with a cavity at the bottom of a fresh water reservoir, subjected to steady heating from below and steady salt-water inflow has two distinct states, and exhibits a hysteresis range. Oscillations and transitions like those seen in these experiments may exist in natural bodies with a layer of fresh water cooled from above such as fjords, polar bays, or larger polar regions. The oscillation periods are much greater than either the fresh water or the thermal time scale, making the oscillation mechanism a candidate for climate oscillations. (Much of this work was done at the GFD summer program).

OS52D-0258 1330h POSTER

Simulation of the Stratified Turbulent Ekman Layer

Brian C Barr[1] (352-392-1436x1418; barr@coastal.ufl.edu)

Donald N Slinn[1] (352-392-1436x1431; slinn@coastal.ufl.edu)

Manhar R Dhanak[2] (561-297-2827; manhar@oe.fau.edu)

[1]University of Florida , Department of Civil and Coastal Engineering, Gainesville, FL 32611-6590

[2]Florida Atlantic University , Department of Ocean Engineering, Boca Raton, FL 33431-0991

We investigate the role of density stratification on a turbulent Ekman layer induced by a wind on the ocean surface, using Large Eddy Simulations (LES). Analyses of the flow structure and statistics are presented, highlighting the effect of the stratification on modifying the depth of the Ekman layer.

Strong initial stable stratification is effective at inhibiting the growth of the Ekman layer during the first few inertial periods until the layer becomes more homogenized after which it grows at a rate proportional to the background stratification. Conversely, an unstable background stratification, for example possible under night time cooling conditions or surface evaporation, is quickly mixed by the Ekman layer and increases the overall depth of the shear layer.

It has been found that the tangential component of the Coriolis force, often neglected in geophysical applications, is significant at influencing the net properties of the Ekman layer, and can either increase or decrease the mixed layer depth depending on the wind direction and latitude. The time dependent problem of a variable wind stress is investigated and results are compared to turbulence measurements collected with an Autonomous Underwater Vehicle (AUV). The numerical method uses a pseudo-spectral Fourier technique for the horizontal plane, and a finite difference discretization in the vertical direction.

The dynamic LES model is used for the subgrid closure. The domain is periodic horizontally and extends to two Ekman depths vertically with an aspect ratio of 6x6x1 to permit development of the fastest growing linearly unstable modes.

OS52D-0259 1330h POSTER

Iterated Application of a Linear Inverse Temperature Model to Lake Michigan SSTs Generated by CH3D

Jennifer A. Shore[1] (614-247-6051; shore.13@osu.edu)

Yong Guo[1] (guo.35@osu.edu)

Keith W. Bedford[1] (bedford.1@osu.edu)

[1]Ohio State University, Civil and Environmental Engineering and Geodetic Science, 2070 Neil Ave, Columbus, OH 43210, United States

A methodology is presented describing the adjustment of a Lake Michigan hydrodynamic simulation through iterated application of a linear inverse temperature model. CH3D, a numerical model developed by the U.S. Army Corps of Engineers, is used to generate Lake Michigan surface temperatures for Mar 14, 2000. The simulation is initiated from Jan 1, 2000 under hourly windstress observations using a spatially uniform eddy diffusivity field. An inverse model is derived from the 2-d linear temperature diffusion equation which solves for eddy diffusivity given a surface temperature field. Observational SSTs are blended with model predicted temperatures and the inverse model is applied resulting in an adjustment to a spatially non-uniform eddy diffusivity field. The lake simulation is then re-initialized for the same time period with the refined diffusivity field. The process is repeated until the diffusivity field converges. The technique is tested using Great Lakes Forecasting System SST model output as a substitute for observational data, but the method is suitable for NOAA satellite SST data. This work was supported by the National Science Foundation.

OS52D-0260 1330h POSTER

Error Analysis and the Computation of Turbulent Fluctuations for 3D Volume Reconstructions of Acoustic Images of Black Smoker Plumes

Karen G Bemis[1] (732-445-1225; bemis@rci.rutgers.edu)

Peter A Rona[1]

Darrell R Jackson[2]

Christopher D Jones[2]

[1]Institute of Marine and Coastal Sciences and Department of Geological Sciences, Rutgers University, New Brunswick, NJ 08854, United States

[2]Applied Physics Laboratory, University of Washington, Seattle, WA 98105, United States

We present an error analysis and statistical description of 3D volume reconstructions and measurements based on our acoustic images of a high-temperature black smoker-type plume. Sources of error include (1) the intrinsic variance due to particle motion in the plume since the acoustic images are based on backscatter from small (5-100 μm) particles, (2) noise produced by the ROV Jason system on which the sonar was mounted, and (3) unwanted echos from the surrounding seafloor returning through the sonar sidelobes. Additional fluctuations in the particle concentration due to plume turbulence lead to time variations in the measured backscatter.

