

The seasonal cycle of mixed layer dynamics and phytoplankton biomass in the Sub-Antarctic Zone: A high-resolution glider experiment

Swart S
Thomalla SJ
Monteiro PMS

ABSTRACT:

In the Southern Ocean there is increasing evidence that seasonal to subseasonal temporal scales, meso- and submesoscales play an important role in understanding the sensitivity of ocean primary productivity to climate change. In this study, high-resolution glider data (3 hourly, 2 km horizontal resolution), from ~6 months of sampling (spring through summer) in the Sub-Antarctic Zone, is used to assess 1) the different forcing mechanisms driving variability in upper ocean physics and 2) how these may characterize the seasonal cycle of phytoplankton production. Results highlight the important role meso- to submesoscale features have in driving vertical stratification and early phytoplankton bloom initiations in spring by increasing light exposure. In summer, the combined role of solar heat flux, mesoscale features and subseasonal storms on the extent of the mixed layer is proposed to regulate both light and iron to the upper ocean at appropriate time scales for phytoplankton growth, thereby sustaining the bloom for an extended period through to late summer. This study highlights the need for climate models to resolve both meso- to submesoscale and subseasonal processes in order to accurately reflect the phenology of the phytoplankton community and understand the sensitivity of ocean primary productivity to climate change.