OS62A-0242 1330h POSTER

Simulation of Wind-Driven Circulation on the Northern California Coast

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Time-dependent, three-dimensional circulation on the continental shelf off California in the region from 37.75°N to 40.25°N is studied using the Regional Ocean Modeling System (ROMS). ROMS is a free-surface, hydrostatic, primitive equation ocean model that uses generalized sigma coordinates in the vertical and orthogonal curvilinear coordinates in the horizontal. A limited area curvilinear grid with realistic local topography is specified. The grid extends 465 km alongshore and 225 km offshore (204 by 100 grid cells) with 40 vertical levels. The response of the coastal ocean during summer 2001 upwelling conditions to forcing by observed wind stress and estimated heat flux is examined. Strong upwelling favorable conditions persist throughout the majority of the simulation period. The model simulations show an energetic southward coastal jet that dominates the structure of the alongshore flow over the continental shelf. Interaction of the wind-forced flow with headland features leads to separation at Point Arena and Point Reyes. These flow separation events provide a mechanism for eddy generation on the shelf. When upwelling conditions relax, northward currents develop near the coast. These northward currents vary in strength alongshore but are typically stronger to the south of Point Arena and Point Reyes. Comparisons of the model output with data collected during the WEST (Wind Events and Shelf Transport) field experiment will be presented and the associated dynamics discussed.

OS62A-0243 1330h POSTER

Model Dynamical Balances within the California Undercurrent

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The California Undercurrent (CUC) is a subsurface current that flows poleward year-round off the west coast of North America even though the surface wind stress and resulting surface currents are equatorward over a significant part of the domain for much of the year. Poleward undercurrents such as this have been observed along all the major eastern oceanic boundaries of the world, which suggests that the mechanism for their generation and maintenance may be a common one. Despite this, the dynamics of these currents are not well understood. In this work, the CUC is studied by analyzing numerical simulations from the Naval Research Laboratory's Pacific West Coast (PWC) model and Navy Coastal Ocean Model (NCOM). Both are primitive equation models with 30 sigma levels in the vertical and approximately 9 km horizontal resolution, with domains extending from 30°N to 49°N latitudes and from 135°W longitude to the U.S. west coast. For the PWC model, boundary conditions are obtained from one-way nesting within the global Navy Layered Ocean Model, which is a 7-layer, 1/16° ocean model, and surface wind forcing is obtained from the Coupled Ocean-Atmosphere Mesoscale Prediction System (COAMPS) 10 m winds at 27 km resolution for the year 2000. NCOM is one-way nested within a global NCOM model with 1/8° resolution and 40 vertical levels, and is forced by COAMPS surface winds for the year 2001. Both models contain features of a poleward undercurrent, although with significant spatial and temporal variability. An analysis of the momentum balance in the CUC is carried out by depth-averaging terms in the momentum equations, either over the full water column or over an intermediate range of 125 m to 500 m, the typical depth range of the undercurrent. The terms are then projected onto the local direction of depth-averaged velocity to decompose the balance into along-current and cross-current components.

OS62B MCC: Hall D Saturday 1330h

Data Integration, Publication, and Archival (DIPA) II Posters *(joint with GP, V)*

Presiding: **C Constable,** Scripps Institution of Oceanography**; J Helly,** University of California, San Diego

OS62B-0244 1330h POSTER

Virtual Oregon: A Proof-of-Concept for Seamless Access to Distributed Environmental Information

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Virtual Oregon is a new data coordination center established at Oregon State University in order to: (1) archive environmental and other place-based data on Oregon and associated areas; (2) make those data accessible to a broad spectrum of agencies and individuals via innovative web interfaces; (3) identify key data sets that are not yet available and encourage their collection and dissemination; and (4) facilitate development of statewide standards for archiving, documenting, and disseminating data. Rather than co-locating researchers and data in a physical center, Virtual Oregon employs a distributed architecture that occupies multiple locations while users are presented with the illusion of a single, centralized facility. This approach was selected not just to maximize the impact on campus students, faculty, and staff but also to service broader interactions with extension agents and other members of Oregon State's statewide community.

Virtual Oregon builds on regional GIS centers and databanks in a wide range of disciplines, providing decades of research data on topics as varied as coastal processes, climate, biodiversity, land ownership, water quality, wildfire, and agricultural production. There are four distributed nodes, each serving as a center and clearinghouse for distinct types of information and services:

- Department of Geosciences (College of Science): geospatial coverages, digital aerial and ortho imagery and associated base data - Forestry Sciences Laboratory (USDA Forest Service and Oregon State's College of Forestry): ecological and resource management databases; data analyses; data from computational simulations - Northwest Alliance for Computational Science and Engineering (NACSE): databases based on specimen collections, field observation, images, or analysis of historical documents; user interface design - Valley Library: published maps, books and archival publications, gray literature, photographs and video

Data are harvested from a variety of individuals and research centers and maintained in the distributed nodes using enterprise RDBMS products (Oracle, Sybase, and Microsoft SQL Server) residing on UNIX and Windows platforms. Query Markup Language (QML, a middleware product developed at NACSE) supports database-to-Web interactions by transparently performing queries across multiple RDBMSs and displaying the results as though from a single source. Web-based mapping interfaces (powered by ESRIs Internet Map Server and Spatial Database Engine products) can also be used to explore data visually.

