PREDICTING HYPOXIA AND OCEAN ACIDIFICATION OF THE COASTAL WATERS OF THE CCS: WHAT DO WE KNOW AND WHAT CAN WE EXPECT?

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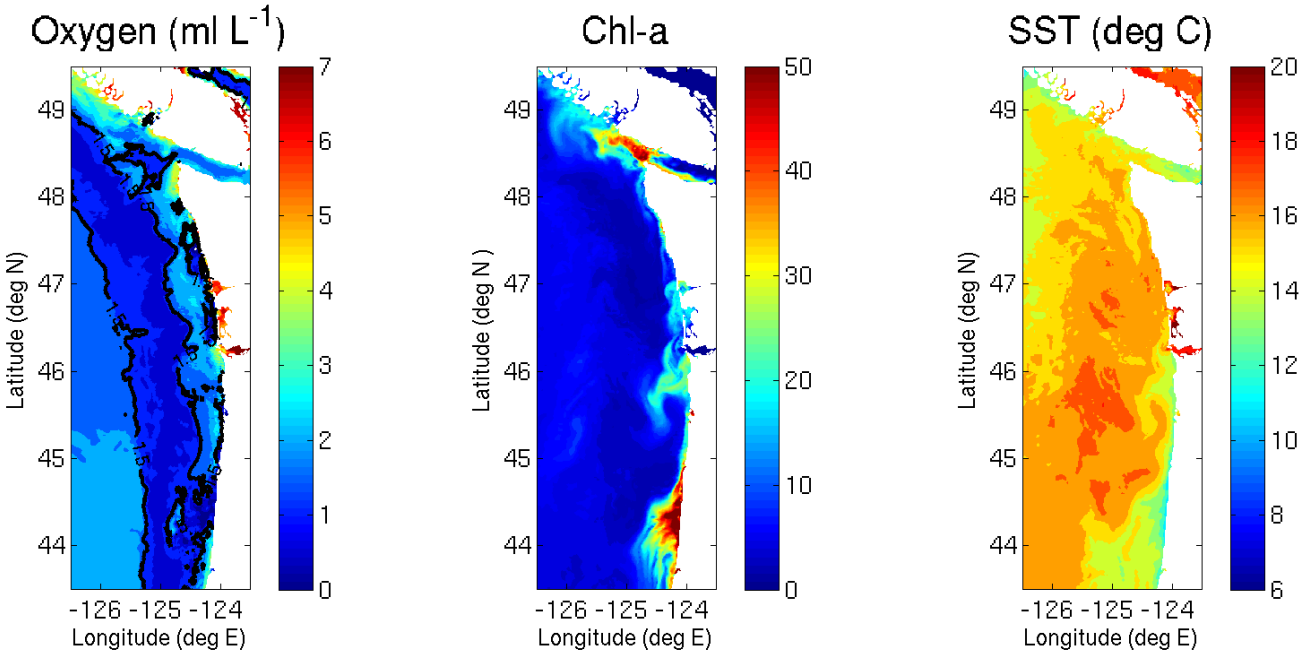

Figure 1. Study region for the J-SCOPE forecast system model. Maps of bottom oxygen (left), chlorophyll (middle, µg/l), and SST from the April 2013 forecasts of August, 2013.

Predictions of ocean acidification and hypoxia were incorporated into the IPCC report (2013) for the first time last year, and forecasts on shorter time scales have now been developed in the California Current system. High-resolution, regional, hindcast models capable of simulating hypoxia and ocean acidification events exist and provide the foundation for forecasting efforts. To build a forecast system, the necessary ingredients include a real-time observational network, a validated downscaled hindcast simulation for the region complete with biogeochemistry, a region with predictive skill in both winds and SST, and an identified group of stakeholders with products designed in mind for them. Here, we use ROMS as the link from short-term, large-scale, climate forecasts to ecological processes relevant to the California Current Integrated Ecosystem Assessment. Our overarching goal is to provide short-term (six to nine month) forecasts of ocean conditions that are testable and relevant to annual management decisions for biological components in the California Current Integrated Ecosystem Assessment (CCIEA) (Levin and Schwing 2011). Regional hindcast models have been developed to understand the dynamics on the shelf with success, such that biogeochemical models can be designed and linked to them as well (Liu et al. 2009; MacCready et al. 2009; Banas et al. 2009; Sutherland et al. 2011; Giddings et al. 2014; Davis et al. 2014; Siedlecki et al. 2015). Ocean models have advanced in their ability to simulate, or hindcast, spatial structures, seasonal variability, and interannual variability when the forcing is known. JISAO's Seasonal Coastal Ocean Prediction of the Ecosystem (J-SCOPE) is a combination of the Regional Ocean Modeling System (ROMS; Haidvogel et al. 2008) with a detailed oxygen model (Siedlecki

et al. 2015) and large-scale predictions from NOAA's Climate Forecast System (CFS) (Saha et al. 2006, 2010; Wen et al. 2012). CFS provides skillful predictions for the region in terms of winds and SST. The CFS is currently being run operationally by NOAA/NCEP/CPC for seasonal weather prediction. In the case of J-SCOPE, NANOOS, the Pacific Northwest regional component of US IOOS, provides the access point to the J-SCOPE seasonal forecasts (http://www.nanoos.org/products/j-scope/), as well as a portal for real-time regional observations. Additionally NANOOS brings linkage to and feedback from resource managers and other stakeholders with interest in the J-SCOPE forecast information. Finally, the CCIEA has partnered with us to advise on the developing product. Through comparisons of model hindcasts and re-forecasts for 2009 and 2013 with local observations, predictive capabilities have been examined for SST, oxygen, and pH. Challenges in forecasting seasonally in the coastal environment include prediction of the fall transition, radiation biases, and the ability of the large-scale model to predict the frequency of relaxations events. Results for the years tested suggest J-SCOPE forecasts had skill on the timescales of a few months.

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