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Impact of wind stress curl on the primary production in the Humboldt Upwelling System

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Upwelling systems are primarily controlled by alongshore wind stress and nearshore wind stress curl. A regional model is used to determine in what extent the primary production in the Peru Current System can be driven by the spatio-temporal structure of wind forcings. Atmospheric forcings that differ in spatial resolution and in the length of the time period considered are found to produce significantly different mean surface chlorophyll distribution and subsurface circulation in key subregions. We show that strongly negative nearshore wind stress curl can control the spatial structure of the alongshore poleward undercurrent which brings nutrient-rich waters to be upwelled, hence generating a productive zone similar to satellite observations. The biological response to local wind stress variability at intraseasonal to interannual timescales is also investigated. A burst in the wind can induce a vertical displacement of the nutricline and modify nutrient input into the euphotic zone, as well as a deepening of the mixed-layer depth and increase dilution and light limitation. These two mechanisms, leading to opposite impact on the coastal productivity are investigated and quantified.