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Barotropic tides in the South Atlantic Bight of the eastern United States coast are examined using a combination of recent observations of pressure and velocity from a permanent coastal ocean observing system and shorter term instrument deployments in the region. The data extent from near-shore to shelf-break and cover the region from Onslow Bay, North Carolina, to St. Augustine, Florida. The principal tidal elevation and depth-averaged velocity ellipse characteristics are described. Monthly variation in the tidal elevation and depth-averaged velocity is assessed from the longest available records.

Cross-shelf semi-diurnal water level amplification and phase lag associated with shelf width changes are observed. Maximum M_2 amplification and cross-shelf phase lag occurs at the widest part of the shelf and decrease to the north and south. Monthly variability of the M_2 tidal elevation and depth-averaged velocity ellipse phase appears significant. Monthly analysis indicates M_2 elevation phase variation of about 5 degrees. Diurnal constituent variability is generally below the error estimates. Comparison with a baroclinic numerical model is discussed.

URL: <http://www.ncsc.org/nopp/sablam>

OS72A MCC: Hall D Sunday 1330h

Remote Sensing of Ocean Surface Winds and Their Scientific

Applications II Posters (*joint with A, GC*)

Presiding: W T Liu, Jet Propulsion

Laboratory; S Xie, University of
Hawaii

OS72A-0333 1330h POSTER

Ocean Observer Synthetic Aperture Radar User and Instrument Requirements and Configuration

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User and instrument requirements for a U.S. operational ocean and land observing synthetic aperture radar (SAR) has emerged out of the Ocean Observer Satellite Study sponsored by the U.S. Dept. of Commerce/Dept. of Defense/National Aeronautics and Space Administration Integrated Program Office. User requirements were identified for thirty parameters that are best measured with SAR instruments. These include coastal sea surface winds, wave characteristics, ocean currents, surf conditions, sea and lake ice type/motion/concentration/edge-location, flood mapping, land surface deformation, land surface topography, soil moisture, and land surface freeze/thaw state. The user requirements have been summarized in an Ocean Observer User Requirements Document including details of horizontal measurement spacing, measurement accuracy, refresh rate, geographic coverage, and long term stability. The SAR instrument requirements needed to measure these parameters were analyzed, drawing on the scientific literature, previous study reports and the experience of the User Requirements Team. The SAR instrument/satellite requirements and notional design that emerged from this process consists of a 15-year mission using three satellites, each with 7.5 year lifetime. During part of the mission, two satellites would fly in formation for cross track interferometry to allow precision land topography measurement. The satellites would be in sun-synchronous polar orbit with 1:00 pm ascending equator crossing time with a 8-day exact repeat orbit. The SAR would be a dual frequency (C-band and L-band), multi-polarization, multi-mode instrument. Orbit maintenance would allow repeat pass interferometry

and antenna design would allow along-track interferometry for ocean current measurement.

OS72A-0334 1330h POSTER

Overview of the Ocean Observer Satellite Study

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A two-year study of ocean satellite remote sensing requirements and instrument/satellite options is nearing completion. This Ocean Observer Study was sponsored by the U.S. Dept. of Commerce/Dept. of Defense/National Aeronautics and Space Administration Integrated Program Office, whose mission is to develop the future U.S. National Polar-Orbiting Operational Environmental Satellite System (NPOESS). A comprehensive Ocean Observer User Requirements Document has been drafted by a team of over 150 government, academic, and private sector scientists, engineers, and administrators. Included are requirements for open and coastal ocean surface, cryospheric, hydrologic, and some land/hazard and atmospheric boundary layer parameters. This document was then used as input to the instrument and satellite study (conducted by the Jet Propulsion Laboratory) which produced five different instrument/satellite configuration options designed to address the maximum number of requirements which will not be met with the already-approved NPOESS instruments. Instruments studied include a synthetic aperture radar (SAR), an altimeter, and a hyperspectral coastal infrared/visible imager. After analyzing the alternatives, it appears that one of the best options is a two-satellite system consisting of (1) an altimeter mission in the TopeX/Poseidon orbit carrying both wide-swath and delayed doppler altimeters, and (2) a multi-polarization, multi-frequency, multi-mode interferometric SAR mission including a coastal imager in a polar sun-synchronous orbit. This paper summarizes the user requirements process, briefly describes the notional satellite configuration, and presents some of the capabilities of the instruments.

