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Data-informed circulation simulations in the river-to-shelf Columbia River system

C. G. Law[1]; A. M. Baptista[1]; C. Seaton[1]; S. Frolov[3]; Y. J. Zhang[1]; K. Cho[1]; Y. H. Spitz[2]; S. M. Durski[2]; N. Hyde[1]
1. CMOP, Oregon Health & Science University, Beaverton, OR, United States.
2. COAS, Oregon State University, Corvallis, OR, United States.
3. CMOP, Montery Bay Aquarium Research Insitute (MBARI), Moss Landing, CA, United States.

“Coastal margin collaboratories” are sustained networked integrations of sensors, platforms, models, data, analyses and social processes. As a collaboratory for the Columbia River coastal margin, SATURN (http://www.stccmop.org/saturn) is prolific in opportunities to explore synergies between observations and simulations. The SATURN observation network includes endurance stations across the river-to-shelf continuum, and a pioneer array with mobile or otherwise un-tethered platforms; six endurance stations include a broad set of biogeochemical variables, and four of those stations are designed to resolve the vertical structure of the water column. In addition, twice or more a year, field campaigns are conducted, combining ships and mobile platforms, all guided in near real-time by endurance stations and circulation forecasts. The modeling system for 3D baroclinic circulation is extensive, with daily forecasts, hindcast databases, and scenario/process simulations that span the river-to-shelf Columbia River. Most often, circulation simulations are based on the unstructured-grid model SELFE (Zhang and Baptista 2008, in Ocean Modeling). Skill assessment is extensive, and takes advantage of the diversity of available observations. Ecological models are emerging, with early efforts (Durski et al., this conference) concentrated on M. rubra, a ciliate which relatively recent (~last decade) and intensely red summer blooms in the estuary may signal an emerging ecosystem shift. Model-independent data assimilation (Frolov et al. 2009, in Dynamics of Atmospheres and Oceans), is used primarily for targeted process understanding (Frolov et al. 2009, in Continental Shelf Research) and for observational network optimization (Frolov et al. 2008, in Continental Shelf Research). After an introduction to SATURN and its modeling system, we will discuss the essential ways in which circulation modeling resorts to the available observations, ranging from non-assimilative skill assessment and model enhancement, to formal data assimilation. We will also discuss why formal data assimilation, although valued and computationally very efficient, is used judiciously.

Contact Information

Antonio M. Baptista, Beaverton, Oregon, United States, 97006-8921, click here to send an email