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To address the threat of tsunami prediction from local slumps is problematic. To generate realistic models of tsunami generation and runup, an essential requirement is for the models to be validated by direct evidence provided from offshore surveying. Case studies are therefore required and a seminal example is the Papua New Guinea tsunami of 1998.

After considerable controversy over the origin of the 1998 PNG tsunami, there is now a body of evidence that supports a cause by sediment slumping offshore of the devastated area. In association with on-shore run-up measurements, five surveys carried out between 1999 and 2000 offshore of the most affected area have resulted in a composite suite of data that locates and images the slump and also allows appraisal of its geotechnical properties. An original dataset of multi-beam bathymetry, high resolution 3.5kHz data, multi-channel seismic, and piston cores in association with ROV and submersible images and direct seabed observation has now been improved with the acquisition in 2001 of a closely spaced grid of single channel seismic data. Better definition of the slump is now possible for use in modelling.

The slump geometry in the context of the regional tectonic setting, suggests a novel type of stability analysis performed with a 1D-consolidation code. The simulation results help constrain slump motion following failure. The geologic, bathymetric and soil mechanic data are now all used in new simulations of fully 3D tsunami generation by the slump as newly defined. The result is a more definite assessment of the susceptibility to slumping of the area offshore of northern PNG. The interpretations and analyses employed in this work may contribute to the identification of other regions susceptible to comparable offshore slumping and tsunami generation.

OS51B MCC: Hall D Friday 0830h EOS Data Access and Manipulation: Tools and Techniques Posters

Presiding: R Pfister, NASA Goddard Space Flight Center; J Behnke, NASA Goddard Space Flight Center; R Ullman, NASA Goddard Space Flight Center

OS51B-0150 0830h POSTER

EOSDIS Science Data Information and Analysis Systems

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NASA's Earth Science Data Information Systems (ESDIS) Project is committed to operating and maintaining a quality Earth Observing System (EOS) Data and Information System (EOSDIS) which enables research by Earth scientists and fosters data accessibility and application by the broader user community. With the recent launch of Aqua, a few hundred new datasets will be added to the current 1560 datasets available through EOSDIS.

One of the core functions at ESDIS is to enable the processing of all science data collected from the various EOS missions including Terra and Aqua, upcoming ICESat and Aura and other missions. There are many EOS Science data producers, data users, planners and managers of available data systems and tools for managing EOS data. There are also many services available through EOSDIS including those that will help scientists process, archive and access data and information for research, applications, planning and management.

This paper will describe system services, functionality, access requirements and procedures and the intended user community that work principally with EOSDIS data. It will address analysis tools, data population tools, specific EOSDIS data sets and metadata types, tools for metadata creation and management, tools for distribution, EOSDIS data formats and distribution techniques. New techniques are critical to the

success of EOS data manipulation including data mining, intelligent data archiving, data fusion, agent technologies, visualization, and other advanced information system concepts. Data management is key to EOSDIS and our strategic focus areas look to EOSDIS evolution, external integration, data system development and relationship building with our user community.

OS51B-0151 0830h POSTER

Earth Observing System (EOS) Data and Service Records Growing Through NASA's Global Change Master Directory

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The Earth Observing System (EOS), the cornerstone of NASA's Earth Science Enterprise (ESE) mission, is highlighted by the successful launches and instrument deployments of the Terra (launch: December, 1999) and Aqua (launch: May, 2002) spacecraft. Data collected by EOS instruments have significantly contributed to our understanding of Earth's processes with the first global pollution measurements, new global vegetation mapping, detection of large iceberg breakups in Antarctica, improved weather system models, and global wildfire monitoring.

How will the student, researcher, educator, planner, or interested public know where to find EOS data? NASA's Global Change Master Directory (GCMD) staff (<http://globalchange.nasa.gov>) works closely with EOS data centers to provide information about EOS data sets that can be searched through the directory. The GCMD holds data set descriptions that inform the user about the spatial and temporal coverage and resolution, where data can be ordered or downloaded, associated investigators, and links to the actual data, along with other information vital to assist the user in determining if the data are what is needed. The GCMD database contains more than 11,700 Earth science data set descriptions, of which more than 3000 refer to data from NASA ESE missions.

The GCMD database can be searched for EOS data sets using an extensive set of Earth science topic keywords (more than 1200 keywords are controlled through a 3 level hierarchy) or by free-text. Data sets can also be discovered by searching by platform (or spacecraft), instrument, data center, geographic location, or project. For example, a user may conduct a search for all data sets from Terra or data sets collected by the MODIS instrument.

Users can focus their searches using GCMD's portal technology to search only those data set descriptions available from the Federation of Earth Science Information Partners (ESIP) through the ESIP portal (<http://gcmd.nasa.gov/Data/portals/esip/>). The ESIP consists of EOS data providers, along with other researchers and organizations using EOS data for research and applications. In addition to locating EOS data sets, users can discover other Earth science data sets from outside the EOS community relevant to global change research from over 1500 data providers from around the world.

Earth science related services (<http://gcmd.nasa.gov/services/>) are also searchable. Examples range from specialized tools for browsing, manipulating, and visualizing EOS data products to Earth science educational products and environmental hazard advisory services. Users can search the services database using controlled keywords or free-text to discover data set specific tools like the misr-view visualization software for MISR and AirMISR data or the Graphical Interface for Subsetting, Mapping, and Ordering (GISMO) tool for snow and ice data.

URL: <http://globalchange.nasa.gov>

OS51B-0152 0830h POSTER

Earth Observing System (EOS) Clearinghouse: A Framework for Sharing Community Data, Services and Tools

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The Earth Observing System ClearingHouse (ECHO) is an enabling framework that allows different data systems and services to work together therefore allowing communities to share tools, services and data. An open system, ECHO's application program interfaces (APIs) are published for use by the user community. The idea is to extend available Earth science resources from the science community, to the science community. ECHO accomplishes this through a metadata clearinghouse and service broker application program interfaces (APIs) based on XML and web service technologies. ECHO is being developed and released in increments to allow for insight and feedback during the development process. As a metadata clearinghouse, it supports iterative query data access and a newer data access paradigm called navigation/discovery, that serves to eliminate zero-hit and mega-hit results sets. As a service broker, ECHO decentralizes tools for manipulating data and supports interoperability of distributed functions. A well documented, message based interface is provided instead of an integrated web server. This approach allows various providers to build their own user interfaces so they are not limited by any single integrated data search and order system. This new approach is consistent with the trend toward a federated community.

URL: <http://eos.nasa.gov/echo>

OS51B-0153 0830h POSTER

EOS-WEBSTER - Providing Satellite Imagery for Everyone

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The University of New Hampshire's WEB-based System for Terrestrial Ecosystem Research (EOS-WEBSTER) distributes a special collection of data and imagery products for the Earth Science community. This collection includes satellite imagery from several sensors including the MODIS instrument aboard TERRA. Our services have been designed so that different types of users can access and use only the data that they want. Users can search EOS-WEBSTER's collections, create spatial and temporal subsets, and order data in ASCII or binary formats. We have developed a suite of MODIS products covering Amazonia. These products serve the Large Scale Biosphere-Atmosphere Project in Amazonia (LBA), a joint project of the Brazilian government and NASA. Products include 8-day reflectances (MOD09A1), daily fire potential (MOD14A1), and 16-day NDVis (MOD13Q1), starting in January 2001. EOS-WEBSTER takes care of obtaining the 14 MODIS tiles that cover Amazonia and stitching them together into a seamless regional coverage. Users can cookie-cut the regional data into smaller areas of interest, such as a field site, a political boundary, or a watershed, then choose an output format such as GrADS and retrieve their order by ftp or on CD-ROM. EOS-WEBSTER delivers MODIS to users whether or not they can manipulate the HDF-EOS format. These regional data sets were developed in cooperation with Eros Data Center to facilitate use of MODIS products by the LBA community. Other products and regions can be developed for other user communities if there is enough interest. Please contact us at support@eos-webster.sr.unh.edu for more information. MODIS is only one of a variety of imagery products available from EOS-WEBSTER. Other platforms include Landsat, SPOT-VEGETATION and IKONOS. We provide Landsat imagery data access to educators by supporting the Forest Watch program, an educational project that includes K-12 teachers and students in UNH research activities that assess the state-of-health of local forest stands. EOS-WEBSTER is a member of the Federation of Earth Science Information Partners (<http://esipfed.org>) and can be viewed at <http://eos-webster.sr.unh.edu>.

