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December 07 - 13, 2013

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Saturday, December 07, 2013

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Sunday, December 08, 2013

You have nothing scheduled for this day

Monday, December 09, 2013

Time	Session Info
8:00 AM-12:20 PM, Hall A-C (Moscone South), **H11E. Innovation in Hydrology Through the Design, Development, and Use of Community Technologies and Resources Posters**	
8:00-8:00 AM	**H11E-1200. Enhancing Access to and Use of NASA Earth Sciences Data via CUAHSI-HIS (Hydrologic Information System) and Other Hydrologic Community Tools** H. Rui; R. Strub; W.L. Teng; B. Vollmer; D.M. Mocko; D.R. Maidment; T.L. Whiteaker
8:00-8:00 AM	**H11E-1204. A New Open Data Open Modeling Framework for the Geosciences Community *(Invited)*** X. Liang; D. Salas; M. Navarro; Y. Liang; W.L. Teng; R.P. Hooper; P.J. Restrepo; J.D. Bales
8:00 AM-10:00 AM, 3006 (Moscone West), **A11I. Remote Sensing of CO2 and CH4: From Missions to Science—Remote Sensing of Carbon Cycle Science I [SWIRL_CU] (cosponsored by AMS)**	
9:00-9:15 AM	**A11I-05. Sensitivity of AIRS and ACOS retrievals to CO2 emissions from biomass burning** T.J. Hearty; A.K. Savtchenko; J.C. Wei; A. Albayrak; B. Vollmer
1:40 PM-6:00 PM, Hall A-C (Moscone South), **IN13B. Persistent Identifiers and Citation in Earth Science Information Infrastructure Posters**	
1:40-1:40 PM	**IN13B-1571. Application of Digital Object Identifiers to data sets at the NASA Goddard Earth Sciences Data and Information Services Center (GES DISC)** B. Vollmer; D. Ostrenga; J.E. Johnson; A.K. Savtchenko; S. Shen; W.L. Teng; J.C. Wei

Tuesday, December 10, 2013

Time	Session Info
8:00 AM-10:00 AM, 2020 (Moscone West), **IN21D. Big Data Analytic Systems: Computing and Collaborating Effectively in Distributed Systems I [SWIRL_CM]**	

9:00-9:15 AM	**IN21D-05. Volume, Variety and Veracity of Big Data Analytics in NASA's Giovanni Tool** C. Lynnes; M. Hegde; C. Smit; J. Pan; K. Bryant; C. Chidambaram; P. Zhao
1:40 PM-6:00 PM, Hall A-C (Moscone South), **A23E. Aerosol, Tropical Cyclones, Volcanic Emissions, Measurements, Data and SASKTRAN Posters**	
1:40-1:40 PM	**A23E-0303. The NASA MEaSUREs-2006 Science Datasets Distributed at GES DISC** C. Shie; G.T. Alcott; M. Chen; J.E. Johnson; S.J. Kempler; G. Lei; D.M. Ostrenga; A.K. Savtchenko; S. Shen; W.L. Teng; E. Vadnais; B. Vollmer; J.C. Wei
1:40-1:40 PM	**A23E-0327. A Satellite Observation Information Service for Data Assimilation Applications** M. Lee; R.J. Weidner; C. Lynnes; I.V. Gerasimov
1:40 PM-6:00 PM, Hall A-C (Moscone South), **IN23A. Big Data Analytic Systems: Computing and Collaborating Effectively in Distributed Systems II Posters [SWIRL_CM]**	
1:40-1:40 PM	**IN23A-1407. The Path from Large Earth Science Datasets to Information** G.A. Vicente
1:40 PM-6:00 PM, Hall A-C (Moscone South), **IN23B. Collaborative Frameworks and Experiences in Earth and Space Science Posters**	
1:40-1:40 PM	**IN23B-1432. Collaborative workbench for cyberinfrastructure to accelerate science algorithm development** R. Ramachandran; M. Maskey; K. Kuo; C. Lynnes
1:40 PM-6:00 PM, Hall A-C (Moscone South), **NH23C. Planning and Mitigation for Natural Hazards Through Specialized Remote Sensing Techniques II Posters**	
1:40-1:40 PM	**NH23C-1540. Hydrologic Severity-based Forecast System for Road Infrastructure Monitoring** F. Hernandez; L. Li; S. Lochan; X. Liang; Y. Liang; W.L. Teng

Wednesday, December 11, 2013

Time	Session Info
8:00 AM-12:20 PM, Hall A-C (Moscone South), **A31C. Measurements, Modeling, and Evaluation of Emissions I Posters**	
8:00-8:00 AM	**A31C-0060. Making NASA Remote Sensing Data Directly Usable in Multiscale Air Quality Models** S.J. Kempler; D. Tong
8:00 AM-12:20 PM, Hall A-C (Moscone South), **IN31C. Search, Discovery and Visual Representation of Scientific Data I Posters**	

8:00-8:00 AM	**IN31C-1516. Exploring NASA Satellite Data with High Resolution Visualization** J.C. Wei; W. Yang; J.E. Johnson; S. Shen; P. Zhao; I.V. Gerasimov; B. Vollmer; G.A. Vicente; L. Pham
10:20 AM-12:20 PM, 2020 (Moscone West), **IN32A. Emerging Technologies in Earth and Space Science Informatics (ESSI) I**	
10:50-11:05 AM	**IN32A-03. Maintaining the momentum of Open Search in Earth Science Data discovery** D.J. Newman; C. Lynnes
10:20 AM-12:20 PM, 3016 (Moscone West), **H32F. Remote Sensing Applications for Water Resources Management II: Groundwater Monitoring, Data Integration and Modeling**	
11:35-11:50 AM	**H32F-06. Global Water Maps** D.R. Maidment; F. Salas; W.L. Teng
1:40 PM-6:00 PM, Hall A-C (Moscone South), **H33E. Global Precipitation Measurement, Validation, and Applications III Posters**	
1:40-1:40 PM	**H33E-1418. Preparing Precipitation Data Access, Value-added Services and Scientific Exploration Tools for the Integrated Multi-satellitE Retrievals for GPM (IMERG)** D. Ostrenga; Z. Liu; S.J. Kempler; B. Vollmer; W.L. Teng

