EGU2020-9013
https://doi.org/10.5194/egusphere-egu2020-9013
EGU General Assembly 2020

Exploring ice core sea ice proxies through process-based modelling

Rachael Rhodes[1], Xin Yang[2], and Eric Wolff[1]
[1]Department of Earth Sciences, University of Cambridge, Cambridge, United Kingdom (rhr34@cam.ac.uk)
[2]British Antarctic Survey, UK Research and Innovation, Cambridge, United Kingdom

It is important to understand the magnitude and rate of past sea ice changes, as well as their timing relative to abrupt shifts in other components of Earth's climate system. Furthermore, records of past sea ice over the last few centuries are urgently needed to assess the scale of natural (internal) variability over decadal timescales. By continuously recording past atmospheric composition, polar ice cores have the potential to document changing sea ice conditions if atmospheric chemistry is altered. Sea salt aerosol, specifically sodium (Na), and bromine enrichment (Br_{enr}, Br/Na enriched relative to seawater ratio) are two ice core sea ice proxies suggested following this premise.

Here we aim to move beyond a conceptual understanding of the controls on Na and Br_{enr} in ice cores by using process-based modelling to test hypotheses. We present results of experiments using a 3D global chemical transport model (p-TOMCAT) that represents marine aerosol emission, transport and deposition. Critically, the complex atmospheric chemistry of bromine is also included. Three fundamental issues will be examined: 1) the partitioning of Br between gas and aerosol phases, 2) sea salt aerosol production from first-year versus multi-year sea ice, and 3) the impact of increased acidity in the atmosphere due to human activity in the Arctic.