OS51B-0154 0830h POSTER

The NASA Earth Observing System Data Gateway

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The Earth Observing System Data Gateway (EDG) is a web-based interface that provides a single point of access to over fifteen hundred data collections held by NASA's Distributed Active Archive Centers (DAACs) and other collaborating data provider sites in the United States and worldwide. These collections include data from current EOS missions Terra and Landsat 7 as well as heritage Earth observation missions and field programs. Data from the recently launched EOS Aqua satellite will also be accessible soon. The EDG is a comprehensive data search and order system that enables users to specify data search criteria, review search results and associated information and preview browse images prior to placing an order request. Other more targeted functions such as Landsat scene subsetting and the ability to search for Atmospheric Infrared Sounder (AIRS) data using global summary browse imagery are also available. This poster will describe and illustrate the end-to-end functionality of the EDG from the users point-of-view.

OS51B-0155 0830h POSTER

The "End-User GIS" Module in the pan-European Satellite-based Information System on Coastal Areas and Lakes (SISCAL)

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SISCAL is a pan-European project dedicated to provide end-users with customized and easy-to-use products (e.g. chlorophyll-a, TSM, SST, TOA etc.) for environmental monitoring of European coastal areas and lakes. SISCAL tries to close the gap between research, satellite data providers and end users. SISCAL is creating a software processor that provide Near-Real-Time data products derived from satellite data and ancillary GIS-based information. The data products and information exchange is taking place entirely through the internet and are tailored to individual customers needs, allowing them to exploit Earth Observation data without extensive and specialized in-house knowledge.

In the frame of SISCAL an End-User GIS module is developed based on ArcView 8.2 software and Spatial Analyst extension from ESRI. The module enables the end-user to automatically download, transform and archive EO products and its metadata from the SISCAL server. During the archiving process (Personal Geodatabase), the module evaluates the incoming products and alarm the end-users if it exceeds pre-defined minimum and maximum values. Special GIS functions are developed for calculating average, difference, trends and other composite scenarios. The End-User GIS module is currently at a prototype stage and is used by the SISCAL end-users for evaluation.

URL: <http://www.siscal.net>

OS51B-0156 0830h POSTER

NWGISS: The Web GIS Software Suite for Interoperable Access and Manipulation of EOS Data

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NASA HDF-EOS Web GIS Software Suite (NWGISS) is a web-based data and information system that provides interoperable data accesses and services of HDF-EOS data to users. The software suite consists of a set of OGC standard compliant components, including a Web Map Server, a Web Coverage Server, a Catalog/Registries Server, a Multiple-protocol Geoinformation Client, and a Toolbox. Those components can work either independently or collaboratively. NWGISS can work with any HDF-4 based HDF-EOS

data. The map server serves HDF-EOS data as maps to any OGC-compliant map clients. The coverage server allows GIS users to access multi-dimensional data at user specified geographic location, parameters, map projection, and formats in interoperable way. The catalog/registries server provides the catalog search capabilities to OGC-compliant catalog clients. The Multi-protocol Geoinformation Client enables users to access multi-source data served by OGC compliant web coverage, map, and feature servers and provides a set of data manipulation, processing, and analysis functions at user's desktop. The tool component consists of two-way translators between HDF-EOS and major GIS formats as well as the CreateCapabilities program that automatically creates the XML capability descriptions from the metadata in HDF-EOS. The combination of NWGISS servers and client provides interoperable, personalized, on-demand access and manipulation of EOS data to user community. Executables of all NWGISS components are free to any users and can be downloaded from <http://laits.gmu.edu>.

URL: <http://laits.gmu.edu>

OS51B-0157 0830h POSTER

The Data Validation User Interface: A Navigation/Discovery Client Via ECHO

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The Data Validation User Interface (DVUI) is a proof of concept to show that the Earth Observing System ClearingHouse (ECHO) can support a new data access paradigm and to meet the needs of a real user group that needed cross DAAC data and the type of metadata that will be in ECHO. The DVUI uses the navigation/discovery data access paradigm rather than the more-widely used search and retrieval paradigm. Navigation/discovery UIs allow users to form queries and query the database simultaneously. Users form queries implicitly by selecting desired attribute values from valids. Navigation/discovery UIs can display result set statistics during the query process, so users can know immediately whether their chosen query criteria yields no results or thousands of results. Navigation/discovery UIs rely on the fact that metadata is hosted locally, so the ECHO architecture was an appropriate choice to pursue this UI type.

Specifically, the DVUI allows users to amass the data products needed to validate MODIS land products. The MODIS Land Validation Community currently uses 37 datasets and 4 different UIs to meet their routine validation data access needs. They are further limited because the UIs do not have coincidence evaluation capabilities. The DVUI streamlines the process to one UI and allows users to complete a coincidence evaluation by displaying the results' spatial footprints that are within a spatial and temporal tolerance.

OS51B-0158 0830h POSTER

Content-Based Metadata Workbench: An innovative Tool to Compare Geophysical Parameters

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Content Based Metadata Workbench (CBMW) is a prototype that seeks to improve the utility of information hidden in NASA's Earth science data systems by providing a global geophysical parameter data warehouse that is interoperable with metadata search systems. It will provide the following: a mechanism for content-based metadata searching of Earth science data, a research planning tool that includes inter-parameter visualization, and a broad warehouse of meaningful Earth science data to serve as a target for data mining. The team has just completed phase one of the prototype, which includes the development of CBMW data warehouse and integration of ordering interface and visualization of multiple parameters.

CBMW takes an innovative approach to identify and compare anomalies and events from higher-level satellite remote sensing data products. CBMW has used

level-3 Earth science data products and built a content-metadata "warehouse". This warehouse will serve as a data workbench for other data mining prototypes. CBMW used level 3 data products since they are based on widely accepted algorithms and relatively smaller in volume compared to lower level products. Using products from EOS Terra MODIS atmosphere data, TRMM fire and precipitation data, and AVHRR NVDI data, a database was developed to store geophysical parameters. The database was integrated with a GUI that enables detection of anomalies and relationships between multiple geophysical parameters through visualization.

CBMW will provide the following: a mechanism for content-based Metadata searching of Earth science data, a research planning tool that includes inter-parameter visualization, and a broad warehouse of meaningful Earth science data to serve as a target for data mining. CBMW data warehouse is also interoperable with metadata search systems such as ECHO.

