Abstracts for the AGU Fall Meeting 8–12 December 2003

Union

U11A MCC: 3001-3003 Monday 0800h

Union Tutorials I

Presiding: **R L Wesson,** U.S. Geological Survey**; J T Snow,** University of Oklahoma

U11A-01 0800h INVITED

What is an Earth System Model?

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Global three-dimensional Earth System Models have their roots in numerical weather prediction models, which predict the processes that accelerate air masses and change temperature and moisture. Models of the last two decades have focused on the physics of the coupled atmosphere-ocean-land-ice system, and how alteration of the physical forcing affects the fluxes of energy and water and hence the circulation and climate. Current earth system models include chemistry and biogeochemistry of the Earth System, and attempt to predict changes in atmospheric composition and their consequence on circulation, climate and the biosphere. The hierarchy of Earth System Models will be reviewed. An Earth System Model that includes interactive terrestrial and oceanic carbon cycles will be presented. Data not available but urgently needed to test and validate/falsify the models will be emphasized.

U11A-02 0900h INVITED

A Biased View of Data Assimilation

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Modern data assimilation for the atmosphere and ocean combines information from observations and a prediction model to produce an estimate of the state of the physical system. Data assimilation is used not only to generate 'analyses' of the system state, but also to produce initial conditions for prediction models. In addition, it can be used to improve both the observing system as well as the prediction model. All of the methods in common use can be derived as heuristic simplifications of an elementary Bayesian filtering algorithm. An introduction to general filtering will be followed by a brief description of several prominent assimilation algorithms. Special attention will be given to ensemble-based filtering methods which have been developed relatively recently. A number of interesting research problems, related both to innovative applications of existing assimilation methods and to improving these methods will be outlined.

U11B MCC: Level 1 Monday 0830h

The Contributions of 20 Years of Scientific Ocean Drilling I Posters

Presiding: **K Becker,** Rosenstiel School of Marine and Atmospheric Science, University of Miami**; N Pisias,** Oregon State University

U11B-0001 0830h POSTER

The Advisory Structure of the Drilling Program Over the Past Forty Years

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The JOIDES advisory structure for DSDP and ODP has changed in significant ways during the 36-year existence of these ocean drilling programs. This paper discusses these changes in the light of the new IODP drilling program that will have started by the time of the AGU fall meeting. In the first phase of drilling, the advisory structure was centered on regional goals, since the program was at that time a very exploratory one. As drilling became more sophisticated, it was necessary to start new kinds of advisory structures, in which specific elements of drilling were studied and recommendations made. Throughout, the highest authority has been the Executive Committee, which has approved both the program plan and the science plan for each year. It has also made recommendations about eh new program that have had a significant effect on the development of the new drilling program. Recently the next committee down the ladder has been the Science Committee that has essentially been a review committee for the various proposals that have been submitted, and has ranked these proposals. The Operations Committee then arranges the ranked proposals into a coherent drilling program. The Science Committee also oversees the other committees in the science advisory structure. Over the years the rules about conflict of interest have been strengthened, such that in many cases, members of the Science Committee have been recused from ranking proposals when they have an interest in the proposals. Also, scientists cannot sit on more than one committee at a time (apart from members of the Budget Committee - drawn from Science Committee and Executive Committee - and members of the Operations Committee). The advisory structure has also become much less restrictive over the years, and the US members of the Science Committee is now formed of scientists who have an interest in marine drilling, and the membership is drawn from the national community, and not just from members of JOI Inc. The presence of non-US scientists on the advisory structure has been of immense benefit, as has their participation in the shipboard science crew. The new drilling program, jointly funded by the United States and Japan, will hopefully draw on an enthusiastic body of scientists from other countries.

U11B-0002 0830h POSTER

Monitoring co-seismic plate deformation and fluid flow with ODP hydrogeologic observatories

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ODP CORK (Circulation Obviation Retrofit Kit) instrumentation was originally developed to seal holes and determine fluid flow rates and driving forces in hydrologically active settings. Over the first decade of CORK monitoring, a number of observations have been made that range well beyond these objectives. In several instances, records of formation pressure and temperature have provide quantitative information about local and regional (up to 250 km range) crustal strain and fluid flow associated with inter- and intra-plate seismogenic slip. These include two seafloor spreading events and associated seismic swarms on the Juan de Fuca Ridge, slip on the Nootka transform fault, a mid-plate earthquake on the Juan de Fuca Ridge flank, and two deep Mariana subduction zone earthquakes. With the exception of the Mariana events, signals associated with seismic wave ground motion are not resolved, although improvements to instrumentation will allow these to be studied in the future. Pressure transients of all the events observed to date include a coseismic component that is believed to be the response to elastic plate strain, and a post-seismic component that reflects hydrologic diffusion along pressure gradients between volumes of rock with contrasting elastic response or drainage through the seafloor. The coseismic components vary in sign and relative amplitude in a manner consistent with seismic moment tensors, although the absolute amplitudes of the strain-induced pressure anomalies are often much larger than predicted from seismic moment. The post-seismic transients occur over time scales that range from hours to a few hundred days, generally consistent with the hydrologic structure at the various borehole sites, but often indicating formation-scale permeabilities that are considerably higher than estimated from borehole pumping and flow experiments. Data from CORKs have also shown that transient changes in mechanical and hydrologic properties, inferred from changes in the formation-pressure response to seafloor tidal loading, result from plate strain. CORK monitoring continues on the axis and flank of the Juan de Fuca Ridge and at the Nankai and Middle America subduction zones, and opportunities exist for refurbishing old sites in the Cascadia, Mariana, and Barbados subduction zones and the Costa Rica Rift flank. It is our hope that long-term hydrologic monitoring at these and new sites will provide new knowledge and understanding of earthquake rupture and plate strain processes, and the role of water in both.

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U11B-0003 0830h POSTER

Third Party Borehole Seismic Experiments During the Ocean Drilling Program

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Third party borehole seismic experiments on the Ocean Drilling Program began with an oblique seismic experiment on Leg 102 at Site 418 in the Western Atlantic. Upper ocean crust here is characterized by a normal seismic layer 2 vertical velocity gradient, lateral velocity variations, azimuthal anisotropy, and azimuth dependent scattering. A normal incidence VSP was run on Leg 118 in the gabbro sequence at Hole 735B on the Southwest Indian Ridge. The vertical seismic velocity inferred from arrival times is similar to that observed horizontally by refraction in ocean layer 3, but attenuation is anomalously high, which prompted the hypothesis that the gabbro cored may not actually represent the bulk of Layer 3 material. The VSP data acquired at Hole 504B in the eastern equatorial Pacific on Legs 111 and 148 helped to constrain the P and S velocity structure at the site and showed that upper layer 3 at this site, at a depth of over 2 km into the crust, consisted of the lower portion of the sheeted dikes rather than gabbro. Both offset and normal incidence VSPs were run on Leg 164 to study the seismic velocity structure of gas hydrates on the Blake Ridge. A new innovation on ODP was the deployment of broadband seismometers in boreholes. Whereas the conventional VSPs and offset VSPs mentioned above operate in the frequency range from 1 to 100Hz, broadband seismometers are used in earthquake seismology and operate in the range from 0.001 to 10Hz. The first broadband seismometer test was carried out from the drill ship on Leg 128 in the Japan Sea. Subsequently 4 permanent broadband borehole seismic observatories were installed in the Western Pacific and Japan Trench on Legs 186, 191 and 195. The ODP era also saw the development of systems for re-entering boreholes from conventional research vessels after the drill ship left the site. Borehole seismic experiments and installations that used this wireline reentry technology were carried out in DSDP Holes 534 (Blake-Bahama Basin) and 396 (Mid-Atlantic Ridge at 23degr north) and ODP Hole 843B (south of Oahu). The latter experiment (Ocean Seismic Network Pilot Experiment) carried out a test of 3 configurations of broadband seafloor seismic installation in preparation for extending the Global Seismic Network to the deep ocean.