

# UC San Diego

## Research Final Reports

### Title

Modeling Water and Sediment Quality in the Coastal Ocean

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### Authors

Stolzenbach, Keith D.  
McWilliams, James C.

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Modeling Water and Sediment Quality in the Coastal Ocean  
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Keith D. Stolzenbach  
UCLA  
Department of Civil and Environmental Engineering  
stolzenb@ucla.edu  
310-206-7624

James C. McWilliams  
UCLA  
Department of Atmospheric and Oceanic Sciences  
jcm@atmos.ucla.edu  
310-825-9663

**Project Goals and Objectives**

The overall goal of the research project is to develop a model of water and sediment quality capable of forecasting environmental events occurring over small space and time scales in the coastal zone, including embayments, harbors, and shoreline regions.

**Briefly describe project methodology**

The proposed research will build upon completed and ongoing research on coastal water quality modeling conducted by the PIs that has resulted in the development of the Regional Ocean Modeling System (ROMS), which is the first model used to compute three-dimensional variability in physical and biogeochemical parameters along the entire U.S. West Coast at a resolution capable of resolving regional processes. This model has recently been implemented at resolutions as fine as 0.5 km in Santa Monica Bay and Monterey Bay. The model has been demonstrated to be highly successful in reproducing the spatial and temporal scales of coastal upwelling that is key to coastal productivity on the scale of the U. S. West Coast as well as in hindcasting a major upwelling event in the Southern California Bight and Santa Monica Bay.

**Describe progress and accomplishments toward meeting goals and objectives**

Progress toward achieving the overall objectives of the project has been very good, including the following. A new computational grid with a resolution of 1 km has been implemented over the entire Southern California Bight. This grid has been used to compute the transport of bacteria from the Orange County Sanitation Districts sewage outfall, including the generation of probability distributions for the presence of bacteria, and to determine the flushing characteristics of San Pedro Bay, a major coastal embayment near Los Angeles. Calculations have also been performed of the transport of river discharge of stormwater on a regional and local scale within the Southern California Bight. Simulation of sewage discharges at mid water depth have been implemented. The calculations with river and sewage discharges have been used to assess the impact of stormwater and sewage on the nutrient budget for the coastal region near Los Angeles. Model simulations have been compared with remotely sensed data and with data from moored platforms.

### **Project outcomes**

Developments and improvements in the Regional Ocean Modeling System (ROMS) are shared within the ROMS user community (see <http://www.myroms.org/>).

### **Impacts of project**

We have identified several general categories of users who will benefit from the results of this research:

- The modeling capability can be used in a predictive mode by local, state, and federal environmental regulators currently setting standards for non-point storm water runoff and Total Maximum Daily Loads for inland streams that discharge to the ocean and for atmospheric emissions.
- The research will also benefit the operators of municipal and industrial facilities that discharge into impacted embayments who need to understand the impacts of their respective discharges.
- The research will assist EPA and other regulatory agencies in evaluation of alternative schemes for remediation of contaminated coastal sediments, such as the DDT patch near Santa Monica Bay, currently the focus of a federal Superfund effort.
- The research will be useful to marine scientists trying to understand how the physical and biogeochemical processes in enclosed embayments interact with the natural aquatic ecosystem.
- The research will be useful to marine scientists trying to understand where to site marine protected areas.
- The research will assist scientists in understanding the causes and characteristics of harmful algal blooms in the coastal region.

### **Benefits, commercialization and application of project results**

The Orange County Sanitation Districts has used the ROMS simulations of bacteria from its ocean sewage discharge to assess the option of discontinuing chlorination of its effluent, a process that currently costs more than 5 million dollars per year.

Contact: Dr. George Robertson, grobertson@ocsd.com, (714) 593-7468

### **Issue-based forecast capabilities**

The ROMS model can be used to assess regional and local impacts of natural (upwelling) and anthropogenic (pollutant discharges).

### **Publications**

#### Conference papers, proceedings, symposia

Title: Simulation of Stormwater Plumes in the Southern California Bight Using the Regional Ocean Modeling System

Authors: Eileen Deng, Changming Dong, Nikolay Nezlin, Xavier Capet, James McWilliams, Keith D. Stolzenbach

Date: September 17-20, 2006

Conference Title: California and the World Ocean '06 Conference

Location: Long Beach, CA

Title: ROMS Simulations of Southern California Bight Stormwater Plumes

Authors: Eileen Deng, Changming Dong, James McWilliams, Keith Stolzenbach

Date: June 17-22, 2007

Conference Title: Gordon Research Conference on Coastal Ocean Modeling

Location: New London, NH

Title: Modeling the Dynamics and Transport of Southern California Stormwater Plumes

Authors: Eileen Idica, Changming Dong, James McWilliams, Keith Stolzenbach

Date: March 2-7, 2008

Conference Title: 2008 Ocean Sciences Meeting

Location: New Orlando, FL

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**Cooperating organizations**

Local and state

The Sanitation Districts of Los Angeles and Orange Counties have provided monitoring data for comparison with model simulations.

**Keywords**

California, circulation, coastal, current, diffusion, ecosystem, oceanography, pollution, sediment, stratification