OS72A-0335 1330h POSTER

Optical and Radar Observations of Surface Eddies in the North Atlantic Ocean Reveal Complex Physical and Biological Processes

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Numerous oceanographic studies have revealed the existence of near-circular oceanic disturbances along ocean boundaries, characterized by long-lasting ocean height anomalies and in some cases, abrupt sea surface temperature boundaries. These complex surface features, denominated marine eddies, represent unique atmospheric/marine manifestations that serve as primary factors that maintain the biological balance of the global marine ecosystem. This study utilized data from both active and passive sensors for the detection, mapping and 3-dimensional modelling of the physical and biological processes that occur at marine cyclonic and anticyclonic centers in the Atlantic Ocean off the coast of the United States. For this purpose, wave height data from the TOPEX/Poseidon radar sensor was obtained and merged with AVHRR sea-surface temperature maps in order to create 3-D scientific visualizations. Furthermore, the radar altimetry data was also compared to observations from other optical sensors, including SeaWiFS and MODIS. This study has demonstrated the numerous advantages of data fusion, including radar and spectral datasets, and allowed for the modeling of physical and biological processes that occur at these centers. In addition, the satellite data allowed for the identification and mapping of small-scale surface disturbances that coexisted with the mesoscale eddies. This technique proved to be particularly advantageous for topics related to the oceanographic remote sensing discipline.

OS72A-0336 1330h POSTER

Interpreting Satellite Views of Biophysical Coupling With Subsurface TAO/TRITON data in the Tropical Pacific

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The concurrent operation of the TOPEX altimeter (SSH) and the SeaWiFS ocean color sensor (chlorophyll) has allowed unprecedented views of biophysical coupling in the surface ocean. SSH largely reflects changes in the thermocline depth, which can directly impact the vertical flux of nutrients to the surface by moving the nutricline into or out of the surface mixed layer. As a result, surface chlorophyll and SSH are generally negatively correlated because higher SSH indicates a deeper thermocline and nutricline. There is however significant geographical variability in the relationships between SSH and thermocline variability and between the depths of the thermocline and nutricline. The strongest negative correlations between SSH and chlorophyll should occur in the tropics, as the relationship between both SSH and thermocline depth and thermocline depth and nutricline depth, are tightest in this region. However, significant positive correlations between SSH and chlorophyll are observed in the western tropical Atlantic and in the central tropical Pacific. To understand the underlying causes for this apparent decoupling of SSH and chlorophyll in the tropical Pacific we use subsurface temperature structure data from the TAO/TRITON moorings to investigate the validity of the primary assumption that satellite SSH reflects changes in the depth of the thermocline. The physical forcing of chlorophyll in this region is also examined using other satellite datasets.

OS72A-0337 1330h POSTER

Vertical Structure of the Zonal Currents Across the Luzon Strait

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The behavior of water exchange between the South China Sea (SCS) and the West Philippines Sea (WPS) is key issue for the formation of the SCS water. Hydrographic investigations so far conducted mostly focused on the intrusion of the WPS water into the SCS. Though some marine chemistry observations and inverse calculation suggested outflows from the SCS in the intermediate layer, the specific vertical distribution of the zonal currents is yet not clear, and the driving mechanisms remain unknown.

In the present paper, we show the basic vertical structure of the zonal currents across a meridional-vertical section in the Luzon Strait (LS) from a global ocean circulation model, and present a simple formulation to illustrate the mechanisms generating the model-produced vertical structure.

The ocean circulation model has a fine grid (1/6 by 1/6 deg) covering the Pacific-Asian marginal seas and a coarse grid (3 by 3 deg) covering the rest of the global ocean. The model results show that the zonal currents across the LS section basically possess a four-layer structure. The first layer is the surface Ekman layer, in which the currents are toward the west in winter and toward the east in summer with the annual mean velocities toward the west. The second layer covers the subsurface and intermediate layers, in which the prevailing currents are westward. The third layer is the deep layer, in which the prevailing currents point to the east. The fourth layer is the bottom layer in terms of the LS (or, lower deep layer in terms of the SCS or WPS), in which the prevailing currents are westward.

The structure of the second through fourth layers can be attributed to vertical mixing of water density. That is, due to the vertical mixing, the water in the upper layers in the SCS is denser than in the WPS, while the water in the lower layers in the SCS is less dense than in the WPS. Under the constraint of mass conservation, this horizontal gradient of the water density can cause a couple of pressure torques, which in turn result in westward flows in the second and fourth layers and eastward flow in the third layer. The annual mean flow in the first layer is a result of three mechanisms.

