OS21O-10 1115h

The Formation of an Iron Curtain in the Subterranean Estuary of a Coastal Bay

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Recent studies indicate that groundwater may contribute significant fluxes of dissolved chemical species to the oceans. The magnitude of such fluxes is influenced by biogeochemical processes occurring in the subterranean estuary, defined as the mixing zone between groundwater and seawater in a coastal aquifer. In contrast to surface estuaries, little is known about chemical reactions in subterranean estuaries mainly because they are difficult to sample due to their subsurface location. Here we report the discovery of an "Iron Curtain" in a subterranean estuary on Cape Cod. The term "Iron Curtain" refers to the precipitation of groundwater-borne dissolved ferrous iron and subsequent accumulation of iron oxides onto subsurface sands at the groundwater-seawa ter interface. The formation of an Iron Curtain is not likely limited to the study area of interest; any coastal aquifer bearing high concentrations of dissolved ferrous iron that intercepts surface water is likely to exhibit this feature. As naturally-occurring iron oxides are strong adsorbers and concentrators of many dissolved chemical species, the occurrence of an Iron Curtain has broad implications for transport of natural and anthropogenic materials from aquifers into coastal waters.

OS21O-11 1130h

Flushing Rates of Coastal Bays and Inlets Revisited: Implications for Coastal Planning and Ecological Studies

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Many coastal inlets and embayments are under constant or increasing pressure to support the competing requirements of commercial, customary and recreational fisheries, acting as sinks for effluent and pollutants, hosting aquaculture activities; and ribbon coastal development. Management of these activities also varies significantly. For example, wild stock fisheries are often managed over large spatial scales. By contrast, aquaculture activities, effluent discharges and coastal constructions are generally managed over very small spatial scales (O(100s of metres)). Therefore in the case of embayments and coastal inlets, often different sectors and activities are managed completely independently of one another. However, in reality many of these activities are connected through water current flows. The traditional method of accounting for movents in bays and inlets has been to determine the flushing rate for the entire inlet. However, these calculations almost always contain no spatial information and the results can be extremely sensitive to different forcing processes. Furthermore, the lack of spatial information can lead to implied assumptions about spatial scales of ecological processes, particularly larval transport and recruitment. Circulation, and therefore the distribution of seston in embayments and inlets is driven primary by tidal processes, local and in some cases remote winds. Forcing processes acting over seasonal scales also play important roles in many cases. Therefore the individual and combined responses to these forcing processes ensures high spatial and temporal viability in flows implying that simplifying flows and exchange into a single flushing rate calculation is entirely inappropriate.

The use of high-resolution numerical models has revealed the true complexity of circulation processes in many coastal embayments and inlets. However the full implications of this variability is often overlooked, particularly in the design of environmental impacts assessments and marine ecological investigations. The implications of high spatial and temporal viability in circulation in embayments and coastal inlets is discussed.

OS21O-12 1145h

Pollution Hazards off the Southern California Coast: Satellite and In-Situ Observations of Naturally Occurring Oil Seepage and Storm Water Runoff Plumes

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The coastal waters off southern California are characterized by anthropogenic and naturally occurring pollution hazards. Pollutant-laden storm water runoff plumes are common coastal ocean features throughout the Southern California Bight following winter storms. In Santa Monica Bay, these plumes have been associated with high toxicity and water-borne pathogens. Natural liquid oil seepage is observed throughout the year in the Santa Barbara Channel off Coal Oil Point, and in Santa Monica Bay off Redondo Beach. The size and episodic nature of these phenomena, however, make them difficult to characterize by conventional shipboard sampling. Space-borne synthetic aperture radar (SAR) sensors are well suited to observing them since they provide frequent, synoptic, high-resolution, all-weather observations. The aim of this project is to initially quantify the frequency of occurrence, spatial extent, and dynamics of natural oil slicks and storm water runoff plumes off the coast of southern California using multi-sensor SAR data (e.g., Radarsat, ERS-1, ERS-2). Surfactants from these pollution hazards smooth surface waters, making them readily observable by SAR. These SAR observations will be complemented by other satellite (e.g., ocean color, AVHRR) and coincident field data (e.g., surface currents from HF coastal radar arrays and buoys, winds, precipitation, discharge) where possible. In particular, we hope to characterize the time-space response of these phenomena to variable oceanographic and atmospheric conditions. In this regard, the observation of natural oil slicks could provide important insights into the movement of accidental oil spills, including likely dispersal patterns. We expect this research will contribute to an improved understanding of pollution hazards in southern California coastal waters, and provide valuable information for coastal management.

