Geophysical Research Abstracts
Vol. 16, EGU2014-13786, 2014
EGU General Assembly 2014

Investigating the spring bloom initiation and net community production in the Subantarctic Southern Ocean using high-resolution in situ glider data

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Phytoplankton bloom phenology has important consequences for marine ecosystems, fisheries and carbon export to the ocean interior. As such, it is important to examine the drivers of phytoplankton bloom initiation and their sensitivity to inter-annual climate variability and change. In this study we use ∼6 months of in-situ high-resolution glider data to investigate the spring bloom initiation in the subantarctic zone (SAZ) of the Southern Ocean by implementing three different methods; a rate of change method, a threshold method and a cumulative sum method. The bloom initiation dates are critically compared to one another and the drivers of discrepancies assessed to inform on the sensitivities of different methods to processes driving the seasonal evolution of phytoplankton biomass in the subantarctic. The bloom initiation dates combined with in situ glider data of chlorophyll, light, and mixed layer depth allow us to resolve both Sverdrup's Critical Depth and Behrenfeld's Disturbance Recovery models through the water column and thus determine the seasonal evolution of net community production and respiration rates and the potential for carbon export. The outputs of the two different models are compared to one another in the context of their sensitivities to water column processes thereby refining their ability to address specific system scale questions. The novelty of this study is that gliders provide an unprecedented dataset to assess the seasonal cycle of phytoplankton biomass throughout the water column at high resolution, thus enhancing our understanding of net community production and export processes at submeso-space and sub-seasonal time scales.