OS72A-0338 1330h POSTER

Data Assimilation in the South China Sea during ENSO

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ABSTRACT

Sea surface heights from the 9-year TOPEX/Poseidon altimeter are assimilated into a three-dimensional primitive equation model to derive the circulation in the South China Sea. With data assimilation the model resolves not only the basin-wide circulation but also a dipole off Vietnam and a low/high feature near the Luzon Strait. Mesoscale features are missing in the simulation without data assimilation because of poor resolution in the wind field and inadequate knowledge of the transport through the Luzon Strait. Comparing to the case without data assimilation, data assimilation reduces the root mean square error between the simulated and observed sea surface heights by a factor of 2-3. The 9-year model outputs are analyzed using time-domain Empirical Orthogonal Functions (EOF). Spatial and temporal variations of the first two modes from the simulation compare favorably with those derived from satellite altimetry. Mode 2 is responsible for the asymmetric seasonal and interannual variations, which are particularly noticeable during ENSO. Circulation derived from data assimilation under climatological conditions is contrasted with that during ENSO. In the normal winter, flow at 50 m depth is strong and cyclonic. Flow at 900 m depth is cyclonic as well. The deep cyclone persists into the following summer. During the ENSO winter, features in the flow field at 50 m depth either weaken or disappear, and circulation at 900 m depth is anticyclonic. In the summer of 1995 the dipole and the eastward jet off Vietnam at 50 m depth are missing, and the anticyclonic circulation at 900 m depth persists. Temperature at 65 m shows significant warming from fall 1994 to summer 1995. A weakened flow field and warming in the upper ocean are consistent with findings from earlier ENSO events.

OS72A-0339 1330h POSTER

The vortex streets on a X-SAR image caused by tidal currents.

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The sea surface imprint of two vortex streets behind two small islands were observed on a Synthetic Aperture Radar (SAR) X band image on April 14, 1994 in coastal waters. The vortex streets are analogous to the classical Von Karman vortex streets produced by strong currents with obstacle. The direction of tidal currents and wind data substantiate that the vortex streets are caused by tidal currents and not by wind. The most of vortex streets on SAR images were originated from atmospheric effects and the vortex streets produced by coastal waters itself on a SAR image is a singular case. The characteristics of vortex streets are analyzed using the size of the vortex streets and tidal currents simulated using tidal constituent data.

OS72A-0340 1330h POSTER

Comparison of Radar Altimeter and SAR-Imagette Derived Significant Wave Height

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Microwave sensors such as satellite radar altimeter (RA) or synthetic aperture radar (SAR) flown on the ERS and ENVISAT satellites are valuable tools for weather and daytime independent observation of the ocean surface.

Apart from the ability of RA to determine the mean or instantaneous sea surface heights, the returning waveform can be used to estimate the significant wave height (SWH) with a very high accuracy. The rms difference against in-situ buoy measurements is about 0.2 m only. Using an empirical function which relates SWH to near surface wind speed under the assumption of a fully developed sea allows to calculate the swell component in the RA measurement. Since RA is a point measuring instrument, the result lacks any directional information about the wave field.

The global data set of complex imagnettes allows to identify travelling directions of wave components. Two-dimensional ocean wave spectra are derived from SAR imagnettes by non-linear inversion of the SAR imaging mechanism. Individual wave systems are detected by a so-called partitioning algorithm. These wave systems are classified into swell and wind sea. As SAR spectra are affected by an azimuthal cut-off, short waves propagating in flight direction are not resolved by this method. The resulting wave parameters include not only wave height, but also wave length and wave direction.

Even though there is a 300 km offset between simultaneous ERS-2 measurements of RA and SAR we found some remarkable agreements of the two techniques. We present results of comparisons under various wind and wave conditions from different geographic regions.

As the new European Satellite ENVISAT will provide cross spectra on a global and continuous basis, interest in the described techniques is growing.