OS51B-0159 0830h POSTER

Providing Direct Access to EOS Data via Data Pools

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As the EOSDIS archives grow, it could easily become more difficult for users to find and retrieve the data they need and to quickly get that data into a form they can use. NASA has been developing capabilities to address this concern over the past year and recently deployed an initial set of capabilities to its major Distributed Active Archive Centers (DAACs). The solution, called Data Pools, makes a significant portion of the data in the EOSDIS archives available on-line for immediate access, and provides several innovative data navigation, tailoring and rapid access services to help users quickly find just the data they need, get it into a form they can use, and then quickly retrieve the data. Ultimately, the Data Pools architecture will be expanded to provide a cost-effective evolutionary architecture for EOSDIS. This presentation describes the Data Pools architecture, its role in future EOSDIS evolution, and results to date of the Data Pool deployment.

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ECS DAAC Data Pools

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As part of its Earth Observing System (EOS), NASA supports operations for several satellites including Landsat 7, Terra, and Aqua. ECS (EOSDIS Core System) is a vast archival and distribution system and includes several Distributed Active Archive Centers (DAACs) located around the United States. EOSDIS reached a milestone in February when its data holdings exceeded one petabyte (1,000 terabytes) in size. It has been operational since 1999 and originally was intended to serve a large community of Earth Science researchers studying global climate change. The Synergy Program was initiated in 2000 with the purpose of exploring and expanding the use of remote sensing data beyond the traditional research community to the applications community including natural resource managers, disaster/emergency managers, urban planners and others. This included facilitating data access at the DAACs to enable non-researchers to exploit the data for their specific applications.

The combined volume of data archived daily across the DAACs is of the order of three terabytes. These archived data are made available to the research community and to general users of ECS data. Currently, the average data volume distributed daily is two terabytes, which combined with an ever-increasing need for timely access to these data, taxes the ECS processing and archival resources for more real-time use than was previously intended for research purposes. As a result, the delivery of data sets to users was being delayed in many cases, to unacceptable limits.

Raytheon, under the auspices of the Synergy Program, investigated methods at making data more accessible at a lower cost of resources (processing and archival) at the DAACs. Large on-line caches (as big as 70 Terabytes) of data were determined to be a solution that would allow users who require contemporary data to access them without having to pull it from the archive. These on-line caches are referred to as "Data Pools."

In the Data Pool concept, data is inserted via subscriptions based on ECS events, for example, arrival of data matching a specific spatial context. Upon acquisition, these data are written to the Data Pools as well as to the permanent archive. The data is then accessed

via a public Web interface, which provides a drilldown search, using data group, spatial, temporal and other flags. The result set is displayed as a list of ftp links to the data, which the user can click and directly download. Data Pool holdings are continuously renewed as the data is allowed to expire and is replaced by more current insertions. In addition, the Data Pool may also house data sets that though not contemporary, receive significant user attention, i.e. a Chernobyl-type of incident, a flood, or a forest fire.

The benefits are that users who require contemporary data can access the data immediately (within 24 hours of acquisition) under a much improved access technique. Users not requiring contemporary data, benefit from the Data Pools by having greater archival and processing resources (and a shorter processing queue) made available to them. All users benefit now from the capability to have standing data orders for data matching a geographic context (spatial description), a capability also developed under the Synergy program.

The Data Pools are currently being installed and checked at each of the DAACs. Additionally, several improvements to the search capabilities, data manipulation tools and overall storage capacity are being developed and will be installed in the First Quarter of 2003.

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Near-line Archive Data Mining at the Goddard Distributed Active Archive Center

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NASA's Earth Observing System (EOS) is generating immense volumes of data, in some cases too much to provide to users with data-intensive needs. As an alternative to moving the data to the user and his/her research algorithms, we are providing a means to move the algorithms to the data. The Near-line Archive Data Mining (NADM) system is the Goddard Earth Sciences Distributed Active Archive Center's (GES DAAC) web data mining portal to the EOS Data and Information System (EOSDIS) data pool, a 50-TB online disk cache. The NADM web portal enables registered users to submit and execute data mining algorithm codes on the data in the EOSDIS data pool. A web interface allows the user to access the NADM system. The users first develops personalized data mining code on their home platform and then uploads them to the NADM system. The C, FORTRAN and IDL languages are currently supported. The user developed code is automatically audited for any potential security problems before it is installed within the NADM system and made available to the user. Once the code has been installed the user is provided a test environment where he/she can test the execution of the software against data sets of the user's choosing. When the user is satisfied with the results, he/she can promote their code to the "operational" environment. From here the user can interactively run his/her code on the data available in the EOSDIS data pool. The user can also set up a processing subscription. The subscription will automatically process new data as it becomes available in the EOSDIS data pool. The generated mined data products are then made available for FTP pickup. The NADM system uses the GES DAAC-developed Simple Scalable Script-based Science Processor (S4P) to automate tasks and perform the actual data processing. Users will also have the option of selecting a DAAC-provided data mining algorithm and using it to process the data of their choice.

OS51B-0162 0830h POSTER

Making NASA Data Easier to Use: Data Product Standardization for NASA's EOS Aura Mission

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The four instruments, HIRDLS, MLS, OMI and TES, aboard NASA's Earth Observing System (EOS) Aura satellite will make important contributions to atmospheric chemistry and climate change research. To promote cross-platform synergy and to make the data easier to use in general, the Aura instrument teams are standardizing their Level 2 data products as much as possible. While the Hierarchical Data Format for EOS (HDF-EOS) constrains HDF with its POINT, SWATH and GRID implementations, it is still possible to create two files that are completely different and would require dramatically different readers. By adhering to a more rigid standard, Aura instrument teams are attempting to aid satellite-wide data usability. An overview of the Aura HDF-EOS File Format Guidelines will be presented and the features that ease data use will be highlighted.

URL: <http://www.eos.ucar.edu/irdls/HDFEOS-Aura-File-Format-Guidelines.doc>

OS51B-0163 0830h POSTER

Stable Data Element Referencing and Formal Reformatting Languages for Earth Science Data

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In many cases, interdisciplinary data users need to be able to identify particular data elements within files, even if the files have moved from their original data providers and have been reformatted. For example, if a science investigator has identified MODIS pixels belonging to a hurricane, his work may require his being able to find the same pixels even if that file has been transferred from NASA to NOAA, where the latter may have reformatted the original file. We describe the ability to obtain and extract such identifiable data elements as 'referential stability'. In this paper, we identify important constraints that referential stability places upon reformatting and explore the possibilities of supporting this constraint using formal descriptions of reformatting processes. The approach we suggest is useful for extracting nameable subsets from files, which allows extensible metadata annotations based on object identification from data mining, and for reducing error in reformatting files when they are moved from one medium to another as part of persistent data archival.

OS51B-0164 0830h POSTER

Selecting HDF5 as the Standard for NPOESS Environmental and Sensor Data Products

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The National Polar-orbiting Operational Environmental Satellite System (NPOESS) will, in the next decade, replace two existing polar environmental satellite systems, DMSP and POES. The converged system will provide significantly enhanced sensing characteristics desired by the civil and national security communities. As a result, raw and processed data rates will increase by at least 30-fold.

The interface data processing segment (IDPS) produces raw, calibrated sensor, and environmental data products for its direct users significantly faster than current systems. Four major NOAA and DoD processing sites will each host a full version of IDPS. Similar

software will be provided to users who wish to process direct downlinks from the NPOESS satellites.

The program office and its TRW/Raytheon contractor team chose HDF5 as the standard to distribute IDPS data to users. After considering a variety of available format standards, several attributes led to this selection.

- o Familiarity – Environmental scientists already have experience with the standard, most recently from EOS products.

- o Maturity – HDF has shown its "staying power", and has been available long enough to have matured from user experiences. NASA, DOE, and others invested heavily in its development.

- o Capability – HDF was designed to manage large, compound data sets within high performance computing environments.

