number of the Argo data. These products captured well the temperature and surface salinity variations in the western tropical Pacific associated with the El-Nino event in late 2002. Furthermore, the dynamic height anomaly correlated well with tide station data in Naha, Japan including extraordinary high tide period in Jul. 2001. From these results, we think that the objective analyses can be used for monitoring basin wide ocean variations.

OS41B-0805 0830h POSTER

Island mass effect in Marquesas Islands

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As part of the Subtropical Gyre of the South Pacific Ocean, waters of the Exclusive Economical Zone of French Polynesia are poor in chlorophyll a. However, analysis of Ocean Color data from around the Marquesas Islands (135°W-145°W; 6°S-12°S) sometimes shows water with high chlorophyll a content reaching the surface. This type of event is noticeable after an El Niño period and is stronger during a La Niña period. The appearance of water with high chlorophyll content at the sea surface has been attributed to the island mass effect which consists of a combination of turbulent mixing and advection from the South Equatorial Current. We investigate the phenomenon in the Marquesas Islands using sea surface height, ocean color, wind and sea surface temperature data available from the period of 1997-2002. Conditions favorable to the set up of the island mass effect are determined with regard to the variability in each data set.

OS41B-0806 0830h POSTER

On the South Pacific subtropical overturning cell in October/November 1999 and comparison with a climatology.

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Two sections, 165°E and 180°, and along the equator in between, were sampled during WESPALIS 1 cruise in Oct./Nov. 1999. The high salinity tongue of the South Pacific subtropical overturning cell (STC) is described. In particular the pathways of the circulation are exhibited. Then a comparison with a 10-year climatology is performed and the deviations from the climatology are described in terms of heat content exchange between the upper ocean surface layers. It is shown that the heat exchange between the STC and the equatorial mixed layer is more intense during Warm events of ENSO.

OS41B-0807 0830h POSTER

Intrabasin Comparison of Surface Radiocarbon Levels in the Indian Ocean Between Coral Records and Three-Dimension Global Ocean Models

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We have conducted a model-data comparison between time histories of surface radiocarbon from three-dimension ocean models that participated in the second phase of the Ocean Carbon-Cycle Model Intercomparison Project and observed radiocarbon variability recorded in coral records from the coasts of Kenya and Sumatra. Our coral results show the Kenyan radiocarbon response leading the Sumatran response by 2-3 years during the initial input of bomb C-14. These coral records comprise the first intrabasin record of surface water radiocarbon variability in the equatorial Indian Ocean and provide an independent evaluation of model performance across the Indian Ocean basin. Oceanic uptake and transport of bomb produced radiocarbon is a useful diagnostic in global ocean models to test parameterization of interior mixing and air-sea gas exchange between the ocean and atmosphere. Those models that include a more sophisticated vertical mixing scheme are apparently more capable of matching observed coral radiocarbon time-series. Yet, the large range of model simulation at both sites imply factors such as resolution, topography and physical forcing are more important than choice of mixing parameterization in explaining inter-model differences. None of the models reproduce the time-lag in the rate of bomb C-14 response between the Kenya and Sumatra coral sites. The simulation failure suggests that the lead/lag relationship in the coral records may be a function of small scale processes and/or coastal processes, such as lateral advection, coastal upwelling and rapid mixing with subsurface water, that are difficult to model with a coarse resolution OGCM.

OS41C MCC: Level 2 Thursday 0830h

General Ocean Sciences: Ocean Circulation Posters

Presiding: **X Liang,** Harvard University**; P Rhines,** University of Washington

OS41C-0808 0830h POSTER

A numerical simulation of eastern subarctic circulation in the North Pacific

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The Subarctic Pacific Ocean, the terminal point of the deep thermohaline circulation, is a productive ecosystem which experiences large seasonal and interannual changes in upper ocean physics, and is considered to be very important in the global organic carbon cycle. In the present study, a primitive equation model (Geophysical Fluid Dynamics Laboratory's MOM 3) with high horizontal and vertical resolution is applied to simulate the mechanism of eastern sub-arctic Pacific (including the Alaskan Stream and Alaska Coastal Current, which influence the Bering Sea). In addition, we present quantitative estimates of the subarctic Pacific ocean circulation features, which include the description of volume and heat transports. By analysis of velocity, temperature and salinity fields, we also give a brief discussion of the interaction between the eastern subarctic water and neighbour water masses in North Pacific.