The data were collected in July 2000 by a SM2000 (330 MHz) sonar mounted on the ROV Jason. The sonar system was calibrated to record absolute backscatter pressure. The squared magnitude of backscattered pressure is converted to differential backscatter cross-section per unit volume (units 1/m), which is proportional to particulate concentration. Three-dimensional imaging data were obtained by a combination of time gating, digital beamforming, and mechanical scanning for resolution in range, azimuth, and elevation, respectively.

Several different processing steps were applied to the data to reduce the error: (a) averaging along the pings with a range window of 1 m reduced the standard error in a single ping due to intrinsic variance from 1 to 0.44, (b) narrow-band notch filtering reduced the effects of tonal noise, (c) bursts effected by occasional impulsive noise events were simply eliminated from further processing, (d) successive pings were subtracted in an effort to cancel out the effects of unwanted sidelobe returns. The resulting data were interpolated onto a uniform 3D grid with 0.5 m spacing.

The statistics of six successive 3D volumes were computed. Averaging the six volumes further reduced the standard error to 0.18. The total rms error, computed as the sample standard deviation divided by the square root of 6 (the number of volumes averaged into the mean), includes all sources of random error and falls in the range 0.1-0.4x10^{-4} 1/m. Intrinsic error (18% of mean) and rms error are both low compared to mean backscattering cross-section (core maximum is 1.1x10^{-4} 1/m) and similar to minimum values (core minimum is 0.3x10^{-4} 1/m). Total fluctuation in the plume structure during 20 minutes of recording (all volumes) falls in the range 0.1-3.0x10^{-4} 1/m, with the largest values in the plume core reflecting the high variability expected in a plume core. The rms fluctuations decay upwards along the plume axis at a similar rate as the mean backscattering cross-section, indicating that the dilution process is self-similar, as in buoyant plume models, even though particles are not true passive tracers. The effective plume width increases at the predicted rate of 0.1 m/m for a fully developed plume. Despite significant error levels, the turbulence structure of the plume is observed in the acoustic data and provides some constraints on the entrainment and dilution mechanisms.

URL: http://www.rci.rutgers.edu/~bemis/acoustic.htm

OS52D-0261 1330h POSTER

Turbulent Flow Over Submarine Canyon

Andjelka Srdic-Mitrovic[1] (480-965-1088; srdic@asu.edu)

David Smith[1] (480-965-1088; david.c.smith@asu.edu)

Don Boyer[1] (480- 965-1382; don.boyer@asu.edu)

Joel Sommeria[2] (33-4-76-86-61-82)

[1]Environmental Fluid Dynamics Program, Department of Mechanical and Aerospace Engineering, Arizona State University , S. Rural Rd., Tempe, AZ 85287, United States

[2]Laboratoire des Ecoulements Gophysiques et Industriels (LEGI) Equipe Coriolis, Universit Joseph Fourier-CNRS-INPG, 21 avenue des Martyrs, Grenoble 3800, France

Results presented herein are part of an extensive research effort aimed at understanding to what extent laboratory experiments can be used as benchmarks for the development of numerical models (in the present context, models of coastal currents). Recent laboratory studies of laminar flows along model coastal regions have proven useful in the development and testing of associated numerical models. Recognizing, however, that the oceanic environment is by nature turbulent, it is important that these studies be extended to include turbulence. To initiate this line of inquiry, the present study introduced turbulence by mechanical means along the model ocean floor.