Thursday, December 12, 2013

Time	Session Info
8:00 AM-12:20 PM, Hall A-C (Moscone South), **B41A. Earth Observations for Global Agricultural Monitoring II Posters**	
8:00-8:00 AM	**B41A-0375. Enhancing USDA's Retrospective Analog Year Analyses Using NASA Satellite Precipitation and Soil Moisture Data** W.L. Teng; H.D. Shannon
10:20 AM-12:20 PM, 3022 (Moscone West), **H42F. Utilizing Precipitation Data Sets and Quantifying Associated Uncertainties in Hydrometeorological and Climate Impact Applications I**	
12:05-12:20 PM	**H42F-08. Implementing the International Precipitation Working Group (IPWG) Validation Statistics in Online Tools to Inter-compare and Characterize Satellite-derived Global Precipitation Products** Z. Liu; D. Ostrenga; W.L. Teng; S.J. Kempler
1:40 PM-6:00 PM, Hall A-C (Moscone South), **A43B. Cloud, Convection, Radiation, Water and Energy Cycles I Posters**	
1:40-1:40 PM	**A43B-0254. AIRS Version 6 Products and Data Services at NASA GES DISC** F. Ding; A.K. Savtchenko; T.J. Hearty; M.L. Theobald; B. Vollmer; E. Esfandiari

1:40 PM-6:00 PM, Hall A-C (Moscone South), **A43D. Multi-sensor and Model Aerosol Data Synergy for Climate and Air Quality Applications I Posters [SWIRL_DA]**	
1:40-1:40 PM	**A43D-0297. Evaluation of Uncertainty in Satellite Monthly Aerosol Products Associated with Spatial Sampling** S. Shen; C. Lynnes; A.M. Sayer; C. Bettenhausen; J.C. Wei; B. Vollmer; N.C. Hsu; S.J. Kempler

Friday, December 13, 2013

Time	Session Info
8:00 AM-12:20 PM, Hall A-C (Moscone South), **IN51A. Approaches, Architectures and Standards for End to End Brokering I Posters**	
8:00-8:00 AM	**IN51A-1539. Performance, Agility and Cost of Cloud Computing Services for NASA GES DISC Giovanni Application** L. Pham; A. Chen; S. Wharton; E.L. Winter; C. Lynnes
10:20 AM-12:20 PM, 3012 (Moscone West), **A52D. Mineral Dust Aerosols: From Small-Scale Insights to Large-Scale Understanding III [SWIRL_DA] (cosponsored by AMS)**	
11:45-12:00 PM	**A52D-06. Long-term dust climatology in the western United States** D. Tong; H. Lei; J.X. Wang; P. Lee
1:40 PM-6:00 PM, Hall A-C (Moscone South), **IN53D. Semantically Enabling Annotation, Discovery, Access, and Integration of Scientific Data II Posters**	
1:40-1:40 PM	**IN53D-1592. Discovering accessibility, display, and manipulation of data in a data portal** N.J. Hoebelheinrich; P. West; P.A. Fox; C. Lynnes

Final ID: H11E-1200

Enhancing Access to and Use of NASA Earth Sciences Data via CUAHSI-HIS (Hydrologic Information System) and Other Hydrologic Community Tools

H. Rui; [1, 2]; *R. Strub;* [1, 2]; *W. L. Teng;* [1, 2]; *B. Vollmer;* [1]; *D. M. Mocko;* [3, 4]; *D. R. Maidment;* [5]; *T. L. Whiteaker;* [5]
;
1. GES DISC, GSFC NASA, Greenbelt, MD, United States.
2. ADNET Systems, Inc., Rockville, MD, United States.
3. HSL, GSFC NASA, Greenbelt, MD, United States.
4. SAIC, Beltsville, MD, United States.
5. University of Texas, Austin, TX, United States.

Body: The way NASA earth sciences data are typically archived (by time steps, one step per file, often containing multiple variables) is not optimal for their access by the hydrologic community, particularly if the data volume and/or number of data files are large. To enhance the access to and use of these NASA data, the NASA Goddard Earth Sciences Data and Information Services Center (GES DISC) adopted two approaches, in a project supported by the NASA ACCESS Program. The first is to optimally reorganize two large hydrological data sets for more efficient access, as time series, and to integrate the time series data (aka “data rods”) into hydrologic community tools, such as CUAHSI-HIS, EPA-BASINS, and Esri-ArcGIS. This effort has thus far resulted in the reorganization and archive (as data rods) of the following variables from the North American and Global Land Data Assimilation Systems (NLDAS and GLDAS, respectively): precipitation, soil moisture, evapotranspiration, runoff, near-surface specific humidity, potential evaporation, soil temperature, near surface air temperature, and near-surface wind. The second approach is to leverage the NASA Simple Subset Wizard (SSW), which was developed to unite data search and subsetters at various NASA EOSDIS data centers into a single, simple, seamless process. Data accessed via SSW are converted to time series before being made available via Web service. Leveraging SSW makes all data accessible via SSW potentially available to HIS users, which increases the number of data sets available as time series beyond those available as data rods. Thus far, a set of selected variables from the NASA Modern Era-Retrospective Analysis for Research and Applications Land Surface (MERRA-Land) data set has been integrated into CUAHSI-HIS, including evaporation, land surface temperature, runoff, soil moisture, soil temperature, precipitation, and transpiration. All data integration into these tools has been conducted in collaboration with their respective communities. Specifically, the GES DISC worked closely with the University of Texas (also part of the NASA ACCESS project) to seamlessly integrate these hydrology-related variables into CUAHSI-HIS. With NLDAS, GLDAS, and MERRA data integrated into CUAHSI-HIS, the data can be accessed via HydroDesktop (a windows-based GIS application) along with other existing HIS data, and analyzed with the built-in functions for water-cycle-related applications, research, and data validation. Case studies will be presented on the access to and use of NLDAS, GLDAS, and MERRA data for drought monitoring, Probable Maximum Precipitation (PMP), hurricane rainfall effects on soil moisture and runoff, as well as data inter-comparison. An example of GLDAS in ArcGIS Online, World Soil Moisture, will also be given. Featured with the long time series of GLDAS soil moisture data and powered by Esri-ArcGIS, the World Soil Moisture server allows users to click on any location in the world to view its soil moisture in ASCII or as a time series plot. Full records of the NLDAS, GLDAS, and MERRA data are accessible from NASA GES DISC via Mirador (http://mirador.gsfc.nasa.gov/), SSW (http://disc.sci.gsfc.nasa.gov/SSW/), Giovanni (http://disc.sci.gsfc.nasa.gov/giovanni/overview), OPeNDAP/GDS (http://disc.sci.gsfc.nasa.gov/services), as well as direct FTP.