OS72A-0341 1330h POSTER

Wind-Driven Waves in Tampa Bay, Florida

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Turbidity and nutrient flux due to sediment resuspension by waves and currents are important factors controlling water quality in Tampa Bay. During December 2001 and January 2002, four Sea Bird Electronics SeaGauge wave and tide recorders were deployed in Tampa Bay in each major bay segment. Since May 2002, a SeaGauge has been continuously deployed at a site in middle Tampa Bay as a component of the Bay Regional Atmospheric Chemistry Experiment (BRACE). Initial results for the summer 2002 data indicate that significant wave height is linearly dependent on wind speed and direction over a range of 1 to 12 m/s. The data were divided into four groups according to wind direction. Wave height dependence on wind speed was examined for each group. Both northeasterly and southwesterly winds force significant wave heights that are about 30% larger than those for northwesterly and southeasterly winds. This difference is explained by variations in fetch due to basin shape. Comparisons are made between these observations and the results of a SWAN-based model of Tampa Bay. The SWAN wave model is coupled to a three-dimensional circulation model and computes wave spectra at each model grid cell under observed wind conditions and modeled water velocity. When SWAN is run without dissipation, the model results are generally similar in wave period but about 25%-50% higher in significant wave height than the observations. The impact of various dissipation mechanisms such as bottom drag and whitecapping on the wave state is being investigated. Preliminary analyses on winter data give similar results.

URL: <http://ompl.marine.usf.edu/BRACE>

OS72A-0342 1330h POSTER

Development of a Storm Surge Prediction Scheme, Coupling Wind and Wave Forcing using ADCIRC

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As a component of a recent NOPP project entitled, "Real Time Forecasting System of Winds, Waves, and Surge from Tropical Cyclones" (Graber et al., 2002) we are working to improve storm surge predictions. The damage caused by tropical cyclones in the past century is well documented. Here, we use Hurricane Georges

as a case study to calibrate our model. Georges passed across the Caribbean and through the Florida Strait into the Gulf of Mexico in late September 1998. It made landfall along the Gulf coast of the U.S., impacting Louisiana, Mississippi, Alabama, and the Florida Panhandle. As model input we use available wind and pressure field data assimilated by NOPP partner Ocean-weather Inc., coupled with estimated wave fields predicted with the third generation Wave Action Model (WAM3G).

The heart of the scheme utilizes the Advanced Circulation Model for Shelves, Coastal Seas and Estuaries (ADCIRC) (Luettich and Westerink). The model solves the two-dimensional, depth-integrated (2DDI), shallow water equations. We show results of sensitivity tests of various air-sea drag formulations and grid resolution on predicted surge levels. The calculated surge levels, generated from combinations of wind, pressure, tide, and wave fields, are compared to sparse observations collected at selected locations along the Gulf coast. We report on our progress of isolating contributions to the total surge from forcing effects of breaking wave induced radiation stresses, wind stresses, pressure fields, and tides. Results indicate that significant contributions to the total surge are produced by each mechanism, but that the total surge is not a linear combination of individual effects.

OS72A-0343 1330h POSTER

The Effects of Wind Forcing and Background Mean Currents on the Latitudinal Structure of Rossby Waves

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Observations of thermocline depth and sea surface height variability in the tropical Pacific consistently find larger amplitude Rossby waves north of the equator than south of the equator with phase speeds that are slower than the first meridional mode of classical theory. Classical theory assumes zero background mean flow and has either symmetric (odd meridional modes) or antisymmetric (even modes) Hermite function solutions for the meridional structure of sea surface height.

The Gent-Cane (1989) reduced gravity, beta-plane model forced with QuikSCAT scatterometer winds is able to simulate the qualitative features of this equatorial asymmetry with Rossby wave phase speeds similar to those calculated from observations. We perform a series of model runs to distinguish between two hypotheses: the asymmetric waves are due to asymmetries in the time-varying wind forcing, or they are due to asymmetric background mean currents. Since the asymmetric background mean flow of the Equatorial Current System is created by asymmetric mean wind forcing, it is a challenge to separate these two hypotheses. In one set of numerical experiments, we spin up the model with steady, equatorially asymmetric winds and then apply idealized equatorially symmetric, time-varying winds as a perturbation to the system. In another set of numerical experiments, we spin up the model with steady, equatorially symmetric winds and then apply idealized equatorially asymmetric, time-varying winds. The results of the model runs will be compared qualitatively with observations by the TOPEX/POSEIDON altimeter to assess the relative importance of the two hypothesized mechanisms for determining the latitudinal structure of the equatorial Rossby waves.