- o Compatibility – HDF operates on multiple appropriate operating systems.

- o Availability – HDF was developed in the public interest at NCSA, and is freely available.

- o Interoperability – The DoD Joint Technical Architecture is in the process of accepting HDF as a standard for interoperability among DoD systems.

The NPOESS engineering development phase began this fall. Under the shared system responsibility contracting model, TRW and Raytheon have begun to work with the program office and consult with NCSA to make final implementation decisions. Among the issues to be considered are the relationship between HDF and descriptive metadata; consistent data structure implementations for dissimilar sensors; correlations between time- and space-delimited data sets; and policies to assure long-term stability of the standard.

The IDPS will be ready with its HDF implementation to support the NPOESS Preparatory Program in 2006. NPP is a joint NASA-NPOESS program office mission designed to provide interim data continuity to the climate research community, and to reduce risk for the new NPOESS sensors.

URL: <http://www.ipo.noaa.gov>

OS51B-0165 0830h POSTER

Backtrack Orbit Search Algorithm

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A Mathematical Solution to a Mathematical Problem.

With the dramatic increase in satellite-borne sensor resolution traditional methods of spatially searching for orbital data have become inadequate. As data volumes increase end-users of the data have become increasingly intolerant of false positives. And, as computing power rapidly increases end-users have come to expect equally rapid search speeds. Meanwhile data archives have an interest in delivering the minimum amount of data that meets users' needs. This keeps their costs down and allows them to serve more users in a more timely manner.

Many methods of spatial search for orbital data have been tried in the past and found wanting. The ever popular lat/lon bounding box on a flat Earth is highly inaccurate. Spatial search based on nominal "orbits" is somewhat more accurate at much higher implementation cost and slower performance. Spatial search of orbital data based on predict orbit models are very accurate at a much higher maintenance cost and slower performance.

This poster describes the Backtrack Orbit Search Algorithm—an alternative spatial search method for orbital data. Backtrack has a degree of accuracy that rivals predict methods while being faster, less costly to implement, and less costly to maintain than other methods.

OS51B-0166 0830h POSTER

Spatial Tools for a Round Planet

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For many geophysical disciplines it is sufficient, and often expedient, to treat the Earth as a Cartesian plane, at least for data search and order purposes. Unfortunately the Earth is round and the majority of Earth Science data is being gathered by satellite born sensors circling the Earth in polar orbits. As the number of sensors increases, and the resolution of those sensors increases, the sheer volume of the available data has made the flat Earth paradigm increasingly problematic.

Cryospheric Science is one discipline that is ill-served by the flat Earth paradigm so the National Snow and Ice Data Center has been working with the sphere for quite some time. We have found that treating the Earth as a sphere significantly increases spatial search accuracy for many data types and consequently can be

of equal, or even greater, benefit to scientists working in the tropics and mid-latitudes. This poster describes a number of Java tools we have developed to make working with the sphere easier on both sides (client and server) of data search and order systems.

OS51B-0167 0830h POSTER

HDF-EOS Tools and Information Web Site

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The ESDIS Project at NASA/GSFC maintains an HDF-EOS Tools and Information web site (<http://hdfeos.gsfc.nasa.gov>) from which visitors can obtain information about HDF-EOS data formats, libraries, and tools; past and future HDF & HDF-EOS Workshops; and links to other sites with related information. With this web site we hope to serve as a central location through which users can find information about HDF-EOS; provide information about or download of tools that support HDF-EOS; incorporate real users' feedback regarding the tools including which tools work best for different applications, etc.; and announce upcoming HDF & HDF-EOS Workshops and serve proceedings from past workshops.

The web site recently underwent a major upgrade in order to facilitate more interactions with and feedback from HDF-EOS users. The site began to deploy several new features in May of this year including a filterable tool list, an enhanced user feedback section, and a searchable workshop presentation database. Future plans include hosting an online, searchable archive of the eosools mailing list.

URL: <http://hdfeos.gsfc.nasa.gov>

OS51B-0168 0830h POSTER

EOS ODL Metadata On-line Viewer

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We have recently developed and deployed an EOS ODL metadata on-line viewer. The EOS ODL metadata viewer is a web server that takes: 1) an EOS metadata file in Object Description Language (ODL), 2) parameters, such as which metadata to view and what style of display to use, and returns an HTML or XML document displaying the requested metadata in the requested style. This tool is developed to address widespread complaints by science community that the EOS Data and Information System (EOSDIS) metadata files in ODL are difficult to read by allowing users to upload and view an ODL metadata file in different styles using a web browser. Users have the selection to view all the metadata or part of the metadata, such as Collection metadata, Granule metadata, or Unsupported Metadata. Choices of display styles include 1) Web: a mouseable display with tabs and turn-down menus, 2) Outline: Formatted and colored text, suitable for printing, 3) Generic: Simple indented text, a direct representation of the underlying ODL metadata, and 4) None: No stylesheet is applied and the XML generated by the converter is returned directly. Not all display styles are implemented for all the metadata choices. For example, Web style is only implemented for Collection and Granule metadata groups with known attribute fields, but not for Unsupported, Other, and All metadata.

The overall strategy of the ODL viewer is to transform an ODL metadata file to a viewable HTML in two steps. The first step is to convert the ODL metadata file to an XML using a Java-based parser/translator called ODL2XML. The second step is to transform the XML to an HTML using stylesheets. Both operations are done on the server side. This allows a lot of flexibility in the final result, and is very portable cross-platform. Perl CGI behind the Apache web server is used to run the Java ODL2XML, and then run the results through an XSLT processor. The EOS ODL viewer can be accessed from either a PC or a Mac using Internet Explorer 5.0+ or Netscape 4.7+.

URL: http://ufm.gsfc.nasa.gov/EOS_ODL_view.html

OS51B-0169 0830h POSTER

HDF-EOS DATA AND METADATA UPDATING AND VERIFYING TOOLS

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This presentation introduces two HDF-EOS data usability tools. One is HDF-EOS metadata updater and another is HDF-EOS data verifier. During EOS data processing and archiving, two metadata files are produced. One is an independent metadata file, i.e., .met file that is usually delivered with the HDF-EOS datasets, and the other is a metadata file embedded in HDF-EOS data. The .met file contains inventory and collection metadata while metadata in HDF-EOS file contains archival and inventory metadata. In order to get complete metadata information, users need to access both metadata files. This tool is to combine two metadata files and update the metadata file embedded in the HDF-EOS using the combined metadata file.

HDF-EOS data verifier tool is to verify and rename HDF-EOS field names to standard HDF-EOS naming conventions so that other tools using standard HDF-EOS library can access the data fields. This tool has two functions: discovering field names that do not conform to the standard HDF-EOS naming conventions and renaming them to standard names.

These tools have command line and GUI versions. The metadata reading and writing components are using HDF-EOS and ODL libraries in C language. The GUI components are using Java language. These components are integrated using GUI Java Native Interface (JNI). HDF-EOS metadata updater and data verifier tools can be used by data providers in data production or end users.

OS51B-0170 0830h POSTER

An Open Software Tool to Support Data Visualization

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Much success has been derived from employing "playback" tools for the viewing and analysis of instrument telemetry. The ability to quickly navigate through a data set and detect anomalies, find patterns and recognize trends is powerful, and can quickly result in increased data quality. A typical playback tool is composed of a controller, one or more views and a data model.