OS41C-0809 0830h POSTER

Non-hydrosatatic Effects in Exchange Flows

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An important class of stratified flows is exchange flows in which fluids of different densities move in opposite directions through a channel. These flows are studied mainly in the frame of an internal hydraulic theory. However geophysical flows are more complicated than a two-layer hydraulic solution. In this paper the hydrodynamics of exchange flows is investigated with focusing on the role of non-hydrostatic effects, friction, mixing and an impact of an unsteady barotropic tide forcing on hydrodynamics of water exchange in the straits. Special attention is given to design of physically relevant time-dependence boundary conditions at the open boundaries. The numerical tool for investigations is a three-dimensional, non-hydrostatic, numerical model of free surface stratified flows (Kanarska Y., Maderich V, 2003). The model is a non-hydrostatic extension of the free-surface primitive equation POM model. A mode splitting technique, decomposition of pressure and velocity fields into hydrostatic and non-hydrostatic components and sequential calculation of these components are the base of numerical algorithm of the model. At first the model is used to investigate different regimes of exchange flows ranging from dispersive gravity waves in the seiche flows to shear instability in the lock-exchange flows including transition regimes where both mechanisms occur. The investigation of the energetics and the resulting diapycnal mixing is carried on the base of the analysis of available potential energy. Then the model is applied for an investigation of the exchange flows in a long and narrow strait with a sill or contraction for the configuration of experiments of Maderich (2000) and to the simulation of the water circulation in the Dadanelles strait. Calculations and analysis based on a three-layer decomposition with an intermediate layer of variable density showed the importance of entrainment and friction in the long straits. As a result the composite Froude number is significantly lower in comparison to predictions of two-layer hydraulic theory. Developed time-dependent boundary conditions at the open boundaries allow simulating the unsteady exchange with barotropic tidal forcing. For the first time the seasonal changes for the water exchange in the Dardanelles were simulated. The obtained results show strong mixing in most narrow zone of the strait. It was found that both baroclinic an barotropic variability are important for flow hydrodynamics.

OS41C-0810 0830h POSTER

The Ocean's Abyssal Mass Flux Sustained Primarily By the Wind: Vector Correlation of Time Series in Upper and Abyssal Layers

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As Wunsch has recently noted (2002), use of the term "thermohaline circulation" is muddled. The term is used with at least seven inconsistent meanings, among them abyssal circulation, the circulation driven by density and pressure differences in the deep ocean, the global conveyor, and at least four others. The use of a single term for all these concepts can create an impression that an understanding exists whereby in various combinations the seven meanings have been demonstrated to mean the same thing. But that is not the case. A particularly important consequence of the muddle is the way in which abyssal circulation is sometimes taken to be driven mostly or entirely by temperature and density differences, and equivalent to the global conveyor. But in fact the distinction between abyssal and upper-layer circulation has not been measured. To find out whether available data justifies a distinction between the upper-layer and abyssal circulations, this study surveyed velocity time series obtained by deep current meter moorings. Altogether, 114 moorings were identified, drawn from about three dozen experiments worldwide over the period 1973-1996, each of which deployed current meters in both the upper ($200<z<1000$) and abyssal ($z>3750$) layers. For each pair of current meters, the Kundu and Crosby measures of vector correlation were estimated, as well as coherences for periods from 10 to 60 days. In the North Atlantic, for example, Kundu vector correlation (50-day window): 0.48 +/- .03
Crosby vector correlation (absolute value, 50 day window): 0.46 +/- .07
Coherence at 60 days: .36 +/- .07
- at 30 days: 0.40 +/- .06
- at 10 days: 0.22 +/- .05
Most figures for the South Atlantic, Pacific and Southern Oceans are similar. Those obtained in the Indian Ocean or near the Equator are somewhat different. The statistics obtained here are consistent with the work of Wunsch (1997), and tend to confirm Wunsch's result that current velocities at depth are linked with those in the upper layers. Energetics of the circulation that do not take this into account are making an unjustifiable approximation of the physics. These results do not tell us whether time averaged flow on longer time scales might permit distinction of upper layer and abyssal flow components. Some intriguing corollaries do follow. First, the abyssal circulation is not identically the same thing as a global conveyor belt driven by temperature and density differences. Rather, as Wunsch noted (2002), the ocean's mass flux is sustained primarily by the wind. We may add that these wind patterns are about as robust as the temperature differences between equator and pole; this major driver of circulation is not a frail phenomenon. Second, the classical notion of a level of no motion that is also a constant-density surface, an LNM, is inconsistent with the results presented here. Such an LNM would wall off the upper layer circulation from the lower, and as