OS72A-0344 1330h POSTER

ERA-40 Ocean Surface Heat Flux: Evaluation of the Model Spins

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Oceanic models forecasting skill strongly depends on surface heat fluxes. When computed from atmospheric models, surface heat fluxes are affected by the spin-up (or spin-down), i.e. they increase (or decrease) with the forecast length. Such behavior may bias coupled atmosphere-ocean system output. The European Centre for Medium Range Forecast (ECMWF) Re-Analysis 40-year (ERA-40) ocean surface fluxes has

been used to quantify initial jumps of turbulent and radiative fluxes. A climatological evaluation for the period 1989 to 1993 was made. We studied the seasonal cycle of surface fluxes spins both at global and regional scales. Surface fluxes have been analyzed as a function of hours elapsed from the forecast base time, named time rejected [Tr]. Whatever the season, the global averaged latent heat flux increases as a function of [Tr], leveling off after 24 hours. Global averaged sensible and radiative fluxes exhibit stability after 6 hours. Very different spin-up versus the latitude and the season exist which denote a strong dispersion around global averages. Some reasons of such different behaviors are suggested. A second purpose of the current study is to compare ERA-40 with ECMWF Re-Analysis 15-year (ERA-15). Results show that ERA-15 spins are larger than ERA-40 ones.

URL: <http://www.ecmwf.int/research/era>

OS72A-0345 1330h POSTER

Comparison of Airborne Lidar and Multibeam Bathymetric Data in the Florida Reef Tract Along Broward County

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Most mapping of Floridas coral resources has been in the relatively shallow waters of the Florida Keys. However, it is well known that large concentrations of corals are found in deeper waters off Floridas eastern seaboard. To date, technological limitations have precluded the mapping of corals in these deeper waters. Satellite imaging systems and natural color aerial photography, two mapping mainstays, are generally only effective in Florida waters shallower than 20 meters. Conservation of the northern portion of the Florida reef tract, which parallels the Atlantic coast in Miami-Dade, Broward and Palm Beach counties, has been hampered by the fact that there are little or no coordinated management, monitoring and mapping activities in place. To assist the Broward county shore protection project geographic information systems database, a Laser Airborne Depth Sounder (LADS) survey was performed in 2001. The survey flanked the 43 km shoreline to a depth of ~50m and distances out to 2km in the north and 3.5km in the southern portion at a spatial resolution of 1.524m (5ft). Additionally, in November 2000 as part of a container vessel grounding lawsuit, funding was allocated to find an alternative anchorage for Port Everglades. The Simrad EM3000 multibeam system was used to collect data in a 2km x 2km square south of Port Everglades, offshore at a depth from 7m to 36m deep and at a spatial resolution of 1m. The area of overlap coincided with the second and third reef tracts, which have the highest biodiversity of the three reef tracts. These datasets were compared at overlapping geographic extents.

URL: <http://www.floridamarine.org>

OS72A-0346 1330h POSTER

Comparison of Bathymetry and Bottom Characteristics From Hyperspectral Remote Sensing Data and Shipborne Acoustic Measurements

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There is growing interest in applying optical remote sensing techniques to shallow-water geological applications such as bathymetry and bottom characterization. Model inversions of hyperspectral remote-sensing reflectance imagery can provide estimates of bottom albedo and depth. This research was conducted in support of the HyCODE (Hyperspectral Coupled Ocean Dynamics Experiment) project in order to test optical sensor performance and the use of a hyperspectral remote-sensing reflectance algorithm for shallow waters in estimating bottom depths and reflectance. The objective of this project was to compare optically derived products of bottom depths and reflectance to shipborne acoustic measurements of bathymetry and backscatter.

A set of three high-resolution, multibeam surveys within an 18 km by 1.5 km shore-perpendicular transect 5 km offshore of Sarasota, Florida were collected at water depths ranging from 8 m to 16 m. These products are compared to bottom depths derived from aircraft remote-sensing data collected with the AVIRIS (Airborne Visible-Infrared Imaging Spectrometer) instrument data by means of a semi-analytical remote sensing reflectance model. The pixel size of the multibeam bathymetry and AVIRIS data are 0.25 m and 10 m, respectively. When viewed at full resolution, the multibeam bathymetry data show small-scale sedimentary bedforms (wavelength 10m, amplitude 1m) that are not observed in the lower resolution hyperspectral bathymetry. However, model-derived bottom depths agree well with a smoothed version of the multibeam bathymetry. Depths derived from shipborne hyperspectral measurements were accurate within 13%. In areas where diver observations confirmed biological growth and bioturbation, derived bottom depths were less accurate.

