EGU21-9187
https://doi.org/10.5194/egusphere-egu21-9187
EGU General Assembly 2021

Tephra in the Greenland Ice cores: Insights into Icelandic volcano-climate impacts

Imogen Gabriel[1], Gill Plunkett[2], Peter Abbott[1], Bergrún Óladóttir[3,4], Joseph McConnell[5], Maria Hörhold[6], and Michael Sigl[1,7]

[1]Climate and Environmental Physics & Oeschger Centre for Climate Change Research, University of Bern, Bern, Switzerland (imogen.gabriel@climate.unibe.ch)

[2]School of Natural and Built Environment, Queen's University Belfast, Belfast, UK

[3]Institute of Earth Sciences, University of Iceland, Reykjavík, Iceland

[4]Icelandic Meteorological Office, Bústaðavegur 9, 150 Reykjavík, Iceland

[5]Desert Research Institute, Nevada System of Higher Education, Reno, USA

[6]Alfred-Wegener-Institut Helmholtz-Zentrum für Polar- und Meeresforschung, Bremerhaven, Germany

[7]Department of Geosciences, University of Oslo, Oslo, Norway

Volcanic eruptions are considered as one of the primary natural drivers for changes in the global climate system and understanding the impact of past eruptions on the climate is integral to adopt appropriate responses towards future volcanic eruptions.

The Greenland ice core records are dominated by Icelandic eruptions, with several volcanic systems (Katla, Hekla, Bárðarbunga-Veiðivötn and Grimsvötn) being highly active throughout the Holocene. A notable period of increased Icelandic volcanic activity occurred between 500-1250 AD and coincided with climatic changes in the North Atlantic region which may have facilitated the Viking settlement of Greenland and Iceland. However, a number of these volcanic events are poorly constrained (duration and magnitude). Consequently, the Greenland ice cores offer the opportunity to reliably reconstruct past Icelandic volcanism (duration, magnitude and frequency) due to their high-resolution, the proximity of Iceland to Greenland and subsequent increased likelihood of volcanic fallout deposits (tephra particles and sulphur aerosols) being preserved. However, both the high frequency of eruptions between 500-1250 AD and the geochemical similarity of Iceland's volcanic centres present challenges in making the required robust geochemical correlations between the source volcano and the ice core records and ultimately reliably assessing the climatic-societal impacts of these eruptions.

To address this, we use two Greenland ice core records (TUNU2013 and B19) and undertake geochemical analysis on tephra from the volcanic events in the selected time window which have been detected and sampled using novel techniques (insoluble particle peaks and sulphur acidity peaks). Further geochemical analysis of proximal material enables robust correlations to be made between the events in the ice core records and their volcanic centres. The high-resolution of these polar archives provides a precise age for the event and when utilised alongside other proxies (i.e. sulphur aerosols), both the duration and magnitude of these eruptions can be constrained, and

the climatic-societal impacts of these eruptions reliably assessed.