In a proof-of-concept under development, users currently have the option of beginning with either the "thematic" or "place-based" interfaces. Ultimately, users will be able to move freely back and forth between the two paradigms, for example initially narrowing the scope of inquiry based on discipline or attributes, moving to the visual interface to refine the search based on location or some set of geospatial characteristics, then moving back to query-based exploration to delve to fine levels of detail. Usability engineering methodologies are being applied so that all navigation and query mechanisms are both maximally productive and easily learned by novices.

URL: http://virtual-oregon.nacse.org

OS62B-0245 1330h POSTER

New Challenges in Sample-Based Data Implementation

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Geochemical data on rocks are now widely available in relational databases (PetDB, GEOROC, NAVDAT) served over the internet, using the schema of Lehnert et al. (2000). The widespread access to data has significantly increased the overall efficiency of researchers. It has aided the complete range of research activities including teaching, proposal writing and publication, and allows people from related fields to address geochemical problems (e.g Kellogg 2002).

Future advances have to include more than simply adding more analytical data in the same formats: (1) A scheme of universal sample identification will be essential for terrestrial samples to allow compilation of data from different sources on the same sample. How to develop and implement such a scheme is challenging and should happen in coordination and cooperation with existing and emerging efforts for terrestrial sample archives (e.g. Goldstein et al., 2001). (2) The ability to integrate geochemical with geophysical and geological data is vital. Visualization of data on maps and comparison of geochemical data to grid-based data presentations requires effective integration of relational databases with GIS and other information technologies such as XML. The industrial and government orientation of widespread commercial products may not satisfy the specific and flexible needs of researchers. (3) Easy access to other published material needs to be dealt with in terms of intellectual property. For example, published sample location maps are often not available in digital format, and reproduction of those (copyrighted) maps from publications, with links to the data would be valuable. It would also be useful to provide access to pdf files of complete publications through a simple database link, which would require a different level of cooperation with publishers. (4) Derivative products that compile data from different sources and their presentation on appropriate maps or other visualizations would be a further advantage for a wide variety of research problems. Automated update of such products would require successful resolution of the previous three challenges.

Goldstein, S.L., W. Melson, Geochemical News: 108: 19-20, 2001.

Kellogg, J.B. et al., Geochim Cosmochim Acta 66, A391, 2002.

Lehnert, K. et al., Geochemistry, Geophysics, Geosystems 1, 2000.

URL: http://www.ldeo.columbia.edu/RidgePetDB

OS62B-0246 1330h POSTER

The Integration and Enhancement of Seafloor and Land Topography With Satellite Data

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This presentation will illustrate several useful techniques to integrate disparate marine and land data. Six data sets were combined, so that a variety of geophysical information is represented while preserving spatial detail through the entire elevation range. There is significant utility in bringing these data together in a single map/image.

The color component of the image depicts bathymetry in the marine setting and vegetation distribution on the land areas. The colors of the marine portion of the image were derived from Smith and Sandwell's bathymetric solution below 72 degrees of latitude and ETOPO5 data above 72 degrees of latitude. The color is scaled to accentuate bathymetric features, such as the continental shelf and mid-ocean ridges. The color component of the land was enhanced from an AVHRR false color infrared dataset that was acquired from WorldSat International. These colors on the marine and land data sets were draped over the textural component of the image. A key objective of this map was to preserve as much of the tectonic detail as possible for the complete bathymetric and topographic range. The marine textural information was derived from Sandwell and Smith's bathymetric and gravity solutions. The land texture came from

GTOPO30 data. The texture was differentially enhanced to accentuate areas of low relief. The image is artificially illuminated from the north.

For nearly 20 years ExxonMobil has had the opportunity to integrate large grids of marine data received from many sources. This is a recent image that follows our earlier efforts using data acquired from Sandwell, Smith, Rapp, Haxby, The USGS, The World Data Center, and others. Significant improvements in the quality and utility of marine data have been very achieved in part to the efforts and cooperation of many academic and government organizations.

OS62B-0247 1330h POSTER

Implementation and compatibility of a North American Volcanic and Plutonic rock database (NAVDAT)

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NAVDAT is a database for igneous rocks in western North America that will contain geochemical and age information primarily on Cenozoic rocks. NAVDAT will allow exploration of temporal and spatial patterns in igneous activity, and to connect these patterns with local and regional tectonic development and lithospheric structure. The database will be web-accessible for downloads and queries (navdat.geo.ku.edu). Allied information, such as geologic and geophysical maps, crustal structure, etc., will also be available through a map interface.

We have attempted to keep the NAVDAT schema compatible with that for PetDB and GEOROC (petdb.ldeo.columbia.edu, georoc.mpch-mainz.gwdg.de) in order to build consensus on an overall structure for of an igneous rock database. The issues to be addressed by continent-based NAVDAT, however, are somewhat different from ocean-floor based PetDB, and the schema required numerous modifications. We have extended the schema in several areas to meet the needs of the on-land database. Location and age information become critical because we are trying define changes in magma source with time tied to structural position and setting. For this reason, we have added more fields to cover such issues as how a rock is dated and where it is located. In addition, we have implemented an expanded reference section that imports all information available in AGI's Georef database. This should allow for superior query ability.

One recurring issue in constructing the NAVDAT database is the inconsistency in the way geochemical data are reported. The following is a suggested publication check-list for geochemists that will enable more robust database construction: 1) all samples must have locations reported as accurately as possible, not just located on a map figure or given as a general location; 2) known sample ages must be given and the method of dating explained (e.g., directly dated, stratigraphically bracketed, or correlated in a regional sense); 3) laboratory techniques must be documented, and include both where and how analyses were done; 4) it must be made clear when reporting data for a standard whether the other data presented have been renormalized using an accepted value for the standard (especially for isotopic data).