Acoustic backscatter corresponds well with the aircraft hyperspectral imagery and in situ measurements of bottom reflectance. Acoustic backscatter was used to define the distribution of different bottom types. Acoustic backscatter imagery corresponds well with the AVIRIS data in the middle to outer study area, implying a close correspondence between seafloor character and optical reflectance. AVIRIS data in the inner study area show poorer correspondence with the acoustic facies, indicating greater water column effects (turbidity). Acoustic backscatter as a proxy for bottom albedo, in conjunction with multibeam bathymetry data, will allow for more precise modeling of the optical signal in coastal environments.

URL: <http://www.marine.usf.edu>

OS72A-0347 1330h POSTER

Impact of QuikSCAT-Derived Wind Stress on High-Resolution Kuroshio Modeling

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Spectral bandwidth of the wind stress over the ocean is broad in time and space. The scale of the oceanic responses, therefore, would vary from an upper-ocean nonlinear mixing to a basin-wide general circulation largely governed by linear Sverdrup dynamics. What is the impact of such broad-banded wind stress to a local mid-latitude mesoscale ocean dynamics? The Kuroshio south of Japan is known to have two preferred paths: a straight one and a meandering one. In its bimodal state, the choice of the path state is sensitive to perturbations such as mesoscale eddy. Because of its sensitivity to external forcing, the Kuroshio, in its bimodal state, provides a unique setting to test the impact of high-frequency wind forcing on the ocean currents.

We, therefore, used a regional inflow-outflow Kuroshio/Oyashio GCM as a test-bed and forced the model by QuikSCAT-derived daily wind stress (2000-2001). The same model forced by an annual mean Hellerman-Rosenstein wind stress exhibited a bimodal Kuroshio path state at a fixed 35 Sv Kuroshio inflow. In addition, the variability of the Kuroshio path was large because of energetic eddy activities. The exact timing of the transition of the path was sensitive to changes in the initial condition as well as model parameters. It is, therefore, likely that the evolution of the modeled Kuroshio path would alter if a broad-spectrum wind stress was used.

In a preliminary study using different initial conditions, we have seen a case where the meander growth was enhanced by the use of QuikSCAT wind. In another case, however, no statistically relevant change was observed. It is anticipated that there also can be a case where the reduction of the amplitude of the meander

is caused by QuikSCAT wind. It is obvious, therefore, that the use of high-frequency wind stress will add perturbations to the flow, which is large enough to cause the evolution of the Kuroshio to become more chaotic.

In an on going experiment, we will continue using our regional Kuroshio model as a test-bed to elucidate the dynamics of how the high-frequency wind forcing impacts the underlying oceanic flow, and also to understand what frequency band of the wind-stress influences most the local current system. As an outcome of this study, we may be able to identify the role of the high frequency wind forcing in the predictability of the ocean currents.

OS72A-0348 1330h POSTER

Using an Airborne Doppler Lidar to Evaluate QuikSCAT and RadarSat Derived Winds

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While near surface winds derived from space-based remote sensing have proven very useful, both operationally and for research, there remain several issues not fully resolved. Besides the persistent wind direction uncertainty, high wind speeds (> 25 m/s) and organized circulations such as those associated with large marine atmospheric boundary layer eddies continue to introduce magnitude and representativeness errors in the data products.

The US Navy and the Integrated Program Office of NPOESS have jointly sponsored the installation and use of a scanning Doppler lidar on a Navy Twin Otter aircraft. The lidar is a 2 micron coherent system with a side door mounted hemispherical scanner. Returns from aerosols are processed to obtain wind profiles (above and below flight level). The measurement accuracy is on the order of a few cm/sec in speed and a degree or two in direction. The footprint of the lidar beam is < 1 meter and the full profiles are constructed with wind observations over a one kilometer flight segment. The vertical resolution is usually < 50 meters. In the nadir looking mode, the Doppler lidar can resolve wave structures with < 5 cm/sec vertical motion accuracy and with .5 meter horizontal resolution.

In the Spring of 2002, the lidar was flown over Monterey Bay (CA) during QuikSCAT and RadarSat overpasses. Cloud streets were observed from the aircraft and with the lidar in the vicinity of organized patterns in the RadarSAT returns. The lidar data offer detailed insight into the velocity and aerosol structures within the larger footprints of the space-based sensors. Detailed analyses of the collocated lidar, QuikSCAT and RadarSAT data will be presented along with plans for the future use of this new research facility.