URL: http://disc.sci.gsfc.nasa.gov/hydrology/data-holdings

Final ID: H11E-1204

A New Open Data Open Modeling Framework for the Geosciences Community *(Invited)*

X. Liang; [1]; *D. Salas;* [1]; *M. Navarro;* [2]; *Y. Liang;* [2]; *W. L. Teng;* [3]; *R. P. Hooper;* [4]; *P. J. Restrepo;* [5]; *J. D. Bales;* [6];

1. Department of Civil and Environmental Engineering, University of Pittsburgh, Pittsburgh, PA, United States.
2. Department of Computer and Information Science, Indiana Univ.-Purdue Univ. , Indianapolis, IN, United States.
3. NASA Goddard Earth Sciences Data and Information Services Center (ADNET), Greenbelt, MD, United States.
4. Consortium of Universities for the Advancement of Hydrologic Science, Medford, MA, United States.
5. NOAA/NWS North Central River Forecast Center, Chanhassen, MN, United States.
6. U.S. Geological Survey, Reston, VA, United States.

Body: A prototype Open Hydrospheric Modeling Framework (OHMF), also called Open Data Open Modeling framework, has been developed to address two key modeling challenges faced by the broad research community: (1) accessing external data from diverse sources and (2) execution, coupling, and evaluation/intercomparison of various and complex models. The former is achieved via the Open Data architecture, while the latter is achieved via the Open Modeling architecture. The Open Data architecture adopts a common internal data model and representation, to facilitate the integration of various external data sources into OHMF, using Data Agents that handle remote data access protocols (e.g., OPeNDAP, Web services), metadata standards, and source-specific implementations. These Data Agents hide the heterogeneity of the external data sources and provide a common interface to the OHMF system core. The Open Modeling architecture allows different models or modules to be easily integrated into OHMF. The OHMF architectural design offers a general many-to-many connectivity between individual models and external data sources, instead of one-to-one connectivity from data access to model simulation results. OHMF adopts a graphical scientific workflow, offers tools to re-scale in space and time, and provides multi-scale data fusion and assimilation functionality. Notably, the OHMF system employs a strategy that does not require re-compiling or adding interface codes for a user's model to be integrated. Thus, a corresponding model agent can be easily developed by a user. Once an agent is available for a model, it can be shared and used by others. An example will be presented to illustrate the prototype OHMF system and the automatic flow from accessing data to model simulation results in a user-friendly workflow-controlled environment.

Final ID: A11I-05

Sensitivity of AIRS and ACOS retrievals to CO2 emissions from biomass burning

T. J. Hearty; [1]; *A. K. Savtchenko;* [2]; *J. C. Wei;* [2]; *A. Albayrak;* [2]; *B. Vollmer;* [3];

1. GSFC/Wyle, Falls Church, VA, United States.
2. GSFC/Adnet, Greenbelt, MD, United States.
3. GSFC, Greenbelt, MD, United States.

Body: One of the ongoing challenges for climate studies is to understand the sources and sinks of CO2 in the Earth system. We attempt to identify sources of CO2 using two missions that are currently able make global CO2 observations from space: AIRS and ACOS. Although these missions have different sensitivities and sampling rates for atmospheric CO2, in global and regional averages they are both sensitive to the current increase of ~ 1.8 ppm/year that is driving much of the concern for climate change as well as seasonal variations that have an amplitude of a few ppm.

In order to test the ability of the AIRS and ACOS missions to identify CO2 emission sources we investigate two events: (1) The fires in Russia in 2010; (2) the 2010 biomass burning season in the Amazon. Based on published estimates of the ratio of C02 to CO emission from forest fires, the increase in CO2 in the vicinity of these fires should be 1-2 ppm (i.e., similar to the seasonal signal). By separating the CO2 observations in the vicinity of these fires into polluted (high CO) and clean (low CO) regions we expected to see differences in the CO2 concentration. The inability of the ACOS v2.9 or v3.3 retrieval algorithms to detect significant differences between polluted and clean regions demonstrates the great challenges current missions face in monitoring surface fluxes (sources and sinks) of carbon dioxide.

Final ID: IN13B-1571

Application of Digital Object Identifiers to data sets at the NASA Goddard Earth Sciences Data and Information Services Center (GES DISC)

B. Vollmer; [1]; *D. Ostrenga;* [2]; *J. E. Johnson;* [2]; *A. K. Savtchenko;* [2]; *S. Shen;* [3]; *W. L. Teng;* [2]; *J. C. Wei;* [2];

1. NASA GSFC, Greenbelt, MD, United States.
2. Adnet Systems Inc., Rockville, MD, United States.
3. George Mason University, Fairfax, VA, United States.

Body:

Digital Object Identifiers (DOIs) are applied to selected data sets at the NASA Goddard Earth Sciences Data and Information Services Center (GES DISC). The DOI® system provides an Internet resolution service for unique and persistent identifiers of digital objects. Products assigned DOIs include data from the NASA MEaSUREs Program, the Earth Observing System (EOS) Aqua Atmospheric Infrared Sounder (AIRS) and EOS Aura High Resolution Dynamics Limb Sounder (HIRDLS). DOIs are acquired and registered through EZID, California Digital Library and DataCite.

GES DISC hosts a data set landing page associated with each DOI containing information on and access to the data including a recommended data citation when using the product in research or applications.

This work includes participation with the earth science community (e.g., Earth Science Information Partners (ESIP) Federation) and the NASA Earth Science Data and Information System (ESDIS) Project to identify, establish and implement best practices for assigning DOIs and managing supporting information, including metadata, for earth science data sets.

Future work includes (1) coordination with NASA mission Science Teams and other data providers on the assignment of DOIs for other GES DISC data holdings, particularly for future missions such as Orbiting Carbon Observatory -2 and -3 (OCO-2, OCO-3) and projects (MEaSUREs 2012), (2) construction of landing pages that are both human and machine readable, and (3) pursuing the linking of data and publications with tools such as the Thomson Reuters Data Citation Index.

Final ID: IN21D-05

Volume, Variety and Veracity of Big Data Analytics in NASA's Giovanni Tool

C. Lynnes; [1]; *M. Hegde;* [1]; *C. Smit;* [1]; *J. Pan;* [1]; *K. Bryant;* [1]; *C. Chidambaram;* [1]; *P. Zhao;* [1, 2];
1. NASA/GSFC, Greenbelt, MD, United States.
2. George Mason University, Fairfax, VA, United States.