Here we present such a tool extended to work with geophysical data sets and an extensible framework that allows researchers to plug-in their own data models and views. An open, collaborative environment is promoted by allowing data models (for access) and views (for display/analysis) to be shared and modified as needed. The software architecture is outlined along with results of a case-study developed with simulated HIRDLS data using the NASA EOS Aura Level-2 format. Future development will focus on facilitating inter-comparisons (using multiple data models) and other tasks commonly associated with validation.

OS51B-0171 0830h POSTER

Chaining Distributed Services for Mining, Fusion, and Visualization

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The Information Technology and Systems Center (ITSC) at the University of Alabama in Huntsville, as a NASA Earth Science Information Partner (ESIP), is researching the use of distributed services for data mining, subsetting, image processing, image/map generation and other spatially oriented data applications.

Many of these applications lend themselves well to being broken down into discrete processes that can be combined in different ways to solve more complex problems. A service chain may combine a variety of processing or analysis services, like data mining, with standard protocols for returning results to the user, such as the Web Mapping Services defined by the OpenGIS Consortium. However, applying distributed service technologies to the processing of Earth Science data sets presents unique problems. Conventional distributed service protocols such as the Simple Object Access Protocol (SOAP) tend to be best suited for exchanging textual data or relatively small amounts of binary data, but processing Earth Science data typically means working with files on the order of megabytes or even gigabytes in size. ITSC researchers have been investigating alternative solutions for providing distributed services that are capable of processing and passing large amounts of data in a service chaining architecture. ITSC will demonstrate integrating simple, autonomous data processing services into chains that efficiently process large Earth Science data sets and can be easily reused in other distributed applications. This presentation will illustrate how the Earth Science Markup Language (ESML) can be used in this environment to describe the output format of a service in the same way it is used to describe the format of a data set.

OS51B-0172 0830h POSTER

The EOS Imaging Tool

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The EOS Imaging Tool, developed at the National Snow and Ice Data Center (NSIDC), is designed to maximize the utility of MODIS data products, in particular the snow and ice products archived at the NSIDC DAAC. Originally called the Polar HDF-EOS Data Imaging and Subsetting (PHDIS) Tool, the software has been greatly enhanced to work with a wider variety of products, and to allow access to the bit-level metadata stored in many MODIS products. This poster will demonstrate this new functionality together with the original interface which can be used to open, geolocate, and create images from any number of swath or grid products in separate but dynamically linked windows.

OS51B-0173 0830h POSTER

Libraries and Tools for efficiently computing and analyzing NASA Earth Science Data with HDF and HDF5

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The Hierarchical Data Format (HDF) developed at the National Center for Supercomputing Application (NCSA) at University of Illinois at Urbana-Champaign has become the primary standard file format for storing data from NASA's Earth Observing System (EOS). Data from Landsat 7 and Terra (including the CERES, MODIS and MISR instruments) are all stored in HDF and/or HDF-EOS.

HDF5 is a new data format and library, which has many significant improvements over the older versions of HDF. HDF5 can support files larger than 2 Gigabytes and a much larger number of objects in one file. Moreover, the parallel version of HDF5 is capable of performing I/O efficiently in parallel computing environments (including Linux clusters). Parallel HDF5 uses MPI-I/O.

HDF5 is or soon will be used by many important Earth Science projects. Future NASA EOS missions, beginning with the Aura platform (to be launched in 2003) will use HDF5 and HDF-EOS5. The NPOESS project is considering HDF5 as its primary data format. NCSA is integrating HDF5 into the WRF model.

URL: <http://hdf.nasa.uiuc.edu>

OS51B-0174 0830h POSTER

HDF5 Tools in the Interactive Data Language (IDL)

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The Interactive Data Language, from Research Systems, Inc. (A Kodak subsidiary), now supports tools for querying and reading HDF5 files. The HDF5 module is included as part of the standard IDL application, available from <http://www.ResearchSystems.com>. The IDL HDF5 interface consists of a dynamically loadable module that provides a set of IDL software routines to directly access the NCSA HDF5 C library. In addition, the IDL HDF5 module has the ability to parse entire HDF5 files into IDL structures, and contains an HDF5 Browser which lets users interactively explore files and import data into IDL. We will demonstrate the use of the HDF5 routines, as well as the parser and the HDF5 Browser.

URL: <http://www.ResearchSystems.com>

OS51B-0175 0830h POSTER

WINVICAR A Windows Based Image Analysis Software Package Suitable for Manipulating EOS Data

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WINVICAR is a collection of approximately 150 programs developed for processing of image data on the Windows platform. WINVICAR is a derivative of the VICAR package developed for image processing on the Unix and VAX/VMS platforms. The programs in the WINVICAR package can be run either at the command prompt or via a graphical user interface (GUI). The programs can also be scripted in batch files. The GUI interface requires that Microsoft Internet Explorer and the Microsoft Windows Scripting be installed on the computer. WINVICAR works on the more recent versions of the Windows operating system. The WINVICAR package includes a customized radiative transfer code for determining and compensating for atmospheric effects in image data. WINVICAR includes numerous programs developed specifically for manipulating data from certain NASA imaging instruments such as the MASTER airborne simulator. MASTER is an airborne imaging system designed to simulate and help validate data from the Moderate Resolution Imaging Spectroradiometer (MODIS) and Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER) instruments on NASA Spacecraft.

Although the WINVICAR package contains numerous general-purpose image-processing programs for completeness, its primary purpose is to allow users to manipulate data from certain NASA airborne and spaceborne imaging instruments.

The WINVICAR package is distributed through the WINVICAR website:

<http://winvicar.jpl.nasa.gov>

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Reference herein to any specific commercial product, process, or service by trade names, trademark, manufacturer or otherwise does not imply endorsement by the United States or the Jet Propulsion Laboratory, California Institute of Technology.

URL: <http://winvicar.jpl.nasa.gov>

OS51B-0176 0830h POSTER

GES DAAC HDF Data Processing and Visualization Tools

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The Goddard Earth Sciences (GES) Distributed Active Archive Center (DAAC) plays a major role in enabling basic scientific research and providing access to scientific data to the general user community. Several GES DAAC Data Support Teams provide expert assistance to users in accessing data, including information on visualization tools and documentation for data products. To provide easy access to the science data, the data support teams have additionally developed many online and desktop tools for data processing and visualization. This presentation is an overview of major HDF tools implemented at the GES DAAC and aimed at optimizing access to EOS data for the Earth Sciences community. GES DAAC ONLINE TOOLS: MODIS and AIRS on-demand Channel/Variable Sub-setter are web-based, on-the-fly/on-demand subsetters that perform channel/variable subsetting and restructuring for Level1B and Level 2 data products. Users can specify criteria to subset data files with desired channels and variables and then download the subsetted file. AIRS QuickLook is a CGI/IDL combo package that allows users to view AIRS/HSB/AMSU Level-1B data online by specifying a channel prior to obtaining data. A global map is also provided along with the image to show geographic coverage of the granule and flight direction of the spacecraft. OASIS (Online data Analysis) is an IDL-based HTML/CGI interface for search, selection, and simple analysis of earth science data. It supports binary and GRIB formatted data, such as TOVS, Data Assimilation products, and some NCEP operational products. TRMM Online Analysis System is designed for quick exploration, analyses, and visualization of TRMM Level-3 and other precipitation products. The products consist of the daily (3B42), monthly (3B43), near-real-time (3B42RT), and Willmott's climate data. The system is also designed to be simple and easy to use - users can plot the average or accumulated rainfall over their region of interest for a given time period, or plot the time series of regional rainfall average. WebGIS is an online web software that implements the Open GIS Consortium (OGC) standards for mapping requests and rendering. It allows users access to TRMM, MODIS, SeaWiFS, and AVHRR data from several DAAC map servers, as well as externally served data such as political boundaries, population centers, lakes, rivers, and elevation. GES DAAC DESKTOP TOOLS: HDFLook-MODIS is a new, multifunctional, data processing and visualization tool for Radiometric and Geolocation, Atmosphere, Ocean, and Land MODIS HDF-EOS data. Features include (1) accessing and visualization of all swath (Levels 1 and 2) MODIS and AIRS products, and gridded (Levels 3 and 4) MODIS products; (2) re-mapping of swath data to world map; (3) geo-projection conversion; (4) interactive and batch mode capabilities; (5) subsetting and multi-granule processing; and (6) data conversion. SIMAP is an IDL-based script that is designed to read and map MODIS Level 1B (L1B) and Level 2 (L2) Ocean and Atmosphere products. It is a non-interactive, command line executed tool. The resulting maps are scaled to physical units (e.g., radiances, concentrations, brightness temperatures) and saved in binary files. TRMM HDF (in C and Fortran), reads in TRMM HDF data files and writes out user-selected SDS arrays and Vdata tables as separate flat binary files.

