Geophysical Research Abstracts
Vol. 17, EGU2015-15705-1, 2015
EGU General Assembly 2015

Temperature variability of the last 1000 years in Antarctica from inert gas isotopes

Anais Orsi (1), Amaelle Landais (1), and Jeffrey P. Severinghaus (2)

(1) Laboratoire des Sciences du Climat et de l'environnement, L'Orme des Merisiers, Gif-sur-Yvette, France (anais.orsi@lsce.ipsl.fr), (2) Scripps Institution of Oceanography, La Jolla, CA, USA

A large effort has been made to document the climate history of the last two thousand years, but there are still substantial gaps in the Southern Hemisphere, especially at high latitudes, where the changes in the climate are the largest. These gaps limit our understanding of the most fundamental driving mechanisms of the climate. In particular, the impact of solar minima on surface temperature is not fully understood.

Here, we investigate the spatial structure of multi decadal climate variability in Antarctica, assess the significance of the Little Ice Age minimum documented elsewhere.
We present a 1000 year temperature record at two sites in Antarctica: WAIS Divide (79°S, 112°W, 1766 m a.s.l), and Talos Dome (72°S, 159°E, 2315 m a.s.l), reconstructed from the combination of inert gas isotopes from the ice core and borehole temperature measurements. Borehole temperature provides an absolute estimate of long-term trends, while noble gases track decadal to centennial scale changes. This method provides a temperature reconstruction that is independent of water isotopes, and allows us to improve our understanding of water isotopes as a temperature proxy, and use them to track circulation changes.

We find that there is a pronounced cooling trend over the last millennium at both sites, but it is stronger in East Antarctica (Talos Dome) than West Antarctica (WAIS-D). At WAIS Divide, we find that "Little Ice Age" cold period of 1400-1800 was 0.52°C colder than the last century, and that the recent warming trend (0.23°C/decade since 1960) has past analogs about every 200 years. At Talos Dome, the pronounced cooling trend over the whole record is not visible in the water isotope record, which suggests that there is a compensation of several sources of fractionation.

Overall, both records are consistent with the idea that the solar minima and persistent volcanic activity of the Little Ice Age (1400-1850 A.D.) had a significant impact on the surface temperature in Antarctica. The feedbacks amplifying the forcing were likely stronger on the East Antarctic plateau than on the more marine-influenced West Antarctica.