OS62B-0248 1330h POSTER

Earth Science Markup Language: An Overview

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The Earth Science Mark-up Language (ESML) is an effort funded by the NASA Earth Science Technology Office and designed by the Information Technology and Systems Center (ITSC) at the University of Alabama in Huntsville (UAH) as a new approach for allowing data/application interoperability. This new descriptive language, based on the eXtensible Markup Language (XML) provides a structured way to describe not only the content and structure of a data file or collection, but also the semantic information. This combination of structural and semantic information allows an application to intelligently interpret the data, thus facilitating development of search, visualization, and analysis tools that are independent of data type or format. By defining a standard for external metadata to describe the content, structure, and semantics of a file, ESML provides a means for applications to utilize legacy, current, and future data sets in an integrated fashion. This paper will provide an overview of the ESML project, its goals, how various data users and application developers could benefit from ESML, and some selected applications that are utilizing this technology.

URL: http://esml.itsc.uah.edu

OS62B-0249 1330h POSTER

Using GeoVRML for Visual Dissemination of Oceanographic Data

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Visual representation of three dimensional geospatial information is an often requested feature of oceanographic data management systems. The Monterey Bay Aquarium Research Institute's Expedition Database provides access to data from over 2500 submersible dives beginning in 1988. Visualizations of these dives have been produced and are now accessible through a simple web browser interface.

The World Wide Web, database management software, and 3D graphics processing units have advanced to enable simplified viewing of complex data. However; issues such as single precision graphics pipe-line arithmetic and geographic coordinate transformations complicate the presentation of geospatial data. GeoVRML is an open international standard that has been developed to address these issues. In addition to being an ISO standard, GeoVRML provides tools and recommended practices for representing 3D geographic data. Any sort of geospatial data can be represented in GeoVRML including high-resolution bathymetric data, submersible dive tracks, remotely sensed imagery, and animated 3D objects. Furthermore, interactivity with the data may be provided with standard Virtual Reality Modeling Language (VRML) scripts and prototypes. Content placed in GeoVRML format is viewable inside a web browser and can be integrated with web-based data delivery systems to provide easily understood visual representations of geospatial data.

MBARI uses GeoVRML to disseminate 3D replays of submersible dive data stored in its Expedition Database. Terrain data, ship and vehicle navigation, environmental (CTDO) data, video frame grabs, samples data, and video annotation information can all be viewed together using this tool. Tools to generate GeoVRML terrain content have been developed and are provided in the open-source tsmApi and MB-System packages. These tools may be used to convert bathymetric data into multi-resolution quad-tree hierarchical tiles that load efficiently over wide area networks. The level of detail for the terrain is controlled by the user who may interactivly select terrain tiles for higher resolution display. Up to 9 levels of detail (10 m resolution over a distance of 55 km) are effectively visualized using this method.

URL: http://www.mbari.org/~mccann/vrml/ROVDataVis

OS62B-0250 1330h POSTER

Video data annotation, archiving, and access

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Scientifically useful, high-quality video data can be challenging to integrate with other data, and to analyze and archive for use in ocean science. The Monterey Bay Aquarium Research Institute (MBARI) uses high-resolution video equipment to record over 300 remotely operated vehicle dives per year. Over the past 14 years, 13,000 videotapes have been archived and maintained as a centralized institutional resource. MBARI has developed a set of software applications to annotate and access video data. Users can identify the location of video sequences using a data query component; complex queries can be made by constraining temporal, spatial, or physical parameters (e.g., season, location, or depth). The applications reference a knowledge base of over 3,000 biological, geological and technical terms, providing consistent hierarchical information about objects and associated descriptions for annotating video at sea or on shore. The annotation, knowledge base, and query components together provide a comprehensive video archive software system that can be applied to a variety of scientific disciplines. Also in development, using the XML data format, is an interactive reference interface to explore MBARI's deep-sea knowledge base. When complete, the full software system will be disseminated to the research community via the web or CD, to help meet the challenges inherent in archiving video data.

URL: http://www.mbari.org

OS62B-0251 1330h INVITED POSTER

Real-time Metadata Capture Implementations

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The current rate of data acquisition in the ocean sciences precludes the manual generation of appropriate metadata after the fact. Recognizing this fact, we have begun to implement methods for creating metadata and inserting them into relational databases in real-time. We have also created web-based tools for watchstanders and maintenance personnel to enter logbook data in real-time. Several examples will be addressed in this poster.

Enhancements to the Hudson Interactive River Observatory (HIRO) real-time data logging system have been made that create metadata records and insert them (as SQL transactions over a secure wireless TCP/IP connection) into a relational database in real-time. These records document the start and stop time of individual data files, of sensor-specific data streams and of the logging system as a whole.

An interactive watchstanders logbook has been developed and used on the R/V Maurice Ewing to create and log metadata records associated with upgrades to the Hydrosweep DS2 multibeam system. A similar version of this tool is being used to capture the maintenance and update records associated with the HRIO system.

URL: http://data.ldeo.columbia.edu

OS62B-0252 1330h POSTER

A Web-Based Geospatial Metadata Browser

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We are developing a simple Web-based browser for the search and display of earth science metadata. Our design goals are: 1. to permit both map-based (geographical) and forms-based (textual) searching; 2. to integrate a wide variety of data types in a hierarchical fashion; 3. to conform to the FGDC metadata standard; 4. to take advantage of existing open source software wherever possible; 5. to be platform-independent, browser-independent, and "robust" (i.e. avoid application layers which are resource-intensive or behave unpredictably, such as Java applets); and 6. to present metadata in a dynamic fashion via live database connections.

