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Woods Hole Sea Grant: Waves, Tides, and Currents

Perigean Spring Tides -- Predicting Potential Disasters: How Tidal Information May Save You From a Coastal Crisis
Helpful to educators and students.
Giese, G.S.
Marine Extension Bulletin, 2 pp., 1998 WHOI-G-98-007
Also available online: click here

The Coupling Between Harbor Seiches at Palawan Island and Sulu Sea Internal Solitons
Giese, G.S., D. Chapman, and M. Goud Collins
Journal of Physical Oceanography, Vol. 28, pp. 2418-2426, 1998 WHOI-R-98-006

Hydrodynamical Modeling of a Multiple-inlet Estuary/Barrier System: Insight into Tidal Inlet Formation and Stability
Friedrichs, C.T., D.G. Aubrey, G.S. Giese, and P.E. Speer
In: Aubrey, D.G. and G.S. Giese (eds.), Formation and Evolution of Multiple Tidal Inlets, Coastal and Estuarine Studies, American Geophysical Union, Washington, D.C., Vol. 44, pp. 95-112, 1993 WHOI-R-93-010

Coastal Seiches
Giese, G.S. and D.C. Chapman
Oceanus, Vol. 36, No. 1, pp. 38-46, 1993 WHOI-R-93-002

Tidal Residual Currents and Sediment Transport Through Multiple Tidal Inlets
Liu, J.T. and D.G. Aubrey
In: Aubrey, D.G. and G.S. Giese (eds.), Formation and Evolution of Multiple Tidal Inlets, Coastal and Estuarine Studies, American Geophysical Union, Washington, D.C., Vol. 44, pp. 113-157, 1993 WHOI-R-93-011

Non-linear Hydrodynamics of Shallow Tidal Inlet/Bay Systems
Speer, P.E., D.G. Aubrey, and C.T. Freidrichs
In: Parker, B.B. (ed.), Tidal Hydrodynamics, John Wiley & Sons, Inc., New York, 883 pp., pp. 321-339, 1991 WHOI-R-91-010
Shallow tidal inlet/bay systems, common along the New England coast and elsewhere, appear to result from a combination of small physical scale and large offshore tidal amplitude relative to distal channel depths. Shoaling channels effectively truncate the lowest portion of the tide, resulting in an extended falling tide and a slow shallow ebb flow. These systems are analogous to tides propagating up rivers, but important distinctions exist. This study investigates tidal distortion in detail at six such systems, using multiple tide records within individual systems, variations in offshore tidal forcing, and numerical modeling.

Tidal Velocity Asymmetries and Bedload Transport in Shallow Embayments
Fry, V. and D.G. Aubrey
Estuarine, Coastal and Shelf Science, Vol. 30, pp. 453-473, 1990 WHOI-R-90-008
Tidal circulation can cause a net transport of sediment when the tidal velocity is asymmetric about a zero mean (flood or ebb dominant) and the sediment transport rate is related nonlinearly to velocity. The relationship between tidal elevation and velocity is elucidated here to permit determination from tide gauge data and sediment transport relations whether tidal asymmetry needs to be considered as a mechanism for net sediment transport in the embayment of interest. A relationship between elevation and velocity in a shallow water, nonlinear system is derived through the continuity equation and shown to be significantly different than the linear relation. Finite difference numerical solutions of the one-dimensional, shallow water nonlinear equations are compared to the continuity relation and are in agreement especially toward the landward end of the channel. Tide gauge data collected at the landward end of the embayment are most useful for predicting velocity asymmetries throughout a major portion of the embayment channel. The ratio of flood-to-ebb bedload transport and its relation to an asymmetric tidal elevation has been determined for both the linear relation between elevation and velocity and the nonlinear relation. Results show that the ratio of flood-to-ebb bedload transport as calculated from the nonlinear relation between elevation and velocity is similar to the flood-to-ebb ratio calculated from the linear relation because of offsetting effects.

Seasonal Climatology of Tidal Non-linearities in a Shallow Estuary
Aubrey, D.G. and C.T. Freidrichs
In: Aubrey, D.G. and L. Weishar (eds.), Hydrodynamics and Sediment Dynamics of Tidal Inlets, Lecture Notes on Coastal and Estuarine Studies, Springer-Verlag New York, Inc., Vol. 29, pp. 103-124, 1988 WHOI-R-88-022

Non-linear Tidal Distortion in Shallow Well-mixed Estuaries: A Synthesis
Freidrichs, C.T. and D.G. Aubrey
Estuarine, Coastal and Shelf Science, Vol. 27, pp. 521-545, 1988 WHOI-R-88-018

A Finite-depth Wind-wave Model. Part I: Model Description
Graber, H.C. and O.S. Madsen
Journal of Physical Oceanography, Vol. 18, No. 11, pp. 1465-1483, 1988 WHOI-R-88-020

Tide and Wind-forced Currents in Buzzards Bay, Massachusetts

Only available on loan from the National Sea Grant Library
Signell, R.P.
Woods Hole Oceanographic Institution Technical Report WHOI-87-15, 86 pp., 1987 WHOI-T-87-003
The transport and dispersion of waterborne tracers (e.g. pollutants, larvae, and salt) are often of primary interest in shallow bays and estuaries. These processes often depend most importantly on the low-frequency and mean currents even when the instantaneous flow is dominated by tidal currents. This paper describes and explains the mean and low-frequency current response in a typical tidally-dominated coastal embayment with a contamination problem (Buzzards Bay, Massachusetts).

