changes in continental weathering and in oceanic biogeochemical processes and their effects on sedimentation. Material recovered by the Ocean Drilling Program has been essential to deciphering the sedimentary geochemistry of phosphorus and its ocean history through time. We demonstrate that the burial of phosphorus in marine sediments on depths scales of tens to hundreds of meters is controlled by geochemical transformations in the sediment resulting from microbially mediated organic matter oxidation. These transformations are often reflected in interstitial water geochemistry as well, and they have significant influence on carbon/phosphorus burial ratios. These result in a widely disseminated authigenic phase, presumably carbonate fluorapatite. This phase is present at low concentrations in all of the marine sediments we have examined, and is therefore a major sink for oceanic phosphorus burial. Determining the geochemistry and concentration of phosphorus burial provided us the basis for records of phosphorus accumulation in sediments, which we coupled with multi-proxy investigations of tracers related to export productivity (barium excess), biogenic sediment accumulation (opal and calcium carbonate), and sedimentary redox state (sediment trace metals, interstitial water geochemistry). I use several examples to illustrate P burial responses on different timescales in intervals of carbon cycle and/or climate change. These will also be used to demonstrate the fruitful lessons we have learned about geochemical methods, age models and physical properties, and the challenges and value of multi-proxy approaches to ocean history.

U12B-06 1740h

Analogue or Anomaly? Ocean Drilling Evidence From Marine Isotope Stage 11

Jerry F McManus[1] (508-289-3328; jmcmanus@whoi.edu)

Delia W Oppo[1] (508-289-2681; doppo@whoi.edu)

James L Cullen[2] (978-542-6283; james.cullen@salemstate.edu)

Peter Huybers[3] (phuybers@ocean.mit.edu)

Luna Federici[1] (lunaf@stanford.edu)

[1]Dept of Geology and Geophysics, Woods Hole Oceanographic Institution, 360 Woods Hole Road, Woods Hole, MA 02543, United States

[2]Salem State College, Dept. of Geol., Salem, MA 01970, United States

[3]Program in Atmospheres, Oceans and Climate, MIT, PAOC, Cambridge, MA 02139, United States

Ocean Drilling makes it possible to recover high quality sedimentary archives from important earlier geologic intervals, such as Marine Isotope Stage 11 (MIS 11), approximately 400 ky BP. Similar orbital configurations and comparable atmospheric greenhouse gas concentrations have led to the suggestion that MIS 11 is a suitable, possibly the best, geological analogue for the natural development of Holocene and future climate. Yet the anomalously strong climate response during MIS 11 in the absence of strong seasonal insolation changes has long been described as the "the stage 11 problem". Here we review evidence from a number of widely distributed ODP locations indicating that MIS 11 was not likely to have been a "super interglacial" interval characterized by both significantly higher sea-level and global temperatures. We discuss the stability and strength of the meridional overturning circulation as a potential compensator for the limited insolation. We present detailed faunal, ice-rafting, and isotopic records from North Atlantic ODP Sites 980 (55°N, 15°W, 2.2km), 983 (60°N, 24°W, 2.0km), and 984 (61°N, 25°W, 1.6 km) confirm the relative stability of MIS 11 on millennial timescales, and document that the transition to the more characteristic instability of the Pleistocene occurred dramatically and abruptly following the warm interval. In addition, we consider a variety of tuning techniques and apply a new independent dating approach to deep-sea sediment sequences to show that the regional stable warmth of MIS 11 in the North Atlantic long outlasted the elapsed portion of the Holocene. Next, we address the question of possibly higher sea levels during MIS 11 with isotopic evidence from ODP Site 925 (4°N, 43°W, 3.0km) in the Tropical Atlantic, ODP Site 1242 (8°N, 84°W, 1.4km) in the eastern tropical Pacific, and ODP Site 806 (0°N, 159°W, 2.5km) in the western tropical Pacific. Finally, we discuss possible ways to reconcile the apparently conflicting evidence in existing records of sea-level, temperature, and variability during MIS 11.