Body: Earth Observation data have posed challenges to NASA users ever since the launch of several satellites around the turn of the century, generating volumes now measured in petabytes, a volume growth further increased by models assimilating the satellite data. One important approach to bringing Big Data Analytic capabilities to bear on the Volume of data has been the provision of server-side analysis capabilities. For instance, the Geospatial Interactive Online Visualization ANd aNalysis (Giovanni) tool provides a web interface to large volumes of gridded data from several EOSDIS data centers. Giovanni's main objective is to allow the user to explore its data holdings using various forms of visualization and data summarization or aggregation algorithms, thus allowing the user to examine statistics and pictures for the overall data, while eventually acquiring only the most useful data. Thus much of the preprocessing and data reduction aspects can take place on the server, delivering manageable information quantities to the user. In addition to Volume, Giovanni uses open standards to tackle the Variety aspect of Big Data, incorporating data stored in several formats, from several data centers, and making them available in a uniform data format and structure to both the Giovanni algorithms and the end user. The Veracity aspect of Big Data, perhaps the stickiest of wickets, is enhanced through features that enable reproducibility (provenance and URL-driven workflows), and by a Help Desk staffed by scientists with expertise in the science data.

URL: http://giovanni.gsfc.nasa.gov/giovanni/

Final ID: A23E-0303

The NASA MEaSUREs-2006 Science Datasets Distributed at GES DISC

C. Shie; [2, 1]; *G. T. Alcott;* [1]; *M. Chen;* [3, 1]; *J. E. Johnson;* [3, 1]; *S. J. Kempler;* [1]; *G. Lei;* [3, 1]; *D. M. Ostrenga;* [3, 1]; *A. K. Savtchenko;* [3, 1]; *S. Shen;* [4, 1]; *W. L. Teng;* [3, 1]; *E. Vadnais;* [5, 1]; *B. Vollmer;* [1]; *J. C. Wei;* [3, 1];

1. NASA Goddard SFC, Greenbelt, MD, United States.
2. JCET, UMBC, Baltimore County, MD, United States.
3. Adnet Systems Inc., Rockville, MD, United States.
4. GMU, Fairfax, VA, United States.
5. Telophase Corp., Arlington, VA, United States.

Body: The NASA Making Earth System data records for Use in Research Environments program's 2006 (MEaSUREs-2006) solicitation aimed to select projects providing Earth science data products and services highly motivated by NASA's Earth science objectives and contributing to advancing NASA Earth system "missions to measurements" concept. As a result, thirty projects were awarded for funding in October 2007. Through the successful MEaSUREs-2006, NASA has continued its commitment in extending the understanding of the Earth system using consistent records, i.e., particularly focusing on the creation of Earth System Data Records (ESDRs), including Climate Data Records. 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". The Goddard Earth Science Data and Information Services Center (GES DISC) is responsible for managing data distribution and providing user services for seven of the MEaSUREs-2006 projects.

These seven projects created long-term (varying from seven years to longer than thirty years) of global and satellite-based (single- or multi-sensor, or hybrid with assimilation) products. These MEaSUREs science data are diverse and represent (1) total ozone column and ozone vertical profiles; (2) ozone chemistry and related trace gases for the stratosphere; (3) aerosol data records over land and ocean; (4) Earth surface and atmosphere reflectivity; (5) water vapor climate record using cloud classification; (6) air-sea turbulent fluxes; and (7) the major components (storages and fluxes) of the terrestrial water cycle. Each of the seven science data products will be presented in a systematic manner from project introduction, data description to science application. The six currently available products have worldwide attracted many users since their official releases (the earliest issued in October 2010). Useful and interesting info on data usages and user domain distributions resulted from a significant metrics analysis will also be presented at the meeting.

Final ID: A23E-0327

A Satellite Observation Information Service for Data Assimilation Applications

M. Lee; [1]; *R. J. Weidner;* [1]; *C. Lynnes;* [2]; *I. V. Gerasimov;* [2];
1. Jet Propulsion Laboratory, Pasadena, CA, United States.
2. Goddard Space Flight Center, Greenbelt, MD, United States.

Body: Multi-mission Observation Operator (M2O2) team at NASA is developing a streamlined interface mechanism that simplifies the assimilation process of satellite-observations by providing “assimilation-ready” observation information “on-demand”. The “assimilation-ready” observation information is referred to as L2# (L2-sharp) data in contrast to level-2 (L2) data. The “on-demand” indicates a web-service protocol for L2# data request handling. A L2# data service is developed for each atmospheric component of a mission to apply component-specific quality screening and post processing and deliver mission-generic observation information required for assimilation. The observation information is organized for sampling (time and location), sounding (pressure profile and averaging kernel), and retrieval results (a priori state, estimated state, and error).

The M2O2 extensions to GEOS-Chem (version 9.0.1) and GEOS-Chem-Adjoint (version 34) have been employed to assimilate MLS-O3 (2004-2012), TES-O3 (2005-2009), TES-CH4 (2009) and ACOS-XCO2 (2009-2011). The L2# data services for MLS-O3 (2004-current), ACOS-XCO2 (2009-current), and AIRS-CO (2002-current) have been installed at GES DISC for assimilation-community-wide access. We will present the “lessons learned” in three areas: 1) diversity of level-2 data product organization, 2) observation information formulation and validation, and 3) generalized model-coupling process. The M2O2 research is supported by NASA’s Advancing Collaborative Connections for Earth System Science (ACCESS) program.

Final ID: IN23A-1407

The Path from Large Earth Science Datasets to Information

G. A. Vicente; [1];

1. GES DISC, NASA Goddard Space Flight Center, Greenbelt, MD, United States.

Body: The NASA Goddard Earth Sciences Data (GES) and Information Services Center (DISC) is one of the major Science Mission Directorate (SMD) for archiving and distribution of Earth Science remote sensing data, products and services. This virtual portal provides convenient access to Atmospheric Composition and Dynamics, Hydrology, Precipitation, Ozone, and model derived datasets (generated by GSFC's Global Modeling and Assimilation Office), the North American Land Data Assimilation System (NLDAS) and the Global Land Data Assimilation System (GLDAS) data products (both generated by GSFC's Hydrological Sciences Branch).

This presentation demonstrates various tools and computational technologies developed in the GES DISC to manage the huge volume of data and products acquired from various missions and programs over the years. It explores approaches to archive, document, distribute, access and analyze Earth Science data and information as well as addresses the technical and scientific issues, governance and user support problem faced by scientists in need of multi-disciplinary datasets. It also discusses data and product metrics, user distribution profiles and lessons learned through interactions with the science communities around the world. Finally it demonstrates some of the most used data and product visualization and analyses tools developed and maintained by the GES DISC.