The experiments were conducted on the 14 m diameter turntable of the Laboratoire des Ecoulements Gophysiques et Industriels (LEGI) in Grenoble, France. The topography, which includes a vertical coastline, a horizontal shelf, a continental slope and a deep ocean, was placed in the center of a circular test cell. The systems considered were a continuous shelf, slope topography circumscribing the tank, and the same topography incised by a single generic canyon. The surfaces of the model (shelf, slope and canyon) in the experiments were either smooth or rough, with the latter being realized by 3 cm cubical elements placed along isobaths with a spacing of 12 cm. Experiments were conducted for either homogeneous or linearly stratified fluids that were initially in a state of solid body rotation. Relative motion is established by either modulating the tank rotation rate sinusoidally, to provide an along-isobath oscillatory background flow, or impulsively increasing (decreasing) the rotation rate, to provide an along-isobath downwelling (upwelling) favorable current.

The most remarkable difference between laminar and turbulent experiments is the presence of large scale eddies in all of the stratified impulsively forced upwelling/downwelling favorable flows for all topographic models (with/without canyon and smooth/rough boundary). Experiments with homogeneous fluids (barotropic) for both impulsively-started upwelling and downwelling favorable flows demonstrated that, for the parameters investigated, large-scale eddies (e.g., of the order of the width of the continental slope) were not in evidence; i.e., only small-scale disturbances (of the order of centimeters) were observed. These experiments demonstrate that, for the parameters investigated, the flows were barotropically stable. The amplitude of instabilities was larger for the case of downwelling favorable flows.

In a previous study, using laminar flows, we have identified three mechanisms that generate vorticity and hence eddies in the canyon. The present study examines the degree to which these three processes contribute to eddy formation in turbulent experiments.

OS52E MCC: 104 Friday 1330h

Nearshore Processes I *(joint with T)*

Presiding: **N Plant,** Naval Research Laboratory**; A Reniers,** Naval Postgraduate School

OS52E-01 1330h INVITED

Hydrodynamic and morphodynamic modelling of the surf zone

J A Roelvink (31152858706; dano.roelvink@wldelft.nl)

WL — Delft Hydraulics, p.o. box 177, Delft, ZH 2600 MH, Netherlands

Surf zones of sandy beaches are generally very dynamic systems showing complex behaviour over a range of time- and length scales. Modelling of this behaviour has evolved from two extremes of the spectrum: on the one hand, practical engineers who have to predict things on a timescale of months to years are trying to do this in an ever more detailed way, whereas research scientists (a.k.a. 'field guys') have typically tried to understand basic processes first. As long as predictive models are surf-zone averaged (as in many longshore transport predictors) or longshore-averaged (as in coastal profile models) many of the basic processes do not show up in the predictive models or are gathered in lump coefficients with a large scatter. This leads to a frustrating gap between the approaches, where it is often difficult to explain why large sums of money should be spent on either process research that does not improve predictions, or on development of models that do not represent many important processes.

This presentation will focus on the challenge of bringing the process research and the development of predictive models together, in such a way that increased knowledge, for instance on the behaviour of rip currents or sand ripples, actually makes a difference in morphological predictions on practically relevant timescales.

A very important step in meeting this challenge is to improve the efficiency of the process-based models that we can use both for integrating process knowledge and for making practical predictions. Some examples are:

- reducing the domain by improving boundary conditions. A well-known example is the use of cyclic boundary conditions, but these are difficult to implement in implicit schemes and cannot be combined with tidal currents. A Neumann-type boundary condition where the longshore water level gradient is imposed at lateral boundaries provides a solution for surf zone models. - improving the smoothness of transport patterns by taking into account delays in settling and pick-up. Although this means that an advection-diffusion equation must be solved, the overall effect is to reduce computer time as morphological time steps may be increased. - speeding up the morphological process by use of simplified transport approximations or a morphological time scale factors; both approaches can lead to run time reductions of one or two orders of magnitude. - representing very shallow areas by simplified behaviour models, such as allowing a horizontal shift of profiles, rather than spending much computer time on details that are difficult to resolve and unimportant on larger scales. - improving the numerics with a strong focus on the robustness of the system.

The fact that many of these techniques have been developed and integrated into model systems opens the way for substantial improvements in various submodels, and for including smaller-scale processes such as infragravity waves, or a 3D representation of flow and transport, into the simulations.

This leads to a situation where field research and model development and validation may now go hand in hand and where it is becoming rare for large field campaigns not to be accompanied by substantial modelling effort. A further integration in the form of data-model integration, e.g. using remote sensing techniques such as ARGUS, is likely improve our capabilities in understanding and predicting surf zone behaviour.

These aspects will be further explained and illustrated with practical examples during the presentation.