OS21P HC: 323 B Tuesday 0830h

Nutrient Dynamics in Coastal Ecosystems: Linking Physical and Biological Processes III

Presiding: **J M Caffrey,** Center for Environmental Diagnositics and Bioremediation University of West Florida**; T K Frazer,** University of Florida Department of Fisheries and Aquatic Sciences

OS21P-01 0830h

Porewater Flows and Organic Matter Decomposition in Carbonate and Silicate Sands

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Bottom currents and surface gravity waves cause advective pore water exchange in permeable sandy sediments. In flume experiments and in in-situ measurements we quantified the advective exchange rates and used these data to design experiments simulating the percolation of bottom water through the sediment surface layers. In these column experiments we investigated mineralization of organic matter in permeable sands of different mineral composition. In carbonate sands that were characterized by a high specific surface area the decomposition rates exceeded those in silicate sands with the same grain size but a relatively lower specific surface area. We concluded that the sand sediments acted as biocatalytic filters and that the mineral composition of the sand and the surface structure of the grains significantly affected the mineralization efficiency of the sand filters.

URL: http://www.scor-wg114.de/

OS21P-02 0845h

Coupled Biological-Physical Dynamics in Massachusetts Bay during late summer 1998 computed by Error Subspace Statistical Estimation

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The coupled estimation of physical and biological variabilities and uncertainties in Massachusetts Bay is carried out for August-September 1998. The multiscale interdisciplinary data sets were collected during the LOOPS-98 experiment.The models employed are part of the Harvard Ocean Prediction System. The physical model is a 4-d primitive-equation model governing the velocity, temperature and velocity fields. It is coupled to a 4-d biochemical model which governs the interactive evolution and spatial distribution of phytoplanktons, zooplankton, detritus, nitrate, ammonium and cholorophyll.

The use of first-order dynamical balance for the initialization of biological fields and calibration of biological parameters is presented. A multiscale methodology for the initialization of the dominant components of error/variability covariances is illustrated. With the resulting initial fields and error estimates, multivariate data assimilation via Error Subspace Statistical Estimation is carried out. The skill of the physical and biological models are evaluated based on classic and new skill metrics. ESSE smoothing is used to estimate the initial conditions based on future data and dynamics. The properties of the error/variability probability density functions of the coupled state variables are studied.

The impacts of wind-driven advections, buoyancy circulations and vertical mixing on nutrients and plankton fields are quantified. The different regions of trophic enrichment and accumulation in late summer are synthesized and possibly generic coastal biophysical processes outlined. A few dominant dynamical balances, time and space scales are identified. In the light of the recent multiscale ASCOT-2001 experiment in Massachusetts Bay and Gulf of Maine, selected issues and directions for future work are summarized.

OS21P-03 0900h

Estimation of Water and Nutrients Exchanges Between the Continental Shelf and the Deep sea in an Enclosed Marine Environment (the Black Sea)Using a 3D Coupled Hydrodynamical-Biogeochemical Model at Basin Scale.

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A 6-compartment biogeochemical model of nitrogen cycling and plankton productivity has been coupled with a 3D general circulation model in an enclosed environment (the Black Sea) so as to quantify and compare, on a seasonal and annual scale, the typical internal biogeochemical functioning of the shelf and of the deep sea as well as to estimate the nitrogen and water exchanges at the shelf break. Model results indicate that, regarding the deep sea, the shelf acts, throughout the year, as a nutrient source and the total annual nitrogen export to the deep sea roughly corresponds to the annual load of nitrogen discharged by the rivers on the shelf.

The model estimated vertically integrated gross annual primary production is 130 gC m-2 year-1 for the whole basin, 220 gC m-2 year-1 for the shelf and 40 gC m-2 year-1 for the central basin. In agreement with sediment trap observations, model results indicate a rapid and efficient recycling of particulate organic matter in the sub-oxic portion of the water column (60-80 m) of the open sea. More than 95% of the PON produced in the euphotic layer is recycled in the upper 100 m of the water column, 87 % in the upper 80 m and 67 % in the euphotic layer. The model estimates the annual export of POC towards the anoxic layer to 4 1010 mol year-1. This POC is definitely lost for the system and represents 2 % of the annual primary production of the open sea.