Our implementation is based on the MapServer GIS platform (developed at the University of Minnesota with NSF and NASA funding), PostgreSQL relational database management system, and PostGIS geographic database extensions (developed by Refractions Research Inc and available under GNU Public License). All of these packages are well-documented open source software and have been proven in commercial-grade applications. We combine geographical searching (click-and-drag on maps, in both global and polar projections) and textual searching (drop-down menus organized by FGDC category) for a range of geophysical, chemical, and biological data types.

A corresponding framework for collecting and ingesting earth science metadata is reported elsewhere at this meeting (Chayes & Arko, "Real-time Metadata Capture Implementations").

URL: http://data.ldeo.columbia.edu

OS62B-0253 1330h POSTER

Scalable Models of Data Sharing in the Earth Sciences

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Many earth science disciplines are currently experiencing the emergence of new ways of data publication and the establishment of an information technology infrastructure for data archiving and exchange. Building on efforts to standardize data and metadata publication in geochemistry, we discuss options for data publication, archiving and exchange. All of these options have to be structured to meet some minimum requirements of scholarly publication, in particular reliability of archival, reproducibility and falsifiability. All data publication and archival methods should strive to produce data bases that are fully interoperable which requires an appropriate data and metadata interchange protocol. To accomplish the latter we propose a new Metadata Interchange Format (.mif) that can be used for more effective sharing of data and metadata across digital libraries, data archives and research projects. This is not a proposal for a particular set of metadata parameters but rather of a methodology that will enable them to be easily developed and interchanged between research organizations. Examples are provided for geochemical and oceanographic data as well as map images to illustrate the flexibility of the approach.

URL: http://www.g-cubed.org/

OS62B-0254 1330h POSTER

CruiseViewer: SIOExplorer Graphical Interface to Metadata and Archives.

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We are introducing "CruiseViewer" as a prototype graphical interface for the SIOExplorer digital library project, part of the overall NSF National Science Digital Library (NSDL) effort. When complete, CruiseViewer will provide access to nearly 800 cruises, as well as 100 years of documents and images from the archives of the Scripps Institution of Oceanography (SIO). The project emphasizes data object accessibility, a rich metadata format, efficient uploading methods and interoperability with other digital libraries.

The primary function of CruiseViewer is to provide a human interface to the metadata database and to storage systems filled with archival data. The system schema is based on the concept of an "arbitrary digital object" (ADO). Arbitrary in that if the object can be stored on a computer system then SIOExplore can manage it. Common examples are a multibeam swath bathymetry file, a .pdf cruise report, or a tar file containing all the processing scripts used on a cruise. We require a metadata file for every ADO in an ascii "metadata interchange format" (MIF), which has proven to be highly useful for operability and extensibility. Bulk ADO storage is managed using the Storage Resource Broker, SRB, data handling middleware developed at the San Diego Supercomputer Center that centralizes management and access to distributed storage devices. MIF metadata are harvested from several sources and housed in a relational (Oracle) database. For CruiseViewer, cgi scripts resident on an Apache server are the primary communication and service request handling tools.

Along with the CruiseViewer java application, users can query, access and download objects via a separate method that operates through standard web browsers, http://sioexplorer.ucsd.edu. Both provide the functionality to query and view object metadata, and select and download ADOs. For the CruiseViewer application Java 2D is used to add a geo-referencing feature that allows users to select basemap images and have vector shapes representing query results mapped over the basemap in the image panel. The two methods together address a wide range of user access needs and will allow for widespread use of SIOExplorer.

URL: http://sioexplorer.ucsd.edu

OS62B-0255 1330h POSTER

SIOExplorer: Managing Data Flow into a Digital Library

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The diversity of the data held by the Geological Data Center at SIO is a tribute to the evolution of oceanography, from echo sounding rolls and handdrawn charts to modern multibeam bathymetry. However, the changes in sensor technology and organizational approaches since 1903 present real challenges to the archivist, as we struggle to migrate the holdings into a web-accessible digital library for use by the public and scientific community (www.nsdl.org). Automation of the dataflow is an absolute necessity, with millions of files and a terabyte of data, although the biggest challenges come from complexity rather than bulk volume. The problems stem from our diverse archive collection, with its evolving data content, processing practices, naming conventions, and clutter from intermediate or obsolete files. This is not the only or the last data system to suffer from these problems, and an approach has been designed that can be applied to other projects.

Instead of writing code to process each individual type of cruise, which varies from vessel to vessel over the fifty years and 795 cruises, we created a single Canonical Cruise Data Structure (CCDS). After some experimentation, the CCDS now consists of 9 basic categories and a reasonable number of sub-categories (directories) that can hold all the essential information. The key to flexibility and scalability comes from a template-driven rules approach that allows a processing script to harvest data from complex original data structures, and store them in the simple CCDS. The template mimics the structure of the CCDS. As the processing script traverses the template it finds rules for each category, instructing it on where to look for likely sources, and how to prioritize the results when multiple sources are detected. Over time as new situations are encountered, changes are simply made to the template, rather than the code.

After the first tests, it became apparent that a visual method was needed to monitor the success of the harvesting, to make sure that every category is filled with the correct content. We can run simulated tests on our data staging area and report the results immediately in graphical form on our website. The web report shows data found (blue) and not found (red). A mouse-over operation shows the search string used as a rule for selection, and the list of files actually found.