URL: http://www.wldelft.nl/sasme

OS52E-02 1350h INVITED

A Review of the Nearshore NOPP Project

James T Kirby (302-831-2438; kirby@udel.edu)

University of Delaware, Center for Applied Coastal Research, Newark, DE 19716, United States

The National Oceanographic Partnership Program is supporting a major modeling effort in the area of nearshore hydrodynamics and sediment transport. This project, which is just beginning it's fourth of five years, is aimed at developing and testing a comprehensive community model that predicts waves, currents, sediment transport and bathymetric change in the nearshore ocean, between the shoreline and about 10 m water depth. This talk reviews the progress made to date in improving the scientific basis for the modeling effort, and presents an overview of the ongoing development of the modeling system and its individual components, or modules. A set of benchmark tests, developed using existing field and lab data, will be discussed.

OS52E-03 1410h

Predictions of Cross-Shore Sediment Transport in the Inner Surf and Swash Zones

Timothy B Maddux[1] ((508) 289-3739; tbmaddux@whoi.edu)

Britt Raubenheimer[1] ((508) 289-3427; britt@whoi.edu)

Steve Elgar[1] ((508) 289-3614; elgar@whoi.edu)

[1]Woods Hole Oceanographic Institution, MS 9, WHOI, Woods Hole, MA 02543, United States

Predictions of sediment transport models driven with observed inner-surf and swash zone velocities will be compared with each other. Classical energetics-based models (e.g., Bagnold, 1966; Bailard, 1981; Bowen, 1980) for cross-shore sediment transport predict the offshore migration of sandbars observed in the surf zone during storms. Recent studies have suggested that onshore transport and bar migration observed when mean flows are weak can be predicted by accounting for skewed orbital velocity accelerations under asymmetric (pitched-forward) waves. Flow accelerations also are expected to be important in the swash zone.

Velocities were measured for 140 hours at 7 cross-shore locations between the shoreline and about 3-m water depth on the fine-grained, low-sloped Scripps Beach, CA. Bed levels were measured hourly at each sensor location, and swash zone beach profiles were surveyed daily. Offshore significant wave heights ranged from about 55 to 80 cm. In the swash zone, mean flows were offshore-directed and ranged from about 0 to 30 cm/s, and root-mean-square sea-swell and infragravity orbital velocity fluctuations ranged from about 15 to 35 cm/s and 15 to 45 cm/s, respectively.

The classical energetics-based sediment transport model predicts predominantly offshore transport in the inner surf and swash zones (depths of less than about 1 m). Extending the model to account for wave accelerations by using a linear filter that produces a phase shift in the velocity time series (Nielsen, 2002) results in hourly sediment transport estimates that are primarily onshore. However, applying the filter only to the velocities used to estimate the bed stress terms has little effect on the predicted transport. Including a parameterized acceleration skewness term (Drake and Calantoni, 2001) in the energetics model results in prediction of even greater onshore sediment transport than is predicted by the phase-shifted (Nielsen, 2002) model. The contributions of offshore-directed mean flows and of sea-swell and infragravity wave-driven velocities to the predicted swash zone transport will be examined. The model predictions will be evaluated by comparison with the observed morphological changes.

Funding was provided by ONR.

OS52E-04 1425h

Wave Acceleration Induced Sediment Transport in the Surf Zone

Fernanda Hoefel[1] (508-289 3718; fhoefel@mit.edu)

Steve Elgar[2] (508-289 3614; elgar@whoi.edu)

[1]MIT/WHOI Joint Program in Oceanography, WHOI - MS 09, Woods Hole, MA 02543, United States

[2]Woods Hole Oceanographic Institution, MS 11, Woods Hole, MA 02543, United States

A bedload sediment transport formulation (Drake and Calantoni, 2001) that accounts for the effects of near-bottom wave-orbital velocity acceleration skewness predicts onshore sandbar migration observed near Duck, NC. Including acceleration effects in an energetics sediment transport model results in improved skill in reproducing cross-shore sandbar migration patterns observed over a 40 day period during which the bar moved both offshore in storms and onshore between storms. These results suggest that skewed acceleration time series, associated with the pitched forward shapes of nearly breaking and broken waves, play an important role in wave-induced sediment transport in the surf zone. The passage of steep wave fronts results in spikes in acceleration when orbital velocities are directed onshore, producing strong horizontal pressure gradient forces that act on the sediment. In contrast to velocity skewness, which remains approximately constant across the surf zone, acceleration skewness is observed to increase from small values offshore to a maximum near the bar crest, and then to decrease toward the shoreline, producing cross-shore spatial gradients in acceleration-driven transport that are consistent with erosion offshore and accretion onshore of the bar crest. As the sandbar migrates shoreward, the maximum of acceleration skewness also moves onshore, causing a positive feedback mechanism that promotes continued onshore sediment transport motion provided the forcing remains constant.