OS21P-04 0915h

Modeling the Impacts of Decadal Changes in Riverine Nutrient Fluxes on Coastal Eutrophication near the Mississippi River Delta

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A mathematical model was used to link decadal changes in the Mississippi River nutrient fluxes to coastal eutrophication near the Mississippi River Delta. Model simulations suggest that bottom water hypoxia intensified about thirty years ago, as a probable consequence of increased net productivity and increased sedimentation of the organic material produced in the upper water column. Model simulations also suggest that long-term increase in riverine nutrient fluxes has been responsible for this historical decrease in bottom layer oxygen concentrations. Importantly, model simulations are in good agreement with the available historical data from the northern Gulf of Mexico, and are additionally supported by the retrospective analyses of sedimentary records. Conclusively, this modeling study supports the hypothesis that riverine nutrient fluxes, via their influence on net productivity of the upper water column, play a major role in controlling the development of bottom water hypoxia and accumulation of organic carbon in coastal sediments.

OS21P-05 0930h

Using an In-Situ Nitrate Analyzer to Compare Riverine and Tidal Influences on Water Column Nitrate Concentrations in Two Gulf of Mexico Estuaries

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Weeks Bay, Alabama and Apalachicola Bay, Florida are located in the northeastern Gulf of Mexico. The Weeks Bay watershed is 510 km^2 while the Apalachicola Bay watershed is 45000 km^2; similarly freshwater flow to Weeks Bay is about 100 times smaller than that of the Apalachicola River. Both watersheds have experienced rapid population growth. Hourly measurements of nitrate concentrations were made with an in-situ nitrate analyzer at Weeks Bay between January - March 2001 and between July - September 2001. Analyzers were also deployed at Apalachicola Bay in April 2000 and between September - November 2001. A strong negative relationship between nitrate concentration and salinity was evident during all deployments at both locations demonstrating a tight linkage between river flow and nutrient input to these estuaries. Nitrate concentrations were high throughout the year in the main tributary to Weeks Bay. Following rainfall events, nitrate concentrations at the head of Weeks Bay ranged between < 1 uM and 50 uM over a tidal cycle as high salinity, low nitrate water entered the Bay on flood tides and low salinity, high nitrate water entered the Bay on ebb tides. These nutrient inputs to Weeks Bay supported high phytoplankton biomass with spring and summer chlorophyll a concentrations exceeding 20 ug/l. The spring deployment in Apalachicola Bay coincided with a declining river discharge (from 2120 to 425 m^3/s). There was a significant negative relationship between nitrate and salinity in Apalachicola Bay, with salinity explaining about 70% of the variation in nitrate concentrations. Spring chlorophyll a concentrations in Apalachicola Bay were usually less than 10 ug/l. Harmonic regression analysis was used to examine tidal (24.8h), diurnal (24h) and lunar (29.5d) periodicities in nitrate concentrations. Regression models were significant although the amount of variation they could explain varied by deployment.

OS21P-06 0945h

Spatial and Temporal Variability in Nitrogen and Phosphorus Limitation of the Late Summer Phytoplankton in the Baltic Sea

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We studied the variability in nutrient limitation of phytoplankton growth, primary productivity and nitrogen fixation during the cyanobacterial bloom period in the Baltic Sea. Nutrient enrichment bioassays were carried out in the open sea and at a coastal area under high riverine influence. Phytoplankton growth and primary productivity were phosphorus (P) limited or co-limited by P and nitrogen (N) at the coastal sites. Growth rates followed the concentration of P added, and saturated at the highest P concentrations. This suggested N availability did not limit coastal phytoplankton growth. In the open Baltic Sea, either N limitation alone or co-limitation by N and P of growth and primary productivity existed. When N or NP additions increased primary productivity and phytoplankton growth, P or iron additions stimulated nitrogen fixation. For coastal areas in the Baltic Sea, the results suggest that high N availability in relation to P can lead to the exclusion of diazotrophic organisms. For the open Baltic Sea, the results suggest that stimulation of nitrogen fixation due to phosphorus inputs into the upper mixed layer may serve to prolong the occurrence of potentially toxic cyanobacterial blooms.

OS21P-07 1020h

Slow Acid-Release of Iron From Seawater in the California Coastal Upwelling Zone

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Iron concentrations of samples from upwelling and non-upwelling zones were compared. Rates for acid dissociation of labile iron from 0.45 micrometer filtered seawater were obtained from areas of upwelling that contain relatively high concentrations of 'dissolvable Fe'. Little time dependence was found for acid release of complexed iron from samples taken from waters outside of upwelling regions. Hypothetically, this was due to higher concentrations of colloids and complex siderophores in upwelling areas. This study provides evidence that attention should be given to time and degree of acidification in the sample pre-treatment of seawater for iron determinations, particularly in shipboard based techniques.

