |                   |
|                                  | Mirador:         http://mirador.qsfc.nasa.qov/cqi-bin/mirador/homepageAlt.pl?keyword=GSSTF_F08           OPeNDAP:         http://measures.qsfc.nasa.qov/opendap/GSSTF/GSSTF_F08.2b/contents.html   | t.                |
|                                  | Direct FTP: <u>ftp://measures.gsfc.nasa.gov/data/s4pa/GSSTF/GSSTF_F08.2b/</u>  |                   |
|                                  | Product: GSSTF_F10.2b<br>GCMD DIF Document   |                   |
|                                  | Long Name: Surface Turbulent Fluxes, 1x1 deg Daily Grid, Satellite F10<br>Mirador: http://mirador.gsfc.nasa.gov/cgi-bin/mirador/homepageAlt.pl?kevword=GSSTE_E10   |                   |
|                                  | OPeNDAP: http://measures.gsfc.nasa.gov/opendap/GSSTF/GSSTF_F10.2b/contents.html Direct FTP: ftp://measures.gsfc.nasa.gov/data/s4na/GSSTE/GSSTE_F10.2b/   | ac                |
|                                  | Product: GSSTE E11.2b  |                   |
|                                  | GCMD DIF Document  |                   |
|                                  | Long Name:         Surface Turbulent Fluxes, 1x1 deg Dally Grid, Satellite F11           Mirador: <a href="http://mirador.gsfc.nasa.gov/cgi-bin/mirador/homepageAlt.pl?keyword=GSSTF_F11">http://mirador.gsfc.nasa.gov/cgi-bin/mirador/homepageAlt.pl?keyword=GSSTF_F11</a>  |                   |
|                                  | OPeNDAP:         http://measures.gsfc.nasa.gov/opendap/GSSTF/GSSTF_F11.2b/contents.html           Direct FTP:         ftp://measures.gsfc.nasa.gov/data/s4pa/GSSTF/GSSTF_F11.2b/   |                   |
|                                  |  |                   |

access methods ws on projects read the data related Web sites ly Asked Questions

### ect selection

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≻These flux measurements are crucial to: •Understanding global water and energy cycles More accurate prediction of oceanic circulation and transport, owing to better estimation of global oceanic fresh water and momentum flux

Services and documentation available at

http://disc.sci.gsfc.nasa.gov/daacbin/DataHoldingsMEASURES.pl?PRO **GRAM\_List=ChungLinShie** 

Latent heat flux (shades) and wind stress (vectors) for 1998 El Niño, and 2008 La Niña, from GSSTF 2c. MEI from NOAA/ESRL, Wolter and Timlin, 1993 . Timlin, 1993: Monitoring ENSO in COADS with a seasonally adjusted principal component ndex. Proc. of the 17th Climate Diagnostics Workshop, Norman, OK, NOAA/NMC/CAC, NSSL, Oklahoma Climate Survey, CIMMS and the School of Meteorology, University of Oklahoma, 52-57.

### **MEaSUREs Services**

The MEaSUREs data sets will be available through multiple services such as Mirador, OPeNDAP, and the Simple Subset Wizard.



| OPeNDAP           | TF                  |      |                |          |
|-------------------|---------------------|------|----------------|----------|
| Name              | Last Modified       | Size | Response Links | Webstart |
| Parent Directory/ |                     |      |                |          |
| GSSTF.2b/         | 2011-06-17T15:20:03 | -    |                |          |
| GSSTF.2c/         | 2011-11-01T23:45:06 | -    |                |          |
| GSSTFM.2b/        | 2010-10-04T16:47:25 | -    |                |          |
| GSSTFM.2c/        | 2011-11-01T23:45:14 | -    |                |          |
| GSSTFMC.2b/       | 2011-03-24T17:08:54 | -    |                |          |
| GSSTFMC.2c/       | 2011-11-01T23:45:16 | -    |                |          |
| GSSTFM NCEP.2b/   | 2010-10-04T16:47:25 | -    |                |          |
| GSSTFM NCEP.2c/   | 2011-11-01T23:45:15 | -    |                |          |
| GSSTFSC.2b/       | 2011-03-24T17:09:16 | -    |                |          |
| GSSTFSC.2c/       | 2011-11-01T23:45:17 | -    |                |          |
| GSSTFYC.2b/       | 2011-03-24T17:09:25 | -    |                |          |
| GSSTFYC.2c/       | 2011-11-01T23:45:18 | -    |                |          |
| GSSTF F08.2b/     | 2010-10-04T16:47:24 | -    |                |          |
| GSSTF F08.2c/     | 2011-11-01T23:45:07 | -    |                |          |
| GSSTF F10.2b/     | 2010-10-04T16:47:24 | -    |                |          |
| GSSTF F10.2c/     | 2011-11-01T23:45:08 | -    |                |          |
| GSSTF F11.2b/     | 2010-10-04T16:47:25 | -    |                |          |
| GSSTF F11.2c/     | 2011-11-01T23:45:09 | -    |                |          |
| GSSTF F13.2b/     | 2010-10-04T16:47:25 | -    |                |          |
| GSSTF F13.2c/     | 2011-11-01T23:45:10 | -    |                |          |
| GSSTF F14.2b/     | 2010-10-04T16:47:25 | -    |                |          |

The Open Source Project for a Network Data Access **Protocol (OPeNDAP)** provides remote access to individual variables within datasets in a form usable by many tools, such as IDV, McIDAS-V, Panoply, Ferret and GrADS. http://measures.gsfc.nasa.gov/opendap/



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### http://disc.sci.gsfc.nasa.gov/measures

**Public Released Data Sets** 

≥20-year (1987/07-2008/12) series of fluxes of momentum and heat, and air-sea interface characteristics, such as gradient of humidity, temperature, and precipitable water vapor.