they are not walled off, there can be no such LNM. Third, wind stress is being transmitted down column, presumably to the sea floor.

OS41C-0811 0830h POSTER

Seasonal Variations of Water Mass Mixing off Southwest Coast of Taiwan

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Detailed hydrographic surveys for water columns off Pingtung coastal zone, southwestern Taiwan, were preformed using stable oxygen isotope compositions, salinity and temperature data to determine the source and mixing of water masses during summer and winter periods. Results show that horizontal oxygen isotope distributions clearly display the extent of river plume derived from high freshwater input during the summer period. Vertical seawater oxygen isotope values exhibit systematic variations with depth from surface to bottom. Generally, oxygen isotope data of summer coastal waters are relatively depleted to those of the same depths in winter. Except the top surface layer in summer, coastal waters off the Pingtung have a temperature-salinity relationship between the Kuroshio and South China Sea. North Pacific Intermediate and Deep Waters can also be identified by oxygen isotope and salinity. Two layers of relatively depleted oxygen isotope values are found along the Kaoping Canyon in depths ranging from 400 600m and 1200m, respectively, in the summer of 2001. However, only the lower one still remained the depleted oxygen isotope nature in the winter season. Those light oxygen isotope signals of coastal waters in both summer and winter periods provide encouraging evidences of submarine groundwater discharge from the aquifers of the Pingtung Plain and deserve a further study.

OS41C-0812 0830h POSTER

A Parallel Double Front System along the Main Channel of a Barotropic Tidal Inlet

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In an estuary with a significant longitudinal density gradient, fronts can occur during flood stage if a cross channel shear of flow exists. In a wide estuary, models have suggested convergence on the right hand side when facing the downstream direction, because of Coriolis effect, favoring a single front line changing its position with tidal phase. If a front system occurs during different tidal stages including ebb and appears in pairs on both sides of a channel, then neither of the above mechanisms can explain it. Here I report such a front system observed in a barotropic tidal inlet - Sand Shoal Inlet, VA. The front system is observed during different tidal stages within a 13-hour observation period. A 25-ft boat is used to tow an acoustic Doppler current profiler (ADCP) to measure velocity profiles along an hour-glass shaped ship track. A harmonic-statistic analysis is used to analyze the tide, tidal velocity, and mean velocity. The transverse convergence and divergence of velocity are calculated. The rms errors of the harmonic-statistic analysis of the elevation and velocity are about 0.28 m and 0.13 m/s (with a maximum velocity of over 2 m/s), respectively. On average, about 83%, 95%, and 70% of the variabilities of the elevation, longitudinal and transverse velocities respectively can be explained by the M_2 tidal and subtidal constituents. Strong transverse velocity convergences are identified by the analysis and are generally consistent with the observed front positions. The analysis shows that the front system is apparently generated by a combination of several mechanisms including (1) differential rotation of the tidal ellipses and spatial variations of the major axes of the tidal ellipses, owing to the strong bottom friction, and (2) a strong geometric convergence at the inlet. Density effect is found to be negligible and the planetary vorticity tilt effect is also unimportant because of a much higher relative vorticity. The observed front system is distinguished from the conventional estuarine axial convergence fronts which require a strong along channel density gradient. Therefore, in estuaries and coastal embayment where both tides and density gradients are important and where cross-channel bathymetry change is present, the frontal genesis can be a combination of several processes including the tidal convergence fronts discussed here. Presented here also is a barotropic 3D analytic tidal model allowing arbitrary cross channel depth functions to demonstrate the interaction between frictional tide and bathymetry to generate such a front system. The model result suggests that without a density gradient and Coriolis force, an axial front system can develop in a tidal channel with significant cross channel depth variations. Depending on the bathymetry function, a parallel double front can occur on both sides of the channel. The front positions can also vary with tidal phase.