OS21P-08 1035h

Dynamics of Protozooplankton in a Tropical Pelagic food web.

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The Andaman Sea off the south vest coast of Thailand is a very important fishing ground. Knowledge about the food web that support the rich fish stock is however very limited. As a part of a Thai- Danish research programme the structure and dynamics of the pelagic food web was investigated. A prominent feature of the Andaman Sea is a high amplitude internal wave, found around the pycnocline. In general the water column is strongly stratified and nitrate is depleted above the pycnocline. The phytoplankton community is dominated by pico-phytoplankton, which makes up for more that 70 % of the total phytoplankton biomass. The microbial food web has a key role making the pico phytoplankton production available to the copepods. The community of protozooplankton was investigated along transects from the shallow coastal water across the shelf break to the deep blue. The biomass and species composition of the protozooplankton was remarkable constant in time and space and the ciliates and heterotrophic dinoflagellates contributed equally to the biomass of protozooplankton. Microcosm experiments revealed that the protozooplankton responded immediately on addition of nitrate, indicating that the plankton community is close to steady state and intrusion of new nutrients to the euphotoc zone is immediately channelled up the food chain.

OS21P-09 1050h

High Resolution, Real-Time Remote Data Acquisition to Characterize Nutrient Transport and Fate and Major Fish Kills Within an Estuarine System

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The use of land/waterbased advanced remote sensing technologies has enhanced scien-tists ability to closely monitor, both temporally and spatially, impacts of land use practices on nutrient delivery from both surface and groundwater sources into estuaries. The Neuse watershed, within the AlbemarlePamlico system, has undergone rapid industrialized agricultural and urban development in the past decade. Nitrogen loading has significantly increased, exacerbating hypoxic/anoxic events and harmful algal blooms that promote major fish kills. Instantaneous, continuous data collection from remote data acquisition platforms on the Neuse Estuary has become a valuable tool for resource managers to monitor and assign causality to fish kills. The automated stations measure wind speed/direction, air temperature, relative humidity, incident solar radiation, precipitation, water level, water temperature, salinity, dissolved oxygen, pH, redox and precipitation. Computercontrolled profilers take physical, chemical, and biological (chlorophyll) casts of the entire water column on demand. The data acquired from the platform system over the past 18 months have revealed wind-dependent variability in water level, cross-estuary upwelling, and rapid movement of low dissolved-oxygen/high salinity water masses parallel to the shoreline. Data are readily integrated into GIS data layers, which are immediately available to stakeholders via existing webbased access. The resulting database is being used to parameterize the US EPA WASP/EFDC model, to elucidate the mixing and nutrient dynamics of these localized water masses.

OS21P-10 1105h

Distributions and Fluxes of Inorganic Nitrogen in the Five Georgia River Estuaries of the Southeastern United States: River Flow Control vs. Intertidal Marsh Effect

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NO3-, NO2-, and NH4+ data collected during the six-year period were used to investigate their mixing behaviors and correspondent biogeochemical controlling factors in the Savannah, Ogeechee, Altamaha, Satilla, and St. Marys River estuaries along the Georgia coast of the southeastern U.S. A continuous estuarine mixing model was constructed to evaluate the net production and removal, as well as input and output fluxes, of NO3- and NO2- in these systems.

For the coastal plain river estuaries (Satilla and St. Marys), there was a consistent NO3- production zone in the mid-salinity zone, which was followed by a NO2- accumulation zone downstream. NO3- production probably resulted from intensive nitrification. Part, or the entire portion of the NO3- produced was then removed

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within the lower estuaries, which is likely attributed to denitrification within the marsh and/or through local processes. Denitrification was also likely responsible for the downstream NO2- peaks. NH4+ showed two distribution patterns, with one exhibiting high concentrations at both high and low salinity ends, and low in the middle (U-shape), and another having mid to high-salinity peaks (bell shape). Two scenarios alternate between warm (with low river discharge) and cold months (with high river discharge). Such seasonal progression may result from the effect of change in river discharge on nitrification.