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

Final ID: IN23B-1432

Collaborative workbench for cyberinfrastructure to accelerate science algorithm development

R. Ramachandran; [1]; *M. Maskey;* [1]; *K. Kuo;* [2]; *C. Lynnes;* [2];

1. ITSC, University of Alabama in Huntsville, Huntsville, AL, United States.

2. GSFC, NASA, Greenbelt, MD, United States.

Body: There are significant untapped resources for information and knowledge creation within the Earth Science community in the form of data, algorithms, services, analysis workflows or scripts, and the related knowledge about these resources. Despite the huge growth in social networking and collaboration platforms, these resources often reside on an investigator's workstation or laboratory and are rarely shared. A major reason for this is that there are very few scientific collaboration platforms, and those that exist typically require the use of a new set of analysis tools and paradigms to leverage the shared infrastructure. As a result, adoption of these collaborative platforms for science research is inhibited by the high cost to an individual scientist of switching from his or her own familiar environment and set of tools to a new environment and tool set.

This presentation will describe an ongoing project developing an Earth Science Collaborative Workbench (CWB). The CWB approach will eliminate this barrier by augmenting a scientist's current research environment and tool set to allow him or her to easily share diverse data and algorithms. The CWB will leverage evolving technologies such as commodity computing and social networking to design an architecture for scalable collaboration that will support the emerging vision of an Earth Science Collaboratory. The CWB is being implemented on the robust and open source Eclipse framework and will be compatible with widely used scientific analysis tools such as IDL. The myScience Catalog built into CWB will capture and track metadata and provenance about data and algorithms for the researchers in a non-intrusive manner with minimal overhead. Seamless interfaces to multiple Cloud services will support sharing algorithms, data, and analysis results, as well as access to storage and computer resources. A Community Catalog will track the use of shared science artifacts and manage collaborations among researchers.

Final ID: NH23C-1540

Hydrologic Severity-based Forecast System for Road Infrastructure Monitoring

X. Liang; [1]; *F. Hernandez;* [1]; *L. Li;* [1, 3]; *S. Lochan;* [2]; *Y. Liang;* [2]; *W. L. Teng;* [4];

1. Department of Civil and Environmental Engineering, University of Pittsburgh, Pittsburgh, PA, United States.
2. Department of Computer and Information Science, Indiana Univ.-Purdue Univ. Indianapolis, Indianapolis, IN, United States.
3. State Key Laboratory of Hydraulics and Mountain River Engineering, Sichuan University, Chengdu, Sichuan, China.
4. Goddard Earth Sciences Data and Information Services Center (ADNET), NASA, Greenbelt, MD, United States.

Body: The state departments of transportation in the U.S. are responsible for responding to weather- and hydrology-related emergencies affecting the transportation infrastructure, such as heavy rain, flooding, scouring of bridge structures, icing, and fog. These emergency response actions often require significant amount of effort to identify, inspect, and manage, e.g., potentially compromised bridges due to scouring. An online Hydrologic Disaster Forecasting and Response (HDFR) system is being developed for the Pennsylvania Department of Transportation (PennDOT), to provide more accurate estimates on current road infrastructure conditions. The HDFR system can automatically access satellite data from NASA data centers, NOAA radar rainfall measurements, and meteorological and hydrometeorological station observations. The accessed data can be fused, using an extended multi-scale Kalman smoother-based (MKS-based) algorithm to provide enhanced data products. The fused information is then contrasted with historical data, to assess the severity of the weather and hydrological conditions and to provide more accurate estimates of those areas with a high likelihood of being affected by similar emergencies. The real- and near-real-time data, as well as weather forecasts, are input to a multi-scale hydrological simulator. The HDFR system will be able to generate stream flow predictions at road-level scales, allowing for the monitoring of a complex and distributed infrastructure, with less computational resources than those previously required. Preliminary results will be presented that show the advantages of the HDFR system over PennDOT's current methods for identifying bridges in need of inspection.

Final ID: A31C-0060

Making NASA Remote Sensing Data Directly Usable in Multiscale Air Quality Models

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2. GES DISC, NASA Goddard Space Flight Center/George Mason University, Greenbelt, MD, United States.

Body: Air quality modelers represent an important group of NASA Earth science data users. Recent progress in NASA remote sensing data services has enabled usability, intercomparison, and analysis of NASA data generated from multiple sources for a wide variety of science research and application areas. This also applies to the role NASA remote sensing data has played in the development of NASA generated climate models and assimilated data. The process of locating, filtering and interpolating remote sensing data for use in air quality model development is, however, still a barrier to the broader use of satellite data by air quality modelers and model users. In particular, the Community Multiscale Air Quality (CMAQ) modeling community, which includes over 5000 registered users in 90 countries, currently have no easy way to obtain quality assured remote sensing data and convert it into CMAQ model-compatible grid projections and data formats. Incompatibilities between remote sensing data and model required data formats have also hindered remote sensing and model intercomparisons and validation

The various efforts to transform NASA remote sensing data to a format directly usable by air quality modelers have been identified and analyzed. They include:

-Spatial re-projection - Generate regional model gridding.
-Format conversion - Convert to CMAQ model format.
-Quality filtering - Apply quality control flags.
-Model ready output - Provide desired spatial/temporal requirements, format, and projection.

This presentation describes NASA data that are of interest to air quality modelers, description of roadblocks that air quality modelers face in using this data, and present potential solutions that address these roadblocks. Data visualization comparisons, quality filtering examples, and implementation suggestions are provided.

URL: http://disc.gsfc.nasa.gov/

Final ID: IN31C-1516

Exploring NASA Satellite Data with High Resolution Visualization

J. C. Wei; [1, 2]; *W. Yang;* [2, 3]; *J. E. Johnson;* [1, 2]; *S. Shen;* [2, 3]; *P. Zhao;* [2, 3]; *I. V. Gerasimov;* [1, 2]; *B. Vollmer;* [2]; *G. A. Vicente;* [2]; *L. Pham;* [2];

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3. George Mason University, Fairfax, VA, United States.

Body: Satellite data products are important for a wide variety of applications that can bring far-reaching benefits to the science community and the broader society. These benefits can best be achieved if the satellite data are well utilized and interpreted, such as model inputs from satellite, or extreme event (such as volcano eruption, dust storm, …etc) interpretation from satellite. Unfortunately, this is not always the case, despite the abundance and relative maturity of numerous satellite data products provided by NASA and other organizations. Such obstacles may be avoided by providing satellite data as 'Images' with accurate pixel-level (Level 2) information, including pixel coverage area delineation and science team recommended quality screening for individual geophysical parameters.

