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1000 years of climate history from a coastal West Antarctic ice core site

Content

The West Antarctic Ice Sheet (WAIS) is believed to be susceptible to collapse as a result of anthropogenic climate change. Modelling studies and palaeoclimatic evidence have suggested at least partial WAIS collapse and resulting sea level rise during previous warm periods, therefore understanding the stability of the WAIS during warm periods is important. However, ice records from coastal West Antarctica are currently sparse, particularly in the Amundsen and Bellingshausen sectors and none extend further back in time than a few hundred years, limiting the knowledge of spatial climate variability beyond this time period.

A drilling project in 2020 on Sherman Island achieved a 323 m deep borehole using the British Antarctic Survey (BAS) Rapid Access Isotope Drill (RAID), with 1724 discrete samples of ice chippings collected from the entire depth range of the drilled ice. Water isotope ratios and major ion concentrations of the samples were measured using cavity ring-down spectroscopy and ion chromatography. An age scale of this record is presented using annual layer counting of chemical records, volcanic horizon identification and ice flow modelling. We show that the Sherman Island ice record extends to 1160 years before present, providing the oldest continuous ice-derived palaeoclimate history of the coastal Amundsen-Bellingshausen sector to date. A comparison of the chemical and water isotope records with nearby ice cores provides insights into the spatial variability of change over recent centuries. Climate trends in the region of the Amundsen sea glaciers - including Thwaites, considered the most vulnerable to future warming - are investigated. Preliminary results suggest that Sherman Island showed a modest warming trend in the late 20th and early 21st centuries, prior to which temperatures were stable.

Primary authors: ROWELL, Isobel (University of Cambridge); MULVANEY, Robert (British Antarctic Survey); WOLFF, Eric (University of Cambridge, UK); PRYER, Helena (University of Cambridge); TETZNER, Dieter (British Antarctic Survey, UK); THOMAS, E R (British Antarctic Survey); GRIEMAN, Mackenzie (Reed College); MARTIN GARCIA, Carlos (British Antarctic Survey); RIX, Julius (British Antarctic Survey)

Presenter: ROWELL, Isobel (University of Cambridge)

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