OS41C-0813 0830h POSTER

Characteristics of Flow Field in Relation to transportation of Eggs and Larvae of Pelagic Fish in the East China Sea

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Jack mackerel (Trachurus japonicus), one of the most familiar pelagic fishes in the East China Sea was been spawned between winter and spring, estimating from temporal and spatial distributions of fishing grounds near the Kyushu coast. Recently, from result of distributions of larvae collected during February to March, it was reported that main spawning grounds had been formed in the southern part of the East China Sea. These eggs and larvae are transported from spawning grounds by the Kuroshio, and a part of them branches northward at northwest of the Amami Oshima Island. This portion is considered to be distributed to the Sea of Japan by the origin of the Tsushima warm current. However, it is difficult to estimate the amount of eggs and larvae, since there is little information about the branched flow from northern edge of the Kuroshio to the Tsushima warm current during winter season. In this paper, in order to make it clear that how eggs and larvae are transported to the Pacific Ocean or the Sea of Japan from the southern East China Sea, the flow pattern in the East China Sea is to be described. Especially a flow that branches from the Kuroshio at northwest of the Amami Oshima Island is described in detail. Using many infrared imagery obtained by NOAA satellite, we detected both the frontal waves generated at the northern edge of the Kuroshio and the path of warm water branched from the frontal waves. These results revealed important information to measure the volume transport of the Tsushima warm current efficiently. Frontal waves are to be broken on the northern edge of the Kuroshio and became the origins of the Tsushima warm current. We carried out ADCP measurement in and around a breaking frontal wave, by using the quadrireciprocal method which requires four round trip surveys along a transect during a diurnal tidal period of 24 hours and 50 minutes in order to remove a tidal current. We were able to acquire a detailed information about a fine structure of the flow field. Furthermore, from records of the water thermometer equipped at four fixed points along west coast of Kyushu, it was also shown that warm water from the breaking frontal wave influenced to the coastal environment.

OS41C-0814 0830h POSTER

Fluctuations of the cold Oyashio Current front off NE Japan in the last 100 ka

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Millennial-scale alkenone sea surface temperature (UK37 SST) and planktic foraminifer records of IMAGES core MD012419 (38o53.02'N, 143o19.46'E, water depth 2291 m) indicate that the cold Oyahio Current front off NE Japan fluctuated remarkably in the last 100 Ka. The SST record indicates glacial-interglacial changes of 6oC with smaller millennial-scale changes, and these changes are attributed to the interaction of the warm Kuroshio Current and the cold Oyahio Current. Planktic foraminifers of warm water assemblage (P. obliqueloculata, G. menardii and G. sacculifer) appeared in MIS5 when SST was the highest (18.5-20oC), suggesting the Kuroshio Current might have extended northward 3oN higher than today (35oN). Abundant N. pachyderma (left), a characteristic Oyashio Current species for this region, occurred in LGM and Termination I when SST was low (12-15oC). However, temperate water fauna predominated by G. inflata and G. bulloides was found in the Holocene and MIS3&4, suggesting an oceanographic condition similar to today's Perturbed area off NE Japan. In addition, oxygen isotope record of G. inflata indicates salinity might also play an important role in response to paleoceangraphic changes. When UK37 SST increased from MIS 4 (13oC) to MIS 3 (17.5oC), the increasing oxygen isotope of G. inflata suggests the saline Kuroshio water might have mixed with the low salinity Oyashio Water, consistent with planktic foraminiferal data.

