

Trace Metal Variability and Biogeochemical Trends in the Subantarctic Southern Ocean: Insights from the Southern Ocean Time Series site.

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The Southern Ocean Time Series (SOTS) site (~47S; 142E) is located in the subantarctic zone of the Southern Ocean and is situated just south of the interface between subtropical and subantarctic waters. This study examines trace metal variability at this site with an emphasis on understanding iron and zinc trends for samples collected on 5 voyages between 2016 and 2020 and surface water samples collected using the ACE trace metal sampler at monthly resolution between 2021 and 2022.

Salinity and temperature profiles at SOTS displayed significant upper ocean variability influenced by seasonal changes and the intrusion of subtropical water from the north. Dissolved iron (dFe) concentrations also show substantial variability in the upper ocean (<80 m), with the lowest concentrations recorded in 2016 (dFe = 0.06 nmol kg⁻¹) and the concentrations highest in 2020 (dFe = 0.33 nmol kg⁻¹). Dissolved zinc (dZn) results suggest that variability in dFe does not result from contamination, as the lowest dZn concentrations (dZn = 0.08 nmol kg⁻¹) coincide with the higher 2020 dFe concentrations. Instead, dFe variability appears to result from the intrusion of subtropical water, atmospheric input and utilisation through biological processes. Indeed, a positive relationship was associated between chlorophyll and dFe. Likewise, we also see a coupling between dFe and dissolved copper in surface and deep waters. Below the euphotic zone, we note a decline in dZn within the core of Subantarctic Mode Water (SAMW) from 2016 to 2020, which is intriguing but must be interpreted with caution due to the short sampling period. Across the long term, we note a trend of increasing sea surface temperature (1983 to present) and chlorophyll concentrations (1998 to present) at the site.