We are also employing visualization as a quality control technique to screen data prior to storage in the digital library. We are outputting a grid per multibeam file that can be viewed with public domain GMT tools, the Fledermaus visualization package, or ESRI Arcgis software, as a rapid check on sound velocity artifacts, noise levels, and editing status.

URL: http://SIOExplorer.ucsd.edu

OS62B-0256 1330h POSTER

NASA's Eos ClearingHOuse: Integrating Access to Data Services

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ECHO (The Earth Observing System (EOS) ClearingHOuse) is being developed to provide flexibility to NASA's EOS to better meet the needs of the science community. ECHO is a clearinghouse of metadata, representing the data offerings of participating data providers. ECHO is being built with the goal of being an enabling system: Enabling a variety of Data Providers to participate. Enabling access to an ever-changing variety of Earth Science Data. Enabling access to an ever-growing suite of services, provided by the Science Community, which improves the usefulness of this data, including the binding of those services to the data represented in the clearinghouse. The purpose of this enabling philosophy is to support current Science efforts, but also to give the opportunity for creative organizations and individuals to break the traditional paradigm for discovering and leveraging Earth Science Data and Services in completely new ways. This presentation will focus on ECHO's approach to integrating Data Services from varied Service Providers, and facilitating access to those services by the user community. ECHO can be viewed as a typical Service oriented architecture. The fundamental interactions that it supports are (abstractly) Publish, Find and Bind. ECHO provides interfaces and mechanisms that allow organizations to publish their services. Using these interfaces, Service Providers can effectively "plug-in" their capabilities. There are mechanisms that allow the correlation of their service to the data types in the clearinghouse. ECHO's user community can find, or discover, services through a separate set of interfaces. Bindings are the mechanisms that support the invocation of services by ECHO's user community. ECHO supports binding either directly between the user and the service provider, or indirectly by using ECHO as a Service Broker. ECHO is supporting all of these Service capabilities by leveraging the contemporary (and evolving) "standards" of Web Services. Web Services are implemented using a suite of technologies, all based on eXtensible Markup Language (XML). Services present their interfaces (API's) by using Simple Object Access Protocol (SOAP). The Services are described in Web Services Description Language (WSDL). Finally, ECHO will manage a registry of these Services by leveraging Universal Description, Discovery and Integration (UDDI). Using these technologies offers us tremendous potential, and solutions to many of the challenges associated with a distributed service architecture. However, there are several issues related to the use of this approach in general, and each of the technologies specifically. It is recognized that while providing an API-based system is the only way to retain the principle of being an enabling system, people need User Interfaces with which to interact. ECHO provides an approach to allow organizations to offer User Interfaces that correlate to registered services. ECHO is currently working with a number of potential Service Providers to exercise this approach to enabling access to distributed Data Services. This interaction allows us to improve the mechanisms while beginning to offer Services to the Science community in the short term.

OS62B-0257 1330h POSTER

Potential of Scalable Vector Graphics (SVG) for Ocean Science Research

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Scalable Vector Graphics (SVG), a graphic format encoded in Extensible Markup Language (XML), is a recent W3C standard. SVG is text-based and platform-neutral, allowing interoperability and a rich array of features that offer significant promise for the presentation and publication of ocean and earth science research. This presentation (a) provides a brief introduction to SVG with real-world examples; (b) reviews browsers, editors, and other SVG tools; and (c) talks about some of the more powerful capabilities of SVG that might be important for ocean and earth science data presentation, such as searchability, animation and scripting, interactivity, accessibility, dynamic SVG, layers, scalability, SVG Text, SVG Audio, server-side SVG, and embedding metadata and data. A list of useful SVG resources is also given.

URL: http://www.agu.org/pubs/svg

OS62B-0258 1330h INVITED POSTER

A metadata scheme for a rock-magnetic data base - considerations and applications

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The diverse nature of magnetic property data of rocks slows down the development of a proper data base. This diversity concerns not only the set of parameters determined but also the various types of techniques and instrumentation used, the types of samples, their magnetic and thermal history, and last but not least the diversity of potential users including rock-, paleo- and environmental magnetists, magnetic anomaly modelers, researchers interested in magnetic properties of 'standard' magnetic minerals. Needless to say, these aspects impose special constraints on the data base structure. The metadata scheme proposed begins with the same sample information structure as that of the envisaged paleomagnetic data base, thus optimizing flexibility in interfacing or integrating the databases. For fundamental rock magnetism, various additional fields are required for material properties (including mineralogy, grain size, stoichiometry, defect density, etc.) and experimental conditions (including pretreatments and initial state). The proposed data structure aims to strictly separate the actually measured data and the set of derived parameters. The integrated nature of many magnetic studies will require linking to geochemical and chronostratigraphic data bases in the somewhat further future.

