Geophysical Research Abstracts, Vol. 9, 08653, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-08653

Bio-physical modeling of the Hudson River plume dynamics from a bio-optical perspective: implementation of ROMS/EcoSim for LaTTe 2005

B. Cahill (1,2), P. Bissett (1), O. Schofield (2)

(1) Florida Environmental Research Institute, 10500 University Center Dr. Suite 140, Tampa, FL 33612, USA, (2) IMCS, Rutgers University, 71 Dudley Rd, New Brunswick, NJ 08901, USA (bronwyn@marine.rutgers.edu / Fax: +1732 9328578 / Phone: +1732 932 6555)

The variability of the Hudson River plume dynamics is modeled from a bio-optical perspective. The Hudson River plume emanates from the highly urbanized New York / New Jersey Harbor complex, and represents a major pathway for the transport of nutrients and chemical contaminants to the coastal ocean. The fate and transport of this material is controlled not only by plume dynamics but also by biological and chemical processes that are coupled to the dynamics of the plume. As part of the Lagrangian Transport and Transformation Experiment (LaTTE), the Regional Ocean Modeling System, ROMS 2.2 and EcoSim 2.0, have been implemented to model and synthesize LaTTE data from a bio-optical perspective. EcoSim is an ecological/optical modeling system that was developed for simulations of carbon cycling and biological productivity. It includes four phytoplankton functional groups, each with a characteristic pigment suite which vary with the group carbon-to-chlorophyll-a ratio, C:Chl-a. The properties of each functional group evolve over time as a function of light and nutrient conditions. Other EcoSim components include bacteria, dissolved organic matter, and dissolved inorganic carbon cycling. The interaction between EcoSim's components describe autotrophic growth of and competition between the four phytoplankton groups, differential carbon and nitrogen cycling, nitrogen fixation and grazing. Our first simulations focus on March and April 2005, coincident with the LaTTE 2005 field program, when a high springtime discharge from the Hudson River estuary took place, and variable mean winds predominantly fluctuated between northeasterlies and southeasterlies. Our results show a buoyant bulge of freshwater developing seaward of the Hudson River estuary and a freshwater coastal jet developing along the New

Jersey coast. Transport of the freshwater anomaly appears to respond to the prevailing wind direction: northeasterlies transport the freshwater anomaly southwestward along the New Jersey coast; southeasterlies transport the freshwater anomaly northeastward along the coast of Long Island. Analysis of different phytoplankton groups shows a bloom developing along both the New Jersey and New York coastlines in response to transport of nutrient rich, freshwater anomalies. The surface peak biomass is 3.5 mmol N m^{-3}. Nitrate is rapidly depleted in response to the phytoplankton bloom. The bloom move offshore and starts to die out after 6 days. Surface pigment concentrations which correspond to Chl-a released by the phytoplankton groups, peak at 3 mg Chl-a m^{-3}, then start to become depleted after 6 days in concert with the decay of the phytoplankton bloom.