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Quantifying the use of Arctic ice core bromine for past sea ice reconstructions

Content

Bromine in ice cores has been commonly employed as a qualitative sea ice proxy to produce sea ice reconstructions for the polar regions. Here we report the first statistical validation of this proxy by combining two bromine enrichment (with respect to seawater, Br_{enr}) records from Greenland ice cores (RECAP and SIGMA-A) with satellite sea ice observations over three decades. We find that during the 1984-2016 satellite-era, ice core Br_{enr} values are significantly correlated only with first-year sea ice (FYSI) supporting that the gas-phase bromine enrichment processes, preferentially occurring over FYSI, are registered in ice records. Comparing 20th century historical Arctic sea ice observations with sea ice reconstructions, we find a significant relationship between the reconstructed FYSI-fraction in the Greenland Sea and regional atmospheric temperatures. Our findings provide a quantitative and statistical basis for reconstructions of past polar FYSI extent based on bromine in ice cores.

Primary author: SCOTO, Federico (CNR-Institute of Atmospheric Sciences and Climate (ISAC-CNR))

Co-authors: MAFFEZZOLI, Niccolò (Ca'Foscari University of Venice; CNR-Institute of Polar Sciences (CNR-ISP)); CUEVAS, Carlos A. (Department of Atmospheric Chemistry and Climate, Institute of Physical Chemistry Rocasolano (CSIC-IQFR)); VALLELONGA, Paul (Physics of Ice Climate and Earth, Niels Bohr Institute, University of Copenhagen); BARBANTE, Carlo (Ca'Foscari University of Venice; CNR-Institute of Polar Sciences (CNR-ISP)); VARIN, Cristiano (Department of Environmental Sciences, Informatics and Statistics); GAGLIARDI, Alessandro (University of Padua); IIZUKA, Yoshinori (Institute of Low Temperature Science, Hokkaido University); MATOBA, Sumito (Institute of Low Temperature Science, Hokkaido University); SAIZ-LOPEZ, Alfonso (Department of Atmospheric Chemistry and Climate, Institute of Physical Chemistry Rocasolano (CSIC-IQFR)); SPOLAOR, Andrea (CNR-Institute of Polar Sciences (CNR-ISP))

Presenter: SCOTO, Federico (CNR-Institute of Atmospheric Sciences and Climate (ISAC-CNR))