OS62B-0259 1330h INVITED POSTER

Visual Palaeomagnetic Database

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The Global Palaeomagnetic Database (GPMDB) created and developed by McElhinny and Lock (1991, 1996) is used by researchers all over the world. The user-friendly interface makes it unnecessary for users to learn about details of the Microsoft Access software. The next step in the development of these databases lies in the visualisation of data and in the integration of the palaeomagnetic data with Geographical Information Systems (GIS). One of the most popular GIS software among Earth scientists is ArcView. Due to the relative simplicity of the structure of the GPMDB it quite easy to integrate palaeomagnetic data into GIS. It is just necessary to prepare a database file in DBASE format (using the export option of the Microsoft Access, for example) and then to create a subsequent graphic theme (layer) in ArcView. The wide variety of ArcView options enable the use of graduated colours, labels, and different symbols to emphasise ages, palaeomagnetic directions, or other data features. Palaeomagnetic data may be combined with the geological, tectonic, and other maps using a variety of spherical projections. Palaeomagnetic data may be easily integrated into other GIS-oriented databases, such as geochronological databases. In addition to all traditional services known for the GPMDB users, such as queries, ArcView and supplementary Avenue scripts provide many new possibilities. For example, it is very easy now to choose data from a particular polygon (e.g. craton, terrane, orogenic belt etc.). Users of the new visual database also can instantly create a stereoplot for any selected data subset and to calculate mean directions and palaeopoles. It is also possible to display palaeopoles for the selected group of data and to reconstruct a palaeoposition of the continental block using these poles, or Euler pole of rotation. There are obvious advantages of using the visual database. For example, if there are some errors in the geographical position of some data, in many cases it is easy to find them. It is much easier now to test tectonic hypotheses. For instance, it is possible to compare data from two adjacent terranes to decide the time of their collision.

OS62B-0260 1330h POSTER

PMAG: Database Development Under the EarthRef.org Umbrella Website

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EarthRef.org has been compiling resources used to construct Earth Reference Models such as for geochemistry (GERM) and geophysics (REM). This approach can readily be expanded to any type of Earth science data and, to that extent, we have started an online database for paleomagnetism (PMAG) under http://earthref.org/databases/PMAG/. This database stores all measurements and their derived properties for studies on paleomagnetic directions (inclination, declination) and intensities. Ultimately, this database will allow researchers to study on the internet and download important data sets that, for example, display the paleo-secular variations in the intensity of the Earths magnetic field over geological time.

The PMAG database is completely integrated in the EarthRef.org relational database structure and thus benefits significantly from already-existing common database components, such as the EarthRef Reference Database (ERR) and Address Book (ERAB). The ERR allows researchers to find complete sets of literature resources as used in either GERM, REM or PMAG. The ERAB contains the addresses for all contributors to the EarthRef.org databases, but also for all the rock collectors, archivers and analysts appearing in these databases. Integration with both components will ensure direct traceability to the original sources of the PMAG data and metadata.

Data contribution to the PMAG database is most critical in achieving an useful research tool. We have been developing data and metadata templates that can be used to provide all data during the publication process in a standardized format. Software tools are provided to facilitate an easy population of these templates. These tools allow for the import/export of data files in a delimited text format, and they provide functionality to validate data and to check their internal coherence in the template. During and after publication these standardized PMAG templates will be stored in the ERR database. From that moment on they can be searched for and downloaded from the EarthRef.org website. Finally, the contents of these template files will be automatically read out and parsed into the online relational PMAG database.

For more information on the development of PMAG data and metadata standards, template files and software tools, please visit the http://earthref.org/metadata/PMAG/ metadata website.

URL: http://earthref.org/metadata/PMAG/

OS62B-0261 1330h POSTER

PMAG: Relational Database Definition

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The Scripps center for Physical and Chemical Earth References (PACER) was established to help create databases for reference data and make them available to the Earth science community. As part of these efforts PACER supports GERM, REM and PMAG and maintains multiple online databases under the http://earthref.org umbrella website. This website has been built on top of a relational database that allows for the archiving and electronic access to a great variety of data types and formats, permitting data queries using a wide range of metadata. These online databases are designed in Oracle 8.1.5 and they are maintained at the San Diego Supercomputer Center. They are directly available via http://earthref.org/databases/.

A prototype of the PMAG relational database is now operational within the existing EarthRef.org framework under http://earthref.org/databases/PMAG/. As will be shown in our presentation, the PMAG design focuses around the general workflow that results in the determination of typical paleo-magnetic analyses. This ensures that individual data points can be traced between the actual analysis and the specimen, sample, site, locality and expedition it belongs to. These relations guarantee traceability of the data by distinguishing between original and derived data, where the actual (raw) measurements are performed on the specimen level, and data on the sample level and higher are then derived products in the database. These relations may also serve to recalculate site means when new data becomes available for that locality.

The PMAG data records are extensively described in terms of metadata. These metadata are used when scientists search through this online database in order to view and download their needed data. They minimally include method descriptions for field sampling, laboratory techniques and statistical analyses. They also include selection criteria used during the interpretation of the data and, most importantly, critical information about the site location (latitude, longitude, elevation), geography (continent, country, region), geological setting (lithospheric plate or block, tectonic setting), geological age (age range, timescale name, stratigraphic position) and materials (rock type, classification, alteration state).

Each data point and method description is also related to its peer-reviewed reference [citation ID] as archived in the EarthRef Reference Database (ERR). This guarantees direct traceability all the way to its original source, where the user can find the bibliography of each PMAG reference along with every abstract, data table, technical note and/or appendix that are available in digital form and that can be downloaded as PDF/JPEG images and Microsoft Excel/Word data files. This may help scientists and teachers in performing their research since they have easy access to all the scientific data. It also allows for checking potential errors during the digitization process.

Please visit the PMAG website at http://earthref.org/PMAG/ for more information.

URL: http://earthref.org/PMAG/

OS62B-0262 1330h POSTER

Paleointensity Database : Current State and Future

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IAGA Working Group I-3 (Paleomagnetism) and I-4 (Rock Magnetism) initiated the establishment of various databases to cover most types of paleomagnetic data, among which a paleointensity database. This database comprises only absolute paleointensity determinations from igneous rocks and baked contacts, archaeological artifacts are not included. All methods of paleointensity determinations are taken into account as well as all field configurations (normal, reverse or transitional polarity). Around 2.500 data are now available from almost 200 references.

