



# IV ROSS SEA CONFERENCE 2023

Università degli Studi di Napoli "Parthenope"

Via Amm. F. Acton, 38 - 80133 Napoli, ITALY

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**Topic:** Biogeochemistry

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**ABSTRACT Subject :**

Mixing under ice in spring and the initiation of the Ross Sea phytoplankton bloom

**Abstract** 16/01/2023 15:12:55

Various hypotheses have been proposed to explain the timing of the initiation of phytoplankton blooms in temperate and polar systems. The Sverdrup critical depth hypothesis has been most commonly invoked, but other hypotheses have been proposed as well. Nearly all of these invoke the concept of mixed layer depths, and assume that active mixing occurs in some or all of the mixed layer. This in turn controls the integrated (through time and depth) amount of irradiance available for phytoplankton photosynthesis. Despite the critical biogeochemical importance of understanding the bloom initiation controls in polar systems, few data are available on the appropriate time and space scales to adequately test any of the available hypotheses. Data from cruises to the southern Ross Sea in early October, when ice cover is extensive, are used to evaluate mixed layer depths. The data used include temperature, salinity and density vertical distributions, as well as chlorophyll and particulate organic carbon measurements derived from optical sensors. Mixed layer depths are estimated using a variety of techniques (both parametric and non-parametric methods) and the results are surprisingly different. The presence of ice cover restricts air-sea interactions, but ice can continually release brine to drive convection. Stations were occupied at two locations, and vertical distributions were assessed over 24 h through multiple casts. Stations were also re-occupied through time. The results suggest that mixed layers as defined by multiple criteria change rapidly on diel scales and emphasize the importance of brine formation. Chlorophyll concentrations were exceptionally low at the earliest occupied stations (ca.  $0.01 \mu\text{g L}^{-1}$ ), but increased 5-fold over 10 days, suggesting that phytoplankton growth had been initiated. Estimates of critical depth suggest and biological variables suggest that mixing depths best explain the regulation of the bloom onset in the Ross Sea. The earliest proposed dates of bloom initiation are in early October (Smith and Gordon, 1997), but these new analyses suggest that growth likely begins substantially earlier.