We will present a prototype service from the Goddard Earth Sciences Data and Information Services Center (GES DISC) supporting various visualization and data accessing capabilities from satellite Level 2 data (non-aggregated and un-gridded) at high spatial resolution. Functionality will include selecting data sources (e.g., multiple parameters under the same measurement, like NO2 and SO2 from Ozone Monitoring Instrument (OMI), or same parameter with different methods of aggregation, like NO2 in OMNO2G and OMNO2D products), defining area-of-interest and temporal
extents, zooming, panning, overlaying, sliding, and data subsetting and
reformatting. The portal interface will connect to the backend services with
OGC standard-compliant Web Mapping Service (WMS) and Web Coverage Service
(WCS) calls. The interface will also be able to connect to other OGC WMS and
WCS servers, which will greatly enhance its expandability to integrate
additional outside data/map sources.

Final ID: IN32A-03

Maintaining the momentum of Open Search in Earth Science Data discovery

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Body: Federated Search for Earth Observation data has been a hallmark of EOSDIS (Earth Observing System Data and Information System) for two decades. Originally, the EOSDIS Version 0 system provided both data-collection-level and granule/file-level search in the mid 1990s with EOSDIS-specific socket protocols and message formats.

Since that time, the advent of several standards has helped to simplify EOSDIS federated search, beginning with HTTP as the transfer protocol. Most recently, OpenSearch (www.opensearch.org) was employed for the EOS Clearinghouse (ECHO), based on a set of conventions that had been developed within the Earth Science Information Partners (ESIP) Federation.

The ECHO OpenSearch API has evolved to encompass the ESIP RFC and the Open Geospatial Consortium (OGC) Open Search standard. Uptake of the ECHO Open Search API has been significant and has made ECHO accessible to client developers that found the previous ECHO SOAP API and current REST API too complex.

Client adoption of the OpenSearch API appears to be largely driven by the simplicity of the OpenSearch convention. This simplicity is thus important to retain as the standard and convention evolve.

For example, ECHO metrics indicate that the vast majority of ECHO users favor the following search criteria when using the REST API,

- Spatial – bounding box, polygon, line and point
- Temporal – start and end time
- Keywords – free text

Fewer than 10% of searches use additional constraints, particularly those requiring a controlled vocabulary, such as instrument, sensor, etc. This suggests that ongoing standardization efforts around OpenSearch usage for Earth Observation data may be more productive if oriented toward improving support for the Spatial, Temporal and Keyword search aspects.

Areas still requiring improvement include support of

- Concrete requirements for keyword constraints
- Phrasal search for keyword constraints
- Temporal constraint relations
- Terminological symmetry between search URLs and response documents for both temporal and spatial terms
- Best practices for both servers and clients.

Over the past year we have seen several ongoing efforts to further standardize Open Search in the earth science domain such as,

- Federation of Earth Science Information Partners (ESIP)
- Open Geospatial Consortium (OGC)
- Committee on Earth Observation Satellites (CEOS)

Final ID: H32F-06

Global Water Maps

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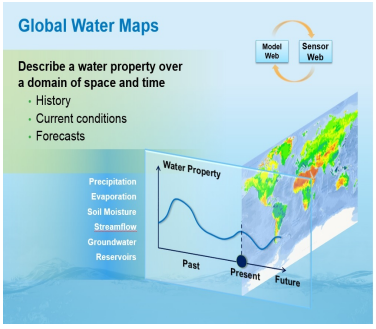
3. ADNET Systems, Inc., , Rockville, MD, United States.

Body: A global water map is a coverage of the earth that describes the state of water circulation in a phase of the hydrologic cycle. This information can be published as a map showing the state of the water variable at a particular point in time, or charted as a time series showing the temporal variation of that variable at a point in space. Such maps can be created through the NASA Land Data Assimilation System (LDAS) for precipitation, evaporation, soil moisture, and other parameters describing the vertical exchange of water between the land and atmosphere, through a combination of observations and simulation modeling. Point observations of water variables such as precipitation and streamflow are carried out by local hydrologic measurement agencies associated with a particular area. These point observations are now being published as web services in the WaterML language and federated using the Global Earth Observing System of Systems to enable the publication of water observations maps for these variables. By combining water maps derived from LDAS with those from federated point observations, a deeper understanding of global water conditions and movement can be created. This information should be described in a Hydrologic Data Book that specifies the information content of each of these map layers so that they can be appropriately used and combined.



Final ID: H33E-1418

Preparing Precipitation Data Access, Value-added Services and Scientific Exploration Tools for the Integrated Multi-satellitE Retrievals for GPM (IMERG)

D. Ostrenga; [1, 3]; *Z. Liu;* [2, 3]; *S. J. Kempler;* [3]; *B. Vollmer;* [3]; *W. L. Teng;* [1, 3];
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Body: The Precipitation Data and Information Services Center (PDISC) (http://disc.gsfc.nasa.gov/precipitation or google: NASA PDISC), located at the NASA Goddard Space Flight Center (GSFC) Earth Sciences (GES) Data and Information Services Center (DISC), is home of the Tropical Rainfall Measuring Mission (TRMM) data archive. For over 15 years, the GES DISC has served not only TRMM, but also other space-based, airborne-based, field campaign and ground-based precipitation data products to the precipitation community and other disciplinary communities as well.

The TRMM Multi-Satellite Precipitation Analysis (TMPA) products are the most popular products in the TRMM product family in terms of data download and access through Mirador, the GES-DISC Interactive Online Visualization ANd aNalysis Infrastructure (Giovanni) and other services. The next generation of TMPA, the Integrated Multi-satellitE Retrievals for GPM (IMERG) to be released in 2014 after the launch of GPM, will be significantly improved in terms of spatial and temporal resolutions. To better serve the user community, we are preparing data services and samples are listed below.

To enable scientific exploration of Earth science data products without going through complicated and often time consuming processes, such as data downloading, data processing, etc., the GES DISC has developed Giovanni in consultation with members of the user community, requesting quick search, subset, analysis and display capabilities for their specific data of interest. For example, the TRMM Online Visualization and Analysis System (TOVAS, http://disc2.nascom.nasa.gov/Giovanni/tovas/) has proven extremely popular, especially as additional datasets have been added upon request. Giovanni will continue to evolve to accommodate GPM data and the multi-sensor data inter-comparisons that will be sure to follow.