OS41C-0815 0830h POSTER

Three-Dimensional Structure of the Circulation Induced by a Shoaling Topographic Wave

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Rectification of Rossby wave energy has been proposed as a mechanism for the maintenance of the recirculation cell of the Gulf Stream (Hogg 1988; Rizzoli et al. 1995). We investigated the three-dimensional structure of potential-vorticity flux and a mean flow induced by a topographic wave incident over a bottom slope analytically and numerically, focusing on the limit that bottom friction is the dominant dissipation process. In this limit it is shown that the topographic wave cannot be a steady source of the potential vorticity outside the bottom Ekman layer. Instead, the distribution of potential vorticity is determined from the initial transient of the topographic wave. This potential vorticity and the heat flux by the topographic wave at the bottom determine the mean flow, and give a relation between the horizontal and vertical scales of the mean flow. When the horizontal scale of the mean flow is larger than the internal deformation radius, the mean flow is almost constant with depth independent of whether or not the topographic wave is trapped near the bottom. Then the mean flow at the bottom is proportional to the divergence of vertically integrated Reynolds stress $\int_{-D}^{0} \overline{u'v'}\, dz$. This divergence, which is caused by bottom friction, is large when the group velocity, c_g and the vertical scale, μ^{-1} of the wave motion are small. Thus the mean flow tends to be large where c_g and μ^{-1} become small, and decreases as the topographic wave is dissipated by bottom friction. Since bottom friction also dissipates the mean flow, the mean flow asymptotes to a constant value as the friction becomes zero. These features of the potential-vorticity flux and the mean flow are reproduced in numerical experiments. It is also shown from the numerical experiment that the distribution of the mean flow depends on the amplitude of the wave because of the Doppler shift of the wave by the mean flow. These feature of the mean flow are preserved when we used stratification and bottom topography resembling to those over the continental slope near the Gulf Stream. The transport of the mean flow is about 20 Sv when the wave amplitude is about 2 cm/s. These numbers are similiar to those observed in the Gulf Stream region.

OS41C-0816 0830h POSTER

Semidiurnal variation of the ocean sound velocity associated with the M_2 internal tide

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Swarm of hydroacoustic waves (T-waves) associated with submarine volcanic activity has often been detected by ocean bottom seismometers (OBSs). In three months from September to December, 1999, a series of large submarine volcanic events occurred in the Izu-Bonin-Mariana volcanic region. We analyzed the waveform data recorded on the 3 submarine cabled OBS arrays (off-Boso, off-Sanriku and off-Kushiro) and the 9-month term broadband OBS array of the Ocean Hemisphere network Project with a few stations deployed near the swarm region. One of the off-Boso array stations was chosen as a reference, which locates at a depth near the SOFAR channel axis. At this reference

station, we selected the largest 40 waveforms in every-hour and stacked them to obtain a reference waveform at every hour. Assuming that the relative arrival time differences among these 40 events are common to all the other stations, the one-hour time window is shifted at each station to obtain the stacked waveform in the best correlation with the reference waveform. This time shift represents a delay or advance of the T-wave arrival relative to the reference station. We calculated the average of the time shifts at each station to determine the average epicenter of the swarm and the average T-wave speed. The epicenter was located at (20.3729° N, 144.9508° E) and the sound speed was determined to be 1.5021 km/s. We found that the every-hour time shift shows a semidiurnal variation with an amplitude of ±0.1 to 0.2 s in a consistent way among the stations. We interpret this as the consequence of the path length change due to vertical distortion of the SOFAR axis in response to the semidiurnal internal tides. This path length change is evaluated from the path length change of a constant density plane near the SOFAR depth. We calculate for this purpose the distribution of the isopycnal vertical displacement and phase associated with the M_2 component of the internal tide. The result shows that the isopycnal vertical displacement along the Boso path is an order of magnitude larger than those along other paths so that the path length change is also an order of magnitude larger. The amplitude and phase of this change are consistent with the observed ones.