Funded by ARO, ONR, and NOPP.

OS52E-05 1440h

Sediment Transport Predictions Using a Coupled Modeling System

David J Welsh[1] (1-614-247-6048; welsh.3@osu.edu)

Keith W Bedford[1] (1-614-292-7338; bedford.1@osu.edu)

Yong Guo[1] (1-614-292-6919; yguo@superior.ceegs.ohio-state.edu)

[1]Ohio State University, Dept. of Civil and Environmental Engineering 470 Hitchcock Hall 2070 Neil Avenue, Columbus, OH 43210, United States

Sediment transport on the continental shelf involves combined wave and current forcing and feedback mechanisms related to bedload and suspended sediment. The level of nonlinear interaction has meant that regional scale models of sediment transport have generally employed simplifications such as a steady wave field and a fixed bed roughness. Recent advances in high performance computing now permit the use of fully coupled bottom boundary layer theory. This functionality is included in the COupled MArine Prediction System (COMAPS), which consists of the three-dimensional CH3D-SED circulation and sediment transport model and the WAM spectral wind-wave model. The wave-current bottom boundary layer (WCBL) module in COMAPS accounts for combined wave and current shear stresses, mobile bed roughness, and stratification due to suspended sediment. WCBL provides CH3D-SED with bottom roughnesses, bottom shear stresses, and reference concentrations. The SED model then calculates bedload and suspended load sediment transport using the concept of an active transport layer subject to erosion and deposition. SED accounts for multiple noncohesive sediment size classes, bed armoring, and the effects of suspended sediment on fluid density and turbulence. This paper will present an analysis of COMAPS predictions of sediment transport and bed evolution from Adriatic Sea hindcasts.

This work is sponsored by the Department of Defense High Performance Computing Modernization Program at the Naval Oceanographic Office.

OS52E-06 1455h

Sediment Transport Predicted by a Quasi two-Dimensional Boundary Layer Model

Stephen M Henderson[1] (541 737 9305; shenders@coas.oregonsate.edu)

John S Allen[1] (jallen@coas.oregonstate.edu)

Priscilla A Newberger[1] (newberg@coas.oregonstate.edu)

[1]College of Oceanic and Atmospheric Sciences, Oregon State University, 104 Ocean Admin. Bldg. COAS, Oregon State University,, Corvallis, OR 97331-5503, United States

Predictions of sediment transport under waves, obtained by coupling a numerical turbulent boundary layer model with standard sediment transport models, differ from the predictions of energetics-based Bagnold/Bailard/Bowen (BBB) models. The mean transport predicted under regular asymmetric waves is about two-thirds of the transport predicted under skewed waves, whereas BBB models predict zero transport under asymmetric waves. The mean currents and sediment transport predicted under irregular, field-observed waves depend strongly on wave-generated momentum fluxes, and on time-variations in T.K.E.. Turbulence is modeled with either a $k-\epsilon$, a $k-l$ (Mellor-Yamada), or a one-equation closure. Nonlinear advective terms are included in the one-dimensional model by assuming that waves propagate without changing form. Suspended sediment transport is modeled by assuming a sediment diffusivity equal to the eddy viscosity, and stress-dependent pickup function. Estimated bedload transport is proportional to $\tau^{3/2}$, where τ is the bed stress.

OS52E-07 1510h

Sediment Transport by Sand Ripples Within the Surf Zone.