Kinematic and Dynamic Estimates from Electromagnetic Current Meter Data
Aubrey, D.G. and J.H. Trowbridge
Journal of Geophysical Research, Vol. 90, No. C5, pp. 9137-9146, 1985 WHOI-R-85-006
Comprehensive laboratory measurements and a thorough review of applicable literature show that electromagnetic current meters (manufactured by Marsh-McBurney, Inc.) are adequate for many kinematic measurements but may lead to excessive errors when using velocity to calculate dynamical quantities (such as bottom friction, Reynolds stress, or log-layer friction velocities). These studies point out a potential difficulty in using these meters in areas of large ambient turbulence levels (20% turbulent intensities), which are characteristic of many near-bottom shallow water environments. Further study is needed to clarify this behavior.

Use of Radio-controlled Miniature Aircraft for Drifter and Dye Current Studies in a Tidal Inlet
Hess, F.R. and D.G. Aubrey
Limnol. Oceanogr., Vol. 30, No. 2, pp. 426-431, 1985 WHOI-R-85-002
A commercially available radio-controlled miniature aircraft was modified and deployed as part of a field study of the ebbtidal flow characteristics of a natural, unstructured tidal inlet. To complement Eulerian current measurements within the main inlet channel, surface drifter and rhodamine dye patches were observed from the miniature aircraft and recorded with a 35- mm camera. Position reference was provided with an array of precisely located markers on land and in the water. The miniature aircraft is an inexpensive, accurate alternative for Lagrangian studies in tidal inlets and estuaries, with many advantages over alternate techniques (such as hot-air balloons, fixed platforms, manned aircraft, or chaser boats).

A Study of Non-linear Tidal Propagation in Shallow Inlet/Estuarine Systems. Part II: Theory
Speer, P.E. and D.G. Aubrey
Estuarine, Coastal and Shelf Science, Vol. 21, pp. 207-224, 1985 WHOI-R-85-009

Performance of Bottom-mounted Directional Wave Gauges
Aubrey, D.G. and W. Hill
Proceedings of Oceans, IEEE, New York, pp. 705-710, 1984 WHOI-R-84-012

Dynamic Response of Spherical Electromagnetic Current Meters
Aubrey, D.G., J.H. Trowbridge, and W.D. Spencer
Proceedings of Oceans, IEEE, New York, pp. 242-248, 1984 WHOI-R-84-011

Dynamic Response of Electromagnetic Current Meters
Only available on loan from the National Sea Grant Library
Aubrey, D.G., W.D. Spencer, and J.H. Trowbridge
Woods Hole Oceanographic Institution Technical Report WHOI-84-20, 150 pp., 1984 WHOI-T-84-002

Tidal Distortion in Shallow Estuaries
Only available on loan from the National Sea Grant Library
Speer, P.E.
Ph.D. Thesis, Massachusetts Institute of Technology/Woods Hole Oceanographic Institution Joint Program in Oceanography, 210 pp., 1984 WHOI-X-84-001

Beach Changes on Coasts with Different Wave Climates
Aubrey, D.G.
In: McLachland, A. and T. Erasmus, (eds.), Sandy Beaches as Ecosystems, D.W. Junk Publishers, The Hague, Netherlands, pp. 63-85, 1983 WHOI-R-83-017
Seasonal and longer-term beach variability is quantified for seven U.S. beaches exposed to widely varying wave climates. One west coast location (southern California) and six east coast locations (from North Carolina to Massachusetts) form the basis of this study. Wave exposure varies from complete exposure to open waves, to partly sheltered locations, and finally to nearly complete sheltering where locally-generated waves dominate. Magnitude of annual beach variability ranged from 3.3 cubic metres to 0.2 cubic metres per metre of beach, with the greatest variability in regions exposed to open ocean waves and the lowest variability along protected coasts. All open coast locations studied had a seasonal variability which accounted for at least 50% of the beach variability. Protected coastal locations had less pronounced seasonal signatures. These seasonal and aseasonal beach responses mirror corresponding seasonality (or lack thereof) in wave and storm climates. The study re-emphasizes the need for careful measurement or estimation of coastal wave climate to enable predictive modelling of shoreline behaviour, and discusses different analysis techniques for analyzing changes in beach profiles through time.

A Continental Shelf Bottom Boundary Layer Model: The Effects of Waves, Currents, and a Moveable Bed
Only available on loan from the National Sea Grant Library
Glenn, S.M.
Ph.D. Thesis. Massachusetts Institute of Technology/Woods Hole Oceanographic Institution Joint Program in Oceanographic Engineering, 1 p. (abstract only), 1983 WHOI-X-83-001

Field Intercomparison of Nearshore Directional Wave Sensors
Grosskopf, W.G., D.G. Aubrey, M.G. Mattie, and M. Mathiesen
Journal of Oceanic Engineering, Vol. OE-8, No. 4, pp. 254-271, 1983 WHOI-R-83-012

Field Evaluation of Sea Data Directional Wave Gage (Model 635-9)
Only available on loan from the National Sea Grant Library
Aubrey, D.G.
Woods Hole Oceanographic Institution Technical Report WHOI-81-28, 53 pp., 1981 WHOI-T-81-001

Development and Application of a Field Instrumentation System for the Investigation of Surf Zone Hydrodynamics
Only available on loan from the National Sea Grant Library
Greer, M.N.
Woods Hole Oceanographic Institution Technical Report WHOI-80-36, 159 pp., 1980 WHOI-Y1-80-001

A Laser Velocimeter for Use in Coastal Boundary Layer Studies
Terry, W.E., W.D. Grant, A.J. Williams III, and L.P. Sanford
Oceans '80, IEEE, New York, pp. 216-219, 1980 WHOI-R-80-026

Short Arm Electric Field Measurements of Ocean Currents
Only available on loan from the National Sea Grant Library
Williams, A.J., R.J. Jaffee, P.F. Poranski, and P.J. Simonetti
1972 WHOI-T-72-002

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