OS72A-0349 1330h POSTER

Comparison of observed and modeled reflectance around sunglint

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If the sea surface were perfectly flat, a single, disc-like reflected image of the Sun would be seen at the specular reflection angle. But this is almost never seen in reality. The sea surface is always rough due to the wind, and this spreads out the image of the Sun from a disc to the speckly column we are all familiar with. The principal effect of the rough surface is to reflect the direct solar beam into a range of angles; the rougher the sea, the wider the range. In other words, the wave slope distribution determines the sunglint pattern.

A scanning spectral photometer is deployed at a coastal ocean platform COVE (CERES Ocean Validation Experiment) site to measure upwelling solar radiances from the sea surface at 11 elevation angles spanning 150 degrees of azimuth. Observed reflectances around sunglint are compared to model simulations which use the classic Cox/Munk slope distribution for visible and near infrared bands. Discrepancies between observations and model simulations are discussed.

OS72A-0350 1330h POSTER

Effects of Fine-Scale Wind Direction Information on Retrieval of Surface Layer Wind Speed From SAR Ocean Surface Imagery

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Wind speed retrievals from C-band SAR sea surface imagery using algorithms such as CMOD4 or CMOD4FR2 depend significantly on the assumed local surface wind direction. To evaluate this dependence, we present retrievals of surface wind speed from RADARSAT SAR images acquired during the Shoaling Waves Experiment (SHOWEX) off the coast of North Carolina in November and December 1999, and retrievals from ScanSAR scenes acquired over the Tropical Atmosphere Ocean Project (TAO) 95 W buoys during April and May 2000. These cases include moderate and low wind regimes and stable and unstable boundary layer stratification. A few images contain the signature of boundary layer roll vortices.

SAR backscatter images can provide wind speed retrievals of ~300m resolution or better, as compared with a typical 25-km scatterometer footprint. SAR wind retrievals typically rely on wind-direction input from relatively coarse numerical models or from a buoy point source. When present, the signature of roll vortices in an image is often used to assign wind direction. Even so, the SAR wind speed images often show wind variability over regions much smaller than typical scatterometer footprints. The question remains: How much of this apparent variability is due to spatial changes in wind direction rather than wind speed?

For the SHOWEX cases we coordinated 50km LongEZ flight legs at ~20m above the sea surface with the SAR overpasses. These surface layer flights provide km-scale wind-direction input for the CMOD4 algorithm. The fine-scale wind-speed and flux measurements also provide 10m wind-speed estimates to compare with the retrieved wind speeds. We present our evaluation of SAR wind retrievals obtained from applying the various wind-direction inputs. We also show the sensitivity of winds retrieved over the TAO array when nearly coincident QuikSCAT scatterometer wind directions are applied instead of point-source winds from TAO buoys.

OS72A-0351 1330h POSTER

Near Real-Time High Resolution Ocean Wind Vectors from QuikSCAT

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The NESDIS of NOAA processes and distributes near real-time global ocean surface wind fields with a 25km resolution, from QuikSCAT scatterometer measurements, since July 1999. The standard wind product is derived from scatterometer backscatter measurements that are actually higher in resolution. This led to the development of a high resolution QuikSCAT wind product. The high resolution product provides wind estimates in 12.5 km by 12.5 km wind vector cells (WVC). Processed with the standard QuikSCAT algorithms the resultant ocean wind field appears noisier than the standard product.

To improve resultant high resolution wind field we defined 'solution probability threshold' (SPT) parameter, which is a function of solution likelihood estimator, mean wind speed, number of solution and across swath position of a given WVC. The average values for this parameter were obtained using four months of collocated high resolution QuikSCAT wind vectors and NCEP global data assimilation systems wind field. This parameter is then used in a baseline processing to

allow all solutions exceeding predefined threshold to influence initialization of ambiguity removal procedure. This filtering of noisy data based on retrieval error estimates before median filtering significantly improved wind direction accuracy.

Due to measurement sampling geometry high resolution product has a tendency of producing wind vectors that are less influenced by rain. To account for this feature we modified rain flagging algorithm by combining multidimensional histogram rain flag and solution probability threshold. This significantly reduced number of WVC that were faultily flagged as rainy.

OS72A-0352 1330h POSTER

A High-Resolution Surface Vector Wind Product for Coastal Oceans: Blending Satellite Scatterometer Measurements with Regional Mesoscale Atmospheric Model Simulations

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A 2-dimensional variational method is used to blend the satellite scatterometer measured (QuikSCAT) and regional mesoscale atmospheric model simulated (COAMPS) surface vector winds for coastal central California. The approach is distinct from existing methods in that it considers errors from both measurements and models. When compared with independent in situ observations, the blended wind product shows consistently higher correlation and smaller RMS errors than QuikSCAT or COAMPS winds. The proposed blending algorithm can be implemented over any part of the world ocean. It should be a valuable tool for describing small-scale atmospheric processes in the coastal zones and for forcing high-resolution coastal ocean models.