Timothy P Stanton[1] (8316563144; stanton@nps.navy.mil)

Micah A Weltmer[1] (8313722215; maweltme@nps.navy.mil)

Edward B Thornton[1] (8316562847; thornton@nps.navy.mil)

[1]Naval Postgraduate School, Oceanography Department Naval Postgraduate School, Monterey, CA 93943, United States

During a recent study of rip currents in Monterey Bay, RIPEX, a system of regular, broad shoals and rip channels offshore from a steep beach face was instrumented to determine current and wave properties while concurrently measuring the large-scale morphological evolution of the area. Detailed measurements of local morphology, and coincident velocity and suspended sediment concentration profiles were made at a fixed location in the surf zone near the middle of one of the shoals. Bed morphology maps were measured with a scanned acoustic altimeter over a 2m square area approximately every 40 minutes, while the velocity/sediment profiler near the center of the map area determined bed height every 30 seconds. The combination of these measurements allow the mass transport of the observed propagating sand ripples to be estimated while measuring the wave and current forcing acting on the bed.

Propagating sand ripples with amplitudes of 0.1 to 0.2m were observed throughout the first 8 days of the 16 day measurement, while nearly flat beds with low frequency bed height changes occurred during the following 6 days. Forcing conditions contributing to this change in ripple morphology and sediment transport by the ripples will be discussed. Preliminary analyses suggest that the first regime with large amplitude, rapidly propagating ripples, was forced by narrow banded swell with low infragravity current content. In contrast, the later period, characterized by nearly flat bed conditions, had comparable RMS wave forcing, but broad-banded wave spectra with very high infragravity energy levels.

OS52E-08 1545h

Are N-minus-one dimensional beaches predictable?

Nathaniel G Plant[1] (228-688-5314; nplant@nrlssc.navy.mil)

K Todd Holland[1] (tholland@nrlssc.navy.mil)

[1]Naval Research Laboratory, Code 7440.3, Stennis Space Center, M 39529

One of the most attractive and interesting features of beaches is their complexity. An important research objective is to explain the patterns of beach surface variability that may be expressed in both cross-shore and alongshore directions. It is also important to explain how these patterns evolve in time. Many approaches to explaining morphologic variability have focused on reduced-dimensional representations, such as neglecting the variations in one physical dimension. This paper investigates the consequences of neglecting alongshore variability to modeling beach surface evolution.

A coupled hydrodynamic/sediment transport model is investigated that aims to predict changes in the alongshore-uniform component of a beach. Systematic deviations between the model predictions and observed alongshore-averaged profiles may be due to the missing physics associated with the missing dimensionality of the model. This hypothesis is tested by comparing model error to observed alongshore variability, characterized from an alongshore-extensive data set that was obtained from ongoing, long-term field observations at Duck, NC. The results are used to suggest a more consistent modeling approach.

OS52E-09 1600h

Rip Currents and Rip Channels on non-barred beaches: A Secondary Morphodynamic Feedback? Field Evidence and Model Results

A. Brad Murray (919 681 5069; abmurray@duke.edu)

Div. of Earth and Ocean Sci./Center for Nonlinear and Complex Systems, Duke Univ., Box 90230, Durham, NC 27708, United States

Modelers treat the development of rip channels on barred beaches as a morphodynamic feedback. Slightly lower parts of an alongshore bar concentrate offshore-directed flow, and as this flow moves into shallower water approaching the bar crest the velocity tends to diverge, causing erosion that further concentrates the flow. However, observations suggest that this is not how rip currents develop on non-barred beaches. Video observations collected from on top of a cliff above Torrey Pines Beach in S. California show that strong, jet-like rip currents can occur without associated rip channels. On this beach, strong rip currents, which tend to last from minutes to tens of minutes (depending on wave characteristics), can be identified in video images by plumes of sediment and/or foam outside the surf zone, and by the refraction of wave crests around the current. Time averaged and rectified video images of times within 20 minutes of rip current occurrences, but when no rip currents were obvious, show approximately alongshore-uniform wave breaking, indicating that any bathymetric nonuniformities were quite subtle. Plots of rip current locations through time show a lack of the clear clustering that would be expected for bathymetrically controlled rips. These plots also suggest alongshore migration of rip currents (a phenomenon familiar to S. California life guards).

On this beach, if wave conditions producing visually obvious rip currents persist for days, visually obvious rip channels can develop. When these cross-shore oriented troughs in the otherwise approximately planar beach exist, rip currents no longer appear in apparently random locations, but are restricted to the channels. These qualitative observations suggest that non-bathymetrically driven rip currents can begin to dig channels. Then, presumably, because of local variations in wave forcing and depth, incipient channels make rip currents more likely to reoccur in those locations, forming a secondary morphodynamic instability (secondary because it does not seem to be essential for producing rip currents).

