Contribution ID: **319** Type: **Oral presentation**

Climatic impact of volcanic eruptions during the last glacial period inferred from Greenland and Antarctic ice cores

Monday, 3 October 2022 09:40 (20 minutes)

Ice core and tree ring records, as well as climate models suggest that volcanism plays a major role in generating the climate variability observed in the Common Era. Since the state of the climate in the Anthropocene already exerts significant stress on society, we are increasingly vulnerable to unpredictable perturbations. To be prepared, the impact of large future eruptions needs to be constrained better. Satellite observations only exist for few major eruptions, which are not large compared to eruptions that will eventually occur over time spans of a hundred years or more.

To learn more about eruptions with return periods of several hundred years, we analyzed volcanic records from ice cores of the last glacial period and compared them with high-resolution paleoclimatic ice core records. Temperature proxies from Antarctica and Greenland show a multiannual cooling around the time of large eruptions due to the effect of stratospheric sulfate aerosols. While the glacial signal is significantly degraded over time, its average amplitude is comparable to the largest eruptions of the Common Era. Eruptions with even larger cooling exist, but their precise amplitude is uncertain. This is because the average cooling signal is smaller than the background proxy variability, and only the largest eruptions exceed the latter. The total variability may be dominated by stratigraphic and glaciological noise.

The volcanic cooling is hemispherically asymmetric, and cold stadial periods are associated with a larger Greenland cooling signal. This suggests that the volcanic impact depends on the background climate state. Furthermore, non-linearities in the climate system may lead to large-scale instabilities (tipping points), where even small perturbations such as volcanic eruptions can lead to an abrupt transition to a different climate state. To this end, we investigated a potential connection of abrupt climate changes (Dansgaard-Oeschger events) in the last glacial and large volcanic eruptions.

Primary authors: Mr SVENSSON, Anders (Physics of Ice, Climate and Earth, Niels Bohr Institute, University of Copenhagen); LOHMANN, Johannes (Niels Bohr Institute, University of Copenhagen); Ms LIN, Jiamei (Physics of Ice, Climate and Earth, Niels Bohr Institute, University of Copenhagen); Mr VINTHER, Bo M. (Physics of Ice, Climate and Earth, Niels Bohr Institute, University of Copenhagen); Mr RASMUSSEN, Sune O. (Physics of Ice, Climate and Earth, Niels Bohr Institute, University of Copenhagen)

Presenter: LOHMANN, Johannes (Niels Bohr Institute, University of Copenhagen)

Track Classification: Rapid changes and teleconnections