U13A MCC: 3001-3003 Monday 1815h

Frontiers of Geophysics

Presiding: **R E Dickinson,** Georgia Institute of Technology

U13A-01 1820h INVITED

Voyager 1 in the Vicinity of the Solar Wind Termination Shock

Edward C Stone ((626) 395-8321; ecs@srl.caltech.edu)

Caltech, 220-47 Downs Laboratory, Pasadena, CA 91125, United States

The termination shock marks the abrupt slowing of the solar wind from supersonic to subsonic speeds as it approaches the edge of the heliosphere. The shock likely accelerates anomalous cosmic rays and reaccelerates galactic cosmic rays and other solar and interplanetary ions. In mid 2002 when Voyager 1 was at 85 AU, it observed an unusual enhancement of MeV ions and electrons that was not present at Voyager 2 at 68 AU. Although some aspects of the energetic particle data suggest that Voyager 1 entered the subsonic flow of the heliosheath at that time, the anomalous cosmic ray intensity remained lower than expected at the shock and the interplanetary magnetic field did not show the compression expected as the wind slows. These and other aspects such as strong field aligned beaming suggest an unexpected complexity in the vicinity of a termination shock that is more dynamic than anticipated. Our understanding of this new region of the heliosphere should continue to increase as Voyager 1 surfs along the shock over the next several years.

U21A MCC: 2002-2004 Tuesday 0800h

Virtual Observatories in Space and Earth Sciences I

Presiding: **L Paxton,** Applied Physics Laboratory, Johns Hopkins University**; M B Weiss,** Applied Physics Laboratory, Johns Hopkins University

U21A-01 0800h INVITED

Moving Beyond IGY: An Electronic Geophysical Year (eGY) Concept

D. N. Baker[1] (daniel.baker@lasp.colorado.edu); C. E. Barton[2] (charles.barton@ga.gov.au); A. S. Rodger[3] (A.Rodger@bas.ac.uk); B. J. Thompson[4] (Barbara.J.Thompson@nasa.gov); B. Fraser[5] (brian.fraser@newcastle.edu.au); V. Papitashvili[6] (papita@umich.edu)

[1]D.N. Baker, LASP/Univ. of Colorado 1234 Innovation Drive, Boulder, CO 80303-7814, United States

[2]C.E. Barton, POB 5414, Kingston, ACT 2604, Australia

[3]A.S. Rodger, Brit. Antarctic Survey Madingley Road, Cambridge CB3 0ET, United Kingdom

[4]B.J. Thompson, NASA/GSFC Code 682, Greenbelt, MD 20771, United States

[5]B. Fraser, Space Physics Group Univ. of Newcastle University Drive, Callaghan, NSW 2308, Australia

[6]V. Papitashvili, SPRL/Univ of Michigan 2455 Hayward St., Ann Arbor, MI 48109-8033, United States

