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