For practical reasons, the paleointensity database was distinct from the global paleomagnetic database. Also only mean results for given cooling units were registered in the paleointensity database. For the future, it will be desirable to construct a more extensive database which will incorporate not only mean estimates per cooling but also the raw data at the specimens level and all necessary metadata as rock magnetism, geology, petrology, radiometric datings Paleointensity data should also be directly linked to global paleodirectional data, as well as with archaeological determinations. This will allow an easier analysis of the total magnetic field and a better way to assess the reliability of the determinations. In some cases, it will also allow reanalysis of the raw data, following improvements in the theory of magnetic acquisition and/ or updating of the determination methods.

OS62B-0263 1330h POSTER

The Global Paleomagnetic Database Should Include Specimen-Level Demagnetization Data

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In their description of the paleomagnetic database, McElhinny and Smethurst [1] provided a reasonable description of the status quo in terms of compiling and storing a quantitative summary of the results from the past 50 years of paleomagnetic investigation. However, recent developments in science and technology have far outpaced the response of the paleomagnetic community on the issue of data archive and storage, and as a consequence this field risks being left in the dust. It is our opinion that the database should be expanded to include the entire set of specimen-level demagnetization data that go into a paleomagnetic study, along with the interpretation made by the authors.

A simple back-of-the-envelope estimate suggests that all the raw paleomagnetic demagnetization data generated in the past 50 years would fit easily on a single hard drive of a personal computer. Other fields are doing precisely this type of the data archiving – for example, nothing is accepted for publication in the good, peer-reviewed molecular genetics journals until the raw sequence data have been deposited in one of the internationally-accepted genetic databanks. As we feel that geophysics is in no way inferior to genetics, we should have no fear of archiving our data and making it publicly available in a similar fashion.

The actual process of measuring and demagnetizing typical paleomagnetic materials has not changed

much in the 30 years since the introduction of superconducting magnetometers, with most studies still utilizing some combination of alternating field, thermal, microwave, or chemical demagnetization to isolate the principal magnetic components (although the number of demagnetization steps per specimen has certainly improved with the increasing use of automation). In contrast, techniques for the analysis of paleomagnetic data have improved substantially (e.g., [2,3]). Hence, public access to the archived raw demagnetization data would not only allow independent scrutiny of the interpretive stage of paleomagnetic data analysis, it would permit new techniques with potentially greater analytical ability to be applied as they are developed for the recognition of otherwise hidden magnetic components in previously published studies.

Most of the popular routines for performing principal component analysis on specimen-level demagnetization data readily allow the importation of data into their fixed format files structure, and the data can be archived and indexed easily in this fashion (see [4,5]). We suggest that the deposition of such data in an expanded paleomagnetic repository be included as an eighth criteria in the commonly-used 7-point Van der Voo reliability scale, and that deposition such data be required before publication in any AGU-sponsored journal.

[1] McElhinny, M.W. and M.A. Smethurst, EOS, 82 (39), 436, 2001. [2] Kirschvink, J.L., GJRAS 62, 699-718, 1980. [3] Mcfadden, P.L., and M.W. McElhinny, EPSL 87 (1-2), 161-172, 1988. [4] http://www.ipgp.jussieu.fr/~cogne/pub/paleomac/PMhome.html [5] http://cires.colorado.edu/people/jones.craig/CHJ_PMag_overview.html

OS62B-0264 1330h POSTER

Archival and Retrieval of Multi-Dimensional Rock Magnetic Data: A Job for BLOB's

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Rock magnetic data range in complexity from simple parameters such as SIRM, to structured multi-dimensional data sets such as First Order Reversal Curves (FORC's) and magnetic susceptibility measured as a function of temperature, amplitude, and frequency. While some data are suited to storage in a conventional database, such as age- or depth-varying parameters common to environmental magnetism, more complex multi-dimensional data sets can not easily be stored in a database. However, these complex data sets can be stored as BLOB's (Binary Large Objects), in separate data files with catalogues and derived parameters in the actual database. Programs or applets can then be written to search through all or a subset of BLOB's for certain information or characteristics that are stored in the data sets. However, searching through a large number of BLOB's is a slow process. It is necessary to provide a fairly comprehensive summary in the forms of metadata, summary data and derived data, which are stored in the database and can be used to limit the scope of the BLOB search. We will illustrate several sets of data from simple to complex and show how the metadata, summary data and derived data relate to the various primary data. We will also propose some initial methods or applets that can be used to search BLOB's and extract useful information.

OS62B-0265 1330h POSTER

PMAG: Database Examples for Paleomagnetic and Archeomagnetic Studies

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The Paleo-Magnetic Archival Group (PMAG) designed a modern paleo-magnetic database that is integrated in the existing EarthRef.org umbrella website. PMAG has been developing data and metadata templates that can be used to assemble all data during the publication process in a standardized format. These standardized templates are available in a Microsoft Excel format and can be manipulated using software tools that form the backbone of the data population efforts for this database. In this presentation, we will lay out some examples and show how to use these templates during data population, publication and how they appear in the online databases under http://earthref.org/databases/PMAG/. Using examples for directional paleomagnetic and archeointensity studies, we will explain what data need to be populated, what information is essential or optional, how to customize the data and metadata templates using the template wizard (which will hide/show certain tables and columns based on the type of study), how to import/export simple text files, how to validate the data, and how to check for the internal coherence of these data in the template. We will also show how to search online in the EarthRef.org archives and how to download the template files to your own computer. Finally, we will show some basic queries that can be made into (a prototype of) the relational PMAG database, in order to retrieve data. For more information on the development of PMAG data and metadata standards, template files and software tools, please visit the http://earthref.org/metadata/PMAG/ metadata website.