During the International Geophysical Year (1957-1958), member countries established many new geophysical observatories pursuing the major IGY objectives - to collect geophysical data as widely as possible and to provide free access to these data for all scientists around the globe. Today, geophysics has attained a rather good understanding within traditional regions, i.e., the atmosphere, ionosphere, magnetosphere, and other such geospheres. At the same time, it has become clear that much of the new and important science is coming from the studies of interfaces and coupling between geospheres. Thus, if geophysical data are made 'transparently" available to a much wider range of scientists and students than to those who do the observations, then new and exciting discoveries can be expected. An International Association of Geomagnetic and Aeronomy (IAGA) task force, recognizing that a key achievement of the IGY was the establishment of a worldwide system of data centers and physical observatories, proposes that for the 50th anniversary of IGY, the worldwide scientific community should endorse and promote an *electronic Geophysical Year (eGY)* initiative. The proposed *eGY* concept would both commemorate the IGY in 2007-2008 and provide a forward impetus to geophysics in 21st century, similar to that provided by the IGY fifty years ago. The IAGA task force strongly advocates: (1) Securing permission and release of existing data; (2) Creating access to information; and (3) Conversion of relevant analog data to digital form. The *eGY* concept embraces all available and upcoming geophysical data (e.g., atmospheric, ionospheric, geomagnetic, gravity, etc.) through the establishment of a series of *virtual geophysical observatories* now being 'deployed" in cyberspace. The *eGY* concept is modern, global, and timely; it is attractive, pragmatic, and affordable. The *eGY* is based on the existing and continually developing computing/networking technologies (e.g., XML, Semantic Web, etc.) and international cyber infrastructure. Moreover, the International Union of Geodesy and Geophysics (IUGG) has supported the *eGY* concept, which can smoothly be incorporated into various existing 'International Year" initiatives - such as the International Polar Year, International Heliophysical Year, or International Year of the Planet Earth.

U21A-02 0820h

Virtual Observatories, Virtual Archives: Only as Good as Their Metadata?

Ruth Duerr[1] (1-303-735-0136; rduerr@nsidc.org); Marilyn Kaminski[1] (marilynk@nsidc.org); Melinda C. Marquis[1] (marquism@kryos.colorado.edu); Mark A Parsons[1] (parsonsm@kryos.colorado.edu); Florence Fetterer[1] (fetterer@kryos.colorado.edu); Keri Webster[1] (kwebster@nsidc.org); Teresa Mullins[1] (tmullins@kryos.colorado.edu)

[1]National Snow and Ice Data Center, University of Colorado UCB 449, Boulder, CO 80309-0449, United States

Over the last 27 years, the National Snow and Ice Data Center has participated in a number of programs that have striven to provide ready access to high-quality observations and long-term geophysical records. In the last 10 years these programs have increasingly involved data archived at multiple, geographically distributed sites. The key lessons we have learned from these experiences are that providing access to data is not sufficient for users to find and successfully use it, and that ensuring long-term preservation of data is especially difficult in a distributed environment. Developing and maintaining appropriate metadata (i.e., information about the data) is key to facilitating data discovery and use and is also important to data preservation, as is maintaining linkage between the data and its metadata. Yet there are many programmatic, scientific and technical challenges to developing and maintaining these metadata and linkages. Examples from a variety of NSIDC programs illustrate these challenges and some of the tools and techniques employed to overcome them.

U21A-03 0835h

CoSEC: Orchestrated Web Services for Living with a Star

Neal Hurlburt[1] (650 354 5504; hurlburt@lmsal.com); Sam Freeland[1] (freeland@lmsal.com); Prasanta Bose[1] (prasanta.bose@lmco.com); Greg Slater[1] (slater@lmsal.com); Frank Hill[2] (hill@noao.edu); Robert Bentley[3] (rdb@mssl.ucl.ac.uk)

[1]Lockheed Martin Advanced Technology Center, O/L9-41, B252 3251 Hanover St, Palo Alto, CA 94304, United States

[2]National Solar Observatory, 950 N. Cherry Ave, Tucson, AZ 85719, United States

[3]Mullard Space Science Laboratory, Holmbury St Mary, Dorking, SUR Rh5 6NT, United Kingdom

The Collaborative Sun-Earth Connector (CoSEC) is a testbed for developing and deploying data and modeling services for the space science community. We will demonstrate the concept using the current prototype, www.lmsal.com/cosec, and offer templates and tools for expanding the prototype with existing space science data and models using the SolarSoft framework. In addition we will discuss how CoSEC to relates to other projects, including other space science Virtual Observatories and the European Grid of Solar Observations. This research has been supported through NASA grant NAG5-10784.

