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The Mount Brown South ice core: initial results and current research from a new, high resolution ice core in the Indian Ocean sector of East Antarctica.

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High resolution ice core records are crucial to understanding past climate variability in Antarctica and the Southern Ocean. While existing long records tell us about how the climate has changed over centuries to millennia, only ice cores that resolve past climate at annual and ideally seasonal resolution can provide insight into features such as the Southern Annular Mode (SAM), westerly wind variability, sea ice extent and changes in snowfall accumulation rate. Records such as this that span more than a few tens or hundreds of years are rare across Antarctica, and in East Antarctica in particular. For the observation-sparse Indian Ocean sector spanning Enderby Land to East Wilkes Land (~45-160 East), only two annually resolved records >2000 years exist. This includes the Law Dome record, which has been crucial for developing proxy climate records relevant to Australia and the southwest Pacific. In the 2017-18 austral summer, we drilled a new high-resolution ice core record in Wilhelm II Land to complement the emerging and existing proxy records from the Law Dome ice core and to enhance our understanding of past climate variability in the observations sparse Indian Ocean sector.

The past climate records now being developed from the new Mount Brown South ice core include trace chemistry analysed by both discrete and continuous flow analysis (CFA), water stable isotopes (discrete and CFA), physical stratigraphy, volcanic tracers (cryptotephra), persistent organic pollutants and snowfall accumulation rates. Interim dating of the record suggests a high annual accumulation rate of 0.3 metres ice equivalent and that the 295 metre record will span around 1200 years to present. Initial atmospheric analysis shows the ice core preserves signals of atmospheric variability from the mid-latitudes of the southern Indian Ocean, as well as signals of large-scale variability such as the El Niño-Southern Oscillation. Work in progress suggests the ice core is subject to episodic moisture intrusions, and likely has a less uniform accumulation regime than the Law Dome ice core to its east. The episodic nature of the accumulation regime increases the complexity of dating the record. However, this complexity is currently being exploited to develop proxies of regional moisture and impurities transport at the seasonal and annual scale, providing insight into synoptic variability in the data sparse southern Indian Ocean and its impacts on meridional moisture transport and ultimately surface mass balance.

Author: VANCE, Tessa

Co-authors: ABRAM, Nerilie (Australian National University); CRISCITIELLO, Alison (University of Alberta); Dr GALLANT, Ailie (Monash University); CROCKART, Camilla (University of Tasmania); CURRAN, Mark (Australian Antarctic Division); FAVIER, Vincent (IGE); GKINIS, Vasileios (Physics of Ice, Climate and Earth, Niels Bohr Institute, University of Copenhagen); HARLAN, Margaret; JACKSON, Sarah (The Australian National University); JONG, Lenneke (Australian Antarctic Division); KJÆR, Helle Astrid (Niels Bohr Institute, university of Copenhagen); Ms LONG, Chelsea (University of Tasmania); Dr MOY, Andrew (Australian Antarctic Division); Ms NATION, Meredith (Australian Antarctic Division); PLUMMER, Christopher (University of Tasmania); Dr ROBERTS, Jason (Australian Antarctic Division); SVENSSON, Anders (Physics of Ice, Climate and Earth, Niels Bohr Institute, University of Copenhagen); VALLELONGA, Paul (Physics of Ice Climate and Earth, Niels Bohr Institute, University of Copenhagen); Ms ZHANG, Lingwei (University of Tasmania); VAN OMMEN, Tas (Australian Antarctic Division)

Presenter: VANCE, Tessa

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