### **AVAILABLE:**

Individual Special Sensor Microwave/Imager (SSM/I) daily data.

Merged estimates on Daily and Monthly scales; Monthly, Seasonal and Yearly Climatology.

| Date Range                     | Number of Items | Avg Size (MB) |  |  |  |  |
|--------------------------------|-----------------|---------------|--|--|--|--|
| 1987-07-09<br>to<br>2009-01-01 | 7773            | 2.268         |  |  |  |  |
| 1987-07-01<br>to<br>2008-12-31 | 261             | 1.03          |  |  |  |  |
| 1992-01-01<br>to<br>2000-05-17 | 2978            | 2.268         |  |  |  |  |
| 1987-07-01<br>to<br>2009-01-01 | 7802            | 1.029         |  |  |  |  |
| 1988-01-01<br>to<br>2008-12-31 | 1               | 3.261         |  |  |  |  |
| 1988-02-01<br>to<br>2008-11-30 | 4               | 3.261         |  |  |  |  |
| 1988-01-01<br>to<br>2008-12-31 | 12              | 3.261         |  |  |  |  |
| 1997-05-08<br>to<br>2008-08-08 | 4109            | 2.268         |  |  |  |  |
| 2000-01-01<br>to<br>2009-01-01 | 3287            | 2.268         |  |  |  |  |
| 1995-05-03<br>to<br>2009-01-01 | 4989            | 2.268         |  |  |  |  |
| 1987-07-09<br>to<br>1992-01-01 | 1565            | 2.268         |  |  |  |  |
| 1991-01-07<br>to<br>1997-11-15 | 2443            | 2.268         |  |  |  |  |

*Mirador* is a drastically simplified interface that employs the Google mini appliance for metadata keyword searches. Other features include quick response, spatial and parameter subsetting, data file hit estimator, Gazetteer (geographic search by feature name capability), and an interactive shopping cart. http://http://mirador.gsfc.nasa.gov/

e Simple Subset Wizard (SSW) is designed to provide imple, unified user interface for submitting subset uests for data. http://disc.gsfc.nasa.gov/SSW/

## from SeaWiFS



Aerosol Optical Thickness (550nm) 1.0

> Daily swath (Level 2) and gridded (Level 3) products (including aerosol optical thickness and Ångström exponent, with coverage over both land and ocean)  $\succ$  The Level 3 products are available at both 0.5° and 1.0° grid resolutions. Services and documentation available at http://disc.sci.gsfc.nasa.gov/daacbin/DataHoldingsMEASURES.pl?PROGRAM\_List=ChristinaHsu

**More Data from** other Projects **Coming Soon** 

### **Data Interoperability, Provenance and Citation**

To provide some consistency and uniformity of MEaSUREs data produced by a variety of data providers (Principal Investigators), the GES DISC has established guidelines for metadata, data formats, and filenames used for MEaSUREs data sets archived and distributed through the GES DISC. A set of standard conventions on metadata and data format will facilitate data management, improve archiving and search methods to improve data sharing, and ultimately, optimize the information available within the data

> The goal is to have MEaSUREs data available and increase its utility to a broad user community, compatible with a wide array of tools (e.g., Panoply) and protocols (e.g., OPeNDAP).

GES DISC is working with data producers to capture and retain information on data provenance in metadata and documentation to enhance interpretation of data and contribute to reproducibility.

> New initiatives to use Data Citation standards: Data from each project will have a permanent citation URL\* with a Web page that contains all the necessary information on how to cite the data sets and any additional relevant information including documentation and data access methods.

Chung-Lin Shie, Long Chiu, Robert Adler, I-I Lin, Eric J. Nelkin, and Joe Ardizzone, 2010. Surface Turbulent Fluxes, 1x1 deg Monthly Grid, Set1 and Set2. Edited by A. Savtchenko. Greenbelt, MD: Goddard Earth Sciences Data and Information Services Center, accessed October 31, 2010 at http://disc.sci.gsfc.nasa.gov/datacite/GSSTFM.2b.html.

N. Christina Hsu, Corey Bettenhausen, and Andrew Sayer, 2011. SeaWiFS Deep Blue Optical Depth and Angstrom Component Daily Level 2 Data. Greenbelt, MD: Goddard Earth Sciences Data and Information Services Center, accessed July21, 2011 at http://disc.sci.gsfc.nasa.gov/datacite/GES\_DISC\_SWDB\_L2\_V002.html.

\* Digital Object Identifiers (DOIs) to replace URLs (2012)



### **Consistent Long-Term Aerosol Data Records over Land and Ocean**

Aerosol data products span the length of the SeaWiFS mission (1997-2010).

Long-term climate data records of aerosols are critically needed to form a consensus among the science community regarding the impact of aerosols on the global radiation budget. Towards this goal, this new data set was created using radiances from the long-running and wellcalibrated SeaWiFS mission, in conjunction with a new ocean retrieval algorithm and an extended Deep Blue retrieval algorithm over land, covering both bright desert as well as vegetated surfaces.



