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Variability of sea salt and methanesulfonate in firn cores from northern Victoria Land, Antarctica: their links to oceanic and atmospheric condition variability in the Ross Sea

Content

The potential ice core proxies of variability in oceanic and atmospheric conditions over the Ross Sea were evaluated. This study examined sea salt sodium (ss-Na⁺) and biogenic sulfur (methanesulfonate, MS⁻) records, covering 23 years between 1990 and 2012, from two firn cores drilled on the Styx Glacier Plateau (SGP), northern Victoria Land, East Antarctica, to examine the potential links between those records and the observational datasets for various climate variables. The comparison showed that the interannual variability of the ss-Na⁺ record is closely related to the Pacific-South American mode 2 (PSA2) in the Ross Sea sector, exhibiting increased ss-Na⁺ flux, which is most likely associated with the frequent penetration of maritime air masses from the western Ross Sea to the SGP during the winter/spring positive phases of the PSA2. The observed MS⁻ record revealed statistically significant positive correlations with the changes in the summertime chlorophyll-a concentration in the Ross Sea polynya (RSP) and wind speed in the southern Ross Sea region. This indicates the dominant role of a combination of changes in the summertime primary productivity and wind speed over the RSP in modulating the MS⁻ deposition flux at the SGP. These results highlight the suitability of the ss-Na⁺ and MS⁻ records from the SGP as proxies for characterizing the variations in climate variables beyond the instrumental limits over the Ross Sea region.

Primary author: HONG, Sangbum (Korea Polar Research Institute)

Co-authors: Mr RO, Seokhyun (Inha University); Dr KIM, Joo-Hong (KOPRI); Dr HAN, Yeongcheol (KOPRI); Dr HUR, Soon Do (KOPRI); Dr KANG, Jung-Ho (KOPRI); Ms KIM, Songyi (KOPRI); Mr LIM, Changkyu (KOPRI); Ms CHANG, Chaewon (KOPRI); Mr MOON, Jangil (KOPRI); Dr KIM, Seong-Joong (KOPRI); Dr HONG, Sungmin (Inha University)

Presenter: HONG, Sangbum (Korea Polar Research Institute)

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