James O’Donnell

My primary research goal is to understand the physical processes that determine the circulation in the coastal ocean. My students and I are currently involved in both the construction and testing of models and the development of observational techniques. I am also interested in fundamental geophysical and environmental fluid dynamics and the application of mathematical and statistical methods to the development of models of biogeochemical processes. Since 2004 I have coordinated the development and operation of the Long Island Sound Integrated Coastal Observing System (LISICOS). This system combines an observational network, a data system, models and analyses to understand and predict processes in Long Island Sound.

Research Interests

River Plumes

At the mouths of many rivers, thin layers of brackish fluid are found at the surface. Unfortunately, existing simulations of water quality in estuaries cannot resolve these features; and, since they are very shallow and transient, it is also difficult to make measurements of their structure. I have developed a model of the dynamics of these phenomena and have recently constructed a ship-mounted instrument array to observe their structure. It is currently being employed to study the plume formed by the Connecticut River in Long Island Sound.

Circulation in Long Island Sound

The long-term movement of water in Long Island Sound strongly influences the water quality. I am currently collaborating with several members of the Department of Marine Sciences faculty on observational programs to determine the structure and evolution of the flow field in the Sound.

Fundamental Geophysical and Environmental Fluid Dynamics

Much has been reamed about the dynamics of the ocean and atmosphere by the study of simple models that include only the dominant processes. Recently, I have contributed to the explanation of the subtle effects of nonlinear processes and stratification in the Rossby and spin-up problems in simple geometries. In collaboration with a student, I am currently developing models of tidally induced residual circulation in idealized coastal plain estuaries and intend to extend this work to more realistic geometries.

Mathematical Models of Environmental Processes

I have recently collaborated with Department of Marine Sciences faculty and students on the application of methods of applied mathematics to the development of models of bioturbation in marine sediments, the cycling of mercury in the equatorial Pacific and the diffusion of Radon from fractured rocks. I am currently working on several related models.

Research Projects

NERACOOS: The Northeast Regional Association fof Coastal Observing Systems – NOAA

Sensitivity of SWEM – EPA

MARCOOS: the Middle Atlantic Bight Coastal OceanObserving System – NOAA

O’Donnell, J., (2008) Measurement of Mixing Rates in Western Long Island Sound, – National Fish and Wildlife Foundation,

Oceanography Students

Amin Ilia – Ph.D. Student

Molly James – Ph.D. Student

Oceanography Alumni

Diane C. Bennett – Ph.D. 2010

Peter Gay – Ph.D. 2005

Adam Houk – M.Sc. 2007

Chunyan Li – Ph.D. 1996

Grant McCardell – Ph.D. 2012

John Modi – M.Sc. 1994

Youngmi Shin – Ph.D. 2019

Research Staff

Kay Howard-Strobel

Postdoctoral Fellows

Grant McCardell

Youngmi Shin

Publications

1. Bennett, D. M., J. O'Donnell, W.F. Bohlen and A.E. Houk (2009) Tides and Overtides in Long Island Sound. Journal of Marine Research, (submitted)
2. O'Donnell, J. (2009). The Dynamics of Estuary Plumes and Fronts. In "*Contemporary Issues in Estuarine Physics,* A. Valle Levinson, edt. (In press).
3. O'Donnell, J, D. Ullman, C. Edwards, T. Fake and A. Allen (2008), Operational Prediction of Lagrangian Trajectories in the Coastal Ocean Using HF Radio Derived Surface Currents. Ocean Modeling (in revision)
4. Gay, P.S. and J. O'Donnell, (2008). Runoff Dependence of the Salinity Intrusion in Linearly Tapered Estuaries. J. Geophys. Res. (in revision).
5. Gay, P.S. and J. O'Donnell, (2009). Comparison of the Salinity Structure of the Chesapeake Bay, the Delaware Bay and Long Island Sound Using a Linearly Tapered Advection-Dispersion Model. Estuaries and Coasts, V32, 68-87.DOI 10.1007/s12237-008-9101-4.
6. O'Donnell, J., H. G. Dam, W. F. Bohlen, W. Fitzgerald, P. S. Gay, A. E. Houk, D. C. Cohen, and M. M. Howard-Strobel (2008). Intermittent Ventilation in the Hypoxic Zone of Western Long Island Sound During the Summer of 2004. J. Geophys. Res. V113, C09025, doi:10.1029/2007JC004716

7. Levine, E.R., L. Goodman, and J. O’Donnell (2009). Turbulence in Coastal Fronts near the Mouth of Long Island Sound, J. Marine Systems (In Press)
8. McCardell, G.M. and J. O’Donnell. (2008). A novel method for estimating vertical eddy diffusivities using diurnal signals with application to Western Long Island Sound. J. Mar. Systems (In press)
9. O’Donnell, J., S.G. Ackleson and E.R. Levine (2008). On the Spatial Scales of a River Plume. J. Geophys. Res. Oceans. V113. C04017, doi:10.1029/2007JC004440.
10. Gay, P.S. and J. O’Donnell (2007) A one dimensional model of the salt flux in estuaries. J. Geophys. Res. 112, C07021, doi:10.1029/2006JC003840
11. Gay, P. S., J. O’Donnell, C. A. Edwards (2004), Correction to “Exchange between Long Island Sound and adjacent waters”, J. Geophys. Res., 109, C10007, doi:10.1029/2004JC002660
12. Ullman, D.S., J. O’Donnell, J. Kohut, T. Fake, and A. Allen (2006). Trajectory Prediction using HF Radar Surface Currents: Monte Carlo Simulations of Prediction Uncertainties. J. Geophys. Res. 111, C12005, DOI 10.1029/2006JC003717
13. Li, C.Y. and J. O