OS72A-0353 1330h POSTER

A Global Comparison of Ekman Pumping From Satellite Scatterometers and Ocean Data Assimilation Estimates

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Ekman pumping, a form of wind-driven upwelling, plays important roles in upper-ocean dynamics, thermodynamics, and biology as well as in boundary-layer meteorology. Inverse models, such as those of ECCO (Estimation of the Circulation and Climate of the Ocean, <http://www.ecco-group.org/>), estimate wind forcing through ocean data assimilation. Scatterometer data provide a stringent test of the skill of the assimilation in estimating wind. Ekman pumping obtained from various scatterometers are compared with those derived from ECCO models which assimilate TOPEX-derived sea level anomalies using the adjoint and Kalman filter/smoothing methods. Differences in Ekman pumping between scatterometer and assimilation estimates are quantified in terms of the mean, standard deviation, and correlation. Changes in the Ekman pumping due to the assimilation are analyzed to identify the spectral (frequency-wavelength) space over which the assimilation has a significant impact. The comparison also highlights aspects where the ECCO model and assimilation schemes need improvement.

OS72A-0354 1330h POSTER

Drift of Floating Debris in the South Pacific Ocean: Application to the Seaweeds Drift in French Polynesia.

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The objective of this study is to determine trajectories of floating debris in the South Pacific Ocean and in particular to study seaweed drift in French Polynesia.

Surface currents are considered to be the sum of the geostrophic and the Ekman components determined from altimetric data of Topex-Poseidon and from wind provided by ERS scatterometer. Data are available on a one degree grid every five days from January 1993 to January 2001. As expected, large variabilities of currents are due to the El Nio event of 1997-1998. Trajectories of floating debris in the South Pacific Ocean are determined by solving the lagrangian equations that give the position of the floating debris every 5 days. First calculations are carried out at the scale of the South Pacific Ocean from 1993 to 2001. Results show that debris follow the main surface currents such as the South Pacific Current, the Perou Current or the South Equatorial Current and the East Australian Current. Whatever the starting point of the debris, the debris after a long period of drift accumulate in the center of the Subtropical gyre at about 110 W and 27 S.

One application of our drifting model is the determination of trajectories of seaweeds that are detached from the reefs. The objective is to understand how two brown seaweed, *Turbinaria ornata*, came to populate the Tuamotu archipelago during the last two decades. This seaweed is found on high volcanic islands (Gambier, Society, Austral and Marquesas islands) while it is absent from the low carbonate islands (Tuamotu atolls). Several simulations have been performed over periods of 3 months supposed to be the seaweed life period in open ocean. The 3 month periods are chosen according to the seasonal variation (dry and wet season) and according to the El Nio and La Nia events. Our results show that at any season seaweeds departing from Marquesas islands can reach the Tuamotu atolls. Seaweeds reach the southernmost part of the Tuamotu atolls if they depart from Gambier islands during El Nio and La Nia.

OS72B MCC: Hall D Sunday 1330h

Scientific Results From Coastal Ocean Observing Systems II Posters (*joint with B*)

Presiding: C N Moers, University of Miami; M Kosro, College of Oceanic and Atmospheric Sciences

OS72B-0355 1330h POSTER

Analysis of Acoustic Signals from Shipping Traffic at Pioneer Seamount

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In September of 2001 a cabled vertical linear array (VLA) of hydrophones was deployed on Pioneer Seamount, 90 km off the California coast near Half Moon Bay, by the NOAA-PMEL and University of Washington-APL. The array of 4 hydrophones is at a depth of 950 m, and the four signals are digitized at the shore end of the cable at 1000 Hz. The data are archived by PMEL, and are available to the public over the internet. Spectrograms of all of the data are accessible on the SFSU web site.

A prominent feature of the spectrograms is the acoustic signal of a passing ship. Some striking interference effects are seen in these spectrograms which provide a means of estimating the distance to the sound source. Even signals from single hydrophones show the effect of interference between direct sound waves and those reflected from the bottom.

The analysis of these interference effects will be discussed, and measurements of ship speed and course will be presented.

URL: <http://www.physics.sfsu.edu/~seamount>