URL: http://earthref.org/metadata/PMAG/

OS62B-0266 1330h INVITED POSTER

Integral Interpretation of Rock Magnetic, Sedimentological and Geochemical Data in Marine Sediment Studies

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Rock magnetic data of marine sedimentary sequences can serve vastly different purposes: (1) identification of NRM carriers, (2) core correlation, (3) orbital age modeling, (4) source and transport tracking, (5) unmixing of terrigenous and biogenous fluxes, and (6) detection of diagenesis effects. Established methods suffice for aim (1) and are often applicable for aims (2-3). For the more ambitious paleoenvironmental aims (4-6), all existing magnetic parameters entail interpretational ambiguities. Magnetic granulometry, for instance, can be an expression of erosion intensity, source mixing, sea level, sorting, winnowing, coarsening by partial depletion or fining by authigenic enrichment. Magnetic concentration parameters and mineral ratios have similar problems. The reliability of paleoclimatic and -oceanographic reconstructions from rock magnetic records depends largely on the correctness of the adapted working hypothesis, which must be newly validated for every location and facies under study.

As illustrated by South Atlantic case studies, some ambiguities can be clarified by co-interpreting temporal patterns, regional trends and accumulation rates of selective rock magnetic parameters (e.g. M_{ar}, M_{ir}, M_{hir} and κ_{fd}). For analyzing depositional system, these 'raw' parameters tend to be more valuable than their more frequently published ratios. They can be internally recalibrated to model cumulative parameters such as κ or M_{sir}. Conditions for the applicability of this 'partial susceptibilities' method are frequently met in marine settings.

An alternative is to calibrate or integrate rock magnetic with sedimentological and geochemical data. Using porosity, $CaCO_3$, Fe data, an open ocean susceptibility signal can be decomposed into continental (source-mixing), marine (carbonate dilution) and diagenetic (depletion/enrichment) components. The magnetite dissolution index Fe/κ_{nd} quantifies reductive magnetite losses. The carbonate-free dry bulk version of κ is reduced to terrigenous influences. To facilitate such analytical methods in future studies, we should not just collect and co-interpret interdiciplinary data sets, but also provide facilities to hold them integrally in rock magnetic data bases.

OS62B-0267 1330h POSTER

Performance Evaluation of INMARSAT Fleet 77 Services Aboard the R/V Ewing

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In late 2001, the R/V Ewing was asked to conduct a trial installation of the Thrane & Thrane [of Denmark] F77 antennae [TT-3084A Capsat] and the newest IMNARSAT communications channel, INMARSAT F. Branded as Fleet F77 Service by INMARSAT, the service provides ISDN 64kbps and 56kbps high quality voice and data connections as well as Mobile Packet Data Service which allows an always on connection under which users pay for the packets they send rather than the time they are connected. Fleet F77 also allows low bandwidth [2.4kbps] Mini-M voice and fax services. While not currently available, the Capsat antennae also is prepared to take advantage of 4th Generation Inm-IV satellites [expected in 2004] allowing LAN speeds up to 432kbps.

The F77 antenna consists of two units, the TT-3084A antenna and a single Below Deck Unit. The Capsat antennae radome is a mere 84 cm in diameter considerably smaller than that typically associated with INMARSAT A or B. It was mounted above the forward port corner of the pilot house atop a reinforced mast. Below deck electronics consist of a single unit containing three analog RJ-11 interfaces, a single ISDN interface, two RS-232 serial interfaces, a USB interface [not functional on our test unit] and a standard Handset. This was mounted in the pilot house electronics space.

The Capsat antennae and associated electronics were installed in Guam in mid February 2002 and the system began operational trials during the following cruise on February 24th. Tests of the Fleet 77 system consisted of Mini-M voice and fax both to and from the ship, 64kbs voice to and from the ship, MPDS connects to shore, and operational tests with the INMARSAT Command Center. The trial period completed May 12th after which the F77 became an integral part of the Ewings communication suite. Results of these tests as well as latency and packet loss measurements made over various data connection types will be presented.

OS62C MCC: Hall D Saturday 1330h

Numerical Ocean Modeling Posters

Presiding: **K R Thompson,** Dalhousie University

OS62C-0268 1330h POSTER

An Identical Twin Experiment for the Development of A 4D-VAR Data Assimilation System for the ARGO Data

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ARGO is an international project aiming at monitoring the world ocean in real time by using automatic profiling floats. The measured profiles of temperature and salinity within the upper and middle layers (2000m) of the Ocean with the ARGO floats, play an important role in understanding and forecasting climate. The data will not only greatly enhance our knowledge to the ocean dynamics but also supply valuable evidences to improve the predictive models.

However, the obtained ARGO data is sparsely distributed both in time and in space. For its effective use, it is necessary to create the physically integrated 3-dimensional gridded dataset from the sparsely observed ARGO data. This study is thus focused on develop a 4D-VAR data assimilation system to meet this demand.

The developed 4D-VAR data assimilation system is constituted with MOM3 (GFDL) and its adjoint by using 4-dimensional variational method. The preconditioned Conjugate Gradient method is also used to solve the system. With this assimilation system, the best-fit solution to the measured data and the oceanographic model can be obtained.