For the piedmont river estuaries (Altamaha and Savannah), the accumulation of NO3- disappeared, but net removal processes still existed. NO2- peaks appeared more upstream. Net NO3- removal and NO2- accumulation also likely resulted from denitrification but with less coalition with marsh. The bell shape of NH4+ in Altamaha was evident in winter, but the U-shape did not fully develop in summer. The bell shape of NH4+ persisted year around in Savannah, probably reflecting the combined effect of fast flow rate, anthropogenic pressure, and groundwater input. Inorganic nitrogen in Ogeechee had mixed behaviors since the river had influence from both piedmont and coastal plains.

The difference in river discharge (R) between piedmont and coastal river estuaries apparently resulted in the observed difference in distribution patterns of nitrogen. The model analysis revealed that 1/R was significantly linear-correlated with net maximum NO3- production (Satilla), net maximum NO3- removal (Satilla, Altamaha and Savannah), and net maximum NO2- production (Altamaha and Savannah), all of which indicated that the corresponding net production and removal rates were largely a constant and lack of seasonal variation. The flux estimation showed the NO3- output and estuarine freshwater flushing time (t) was negatively correlated, while the coalition between NO2- output and t showed three continuously-evolving stages: positive, insensitive, and negative for the five systems. These relationships can be interpreted by combing denitrification and changes of flushing time.

OS21P-11 1120h

Spatial Variation in the Stable Nitrogen Isotope Composition of Nitrate, Submersed Aquatic Macrophytes and Periphyton in Four Spring-fed Streams Along Floridas Central Gulf Coast

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Spatial gradients in nutrient concentrations, particularly of nitrate and/or ammonium, are characteristic of estuarine systems and occur as a result of physical mixing processes and also because of uptake and assimilation by phytoplankton and other photoautotrophs. Isotopic fractionation associated with the uptake and assimilation of nitrate and/or ammonium can, in theory, generate strong spatial gradients in the stable nitrogen isotope composition of the residual pool of dissolved inorganic nitrogen that will also be reflected in the isotopic composition of nitrogen sequestered in particulate forms. Stable nitrogen isotopes can serve as in situ tracers of nitrogen as it moves through an estuarine system. Here we present data from four spring-fed and tidally influenced rivers along Floridas central Gulf coast. Each of the four rivers exhibits elevated nitrate concentrations near their headwaters. In two of the rivers, the Chassahowitzka and Homosassa, nitrate concentrations in the surface water declined precipitously with distance downstream. The decline in nitrate in the Chassahowitzka and the Homosassa Rivers coincided with marked spatial gradients in the stable nitrogen isotope composition of submersed macrophytes and their associated periphyton. These findings are consistent with expected patterns and are presumably a consequence of isotopic fractionation during the uptake and assimilation of nitrate. However, in only one river, i.e. the Homosassa, and only during one sampling period, i.e. 1998, were concomitant changes in the stable nitrogen isotope composition of nitrate observed along the established sampling gradients. In two other rivers, i.e. the Weeki Wachee and Crystal River, nitrate concentrations in the surface waters were relatively uniform along the established sampling gradient and as expected there were no strong spatial gradients in the stable nitrogen isotope composition of either submersed plants or their associated periphyton. Differences in the stable nitrogen isotope composition of submersed aquatic plants and associated periphyton in the four coastal rivers are attributed largely to differences in their physical characteristics that, in turn, influence the light environment and the ability of plants and algae to efficiently exploit the available nitrate.

OS21P-12 1135h

The Seasonal Cycles of Nitrate Supply and Potential New Production in the Gulf of Maine and Georges Bank Regions

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The Gulf of Maine and Georges Bank are highly productive from the standpoints of primary production and fisheries. However, despite high rates of primary production on Georges Bank, secondary production (zooplankton) is somewhat lower than expected. Competing hypotheses put forth to explain lower secondary production on Georges Bank are advective losses and nitrogen limitation. In order to detect the presence of nitrogen limitation in the region, and to test this hypothesis for Georges Bank, amounts of new and regenerated primary production are estimated using a quantity termed "potential new production" (PNP). PNP is defined as the difference between the total derivative of vertically-integrated nitrate (NO3) contained in the euphotic zone and the vertical flux of NO3 into the euphotic zone assuming only Fickian diffusion, after conversion of all nitrogen to carbon using the Redfield ratio. This paper describes the seasonal cycle of new primary production for each of five, satellite-derived hydrographic provinces contained within the Gulf of Maine and Georges Bank region, using PNP as a proxy for new primary production and the negative correlation between near-surface temperature and vertically-integrated NO3 from the euphotic zone. Maximum recharge rate of NO3 within the euphotic zone occurs during winter, between yeardays 15 and 50 (mid-January to mid-February) for all five provinces, in agreement with the timing of maximum convective and mechanical mixing and formation of MIW in the Gulf of Maine. Maximum utilization rate of NO3 within the euphotic zone occurs within 90 days or less of the date of maximum recharge rate, between yeardays 91 and 120 (April), with little phase difference between provinces, in agreement with the general timing of the spring bloom. However, peak-to-peak amplitudes between maximum NO3 recharge rate and maximum NO3 utilization rates are largest for provinces located within the Gulf of Maine. Wintertime NO3 recharge into the euphotic zone within the Gulf of Maine is largely the result of vertical NO3 flux, except for eastern Gulf of Maine where advective NO3 flux into surface waters is important. However, there still exists a significant deficit for wintertime NO3 recharge within eastern Gulf of Maine waters of approximately 3.8 mmol m-2 d-1 which is not able to be accounted for by either vertical diffusive or horizontal advective NO3 fluxes.