However, analysis suggests that this feedback may not be straightforward on non-barred beaches. The velocity of a current moving into deeper water tends to converge. With sediment transport treated as a function of flow velocity, flow convergence tends to produce sediment accumulation. If sediment flux is assumed to vary linearly with local mean velocity (and if the oscillatory component of surf-zone velocities that suspends sediment is assumed to be constant across the surf zone, consistent with data collected during the nearshore transport study at Torrey Pines, 1978), ridges, not channels, would form under rip currents. If sediment flux varies nonlinearly with mean velocity, analysis produces an ambiguous result.

Numerical modeling of sediment transport driven by an approximately realistic flow field (produced by a model of non-bathymetric rip currents) suggests that with the above assumptions, rip currents would initially produce sediment accumulation, creating a negative morphodynamic feedback. However, a lag in the adjustment of suspended-sediment concentrations as they are advected through varying local hydrodynamic conditions will tend to increase the flux of sediment advected out of the surf zone (shown by the plumes of sediment evident in aerial images), inhibiting deposition under a rip current. Including non-local sediment transport in the model (using a treatment that is consistent with both an advection-diffusion equation and a commonly used energetics-based formula for local transport) produces erosion under rip currents, and a positive morphodynamic feedback.

OS52E-10 1615h

Quantification of Surf Zone Bathymetry from Video Observations of Wave Breaking

Stefan Aarninkhof[1,2] (31-15-285-88-89; Stefan.Aarninkhof@wldelft.nl)

Gerben Ruessink[1] (31-15-285-88-94; Gerben.Ruessink@wldelft.nl)

[1]Delft Hydraulics, P.O. Box 177, Delft 2600 MH, Netherlands

[2]Delft University of Technology, P.O. Box 5048, Delft 2600 GA, Netherlands

Cost-efficient methods to quantify surf zone bathymetry with high resolution in time and space would be of great value for coastal research and management. Automated video techniques provide the potential to do so. Time-averaged video observations of the nearshore zone show bright intensities at locations where waves preferentially break. Highly similar patterns are found from model simulations of depth-induced wave breaking, which show increasing rates of wave dissipation in shallow areas like sand bars. Thus, video observations of wave breaking - at least qualitatively - reflect sub-merged beach bathymetry.

In search of the quantification of this relationship, we present a new model concept to map submerged beach bathymetry from time-averaged video images. This is achieved by matching model-predicted and video-observed rates of wave dissipation.

First, time-averaged image intensities are sampled along a cross-shore array and interpreted in terms of a wave dissipation parameter. This involves a correction for the effect of persistent foam, which is visible at time-averaged video images but not predicted by common wave propagation models. The dissipation profiles thus obtained are used to update an initial beach bathymetry through optimisation of the match between measured and modelled rates of wave dissipation. The latter is done by raising the bottom elevation in areas where the measured dissipation rate exceeds the computed dissipation and vice versa. Since the model includes video data with high resolution in time (typically multiple images over a tidal cycle), it allows for virtually continous monitoring of surfzone bathymetry .

Model tests against a synthetic data set of artificially generated wave dissipation profiles have shown the models capability to accurately reconstruct beach bathymetry, over a wide range of morphological configurations. Maximum model deviations were found in the case of highly developed bar-trough systems (bar heights up to 4 m) and near the shoreline. Model performance strongly benefits from an increase of wave heights and tidal ranges.

At the moment, the model is subject to validation against a data set of multiple-barred beach profiles, surveyed during a 3 week period of stormy wheather in the course of the Coast3D field experiments at Egmond (The Netherlands). Although the video-based estimates of bar bathymetry show a shoreward off-set of the location of the inner bar and vertical deviations of 0.5 (0.8) m near the outer (inner) bar crest, these preliminary results show a promising match in terms of profile shape and the migration of the seaward bar face. Model application at the time scale of months to years is subject to present research.

This work was supported by the DIOC Earth Observations of Delft University of Technology, the Delft Cluster program at Delft Hydraulics, the Dutch Ministry of Public Works Rijkswaterstaaat and the EU-funded Coastview project.