Additional PDISC tool and service capabilities being adapted for GPM data include: An on-line PDISC Portal (includes user guide, etc.); Data ingest, processing, distribution from on-line archive; Google-like Mirador data search and access engine; electronic distribution, Subscriptions; Uses semantic technology to help manage large amounts of multi-sensor data and their relationships; Data drill down and search capabilities; Data access through various web services, i.e., OPeNDAP, GDS, WMS, WCS; Conversion into various formats, e.g., netCDF, HDF, KML (for Google Earth), ascii; Exploration, visualization and statistical online analysis through Giovanni; Visualization and analysis of L2 data profiles and maps; Generation of derived products, such as, daily products; Parameter and spatial subsetting; Time and temporal aggregation; Regridding; Data version control and provenance; Data Stewardship - Continuous archive verification; Documentation; Science support for proper data usage, help desk; Monitoring services for applications; Expertise in data related standards and interoperability.
This presentation will further describe the data services at the PDISC that are currently being utilized by precipitation science and application researchers, and the preparation plan for IMERG. Comments and feedback are welcome.

Final ID: B41A-0375

Enhancing USDA's Retrospective Analog Year Analyses Using NASA Satellite Precipitation and Soil Moisture Data

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Body: The USDA World Agricultural Outlook Board (WAOB) is responsible for monitoring weather and climate impacts on domestic and foreign crop development. One of WAOB's primary goals is to determine the net cumulative effect of weather and climate anomalies on final crop yields. To this end, a broad array of information is consulted, including maps, charts, and time series of recent weather, climate, and crop observations; numerical output from weather and crop models; and reports from the press, USDA attachés, and foreign governments. The resulting agricultural weather assessments are published in the Weekly Weather and Crop Bulletin, to keep farmers, policy makers, and commercial agricultural interests informed of weather and climate impacts on agriculture. Because both the amount and timing of precipitation significantly affect crop yields, WAOB has often, as part of its operational process, used historical time series of surface-based precipitation observations to visually identify growing seasons with similar (analog) weather patterns as, and help estimate crop yields for, the current growing season. As part of a larger effort to improve WAOB estimates by integrating NASA remote sensing observations and research results into WAOB's decision-making environment, a more rigorous, statistical method for identifying analog years was developed. This method, termed the analog index (AI), is based on the Nash–Sutcliffe model efficiency coefficient. The AI was computed for five study areas and six growing seasons of data analyzed (2003-2007 as potential analog years and 2008 as the target year). Previously reported results compared the performance of AI for time series derived from surface-based observations vs. satellite-retrieved precipitation data. Those results showed that, for all five areas, crop yield estimates derived from satellite-retrieved precipitation data are closer to measured yields than are estimates derived from surface-based precipitation observations. Subsequent work has compared the relative performance of AI for time series derived from satellite-retrieved surface soil moisture data and from root zone soil moisture derived from the assimilation of surface soil moisture data into a land surface model. These results, which also showed the potential benefits of satellite data for analog year analyses, will be presented.

Final ID: H42F-08

Implementing the International Precipitation Working Group (IPWG) Validation Statistics in Online Tools to Inter-compare and Characterize Satellite-derived Global Precipitation Products

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3. Adnet, McLean, VA, United States.

Body: In recent years, precipitation products generated from algorithms that use multi-satellites are widely used in hydrometeorological applications, i.e. the TRMM Multi-satellite Precipitation Analysis (TMPA). However, differences do exist in satellite-derived precipitation products due to issues such as instrument biases, spatial sampling, orbital changes, heterogeneous surface types, terrain, etc. and it is important to understand and quantify these differences in order for users to apply the knowledge to research and applications.

In 2012, we developed several online prototypes in the TRMM Online Visualization and Analysis System (TOVAS) which is a part of the GES DISC Giovanni (the GES-DISC Interactive Online Visualization ANd aNalysis Infrastructure) family and users can create area plot, time series, scatter plot, ASCII data output, etc. for inter-comparison with a web browser. This year, we are adding the IPWG (International Precipitation Working Group) validation algorithms/statistics to further reveal characteristics and differences in satellite-derived daily products. The IPWG statistics contains 14 methods commonly used in weather forecast verification, such as, Heidke skill score, Hanssen and Kuipers score, Bias score, False alarm ratio, etc. In this presentation, we will show results of these newly added statistical methods.

URL: http://disc.sci.gsfc.nasa.gov/precipitation/tovas

Final ID: A43B-0254

AIRS Version 6 Products and Data Services at NASA GES DISC

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Body: The NASA Goddard Earth Sciences Data and Information Services Center (GES DISC) is the home of processing, archiving, and distribution services for data from the Atmospheric Infrared Sounder (AIRS) mission. The AIRS mission is entering its 11th year of global observations of the atmospheric state, including temperature and humidity profiles, outgoing longwave radiation, cloud properties, and trace gases. The GES DISC, in collaboration with the AIRS Project, released data from the Version 6 algorithm in early 2013. The new algorithm represents a significant improvement over previous versions in terms of greater stability, yield, and quality of products. Among the most substantial advances are: improved soundings of Tropospheric and Sea Surface Temperatures; larger improvements with increasing cloud cover; improved retrievals of surface spectral emissivity; near-complete removal of spurious temperature bias trends seen in earlier versions; substantially improved retrieval yield (i.e., number of soundings accepted for output) for climate studies; AIRS-Only retrievals with comparable accuracy to AIRS+AMSU (Advanced Microwave Sounding Unit) retrievals; and more realistic hemispheric seasonal variability and global distribution of carbon monoxide.

The GES DISC is working to bring the distribution services up-to-date with these new developments. Our focus is on popular services, like variable subsetting and quality screening, which are impacted by the new elements in Version 6. Other developments in visualization services, such as Giovanni, Near-Real Time imagery, and a granule-map viewer, are progressing along with the introduction of the new data; each service presents its own challenge.

This presentation will demonstrate the most significant improvements in Version 6 AIRS products, such as newly added variables (higher resolution outgoing longwave radiation, new cloud property products, etc.), the new quality control schema, and improved retrieval yields. We will also demonstrate the various distribution and visualization services for AIRS data products. The cloud properties, model physics, and water and energy cycles research communities are invited to take advantage of the improvements in Version 6 AIRS products and the various services at GES DISC which provide them.

