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Controlling factors of the seasonal variability of productivity in the southern Humboldt Current System (30°S-40°S): a biophysical modeling approach

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Abstract

The spatial and seasonal variability of nutrients and chlorophyll in the southern Humboldt Current System were assessed using a high-resolution regional ocean circulation model (ROMS) coupled to a biogeochemical model (Pelagic-Interactions Scheme for carbon and Ecosystem Studies; PISCES). The simulated nutrients and chlorophyll fields were validated using satellite and *in situ* observations at a continental shelf time-series station. The annual cycles of modeled chlorophyll and nutrients were consistent with the highest values observed in spring and summer, which is in agreement with enhanced upwelling observations. Co-limitation of phytoplankton growth by nutrients and light was analyzed for diatoms, the dominant phytoplankton group in the simulations. The results showed that co-limitation, near the coast, was governed in autumn and winter by light, and by silicate in spring and summer, whereas other nutrients were limiting offshore between January and April. Nutrient transport in the surface layer was analyzed. Vertical advection reflected areas with higher coastal upwelling, and was partly offset by horizontal processes related to eddy-induced transport from the nearshore to the open ocean. Vertical mixing was shown to play a key role in replenishing the surface layer with nutrients.