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TRMM Online Analysis System

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The Tropical Rainfall Measuring Mission (TRMM) is a joint U.S.-Japan satellite mission to monitor tropical and subtropical (40 S - 40 N) precipitation and to estimate its associated latent heating. The TRMM satellite provides the first detailed and comprehensive dataset on the four dimensional distribution of rainfall and latent heating over vastly undersampled tropical and subtropical oceans and continents. The TRMM satellite was launched on November 27, 1997. Data from the TRMM satellite are archived and distributed by the NASA Goddard DAAC.

The TRMM Online Analysis System is designed for quick exploration, analyses and visualization of TRMM Level-3 and other precipitation products. The products consist of the daily (3B42), the monthly (3B43), the near-real-time (3B42RT) and the Willmott's climate data. The system is also designed to be simple and easy to use. With a few mouse clicks, users can plot average or accumulated rainfall over their region of interest for a given time period, or plot time series of regional rainfall average.

URL: http://daac.gsfc.nasa.gov/CAMPAIGN_DOCS/hydrology/TRMM_analysis.html

OS51B-0178 0830h POSTER

Conversion of HDF-EOS Products into GeoTIFF and GIS-compatible Formats.

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We have developed a tool, which can be used to convert science data in HDF-EOS format into GeoTIFF formatted files. HDF-EOS is the standard format for archive data from EOS instruments. GeoTIFF files are directly accessible to many Geographical Information System Tools. This tool, called the HDF-EOS to GeoTIFF conversion tool (HEG), is available to individual users on Windows, Linux, Sun and SGI platforms. It contains both a graphical and a command line interface. The HEG tool is operable on a wide variety of EOS products, including MODIS, MISR, and ASTER data.

The HEG tool is in the process of being integrated into the interface of the new online archives for earth sciences data developed for NASA archive centers. These online archives are called the ECS Data Pools and are directly associated with the Earth Observing System Core System.

We will discuss basic functionality provided by HEG. This includes sub-sampling, reprojection, reformatting, sub-setting, creation of multi-band GeoTIFFs, and creation of new metadata. We will discuss future enhancements to the tool.

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VENDAVAL - Visual Environment For Data Validation

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Atmospheric InfraRed Sounder (AIRS) data validation and analysis at JPL are supported in part by the Vendaval "Visual Environment for Data Validation" tool. Vendaval is written in IDL and is portable across computing platforms supported by Research Systems Inc. Vendaval is designed to ingest parallel data streams from multiple instruments for intercomparison, the detection of anomalies and the study of multiple products at full spatial and spectral resolution. Data support is based on data object models that supply data to Vendaval in a consistent manner. Currently supported data include the AIRS products in HDF-EOS swath format, radiosondes in HDF and limited support for MISR. Vendaval allows data selection by natural data groupings such as granules, scansets or footprints. Additional data selection criteria (specific products, parameters, or dimension subsetting) is also supported. The Vendaval analysis tools are an expandable set of plug-ins. These include feature-rich interactive tools for viewing AIRS data granules, multivariate scatterplotting, and single footprint analyses via customized plots and data tables. Radiance products currently supported are AIRS infrared and Vis/NIR radiances plus AMSU and HSB microwave radiances. Retrieved products supported are cloud-cleared infrared radiances and two file types containing retrieved geophysical quantities. Also supported are special files containing all products matched to locations of in situ observations, and operational radiosondes. The research described in this publication was carried out at the Jet Propulsion Laboratory, California Institute of Technology, under a contract with the National Aeronautics and Space Administration.

URL: <http://airs.jpl.nasa.gov/>

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MISR_View and MISR_Plot: Software Tools for Accessing and Visualizing MISR's Multispectral, Multiangle Data

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MISR_view and MISR_plot are IDL-based, cross-platform display and analysis software tools specifically for use with Multiangle Imaging Spectroradiometer (MISR) HDF-EOS "grid" data files. Although there is some overlap in the methods the two applications utilize to display MISR parameters, these tools serve distinctly different purposes.

MISR_view is a general-purpose viewing tool for all MISR "grid" data, including MISR L1B2 georectified radiance, MISR L1B2 radiometric cloud masks, all MISR Level 2 geophysical products, the MISR Ancillary Geographic Product, and AirMISR L1B2 georectified radiances. Through the use of a data selection graphical user interface (GUI), a user has the ability to extract any parameters for a contiguous range of blocks, assemble the blocks for display, and overlay parameters having different spatial and bit-depth resolutions into the RGB and ancillary planes of a sophisticated viewing window. The viewing window has several utilities and tools including: data transforms (to perform tasks such as data scaling and unpacking), map projections, vector overlays, linking of multiple viewing windows via geolocation, histogram viewing and stretch manipulation, tools for constructing anaglyphs, automatic scrolling through a large range of blocks at full resolution, loading of 8-bit color tables and emulation of 24-bit RGB color on 8-bit display hardware.

MISR_plot focuses on visualizing the MISR L1B2 georectified radiance product, in particular the 36 radiance measurements per pixel produced by MISR's 9 multispectral cameras, each measuring radiance in 4 spectral bands (red, green, blue, and near infrared). In addition to displaying the radiance data within a viewing window as described earlier, MISR_plot utilizes an additional interface which allows an analyst to view all of the radiance information available at a given pixel, together with a reconstruction of the illumination and viewing geometry that produced this radiance. The radiance data are plotted as a function of viewing angle in a collection of four panels, with each panel representing a MISR spectral band. In addition to these Cartesian plots, the radiance data are also portrayed in four semi-Polar plots, with the origin of a plot representing the intersection of the 9 MISR viewing directions at the pixel in question. Using the ancillary data archived with the MISR imagery, MISR_plot calculates and displays the solar illumination vector, vector normal to the reflecting surface, angle of incidence, angle of emergence, and phase angle on the polar plots. These plots are rendered as three-dimensional graphics that can be scaled and rotated interactively, allowing an analyst to decide upon the best visualization of the illumination and viewing geometry at a given pixel.

OS51B-0181 0830h POSTER

New Tools Available for MISR Instrument Data

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Several tools have been developed to aid in the visualization and analysis of MISR data products. Among the latest are the MISR Browse Tool and a second, as yet unnamed, tool which provides access to structural information and individual components (parameters) of any MISR file as well as visualization, analysis, and output of the parameters.

The MISR Browse Tool provides web-based viewing of the MISR browse image files. The browse images are true color JPEG format images for each camera derived from the red, green and blue bands of the MISR Level 1B2 ellipsoid radiance product at 2.2 km resolution. The radiances are clipped and gamma-stretched to provide overall visibility of cloud, ocean and land features.