Final ID: A43D-0297

Evaluation of Uncertainty in Satellite Monthly Aerosol Products Associated with Spatial Sampling

S. Shen; [1, 2]; *C. Lynnes;* [1]; *A. M. Sayer;* [1, 3]; *C. Bettenhausen;* [1, 4]; *J. C. Wei;* [1, 5]; *B. Vollmer;* [1]; *N. C. Hsu;* [1]; *S. J. Kempler;* [1];

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4. SSAI, Lanham, MD, United States.
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Body: Large amounts of data are frequently missing from global satellite Level 3 daily aerosol products, due to limitations of both the satellite sensor and data retrieval algorithms. Missing data may be caused by orbital gaps, or the impact of cloud, and snow/ice, etc. For example, the spatial completeness (i.e. valid data point ratio) of global 1ox1o resolution daily aerosol optical thickness (AOT) from MODIS (Dark Target algorithm) is about 25-40%, while SeaWiFS (Deep Blue algorithm) is typically 15-23%, and MISR is only ~ 5%. Spatial completeness of AOT varies geographically and seasonally. Wave-like artifacts were observed in MISR monthly products due to large data gaps associated with its narrow orbit. To evaluate uncertainty in AOT caused by spatial incompleteness, using data from NASA Goddard Chemistry Aerosol Radiation and Transport (GOCART) model, data gaps in satellite level 3 daily aerosol products from SeaWiFS (Deep Blue), MODIS (Dark Target), and MISR are simulated. Errors and uncertainty due to spatial sampling are analyzed by comparing the original and filtered model data. The uncertainty of global daily mean AOT has a negative relationship to the spatial completeness, i.e., uncertainty increases as the spatial completeness of the data set decreases. Significant negative bias is found in the global mean of filtered AOT from MODIS, in particular March-September, but not in SeaWiFS and MISR. This is largely due to the lack of coverage over deserts in the MODIS Dark Target data set. Monthly AOT are generally composed from daily data – we found that the differences between monthly data composed from original and filtered model daily data are significant in some regions. This presentation will show a statistical analysis of uncertainty in monthly AOT data due to spatial sampling.

Final ID: IN51A-1539

Performance, Agility and Cost of Cloud Computing Services for NASA GES DISC Giovanni Application

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3. George Mason University, Fairfax, VA, United States.

Body: The NASA Goddard Earth Science Data and Information Services Center (GES DISC) is investigating the performance, agility and cost of Cloud computing for GES DISC applications. Giovanni (Geospatial Interactive Online Visualization ANd aNalysis Infrastructure), one of the core applications at the GES DISC for online climate-related Earth science data access, subsetting, analysis, visualization, and downloading, was used to evaluate the feasibility and effort of porting an application to the Amazon Cloud Services platform. The performance and the cost of running Giovanni on the Amazon Cloud were compared to similar parameters for the GES DISC local operational system.
A Giovanni Time-Series analysis of aerosol absorption optical depth (388nm) from OMI (Ozone Monitoring Instrument)/Aura was selected for these comparisons. All required data were pre-cached in both the Cloud and local system to avoid data transfer delays. The 3-, 6-, 12-, and 24-month data were used for analysis on the Cloud and local system respectively, and the processing times for the analysis were used to evaluate system performance. To investigate application agility, Giovanni was installed and tested on multiple Cloud platforms. The cost of using a Cloud computing platform mainly consists of: computing, storage, data requests, and data transfer in/out. The Cloud computing cost is calculated based on the hourly rate, and the storage cost is calculated based on the rate of Gigabytes per month. Cost for incoming data transfer is free, and for data transfer out, the cost is based on the rate in Gigabytes. The costs for a local server system consist of buying hardware/software, system maintenance/updating, and operating cost. The results showed that the Cloud platform had a 38% better performance and cost 36% less than the local system. This investigation shows the potential of cloud computing to increase system performance and lower the overall cost of system management.

Final ID: A52D-06

Long-term dust climatology in the western United States

D. Tong; [1]; *H. Lei;* [1]; *J. X. Wang;* [1]; *P. Lee;* [1];
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Body: Dust activity is an important indicator to regional climate change. The Dust Bowl in the 1930s was the largest natural catastrophe in the North America history, caused by extended drought and poor land management. Although the severity and duration of the 1930s drought was exceptional, reconstructed paleo-climatic records show that the central U.S. plains have experienced severe droughts about once or twice a century over the past 400 years. Dust record is hence an integral component of the national climate assessment (NCA). This work presents our recent efforts to develop a climate-quality indicator of local windblown dust storms in the U.S. For the arid and semi-arid regions of the western United States, we have developed a novel approach to identify local windblown dust events through routine ambient aerosol monitoring (Tong et al., 2012). This work uses the dust identification algorithm to develop a dust storm dataset (dust indicator), and rely on satellite dust detection and model dust prediction as independent data sources to test, cross-check and validate the dust indicator. This work will extend our research capabilities to contribute developing new climate indicators that are especially aimed at needs of local environmental managers in the Southwestern communities.

Final ID: IN53D-1592

Discovering accessibility, display, and manipulation of data in a data portal

N. J. Hoebelheinrich; [1]; *P. West;* [2]; *P. A. Fox;* [2]; *C. Lynnes;* [3];

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2. Tetherless World Constellation, Rensselaer Polytechnic Institute, Troy, NY, United States.
3. Goddard Space Flight Center, NASA, Greenbelt, MD, United States.

Body: The accessibility of science data products is becoming increasingly easier, with more and more data and scientific community portals coming online all the time. But what can one do with the data product once it has been found? Can I visualize the data product as a map, plot, or graph? Can I import the data into a particular data manipulation tool like MatLab or IDL or iPython Notebook? How is the dataset accessible, and what kind of data products can be generated from it? ToolMatch is a crowd source approach (ontological model, information model, RDF Schema) that allows data and tool providers, and portal developers to enable user discovery of what can be done with a science data product, or conversely, which science data products are usable within a given tool.

Example queries may include “I need data for Carbon dioxide (CO2) concentrations, a climate change indicator, for the summer of 2012, that can be accessed via OPeNDAP Hyrax and plotted as a timeseries.”, or “I need data with measurements of atmospheric aerosol optical depth sliced along latitude and longitude, returned as netcdf data, and accessible in MatLab.”

This contribution outlines the progress of the ToolMatch development, plans for utilizing its capabilities, and efforts to leverage and enhance the use of ToolMatch in various portals.

URL: http://wiki.esipfed.org/index.php/ToolMatch