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Distribution of phytoplankton in the tropical Eastern South Pacific in relation to hydrographic and nutrient conditions

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Hydrographic and biogeochemical measurements were conducted during R/V Meteor M77/3 cruise off the coast of Peru in January 2009. The aim of this survey was to investigate the impact of hydrographical factors like temperature and concentration of dissolved oxygen on nutrient cycling (N, P and Si) along gradients of high variability, putting that into context with the succession of different phytoplankton taxa. Particular emphasis was sampling of a representative east-west transect at 10°S, stretching from the highly productive upwelling area off Peru (78.4°W) to the oligotrophic open ocean of the eastern boundary regime at 82.5°W. Taxonomical composition of the phytoplankton community as well as group abundance was determined using diagnostic phytoplankton pigments measured via HPLC and the program CHEMTAX. The narrow Peruvian continental shelf region was characterized by upwelling events, transporting cold and nutrient-rich deep-water to the euphotic zone and thereby supporting the development of a highly diverse assemblage of microalgae (e.g. cryptophytes, chlorophytes, haptophytes), primarily dominated by diatoms. Upwelled water masses advected beyond the shelf slope enabled minor growth of Phaeocystis, Synechococcus, and chlorophytes above the oxycline (∼50 m). The upper boundary of the oxygen minimum zone (OMZ) corresponded to the nutricline, which separated the nutrient-poor euphotic zone above from the nutrient-replete intermediate waters below. Picocyanobacteria of the genus Prochlorococcus were the only photoautotrophs detected in waters below this hydrographic and biogeochemical boundary layer. Prochlorococcus is known to absorb photons efficiently even at extremely low irradiances, allowing it to inhabit the low-light, high-nutrient layers down to 200 m depth. Changes in the intensity of upwelling events and concomitant changes in nutrient availability might consequently have major implications on distribution and composition of the phytoplankton community.