Image selection begins with the specification of a particular MISR path, one of the 233 distinct repeating orbits, from a table or map. The selection is refined using scrolling lists to choose the actual orbit number (a count of the revolutions since launch, with the latest orbit shown first in the list), the camera, and the block number position along the orbit where the displayed image will be centered (180 blocks per orbit). The selected image is then displayed in a new scrolling window. Additional tools aid in choosing images by date and latitude/longitude coordinates.

The second new tool provides a graphical user interface (GUI) for working with any of the MISR data product files (Levels 1, 2 and 3). It is written in the Interactive Data Language (IDL) software from Research Systems, Inc., so it is portable to any of the platforms supported by IDL. When a file is opened, information about the content of the file is displayed and the GUI is populated with buttons for accessing functionality based on the file's content. The MISR files are written in Hierarchical Data Format (HDF) or HDF-EOS (HDF with added geolocation structures), so those components are exposed for access and may be saved to separate files. The visualization options included mapped display of geolocated parameters and creation of RGB images from separate wavelength bands. Many other features for working with MISR files have been incorporated in this tool, including scaling of raw data parameters.

The MISR Browse Tool may be accessed at <http://eosweb.larc.nasa.gov/MISRBR/>. Additional information about all of the available MISR tools can be obtained at http://eosweb.larc.nasa.gov/PRODOCS/misr/misr_tools.html

URL: <http://eosweb.larc.nasa.gov>

OS51B-0182 0830h POSTER

AIRS/AMSU-A/HSB Data On-demand Subsetting and Visualization Services at NASA GES DISC DAAC

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The Atmospheric Infrared Sounder (AIRS) is a high-resolution infrared sounder closely coupled with AMSU-A (Advanced Microwave Sounding Unit-A) and HSB (Humidity Sounder for Brazil) on EOS Aqua spacecraft launched on May 4, 2002. The data products from AIRS/AMSU-A/HSB will be archived and distributed at the Goddard Distributed Active Archive Center (GDAAC) located in the NASA Goddard Earth Sciences Data and Information Services Center (GES DAAC).

The ADDST is developing tools to read, visualize, analyze and reformat AIRS/AMSU-A/HSB data. The web-based AIRS on-the-fly/on-demand subsetter will be available to perform channel/variable subsetting and restructuring for Level1B (Calibrated Radiances) and Level2 (Atmospheric Retrievals) data products. One can narrow down criteria to subset data files with desired channels and variables and then download the subsetted file. AIRS QuickLook allows users to view AIRS/HSB/AMSU Level-1B data online for a specific channel prior to ordering or downloading data. Global map is also provided along with image to show geographic coverage of the granule and flight direction of the spacecraft.

The Atmospheric Dynamics Data Support Team (ADDST) at the GES DISC/DAAC is providing various services to assist users in understanding, accessing, and using AIRS data product. Information on AIRS data and data analysis tools can be found at AIRS data support informational web site (<http://daac.gsfc.nasa.gov/atmodyn/airs/>) that provides access to various technical online documents, such as, readmes, user guides, instrument guides, images from AIRS/AMSU-A/HSB data, product search and ordering interfaces, HDF-EOS format information, format conversion software, online data analysis tools, other AIRS related web links and more.

Other data support services provided by the ADDST are assist with data mining, helpdesk for user questions on data and information, data ordering, and educational resources.

URL: http://daac.gsfc.nasa.gov/atmodyn/airs/airs_tools.html

OS51B-0183 0830h POSTER

MAS Level-1B HDF Data and Derived Products during the CRYSTAL-FACE Field Campaign

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During July 2002, the Cirrus Regional Study of Tropical Anvils and Cirrus Layers - Florida Area Cirrus Experiment (CRYSTAL-FACE) field campaign was conducted to study the radiative properties of tropical cirrus clouds. The field experiment was a cooperative effort of several government and university organizations, and involved coordination of 6 research aircraft and various ground-based instrumentation. During CRYSTAL-FACE, the MODIS Airborne Simulator (MAS), a 50-channel scanning radiometer was flown onboard the NASA ER-2 aircraft. The MAS was the only visible and infrared imaging instrument flown during the campaign. The purpose of this presentation is to demonstrate how collected raw MAS data is processed in the field to Level-1B HDF format and subsequent science products were then generated and used.

MAS data was collected on all 13 ER-2 missions. All straight and level flight data were processed from raw data to level-1b (geo-located and calibrated to radiance at sensor) and written into a HDF file format. These preliminary data products were generated within 48-hours of data collection. In total 84 gigabytes of MAS data were processed to a Level-1B, HDF format.

The MODIS science team generated several derived post processed and level-2 products, which utilized this MAS Level-1b HDF data. These field-derived products included an ecosystem map, several cloud phase determination models and brightness temperature. Later processing with this MAS HDF data product will be used for determination of cloud optical thickness and cloud particle radius. The MAS level-1b HDF data results will ultimately be compared with MODIS HDF data products for validation and comparison.

URL: http://mas.arc.nasa.gov/data/deploy_html/crystalfacehome.html

OS51B-0184 0830h POSTER

Ocean Color and Sea Surface Temperature Data from the NASA GES DAAC: From Heritage to Heuristics

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The Goddard Earth Sciences Distributed Archive Center (GES DAAC) has been archiving ocean color data, and distributing this data to science and application users, for nearly a decade. The GES DAAC maintains historical data sets from the Coastal Zone Color Scanner (CZCS) and Ocean Color and Temperature Scanner (OCTS), and active mission data sets from the Sea-viewing Wide Field-of-view Sensor (SeaWiFS) and two Moderate Resolution Imaging Spectroradiometers (MODIS) sensors onboard the Terra and Aqua satellites. The GES DAAC therefore provides the user community the immense benefits of multi-year, multi-sensor global observations of oceanic biological and physical processes. As an example, for the first time, MODIS acquires global, simultaneous ocean color and sea surface temperature (SST) data with 1-km resolution.

As remote-sensing missions evolve in terms of data quality and content, the complexity of the data product suite increases. The number of science products is expanding as a result of more sophisticated sensors and new science algorithms. Thus, the GES DAAC faces several challenges: navigating users through multiple ocean data collections, providing tools to visualize data and to reduce the volume of superfluous data acquired by users, and also to provide uninterrupted distribution of data. This presentation attempts to interweave the CZCS, SeaWiFS, and MODIS ocean data archives. CZCS and SeaWiFS ocean color products will be described in parallel with MODIS, with an emphasis on the heritage of science products. The advantages of concurrent MODIS ocean color and SST data are described, as well as current drawbacks and uncertainties. The intention of this presentation is to prepare users for the next generation of ocean remote sensing missions, provide starting points for data and tools information, and to aid in gaining expertise in science data formats and applications.

URL: <http://daac.gsfc.nasa.gov/>

OS51B-0185 0830h POSTER

Performance Comparison Study of Using Gzip and Bzip2 Data Compression Packages to NASA HDF-EOS Data and Other Scientific Data With Different Approaches

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Appropriate data compression algorithm can speed up the process of transferring huge volume of data over the network and can significantly lower data storage costs. NASA EOS data is often in huge data volume and is in need of good data compression algorithm. Gzip and bzip2 are currently two open-source popular data compression packages. In the first part of the poster, we will show the performance comparison results between bzip2 and gzip when applying these two packages to Landsat 7, CERES, ASTER, MODIS, TRIM, TOMS and MISR data. The result shows that generally the data compression ratio through bzip2 is better than that through gzip by 3%-15%; whereas the encoding and decoding time through bzip2 are significantly longer than those through gzip. Neither bzip2 nor gzip can gain good compression ratio for floating point data.