OS52E-11 1630h

Model Parameterization and Experimental Design Issues in Nearshore Bathymetry Inversion

Chandrasekher Narayanan[1] (chandra@ssc.usm.edu)

James M Kaihatu[2] (kaihatu@nrlssc.navy.mil)

Rama Rao[3] (rrao@mit.edu)

[1]Center of Higher Learning, Bldg 1103, Rm 109, Stennis Space Center, MS 39529, United States

[2]Naval Research Laboratory, Bldg 1009, Stennis Space Center, MS 39529, United States

[3]Massachusetts Institute of Technology, Earth Atmospheric ans Planetary Sciences, E-34-402, Cambridge, MA 02142, United States

We present a general method for approaching inverse problems for bathymetric determination under shoaling waves. We run the Korteweg-de Vries (KdV) model for various bathymetric representations while collecting data in the form of free-surface imagery and time-series. A sensitivity matrix is developed that provides information on the range of influence of data on the parameter space. We develop three metrics based on the model sensitivity that can be systematically used to make choices in experiment design and model parameterization. This analysis provides insights that are useful, irrespective of the minimization scheme chosen for inversion. We identify the characteristics of the data (time-series versus snapshots, early time measurements versus long-duration measurements, nearshore measurements versus offshore measurements) and model (bathymetry parameterizations) for inversion to be possible.

We show that *Bruun/Dean* and *Exponential* bathymetric parameterizations are the most conducive for inversion for both timeseries and snapshot data. Also, snapshots that are late in time and time series that are collected close to the shore are ideally suited for bathymetric inversion.

OS52E-12 1645h

Remote Sensing of Radiation Stress Gradients From Optical Imagery

Jason R Killian[1] ((541) 737-3251; jkillian@coas.oregonstate.edu)

Rob A Holman[1] (holman@coas.oregonstate.edu)

[1]Oregon State University, 104 Ocean Admin. Bldg. Oregon State University, Corvallis, OR 97331, United States

Radiation stress, the excess momentum due to the presence of waves, is a function of wave energy. Thus, as waves break in the surf zone, gradients in radiation stress are created with this excess momentum providing a force that is typically of order 10^2 dynes/cm^2, several orders of magnitude greater than wind forcing. These gradients drive all nearshore currents and subsequent sediment transport. Currently, there is no method for direct measurement of radiation stress gradients; all estimations are based on simple differences between pairs of spatially separated sensors. In addition, in-situ sampling is difficult in the hostile environment of the nearshore surf zone. On the other hand, the distinct optical signature of wave breaking has lead to interest in a possible remote sensing technique for direct estimation of radiation stress gradients.

For a beach with plane parallel contours, it can easily be shown that the diagonal element of the radiation stress gradient can be given by:

$\frac{\partial S_{xy}}{\partial x} = < \epsilon > \frac{\sin\alpha}{c}$,

where $< \epsilon >$ is the dissipation of the wave field due to breaking, $\sin\alpha$ is the local angle of incidence, and c is the wave celerity. Remote optical measurements of wave direction (Lippmann & Holman, 1991) and wave phase speed (Stockdon & Holman, 2000) have already been shown to be viable techniques. In addition, Lippmann and Holman (1989) and others have suggested a relationship between modeled wave dissipation and patterns of image intensity from ten-minute time-exposure images. However, no comparisons were made in that work with actual in-situ energy flux measurements. Our current work will focus on better development and testing of this relationship, based on in-situ wave energy measurements collected during the 1997 Sandy Duck field experiment. Emphasis will be on a direct comparison of dissipation measurements computed by finite difference from adjacent sensors and the spatial mean optical intensity between the sensors.

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OS52F MCC: 274 Friday 1330h

Coastal Geology of the Carolinas: Linking the Shelf and Shore I *(joint with T)*

Presiding: **E R Thieler,** U.S. Geological Survey**; D J Mallinson,** East Carolina University

OS52F-01 1330h INVITED

The North Carolina Coastal Geology Cooperativea Model of Federal, State, and Academic Cooperation

Charles W. Hoffman[1] (919-733-7353x25; bill.hoffman@ncmail.net)

E. Robert Thieler[2]

Stanley R. Riggs[3]

William C. Schwab[2]

[1]N.C. Geological Survey, Coastal Plain Office, 1620 MSC, Raleigh, NC 27699, United States

[2]U.S. Geological Survey, 384 Woods Hole Rd., Woods Hole, MA 02543, United States

[3]East Carolina Univ., Dept. of Geology, Greenville, NC 27858, United States