Boston Ultra-Ex: Terrestrial to Marine Carbon Flux

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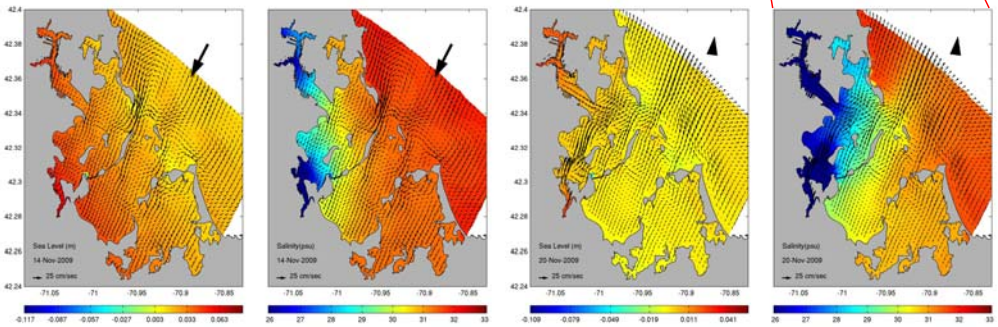
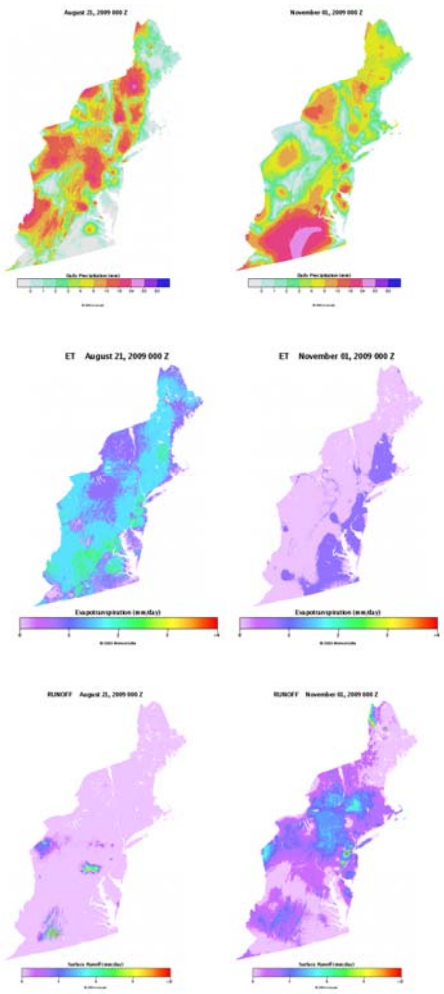
Boston Ultra-Ex is an exploratory project aimed at establishing the metabolism of the greater Boston area and in particular modeling the carbon flows from a region stretching from rural Harvard Forest through the urban core of Boston and out into Boston Harbor and the Massachusetts Bay. MODIS-derived land variables such as albedo, fraction of photosynthetically absorbed radiation, leaf area index, vegetation indexes, and net primary productivity, as well as the phenology of vegetation canopies, the extent of snow cover and the timing of snowmelt, and accurate characterizations of land cover change are being used to drive biogeochemical models and simulate the regional terrestrial carbon, water, and nutrient cycles (Running et al., 2004; Nemani et al. 2003). Similarly, MODIS-derived ocean products monitor ocean productivity and can provide estimates of CDOM and DOC (Mannino et al., 2008).

The Terrestrial Observation and Prediction System (TOPS), developed at NASA Ames (Nemani et al., 2009), provides a framework to bring biogeochemical models and the necessary MODIS satellite-derived inputs together to generate regional daily estimates of vegetation productivity on land. However, the link between daily terrestrial primary productivity and the estuarine and marine DOC remains extremely difficult to quantify (Roulet and Moore, 2006; Evans et al., 2006; Brunet et al., 2009; Grimm et al., 2003), This is governed by soil DOC concentrations, soil moisture, the amount and timing of precipitation and melt events, the extent of coastal and fluvial wetlands, and the impact of land cover disturbances. The spatial distribution of surface moisture conditions can be estimated from MODIS data using surface temperature and vegetation indices (combined as the TVDI—Temperature Vegetation Dryness Index, Sandholt et al., 2002) to establish terrestrial hydrology in response to land use, land cover and precipitation forcing. Systematic stationary monitoring and innovative towed measures of estuarine and Boston Harbor CDOM developed by UMass, Boston can be complemented by sophisticated streamflow models to capture the transport of carbon from the land to the sea and ascertain the terrestrial sources. (Gardner et al, 2005; Huang and Chen, 2009)

The deciduous forests of New England senesce with a wave of spectacular autumn colors that move south through September, October, and November and signal the transition from vegetation productivity to a dormant state. This annual deposit of organic material ultimately contributes to the carbon flow from land to sea in the greater Boston area. The timing and intensity of precipitation events play an important role in the flux of terrestrial carbon to the marine environment.



Greater Boston experienced a period of intense precipitation in mid-November 2009 as the remnants of Hurricane Ida brought 1.5 inches of rain to the area. Modeled streamflow before and after the precipitation event reflects the impact on salinity and sea level on the watersheds emptying into Boston Harbor.



Description:

http://bostoncarbon.org/