URL: http://www.lmsal.com/cosec

U21A-04 0850h

GEON: Cyberinfrastructure for the Geosciences

Dogan Seber[1] (858-822-5409; seber@sdsc.edu)

Randy Keller[2] (keller@geo.utep.edu)

Krishna Sinha[3] (pitlab@vt.edu)

Chaitan Baru[1] (baru@sdsc.edu)

Geon Team

[1]San Diego Supercomputer Center, 9500 Gilman Dr. MC 0505, La Jolla, CA 92093, United States

[2]University of Texas at El Paso, Geological Sciences, El Paso, TX 79902, United States

[3]Virginia Polytechnic Institute and State University, Geological Sciences, Blacksburg, CA 24061, United States

The GEON (GEOscience Network) is a multi-disciplinary research initiative conducted jointly by earth and computer scientists aimed at developing a cyberinfrastructure for the geosciences. GEON has been developed in response to the pressing needs in the geosciences to interlink and share multidisciplinary data sets and tools to understand the complex dynamics of Earth systems. The creation of GEON will provide the critical infrastructure necessary to facilitate much needed collaborative interdisciplinary earth science research. As earth sciences are going through major changes and headed towards integrating interdisciplinary data and knowledge for scientific discovery processes, geoscientists have realized that current systems to conduct such interdisciplinary research are extremely inadequate. In addition to technical difficulties, cultural barriers among earth science disciplines also hinder progress. GEON is designed to alleviate these problems by creating an infrastructure and a cultural environment to enable collaboration and scientific discoveries. Creating such a cyberinfrastructure to integrate, analyze, and model 4D geoscience data poses fundamental IT research challenges due to the extreme heterogeneity of geoscience data formats, storage and computing systems and, most importantly, the ubiquity of hidden semantic and differing conventions, terminologies, and ontological frameworks across disciplines. Integrating data sets at semantic levels and providing users information about data sets, tools, and other resources at the "concept" level will provide unprecedented opportunities for research and education. Researchers will be able to access and utilize, with minimal effort, data and tools from an allied discipline. In its cyberinfrastructure efforts GEON is using grid technology. Grids are designed to provide sustainable and distributed architecture to enable seamless access to data sets and computational resources over the Internet using secure links and connections. The GEONgrid and the grid portal are being built as open source platforms allowing the community to develop their own tools and access mechanisms. As test cases earth science research in GEON is focused on two regions: the Rocky Mountains and the Mid-Atlantic region. The topics being studied in each area are intracontinental deformation and Terrane recognition and analysis, respectively. The GEONgrid can be accessed at http://www.geongrid.org/

URL: http://www.geongrid.org

U21A-05 0905h

EC-Project MEREDIAN: Improved Data Exchange Infrastructure and a Virtual Network for Europe and the Mediterranean

Chad Trabant[1] (+31 30 22 06 405; chad.trabant@knmi.nl)

Torild van Eck[1] (vaneck@knmi.nl)

Bernard Dost[1] (dost@knmi.nl)

. The EC-Project Meredian[2] (vaneck@knmi.nl)

[1]ORFEUS Data Center, Royal Netherlands Meteorological Institute (http://orfeus.knmi.nl), ORFEUS Data Center KNMI Seismology Division Wilhelminalaan 10, De Bilt 3730AE, Netherlands

[2]The EC-Project MEREDIAN (http://orfeus.knmi.nl/meredian), ORFEUS Data Center KNMI Seismology Division Wilhelminalaan 10, De Bilt 3730AE, Netherlands