OS21Q HC: 323 A Tuesday 0830h

Western Pacific Marginal Seas III

Presiding: **C N Mooers,** OPEL/RSMAS/Univ. of Miami**; R Watts,** Graduate School of Oceanography

OS21Q-01 0830h INVITED

Monitoring of Transport Through the Korea Strait

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Volume transport of the Tsushima Current flowing into the East (Japan) Sea through the Korea Strait can be estimated by measuring the cable voltage induced across the strait between Pusan, Korea and Hamada, Japan by the current in the geomagnetic field. Correlation between the voltage and the transport based upon direct measurement of the current by either repeated ship-board ADCP section or a series of bottom-mounted ADCP current meters is very high and the voltage can be converted into the transport reliably. Mean transport for a period from March 1998 to October 2001 is 2.5 $\times$ 10^6 m^3 s^{-1}, which is larger than previous estimates. Energy spectrum of the estimated transport has prominent peaks at tidal frequencies and significant fluctuations are also found on synoptic band, monthly and interannual time scales.

URL: http://eastsea.snu.ac.kr

OS21Q-02 0850h

Synoptic Forcing of Korea Strait Transport

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We examine the mechanisms connecting wind stress to transports fluctuations through the Korea Strait on time scales of 2-20 days. Results indicate that the wind stress across the Japan/East Sea off the Korea peninsula is the most influential for forcing the strait transport. An additional area along the shelf break of the East China Sea also is connects wind stress forcing to strait transport variations. The Yellow Sea area is found play a relatively minor role. This is in spite of the shallowness of the Yellow Sea and its large sea level response to wind stress. The mechanism connecting wind stress off the east coast of the Korean peninsula to Korea Strait transport fluctuations is Kelvin waves. Downwelled Kelvin waves propagate southward along the Korea coast to the Korea Strait where sea level across the strait changes and geostrophic transport increases.

Correlations of observed and model transport to time-lagged wind stress fields indicate that wind stress over the Japan/East Sea or wind stress over the Yellow and East China Seas is influential to the strait transport. However, the wind stress field has large spatial correlations. The wind stress in one area may be dynamically connected to the strait transport and thus be strongly correlated, but wind stress in a dynamically disconnected area may indicate a strong correlation only because it is correlated to the wind stress in the dynamically connected area. Thus the wind stress correlation only provides an indication of importance. A time-lagged correlation analysis is conducted using sea level anomaly observed by TOPEX/POSEIDON to observed transports as well as modeled sea level correlation to modeled transport. The results indicate Kelvin waves propagating along the Korea coast to the Korea Strait. An adjoint model analysis provides a direct examination of the transport sensitivity to the wind stress. The adjoint sensitivity indicates that the transport is most sensitive to wind stress across the Japan/East Sea, wind stress along the East China Sea shelf break is an additional forcing for transport, and wind stress across the Yellow and East China Seas is not a large contributor.

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The Surface Current of the Japan/East Sea and its Energetics

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In the period of 1995-2001, 44 wind-measuring MINIMETs, 131 SVP and 72 NAVY drifters were deployed in the Japan/East Sea (JES). From these drifters, the mean current field was constructed in 0.5° resolution. The time varying geostrophic currents were estimated from the TP/ERS2 sea level anomaly whose eddy energy had been inter-calibrated with the drifter eddy energy observed by the drifters. The wind-driven current were calculated using QuikSCAT data based on a model of wind-driven currents derived from the MINIMET data. A 1995- 2001 surface current field was derived from the mean, time varying geostrophic and wind-driven currents in every 10 days. The drifter tracks within one day of either side of the ten day mean