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Phytoplankton and nutrient distributions in a front-eddy area adjacent to the coastal upwelling zone off Concepcion (Chile): implications for ecosystem productivity.

Carmen Morales (1,2,3), Valeria Anabalón (2,3), Samuel Hormazábal (2,3,4), Marcela Cornejo (2,4), Joaquim Bento (4,5), and Nelson Silva (4)

(1) Depto. de Oceanografía, Facultad de Ciencias Naturales y Oceanográficas, Universidad de Concepción, Concepción, Chile, (2) Instituto Milenio de Oceanografía (IMO-Chile), Universidad de Concepción, Casilla 160-C, Concepción, Chile, (3) Instituto de Oceanografía y Cambio Global, Universidad de Las Palmas de Gran Canaria, 3 Campus Universitario de Tafira, 35017, Las Palmas de Gran Canaria, Spain., (4) Escuela de Ciencias del Mar, Pontificia Universidad Católica de Valparaíso, Valparaíso, Chile, (5) Coastal Research Laboratory-CORELAB, Research and Technology Center West Coast (FTZ), University of Kiel, Kiel, Germany.

The impact that sub-mesoscale (1-10 km) to mesocale (50-100 km) oceanographic variability has on plankton and nutrient distributions (horizontal and vertical) in the coastal upwelling and transition zones off Concepcion was the focus of this study. Satellite time-series data (wind, sea-surface temperature (SST), and altimetry) were used to understand the dynamic context of in situ data derived from a short-term front survey (3 d) during the upwelling period (3-6 February, 2014). The survey included two transects perpendicular to the coast, covering the shelf and shelf-break areas just north of Punta Lavapie, a main upwelling center ($\sim$37°S). Wind and SST time-series data indicated that the survey was undertaken just after a moderate upwelling event (end of January) which lead to a relaxation phase during early February. A submesoscale thermal front was detected previous to and during the survey and results from an eddy tracking algorithm based on altimetry data indicated that this front (F1) was flanked on its oceanic side by an anticyclonic, mesoscale eddy (M1), which was $\sim$25 d old at the sampling time. M1 strengthened the thermal gradient of F1 by bringing warmer oceanic water nearer to the colder coastal upwelling zone. The distributions of hydrographic variables and nutrients in the water column ($<$300 m depth) also denoted these two features. Phytoplankton biomass (Chl-a) and diatom abundance were highest in the surface layer ($<$20 m depth) between the coast and F1, with primary maxima in the latter, whereas they were highest at the subsurface (20-40 m depth) towards M1 and associated with secondary maxima. The distribution of dominant diatoms in the top layer ($<$100 m depth) indicated that both coastal and oceanic species were aggregated at F1 and in M1. These results suggest that the front-eddy interaction creates a complex field of submesoscale processes in the top layer, including vertical nutrient injections and lateral stirring, which contributes to the exportation of coastal communities to the open ocean in this region. We discuss how this interaction might affect ecosystem productivity in the coastal band.