The Mediterranean-European Rapid Earthquake Data Information and Archiving Network (MEREDIAN) project aims to improve the existing European infrastructure for seismological data exchange while simultaneously addressing relevant scientific and technical requirements. Coordinated by the Observatories and Research Facilities for EUropean Seismology (ORFEUS) in The Netherlands, the MEREDIAN consortium is composed of 18 national institutions. With an emphasis on providing uninhibited access to real-time and archived seismic waveform data, the project is supporting the development of general purpose tools and standards for both seismic data suppliers and consumers. A major component of this project is the ongoing development of the Virtual European Broad-band Seismograph Network (VEBSN). The ORFEUS Data Center (ODC) performs the network operations for the VEBSN while data streams from broad-band seismic stations are contributed by consortium members and others. The VEBSN is a fully functional automatic seismic network which locates earthquakes, calculates magnitudes and generates seismic event alerts. The primary purpose of the VEBSN is to expedite and automate data collection at the ODC. This system allows the ODC to provide event-based data sets, from a well distributed group of broad-band stations in the region, within minutes or hours of significant European-Mediterranean seismic events. Our requirements for developing the VEBSN were 1) flexible data transmission software that can interface with diverse data sources at peer institutions, 2) reliable exchange protocols, resistant to data gaps during network congestion or problems and 3) a central system to collect and process all the incoming data streams. Our solution to the first two challenges was to adopt and support the open source Seismological Communication Processor (SeisComP). This package is lightweight, flexible and implements a reliable data transmission protocol, making it an invaluable component of the VEBSN. Besides the SeedLink protocol used by SeisComP we collect data streams using two other reliable protocols, Antelope ORB and CD-1, due to their pre-existence at peer sites. In the interest of time and cost efficiency we purchased the proprietary Antelope software system to function as the central collection and processing hub. EC-Project MEREDIAN: Contract No. EVR1-CT-2000-40007

URL: http://orfeus.knmi.nl/vebsn/

U21A-06 0920h

ROADNET: A Real-time Data Aware System for Earth, Oceanographic, and Environmental Applications

Frank Vernon[1] (flvernon@ucsd.edu); Todd Hansen[2] (tshansen@nlanr.net); Kent Lindquist[3] (kent@lindquistconsulting.com); Bertram Ludascher[2] (ludaesch@sdsc.edu); John Orcutt[1] (jorcutt@ucsd.edu); Arcot Rajasekar[2] (sekar@sdsc.edu)

[1]IGPP, UCSD, La Jolla, CA 92039-0225

[2]SDSC, UCSD, La Jolla, CA 92093

[3]Lindquist Consulting, 59 College Rd, Fairbanks, AK 99701

The Real-time Observatories, Application, and Data management Network (ROADNet) Program aims to develop an integrated, seamless, and transparent environmental information network that will deliver geophysical, oceanographic, hydrological, ecological, and physical data to a variety of users in real-time. ROADNet is a multidisciplinary, multinational partnership of researchers, policymakers, natural resource managers, educators, and students who aim to use the data to advance our understanding and management of coastal, ocean, riparian, and terrestrial Earth systems in Southern California, Mexico, and well off shore. To date, project activity and funding have focused on the design and deployment of network linkages and on the exploratory development of the real-time data management system. We are currently adapting powerful "Data Grid" technologies to the unique challenges associated with the management and manipulation of real-time data. Current "Grid" projects deal with static data files, and significant technical innovation is required to address fundamental problems of real-time data processing, integration, and distribution. The technologies developed through this research will create a system that dynamically adapt downstream processing, cataloging, and data access interfaces when sensors are added or removed from the system; provide for real-time processing and monitoring of data streams–detecting events, and triggering computations, sensor and logger modifications, and other actions; integrate heterogeneous data from multiple (signal) domains; and provide for large-scale archival and querying of "consolidated" data. The software tools which must be developed do not exist, although limited prototype systems are available. This research has implications for the success of large-scale NSF initiatives in the Earth sciences (EarthScope), ocean sciences (OOI- Ocean Observatories Initiative), biological sciences (NEON - National Ecological Observatory Network) and civil engineering (NEES - Network for Earthquake Engineering Simulation). Each of these large scale initiatives aims to collect real-time data from thousands of sensors, and each will require new technologies to process, manage, and communicate real-time multidisciplinary environmental data on regional, national, and global scales.