OS41C-0817 0830h POSTER

The Global S_1 Ocean Tide

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The small S_1 ocean tide is caused primarily by diurnal atmospheric pressure loading. Its excitation is therefore unlike any other diurnal tide. The global character of S_1 is here determined by numerical modeling and by analysis of Topex/Poseidon satellite altimeter data. The two approaches yield reasonably consistent results, and large (>1 cm) amplitudes in several regions are further confirmed by comparison with coastal tide gauges. Notwithstanding their excitation differences, S_1 and other diurnal tides are found to share several common features, such as relatively large amplitudes in the Arabian Sea, the Sea of Okhotsk, and the Gulf of Alaska. The most noticeable difference is the lack of an S_1 Antarctic Kelvin wave. These similarites and differences can be explained in terms of the coherences between near-diurnal oceanic normal modes and the underlying tidal forcings. While gravitational diurnal tidal forces excite primarily a 28-hour Antarctic-Pacific mode, the S_1 air tide excites several other near-diurnal modes, none of which has large amplitudes near Antarctica.

OS41C-0818 0830h POSTER

Multiresolution Interpolation and Detiding of the ADCP data

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To account for the uneven sampling of current measurements collected by acoustic Doppler current profilers, we propose a robust, three-dimensional interpolation scheme based on the multiresolution representation of the regional mean and tidal current fields. Instead of reconstructing the tidal field by getting bin-averaged time series that relies on heavy sampling or invoking radial basis function expansion, such as using the biharmonic splines with subjectively selected knots, the resolving capability of the proposed scheme relies fundamentally on the scale hierarchy of the resolvable local information constrained by the data. We demonstrate that the proposed scheme flexibly incorporates merits of the two conventional techniques. It enforces the resolution of model information while accommodating the local sampling density. Since it is based on knots network defined by regular grids, efforts of experimentally and subjectively constructing the proper number and locations of controlling nodes are avoided. Constructing multiresolution representation of the current fields in terms of the three-dimensional wavelet basis is implemented by computationally effective discrete wavelet transform of coefficients of the interpolation equations. Applications of the proposed multiresolution scheme on artificial as well as field data sets of the ADCP measurements demonstrates that it is a promising approach.

OS41C-0819 0830h POSTER

Thermal Constraints on Upper Basement Permeability Near a Venting Seamount

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We used transient numerical simulations of coupled heat and fluid transport to quantify relations between fluid fluxes, basement permeability, and the vigor of local convection on seafloor heat flow patterns adjacent to a basement outcrop through which warm hydrothermal fluids are discharged. These finite-element models are designed to replicate conditions near the Baby Bare outcrop on 3.5-Ma seafloor on the eastern flank of the Juan de Fuca Ridge, where 5-20 L/s of warm fluid seeps from the seafloor. Several transects of heat flow observations co-located along seismic reflection profiles around this feature provide observational constraints for the models. Heat flow is not greatly influenced by venting at the outcrop at distances of several kilometers from the point of sediment onlap, but values rise abruptly immediately adjacent to the outcrop. The model domain consisted of a 21 km x 5 km radial grid, with 8 sedimentary and 6 basalt units, and a characteristic node spacing of 20-500 meters. Conductive simulations include a small rise in heat flow near the outcrop as a result of conductive refraction, but the magnitude of the rise is much smaller than observed. Additional simulations were run using elevated basement thermal conductivity as a proxy for local convection, to evaluate the vigor of local convection required to generate large increases in heat flow near the outcrop. Nusselt numbers (the ratio of heat transported within the edifice by conduction and advection to that which would be transported by conduction alone) of $100 < Nu < 1000$ are required in order to homogenize temperatures along the sediment-basement interface and closely match the observed heat flow profile. Interestingly, it is not necessary to vent any fluid at the outcrop to generate this pattern; local convection is sufficient. Fully-coupled simulations were run with fluid forced from the seamount at 5-20 L/s. We find that local convection occurs within the seamount in cases with sufficiently low fluid velocities (<10 L/s) and high basement permeabilities ($>10^{-10}$ m^2), and this convection is as effective at redistributing heat as single-pass flow in which little or no local convection occurs.