Strong data locality can be found in many NASA EOS dataset and other scientific dataset. However, general data compression packages like gzip and bzip2 may not take advantage of this characteristic of the being compressed data and may end up with poor data compression performance, especially for floating point data. In the second part of this poster, we will introduce a new approach to use gzip and bzip2 data compression packages. A simple shuffling and re-shuffling algorithm is applied before and after the real data compression procedure. The performance comparison study shows that the combination of shuffling and general data compression approach can improve the compression ratio by more than 10% on average for 32-bit floating point EOS data. It can also improve the compression ratio by 5%-8% on average for 16-bit integer EOS data. It always takes less encoding and decoding time when doing data compression with the combination of shuffling algorithm and bzip2 on scientific data of which data type is larger than 8-bit. It generally takes insignificant extra encoding time when using the combination of shuffling and gzip encoding on NASA EOS data and other scientific data.

The emphasis of the poster is to address that the pre and post data processing procedure should be considered when doing scientific data compression. This poster will also show a clear and easy procedure to use the shuffling algorithm with gzip or bzip2 encoding in HDF5.

URL: <http://hdf.nasa.uiuc.edu>

OS51B-0186 0830h POSTER

Obtaining information from Case 2 Waters using constraints derived from adjacent Case 1 Waters

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Accurate remote sensing of Case 2 waters is a difficult task. Yet these waters are very important due to their ecological and economic impact. Remote sensing of Case 1 waters is less challenging because their composition is simpler. As a consequence, retrieval algorithms appropriate for Case 1 waters are steadily improving. The logical next step is to base retrievals of marine constituents of the more complex Case 2 waters on information gained from adjacent Case 1 waters. In this way the information about aerosols and chlorophyll concentration derived from a pixel believed to contain Case 1 waters, can be used as a constraint to retrieve information about an adjacent pixel believed to contain Case 2 waters. This approach will improve our ability to retrieve marine constituents such as CDOM and sediments from Case 2 waters. Utilizing a newly developed method for simultaneous retrieval of aerosol properties and chlorophyll concentration of Case 1 waters, we have designed an algorithm to retrieve marine constituents of adjacent Case 2 waters. We report here on our methodology and preliminary results. Our findings so far indicate that this technique can be used

not only to retrieve information about Case 2 waters, but also for generating accurate demarcations (boundary masks) between Case 1 and Case 2 waters, and for discriminating between absorbing and non-absorbing aerosols.

OS51C MCC: 274 Friday 0830h

Preliminary Results From the Jason-1 Mission I (joint with G)

Presiding: L Fu, Jet Propulsion Laboratory; Y Menard, Centre National d'Etudes Spatiales

OS51C-01 0830h

The JASON-1 Mission

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On December 7, 2001, Jason-1 was successfully launched by a Boeing Delta 2 rocket from Vandenberg site in USA. This satellite will maintain the high accuracy altimeter service, provided since 1992 by TOPEX/POSEIDON (T/P), ensuring the continuity in observing and monitoring the Ocean Dynamics (intra-seasonal to inter-annual changes, mean sea level, tides...). Despite four times less mass and power, the Jason-1 system has been designed to have the same performances as T/P, measuring sea surface topography at a centimetric level, revisiting every 10 days the same ground tracks. This new CNES/NASA mission, also provides near real-time data for sea state and ocean forecast. Two months after the launch, the Jason-1 satellite was declared operational. The following 8 months were dedicated to the verification of the performances of the system and the cross-calibration with T/P measurements (taking advantage of the tandem flying formation of both satellites). Results of the CalVal investigations, conducted by the Science and Project Teams of the mission, show that in-flight performances are in accordance with pre-launch specifications. Few weeks after the end of the verification phase and the starting of the routine phase, we will make a brief overview of the mission and a status of the first months in orbit.

URL: <http://www-aviso.cnes.fr>

OS51C-02 0845h

Jason-1 : Geophysical Performance Evaluation

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The CNES/NASA Jason-1 mission has been defined to maintain the high accuracy altimeter service provided since 1992 by TOPEX/POSEIDON (T/P), ensuring the continuity in observing and monitoring the Ocean Dynamics, and achieving the measurement of sea surface topography at a centimeter level of accuracy.

Successfully launched by a Boeing Delta 2 rocket from the Vandenberg site (CA, USA) on December 7, 2001, Jason-1 is a true ocean observatory that supplies accurate sea-surface height and sea-state measurements to an international user community. Designed to follow on from T/P, Jason-1's instruments and data processing systems have drawn extensively on the lessons learned from its predecessor. After completion of a 8-month verification phase which ended in October 2002, Jason-1 entered its "Operational phase". The goal of

this paper is to summarize some of the Jason-1 Project Team and Science Working Team's findings about the in-flight performances and error budget of the system and products.

The paper will deal with: (i) the error budget of the Jason-1 mission at geophysical level: altimeter range, significant wave-height, and backscatter coefficient, as well as radiometer brightness temperatures, water vapor content, and cloud liquid content will be addressed; (ii) the characterization of the spectral content of the POSEIDON-2 altimeter measurements onboard Jason-1, (iii) the characterization of the differences between the 2 altimeters onboard T/P (namely, TOPEX and POSEIDON-1) and POSEIDON-2 measurements, (iv) and finally, the cross-calibration of the T/P and Jason-1 microwave radiometers and altimeters that was performed during the Jason-1 verification phase when the T/P and Jason-1 satellites followed each other only 1 minute apart.

OS51C-03 0900h

Results from the TOPEX/Poseidon-Jason Calibration/Verification Mission

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For 210 days (Jan. 15, 2002 - Aug. 15, 2002), the Jason-1 spacecraft followed TOPEX/Poseidon (T/P) along the same groundtrack, separated in time by about 72 seconds. The configuration was designed to measure the sea surface height (SSH) with each altimeter at nearly the same time and location to difference out real sea level variations in order to examine instrument specific errors. The primary goal was to compare the new Jason instrument to the TOPEX instrument, which has been studied, verified, and calibrated for nearly 10 years. For the most part, the Jason measurements appear to be performing as expected. Statistics and maps of the along-track Jason - TOPEX measurement residuals will be presented to demonstrate the performance. An unexpected outcome of the calibration period has also been the discovery of two small, but significant, problems in the TOPEX measurement. One involves the response of the radiometer during certain spacecraft attitude events, and the other involves the sea state bias model used for the TOPEX Side B data. These errors are described, and their effect on the determination of the relative bias between Jason and TOPEX and on the calculation of global mean sea level change is discussed.

OS51C-04 0915h

Jason-1 POD Status and Assessment

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We review the status of the precision orbit determination (POD) activities for Jason-1 and assess the performance relative to the mission requirements and goals. The multiple tracking systems operating on Jason-1 (DORIS, SLR and GPS) provide an opportunity to compare the contribution of the various tracking types to the POD over an extended time interval. In addition to the higher quality two-channel DORIS receiver and more advanced BlackJack GPS receiver, the Jason-1 laser reflector array is much more suitable for high precision calibration work than the array on TOPEX/POSEIDON. Through comparisons of orbits determined by various groups using different combinations of tracking data, we can evaluate the overall quality of orbits. We also review issues affecting the POD accuracy, such as the tracking systems performance and force and measurement modeling choices.

OS51C-05 0930h

Calibrating the Jason-1 Measurement System: Initial Results from the Corsica and Harvest Verification Experiments

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