Ocean Sciences meeting – February 11-16, 2018

https://osm.agu.org/2018/

Spatial and Temporal Patterns of Chlorophyll Concentration in the Southern California Bight

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Abstract

Distinguishing between local, anthropogenic nutrient inputs and large-scale climatic forcing as drivers of coastal phytoplankton biomass is critical to developing effective nutrient management strategies. Here we assess the relative importance of these two drivers by comparing trends in chlorophyll-a between shallow coastal (0.1–16.5 km) and deep offshore (17–700 km) areas, hypothesizing that coastal regions influenced by anthropogenic nutrient inputs may have different spatial and temporal patterns in chlorophyll-a concentration from offshore regions where coastal inputs are less influential. Quarterly conductivity-temperature-depth (CTD) fluorescence measurements collected from three southern California continental shelf regions since 1998 were compared to chlorophyll-a data from the more offshore California Cooperative Fisheries Investigations (CalCOFI) program. The trends in the coastal zone were similar to those offshore, with a gradual increase of chlorophyll-a biomass and shallowing of its maximum layer since the beginning of observations, followed by chlorophyll-a declining and deepening from 2010 to present. An exception was the northern coastal part of SCB, where chlorophyll-a continued increasing after 2010. The long-term increase in chlorophyll-a prior to 2010 was correlated with increased nitrate concentrations in deep waters, while the recent decline was associated with deepening of the upper mixed layer, both linked to the low-frequency climatic cycles of the Pacific Decadal Oscillation and North Pacific Gyre Oscillation. These large-scale factors affecting the physical structure of the water column may also influence the delivery of nutrients from deep ocean outfalls to the euphotic zone, making it difficult to distinguish the effects of anthropogenic inputs on chlorophyll along the coast..