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Phytoplankton blooms during austral summer in the Ross Sea, Antarctica: Driving factors and trophic implications

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Abstract

During the austral summer of 2014, an oceanographic cruise was conducted in the Ross Sea in the framework of the RoME (Ross Sea Mesoscale Experiment) Project. Forty-three hydrological stations were sampled within three different areas: the northern Ross Sea (RoME 1), Terra Nova Bay (RoME 2), and the southern Ross Sea (RoME 3). The ecological and photophysiological characteristics of the phytoplankton were investigated (i.e., size structure, functional groups, PSII maximum quantum efficiency, photoprotective pigments), as related to hydrographic and chemical features. The aim was to identify the mechanisms that modulate phytoplankton blooms, and consequently, the fate of organic materials produced by the blooms. The observed biomass standing stocks were very high (e.g., integrated chlorophyll-a up to 371 mg m^{-2} in the top 100 m). Large differences in phytoplankton community composition, relative contribution of functional groups and photosynthetic parameters were observed among the three subsystems. The diatoms (in different physiological status) were the dominant taxa in RoME 1 and RoME 3; in RoME 1, a post-bloom phase was identified, whereas in RoME 3, an active phytoplankton bloom occurred. In RoME 2, diatoms co-occurred with *Phaeocystis antarctica*, but were vertically segregated by the upper mixed layer, with senescent diatoms dominating in the upper layer, and *P. antarctica* blooming in the deeper layer. The dominance of the phytoplankton micro-fraction over the whole area and the high Chl-a suggested the prevalence of non-grazed large cells, independent of the distribution of the two functional groups. These data emphasise the occurrence of significant temporal changes in the phytoplankton biomass in the Ross Sea during austral summer. The mechanisms that drive such changes and the fate of the carbon production are probably related to the variations in the limiting factors induced by the concurrent hydrological modifications to the Ross Sea, and they remain to be fully clarified. The comparison of conditions observed during summer 2014 and those reported for previous years reveal considerably different ecological assets that might be the result of current