U21A-07 0935h

Development of a GPS Seamless Archive

Michael Scharber[1] (8585341750; mscharber@josh.ucsd.edu)

Yehuda Bock[1] (8585345292; ybock@ucsd.edu)

Brent Gilmore[1] (8585348487; bgilmore@ucsd.edu)

[1]Scripps Institution of Oceanography, IGPP 0225 9500 Gilman Drive, La Jolla, CA 92093-0225, United States

The Scripps Orbit and Permanent Array Center (SOPAC) has completed development of software for UNAVCO's GPS Seamless Archive Center (GSAC). The GSAC is a collection of GPS data archives and their operating agencies that have agreed to exchange information about their individual data holdings. GSAC allows a user to locate GPS data and metadata from these different archives through a single interface; hence GSAC is an operating virtual observatory for continuous and "campaign" GPS data. Data providers collect or generate data and then supply the data to data wholesalers. Data wholesalers collect and archive data and metadata, from one or more data providers. GSAC currently has 7 U.S.-based data wholesalers (NASA's CDDIS, UC Berkeley's NCEDC, NGS, CWU's PANGA archive, SCEC, SOPAC, and UNAVCO). Together these archives hold over 2 million GPS data (RINEX) files collected for over 10,000 monuments, including a nearly complete set of data collected between 1986 and 2003 for the global network and western North America, and a significant quantity of data collected by U.S. scientists in other tectonically active regions. Data retailers collect information from the wholesalers in a well-defined manner and run a service for clients to access the information. Currently there are two GSAC retailers (SOPAC and UNAVCO). The GSAC software suite includes a Web-based interactive client (GSAC Wizard) to locate data, a command-line client to locate and download data, and a retailer service that uses a macro language to pass commands to a server using the http url. The command-line client uses the retailer service to communicate with the retailer server. SOPAC has also modified its map interface to work with GSAC so that GPS data can be located using a spatial context, and maintains a GSAC Home Page (http://gsac.ucsd.edu). In this abstract, we highlight achievements and lessons learned from our development of the current system, but focus on a possible next generation GSAC that will employ modern IT methodologies, provide a virtual archive with a much richer hierarchy of data products and models derived from GPS and other geodetic data, and make the interface with other geophysical virtual archives more feasible.

URL: http://gsac.ucsd.edu

U21A-08 0950h

USGS EROS Data Center Hazards Data Distribution System

Brenda K Jones[1] (605-594-6503; bkjones@usgs.gov)

Ron R Risty[1] (605-594-6969; risty@usgs.gov)

[1]USGS EROS Data Center/SAIC, 47914 252nd St, Sioux Falls, SD 57198, United States

The U.S. Geological Survey EROS Data Center (EDC) responds to emergencies on behalf of various government agencies for human-induced and natural disasters. This response consists of satellite tasking and acquisitions, satellite image registrations, disaster-extent maps analysis and creation, base image provision and support, Web-based mapping services for product delivery, and post disaster data archiving. The EDC Emergency Response staff are on call at all times and have access to many commercial and government satellite and aerial photography tasking authorities. They have access to data processing and photographic laboratory services for off-hour priority requests. EDC staff work with agencies for preparedness planning, which includes provision of base imagery. These data may include digital elevation models, hydrographic models, base satellite images, vector data layers such as roads, aerial photographs, and other pre-disaster data. These layers are incorporated into a Web-based browser and data delivery service, the Hazards Data Distribution System (HDDS). The HDDS can be made accessible either to the general public or to specific agencies. As usage of data for a particular event declines, the data are moved to a post disaster near-line archive that is still accessible, but not in real time. When usage has declined completely, the data are moved to an off-line archive. These data are still accessible, although not in real time, and can be reloaded for historical purposes if another disaster strikes the same area. The HDDS concept anticipates customer requirements and provides faster delivery of data and services. Pending final USGS approval.