Last Interglacial climate variability at TALDICE, East Antarctica

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Abstract

The Antarctic ice sheet is a powerful archive of past climate variability and the EPICA ice core has already provided us with one of the most astonishing records of temperature and greenhouse gases over the past 800,000 years. The last interglacial period, also known as Eemian (ca. 132–116 ka BP), characterized by global temperatures and sea level higher than today, has been found in six East Antarctic ice cores: Vostok, Taylor Dome, Dome F, EPICA Dome C, EPICA Dronning Maud Land and TALDICE. Paleotemperature reconstructions from Antarctic ice cores rely mainly on δD and $\delta^{18}O$ records while the deuterium excess, $d = \delta D - 8*\delta^{18}O$, contains information about climate conditions prevailing in the source regions of precipitation and can be used as an integrated tracer of past hydrological cycle changes.
Here we present a new deuterium excess record obtained from the TALDICE ice core analysing the high-resolution samples obtained from the 5 cm cuttings between 1384 and 1414 m, corresponding to the 115-130 ka BP period. Talos Dome is a peripheral dome of East Antarctica, located in the Ross Sea sector where the TALDICE deep ice core (1620 m) has been retrieved. The coring site (159°11'E 72°49'S; 2315 m a.s.l.; T=-41°C) is located near the dome summit with an ice thickness of about 1795 m and with a snow accumulation rate of 80 mm w.eq./yr, about three to four times higher than other East Antarctic plateau sites. Backtrajectory analyses suggest that Talos Dome is mainly influenced by air masses arriving both from the Pacific (Ross Sea) and Indian Ocean sectors. A previous study (Masson-Delmotte et al., 2011) has shown that the $\delta^{18}O$ records obtained from the East Antarctic deep ice cores depict a quite homogeneous pattern during the present and last interglacials. However, regional differences, particularly important in the case of the TALDICE ice core, may be related to both elevation and regional atmospheric circulation changes. The north-western drainage area of Talos Dome base is mostly below sea level (Wilkes Subglacial Basin). For this reason, this drainage area could be more sensitive to climatic and sea level fluctuations than other sectors of the East Antarctic Ice Sheet. A significant retreat of the marine-based ice in this East Antarctic subglacial basin, may cause a change of the elevation leading to a distinct $\delta^{18}O$ signal at TALDICE ice core site.
The $\delta^{18}O$ and deuterium excess records from TALDICE will be compared to other ice core isotopic records taking advantage of the common ice core chronology, called AICC2012 (Veres et al., 2013), as well as to high resolution ssNa and nssCa records obtained from the TALDICE ice core to understand the regional differences highlighted by this site.

Keywords: Antarctica, water stable isotopes, ice cores, Eemian

References

Masson-Delmotte V., Buiron D., Ekaykin A., Frezzotti M., Gallée H., Jouzel J., Krinner G., Landais A., Motoyama H., