OS32A-0240 1330h POSTER

HURL's 2003 OE and NURP Deep Submergence Science Program in the NW and Main Hawaiian Islands and Projects Planned for 2004-2006.

Keith A. W. Crook (1-808-956-9429; crook@soest.hawaii.edu)

Hawaii Undersea Research Laboratory, SOEST, University of Hawaii,, 1000 Pope Rd MSB 303, Honolulu, HI 96822, United States

This presentation will emphasise the advantages of using manned submersibles in conjunction with ROV pre-surveys during UH's NOAA-funded Hawaii Undersea Research Laboratory 64-day Ocean Exploration research cruise in the NW Hawaiian Islands scheduled for Sept 3-Nov 6, 2003. The up-leg to Kure Atoll will focus on "Submarine Canyon and Scavenger Communities" (PIs Craig Smith & Eric Vetter) and "Characteristics of Deepwater Fish and Precious Corals on the Seamounts Neighboring Hawaii's Most Remote Seal Colonies" (PI: Frank Parrish). Two projects for PIs Amy Baco-Taylor & Timothy Shank are scheduled for the down-leg: "Seamount Surveys of Deep-Water Corals as Related to Geological Setting in the NWHI" and "Reproductive Biology and population genetics of Precious Corals in Hawaii". For 2004 -2006, HURL has 18 peer-reviewed projects approved. These include 45 submersible dives for projects in US Flag Waters SE of Hawaii, during a joint NURP-OE Expedition to American Samoa, scheduled for late 2004 and early 2005. Dives for most projects in the Main and nearer NW Hawaiian Islands will be scheduled for 2006, with a few exceptions. The scope and rationale of this planned program exemplifies the synergy between NOAA's Ocean Exploration and Undersea Research Program objectives.

URL: http://www.soest.hawaii.edu/HURL/research.html

OS32A-0241 1330h POSTER

Paleodictyon, a Living Fossil on the Deepsea Floor

Peter A. Rona[1] (732-932-6555x241; rona@imcs.rutgers.edu); Adolf Seilacher[2] (203-432-3134; geodolf@tuebingen.netsurf.de); Hans Luginsland[2]; Edith Seilacher[2]; Colomban de Vargas[1] (732-932-6555x236; vargas@imcs.rutgers.edu); Costantino Vetriani[1] (732-932-6555x373; vetriani@imcs.rutgers.edu); Joan M. Bernhard[3] (803-777-0563; jmbernha@gwm.sc.edu); Robert M. Sherrell[1] (732-932-6555x252; sherrell@imcs.rutgers.edu); J. Frederick Grassle[1] (732-932-6555x208; grassle@imcs.rutgers.edu); Stephen Low[4] (514-633-6036; slow@videotron.ca); Richard A. Lutz[1] (732-932-6555x200; rlutz@imcs.rutgers.edu)

[1]IMCS and Geological Sciences, Rutgers University, 71 Dudley Road, New Brunswick, NJ 08901-8521, United States

[2]Institut fur Geologie und Palaeontologie der Universitat, Sigwartstrasse 10, Tuebingen 74, Germany

[3]School of Public Health, University of South Carolina, Columbia, SC 29208, United States

[4]The Stephen Low Company, 795 Carson, Suite 6, Dorval, QC H9S1L9, Canada

We report new observations based on high resolution imagery, in situ experiments, and recovery of samples made in conjunction with filming of the IMAX movie, "Volcanoes of the Deep Sea", which reveal hitherto unknown features of an enigmatic form on the deep seafloor. Thousands of strikingly hexagonal patterns (typically 5 to 7 cm diameter) formed by intersecting rows of tiny black dots were originally imaged on a veneer of calcareous lutite along 3 km of a camera tow up the lower east wall of the rift valley of the Mid-Atlantic Ridge between water depths of 3600 m and 3200m at 26o 09'N, 44o48'W (Rona and Merrill, 1976). Defying classification into either a known invertebrate phylum or as the product of a known organism, the hexagonal pattern was tentatively interpreted as the surface expression of a trace fossil (Paleodictyon nodosum) found in deepsea flysch sediments of Eocene age (Seilacher, 1977). Subsequent discoveries revealed that the modern Paleodictyon occurs in an outlying area of the Trans-Atlantic Geotraverse (TAG) hydrothermal field, where high-temperature activity ceased some hundreds of years ago and the veneer of lutite overlies metalliferous sediments. In situ observations show that the black dots are indeed vertical shafts about 1 mm in diameter, each of which connect to the midpoint of a strikingly regular network of horizontal tunnels or tubes 2 to 3 mm beneath the sediment surface. The surface patterns range from sharp shield-like forms several millimeters high that expose underlying metalliferous sediments and are surrounded by shallow moat-like depressions, to flat forms with rounded edges entirely in lutite. This variation suggests a degradation sequence under prevailing (c. 5 cm/s) or episodic near-bottom currents over hundreds of years based on the radiometrically measured regional sedimentation rate. The 3D morphology revealed by artificial erosion confirms identity with the fossil Paleodictyon nodosum. Biological studies of core samples recovered on a recent DSV Alvin dive are underway to test alternative hypotheses for the origin of the Paleodictyon pattern. In the paleontological view, the pattern is a tunnel system constructed as part of the feeding strategy (bacterial farming) of an unknown benthic invertebrate. Another hypothesis claims that we deal with the tubular body of an infaunal member of the Xenophyophorea, a poorly known group of foraminifera, like protozoans

---

OS32B MCC: Level 1 Wednesday 1330h

General Ocean Sciences: Estuaries Posters

Presiding: **M Tzortziou,** University of Maryland, College Park**; H A Zahakos,** Columbia University

OS32B-0242 1330h POSTER

Measurements of Remote Sensing Reflectance in Chesapeake Bay Using In-situ and Satellite (MODIS) Observations

Maria Tzortziou[1] (3016146048; martz@carioca.gsfc.nasa.gov); Ajit Subramaniam[2] (3014051412; ajit@atmos.umd.edu); Jay Herman[3] (3016146039; herman@tparty.gsfc.nasa.gov); Patrick Neale[4] ((443) 482-2285; nealep@SI.EDU); Charles Gallegos[4] ((443) 482-2240; gallegosc@si.edu); Lawrence Harding[5] ((301)403-4220; larry@hpl.umces.edu)

[1]Dept. of Meteorology/ESSIC,UMCP, University of Maryland, College Park, MD 20742

[2]ESSIC,UMCP, University of Maryland, College Park, MD 20742

[3]NASA/GSFC, NASA/Goddard Space Flight Center, Code 916, Greenbelt, MD 20771

[4]Smithsonian Environmental Research Center, SERC, P. O. Box 28, 647 Contees Wharf Road, Edgewater, MD 21037

[5]Center for Environmental Science, Horn Point Laboratory, UMD, University of Maryland, Box 775, 2020 Horns Point Road, Cambridge, MD 21613

Obtaining accurate information on chlorophyll-a (Chl-a) concentration and dissolved organic material (DOM) composition in coastal waters, using remote sensing observations, is critical for primary production studies and carbon-cycling modeling. Since passive remote sensing relies on detecting the signal emerging from the oceans (water leaving radiance, nLw), it is of great significance to examine the accuracy of satellite water leaving radiances measured over coastal regions. In situ measurements of radiation fields and water optical properties were used to interpret satellite water-leaving radiance spectra measured by the Moderate Resolution Imaging Spectroradiometer (MODIS -Terra) over the estuarine waters of the northern mainstream of Chesapeake Bay. Good agreement between in-situ and MODIS data were obtained at longer wavelengths (488 nm and longer) including the spectral shape of the nLw values. There is a systematic problem at the shortest two MODIS wavelengths (412 and 443 nm) including a large percentage of negative or zero nLw values. The main issues that affect the accuracy of satellite estimations over such a highly complex estuarine environment (e.g. proximity to land mass, shallow waters, perturbed atmospheric conditions) were examined in this study.

OS32B-0243 1330h POSTER

Water Temperature Variability Along the West Coast of the Gulf of California

Lucio Godínez[1] (612-123-4759; lorta@ipn.mx)

Guillermo Gutierrez de Velasco[2] (612-121-30-31; ggutierr@cicese.mx)

Jochen Halfar[3] (49-711-121-1338; jochen@pangea.stanford.edu)

Jose Eduardo Valdez[4] (662-259-2169; jvaldez@guayacan.uson.mx)

Jose Manuel Borges[1] (612-122-5344; bosm010371@hotmail.com)

[1]CICIMAR-IPN, Ave. IPN s/n Apdo. postal 592, La Paz 23000, Mexico

[2]CICESE-LA PAZ, Miraflores No. 334, La Paz 23050, Mexico

[3]Institute fur Geologie und Palaontology, Universitat Stuttgart, Herdweg 51, Stuttgart 70174, Germany

[4]DICTUS, Rosales y Niños Heroes s/n, Hermosillo 83000, Mexico

The seawater temperature variability along the west coast of the Gulf of California for the time period March 2002 to March 2003 is discussed. The observations used for the analysis correspond to hourly samples at 10, 15, 20, and 25 m depths from moorings deployed in 35 m total depth at four locations along the west gulf coast, from its mouth to Ballenas channel: Cabo Pulmo (23° 23' N, 109° 25 W), Isla Espíritu Santo (24° 33' N, 110° 24' W), Punta Chivato (27° 04' N, 111° 58' W), and Bahía de los Ángeles (28° 58' N, 113° 31' W). Mean sea water temperatures increase along the gulf from the temperate north region to the subtropical gulf entrance (17 to 26°C). Temperature variability shows periodicities ranging from the seasonal to the semi-diurnal frequencies with decreasing amplitudes as frequency increases. Temperature seasonal cycle changes along the Gulf coast. Its amplitude diminishes from north to south were maximum temperature values are reached about 30 days later. Maximum and minimum values in the cycle increase northward; in contrast to the southward decreasing amplitude. Frequencies higher than seasonal exhibit two distinct patterns: An active spring and summer period and a quiet fall and winter one. During spring and summer vertical temperature differences increase and variability is dominated by 2 to 5° C amplitude oscillations at diurnal, 5 to 7 day, and quarterly frequencies. Fall and winter exhibit an almost constant vertical temperature distribution with weak oscillations (< 1° C amplitude) at the same frequencies.

OS32B-0244 1330h POSTER

Impact of Stratification on Summer Hypoxia in Narragansett Bay, RI: Time-Series Observations and Numerical Modeling

Deanna L Bergondo[1] (401-874-6010; dbergondo@gso.uri.edu)

Christopher R Kincaid[1] (ckincaid@gso.uri.edu)

Dana R Kester[1]

[1]University of Rhode Island Graduate School of Oceanography, South Ferry Road, Narragansett, RI 02882, United States

Determining water column structure in a partially-mixed estuary, such as Narragansett Bay, is important for understanding the impact stratification has on phytoplankton productivity and dissolved oxygen concentrations. Stratification reduces vertical mixing and influences the vertical flux of ecologically important variables such as phytoplankton, heat, oxygen, and nutrients. We utilize a combination of buoy data and numerical modeling to better understand processes surrounding the evolution and breakdown in stratification in Narragansett Bay for a range of environmental conditions. Autonomous sensors have been deployed in Narragansett Bay to collect continuous high temporal resolution chemical and hydrographic data. Data were collected every fifteen minutes 0.5 m below the surface and 1 m from the bottom from July 2001 to December 2001 and from July 2002 to December 2002 at two locations in Narragansett Bay and the Providence River, RI. The suite of water column variables measured were surface and bottom temperature, salinity, dissolved oxygen and pH, and surface chlorophyll. Results show that stratification events occur intermittently in the Providence River and Narragansett Bay and that increased phytoplankton productivity and hypoxia were associated with summertime stratification events. The Regional Ocean Modeling System (ROMS) model, a three-dimensional hydrodynamic model developed by Rutgers University, New Jersey, has been applied to Narragansett Bay to determine how the basic layered flow can be perturbed by runoff events and variable winds. For instance, in the basic stratified flow pattern in Narragansett Bay there is an outward flow of fresher water at the surface and an inward flow of deep denser water within the channel, however, strong south winds shutdown the deep return flow. Time series observations combined with model relationships have been able to enhance the understanding of the development and breakdown of stratification and the impact stratification has on phytoplankton blooms and dissolved oxygen conditions in Narragansett Bay.

OS32B-0245 1330h POSTER

Modeling wetting and drying process in San Francisco Bay using the Princeton Ocean Model

Yusuke Uchiyama (uchiyama@ce.berkeley.edu)

University of California at Berkeley, 631 Davis Hall, Berkeley, CA 94720, United States

Wetting and drying scheme (WDS) is developped to incorporate into the Princeton Ocean Model (POM, Blumberg and Mellor, 1987), which is based upon a sigma-coordinate system. Using a length scale D to characterize the bed topography or the roughness height, WDS scans each grid cell every 2DH external mode time step. If the depth at the center of each grid cell becomes less than D, the cell is considered potentially dry. This grid cell is effectively dry if the depths of all four adjacent cells are also less than D, and subsequently removed from the computational domain. The water elevation retained on the grid cell is set to the corresponding value at the end of the time step, and used for next flooding. If at least one water depth around the four sides of the grid cell is still greater than D, the cell is left in the computational domain to be scanned again by WDS at the next time step. Although WDS seems simplistic, it guarantees mass conservation and works well for an idealized estuarine intertidal basin with a uniform bed slope of about 1:4200. It is realistic that the onshore front of water body immediately runs up the slope during flood to inundate the dried cells in response to tide. This phase speed is relatively faster than that for ebb and accordingly it reproduces the tidal asymmetry. The model is next applied to South San Francisco Bay, California, which is often described as "a tidally oscillating lagoon with density-driven exchanges with the northern reach". The simulation does not include density effect, thus corresponds to summer condition when freshwater input is minimal. Sinusoidal semi-diurnal tide with amplitude of 1.2 m induces wetting and drying processes (WDP) effectively. The number of simultaneously dried-up grid cells varies with time, reaching up to 271 cells. The depth-integrated and 3D surface residual current velocities show that there exists intense horizontal mixing between shallower and deeper regions. Further examination such as detailed hydrodynamics according to WDP, results from a harmonic analysis and particle trackings, etc., will also be presented at the conference.

OS32B-0246 1330h POSTER

Calibration and Validation of a Hydrodynamic Model of the Tidal Hudson River

Harry A Zahakos[1] (917 658 8744; haz2001@columbia.edu)

Peter Schlosser[1,2,3] ((914) 365-8707; peters@ldeo.columbia.edu)

[1]Department of Earth and Environmental Engineering, Columbia University, New York, NY 10027, United States

[2]Department of Earth and Environmental Sciences, Columbia University, New York, NY 10027, United States

[3]Lamont-Doherty Earth Observatory, Columbia University, Palisades, NY 10964, United States

A three dimensional model of the Hudson River Estuary has been constructed using the Estuarine, Coastal and Ocean Model (ECOM) framework. The model domain covers the entire tidal portion of the Hudson River from the Fedaral Dam in Troy, NY to the mouth at the Battery, New York City, nearly 250 km. The model grid is orthogonal and curvilinear with transverse and lateral resolution of approximately 200 and 500 m, respectively, for most of the river. Model inputs include water surface elevations, salinity, and temperature at the open boundary (Battery) and the freshwater inflows from the major upstream and tributary sources representing 80% of the watershed. Model calibration was performed over a two week period of average tide and flow in June 2001 and focuses on accurately reproducing water surface elevations at four stations and surface salinity at five stations along the river. Additional model calibration was performed using a survey of vertical salinity profiles measured at 28 locations along the river during this time. Model validation was performed over a six week period of average to low flow during the same summer and consist of comparisons of water elevations, surface salinity, and a deliberate SF_6 tracer release. Volatilization kinetics were included to simulate gas exchange across the air water interface due to the volatile nature of the tracer. The accuracy of the model in reproducing the hydrodynamics throughout the tidal Hudson River over these short time scales shows that the model can be used with confidence to simulate the short term transport of accidental or intentional releases of pollutants to the river and can assist as a tool for managing the impacts of such releases.

OS32B-0247 1330h POSTER

Unusually high lead-210 inventory in the sediment column of a tidal embayment

Jian Peng (213-740-6736; jianpeng@usc.edu)

USC Earth Sciences, 3651 Trousdale Pkwy, Los Angeles, CA 90089, United States

San Diego Bay is a meso-tidal embayment located in southwestern California near US-Mexican border. Atmospheric fallout of Pb-210, which is the dominant source (>90%) of Pb-210 to the coastal sediments, was 0.17 +/- 0.03 dpm/cm^2/yr, by direct collection of atmospheric fallout as well as measurement of Pb-210 inventories in two soil cores collected from a nearby wetland. The inventory of Pb-210 in bay sediments was calculated from the Pb-210 profiles of sediment cores collected from 7 stations across San Diego Bay. The enrichment factors of Pb-210, defined as the ratios of sediment inventory of Pb-210 versus the rate of atmospheric fallout, were greater than 10.0 in two stations in the north San Diego Bay, which is connected to the Pacific Ocean. In comparison, the enrichment factors were significantly lower for stations located in the inner San Diego Bay (ranging 1.1-3.7). Enrichment factors of up to 3.5 have been reported in other coastal oceanic environments, and the unusually high inventory of Pb-210 in north San Diego Bay suggested dominant input of particle-reactive Pb-210 from outer sea as well as a highly efficient mechanism that retains Pb-210 in the bay sediments. By measuring Pb-210 in both dissolved and particulate phases in waters across San Diego Bay and nearby outer sea, we determined that tidal exchange between particle-laden bay water with outer sea water containing abundant dissolved Pb-210 (3-5 times higher than that in bay water) should be the cause of this unusually high Pb-210 inventory in north San Diego Bay. We define the process as "Pb-210 stripping", in which dissolved-phase Pb-210 supplied by outer sea through tidal exchange was continuously scavenged by settling particulate matter in bay water and retained in the north San Diego Bay. Heavy shipping traffic, tidal resuspension, as well as high productivity in San Diego Bay should have caused high concentration of particulate matter in bay water.

OS32B-0248 1330h POSTER

Airborne Sea-Surface Topography in an Absolute Reference Frame

John M Brozena[1] (202-404-4346; john.brozena@nrl.navy.mil)

Vicki A Childers[1] (vicki.childers@nrl.navy.mil)

Gregg Jacobs[2] (jacobs@nrlssc.navy.mil)

John Blaha[3] (blahaj@navo.navy.mil)

[1]Navak Research Lab, Code 7420, 4555 Overlook Ave SW, Washington, DC 20375, United States

[2]Naval Research Lab, Code 7320, Stennis Space Center, Stennis Space Center, MS 39529, United States

[3]Naval Oceanographic Office, Stennis Space Center, Stennis Space Center, MS 39529, United States

Highly dynamic coastal ocean processes occur at temporal and spatial scales that cannot be captured by the present generation of satellite altimeters. Spaceborne gravity missions such as GRACE also provide time-varying gravity and a geoidal msl reference surface at resolution that is too coarse for many coastal applications. The Naval Research Laboratory and the Naval Oceanographic Office have been testing the application of airborne measurement techniques, gravity and altimetry, to determine sea-surface height and height anomaly at the short scales required for littoral regions. We have developed a precise local gravimetric geoid over a test region in the northern Gulf of Mexico from historical gravity data and recent airborne gravity surveys. The local geoid provides a msl reference surface with a resolution of about 10-15 km and provides a means to connect airborne, satellite and tidegage observations in an absolute (WGS-84) framework. A series of altimetry reflights over the region with time scales of 1 day to 1 year reveal a highly dynamic environment with coherent and rapidly varying sea-surface height anomalies. AXBT data collected at the same time show apparent correlation with wave-like temperature anomalies propagating up the continental slope of the Desoto Canyon. We present animations of the temporal evolution of the surface topography and water column temperature structure down to the 800 m depth of the AXBT sensors.

OS32B-0249 1330h POSTER

Effect of tidal phase on solute flushing from a strait: SF_6 tracer study in the East River, New York

Theodore Caplow[1] (212-854-0640; tc144@columbia.edu)

Peter Schlosser[1,2,3] (854-365-8707; peters@ldeo.columbia.edu)

David T. Ho[2,3] (845-365-8706; david@ldeo.columbia.edu)

[1]Dept. of Earth & Environmental Engineering, Columbia University, 500 West 120 Street, New York, NY 10027, United States

[2]Dept. of Earth & Environmental Science, Columbia University, New York, NY 10027, United States

[3]Lamont-Doherty Earth Observatory, Columbia University, Palisades, NY 10964, United States

Flow in the East River, a 25 km tidal strait connecting Long Island Sound with New York Harbor, is driven by a tidal phase lag between the two ends of the strait. The direction and rate of solutes transported in the strait, including natural materials as well as anthropogenic contaminants, has important implications for the environmental management of Long Island Sound and other fragile local ecosystems. Sulfur hexafluoride (SF_6) is a successful deliberate tracer for rivers, estuaries, and coastal areas. It is non-reactive, inexpensive, and offers an extremely low detection limit. High-resolution transport studies of complex coastal and estuarine areas up to 100 km^2, and lasting up to two weeks, have recently been achieved using a boat-mounted SF_6 measurement system with a sampling interval of 1 min and a detection limit of 1 x 10^{-14} mol L^{-1}. In June 2003, two injections of 6.2 mol sulfur hexafluoride (SF_6) were made 8 days apart in the East River to study residual circulation and rates of solute dissipation at different states of the tide. Both injections were made at the same location, but the first injection occurred at the slack before flood (northward flow), and the second injection occurred at the slack before ebb (southward flow). Tidally synchronized surveys of the SF_6 tracer patch were made by boat for 7 days following the flood injection and for 5 days following the ebb injection. For the flood and ebb injections, respectively, mean displacement of the center of tracer mass within the East River, a proxy for residual circulation, was northward at 0.31 $\pm$ 0.35 and 1.5 $\pm$ 1.0 km day^{-1}, mean fractional tracer loss due to tidal flushing was 0.32 $\pm$ 0.06 day^{-1} and 0.52 $\pm$ 0.10 day^{-1}, and mean residence time was 2.6 $\pm$ 0.4 days and 1.3 $\pm$ 0.6 days. These tracer loss rates include a small correction for air-water gas exchange, which was estimated by a combination of previously established relationships between gas transfer velocity and wind speeds, river flow velocities, and rain rates. Residual circulation appeared to have little impact on tracer fate, while the state of the tide at the time of injection had a large impact. Tracer injected on the ebb tide dissipated more rapidly, indicating a large differential between the mixing power at the two ends of the strait. (In the case of the East River, New York Harbor offered more rapid mixing than Long Island Sound). These results suggest that tidal phasing of contaminant discharges in a strait of this kind (where the tidal excursion is comparable to the length of the strait) has the potential to reduce ecological impacts, by increasing flushing rates and directing a greater fraction of solutes away from ecologically sensitive areas.

URL: http://www.columbia.edu/cu/tracer

OS32C MCC: 3000 Wednesday 1340h

General Ocean Sciences: Ocean Circulation

Presiding: **D E Dietrich,** AcuSea Inc.**; R G Curry,** Woods Hole Oceanographic Institution

OS32C-01 1340h

A Generic Approach to Dynamical Interpretation of Geophysical Fluid Flow Processes

Xiang San Liang[1] (liang@deas.harvard.edu)

Allan R. Robinson[1] (robinson@pacific.deas.harvard.edu)

[1]Harvard University, Pierce Hall G2H 29 Oxford St, Cambridge, MA 02143, United States

A real problem-oriented methodology, localized Multiscale Energy and Vorticity Analysis (MS-EVA), is developed to infer fundamental processes from oceanic data for complex dynamics. In general, geofluid flow processes are locally structured and windowed on scales (i.e., occurring on a range of scales). Many of the existing GFD theories, however, are based on classical analysis tools which are global in nature. A gap, therefore, exists between these theories and real oceanic/atmospheric problems. The development of