OS41C-0820 0830h POSTER

A New Tool for Probing Thermohaline Fine Structure in the Ocean: Seismic Reflection Profiling of the Labrador Current/North Atlantic Current Front

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We present acoustic images of thermohaline structure in the ocean created from marine multichannel seismic reflection profiles across the major oceanographic front between the Labrador Current and the North Atlantic Current. The images show that distinct water masses can be mapped, and their internal structure imaged, using low-frequency acoustic reflections. The reflections are generated by sound-speed contrasts at interfaces across which temperature changes by up to 3 degrees C. Returns from reflection coefficients (RC) as low as 0.0001, corresponding to sound speed changes of 0.3 m/s (temperature changes of 0.1 degrees C), can be imaged. The warm/cold front is characterized by strong (RC 0.004; 12 m/s), east-dipping reflections generated by thermohaline intrusions in the upper 1000 m of the ocean. Regions away from the front show weaker undulating reflectors suggestive of internal waves in the thermocline and submesoscale eddies beneath the thermocline. Our results imply that standard low frequency marine seismic reflection techniques can provide excellent spatial resolution of important oceanic phenomena, including thermohaline intrusions, internal waves and eddies.

OS41C-0821 0830h POSTER

Fine-scale thermohaline structure revealed by seismic reflection profiling in the Gulf of California.

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We present cross-sectional acoustic images of the ocean revealed by standard seismic-reflection profiling acquired in the Gulf of California. The data were acquired with a 6 km streamer, 480 channels and 20 gun array with a frequency content of 10-120 Hz. Seismic lines acquired in several different locations throughout the Gulf of California show similar characteristics. The images reveal acoustic reflections caused by fine-scale thermohaline structure. These reflections are prominent in the uppermost 500 m of the water column and become weaker with depth until they reach 1000 m, where they disappear as the abyssal waters become acoustically transparent. Time-lapse cross-sectional images show no overall change in reflectance characteristics in the uppermost 500m and in deeper waters, but the location of the reflections varies slightly between the images. We believe that these changes in location are consistent with the dynamics of internal waves.

OS42A MCC: Level 2 Thursday 1330h

General Ocean Sciences: Instruments, Techniques, and Programs II Posters

Presiding: **G S Lagerloef,** Earth and Space Research**; C T Friedrichs,** Virginia Institute of Marine Science**; J Diebold,** Lamont-Doherty Earth Observatory

OS

OS42A-0822 1330h POSTER

R/V Mirai, her missions, facilities and special project "BEAGLE 2003"

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The R/V Mirai, with its large ice-strengthened sturdy hull, was launched in 1997. The ship, in particular, with its large size and its anti-rolling device of special design, is capable of undertaking missions to high-latitude and Polar Regions exposed to the extremely harsh weather and sea conditions. The ship is equipped with many state-of-the art oceanographic and marine meteorological instruments and is expected to act as a floating platform for sophisticated interdisciplinary researches, emphasizing on global change. The R/V Mirai has many characteristic features. Several examples are as follows; (1) Possible for longer survey voyages and wide area observation: She has abundance of laboratories and instrumentation for various observation and facilities for data processing and analyzing. (2) Superior navigation under rough weather with ice strengthened hull: Large class vessel in the world as research vessel, equipped with Hybrid type anti-rolling systems. Also its hull structure is ice strengthened for the voyage to the Arctic Ocean area in the summer seasons. (3) Ability to carry large types of observation instruments on board, and deployed and retrieval of equipment in research areas: Transport, deployment and retrieval of ocean observation buoy developed by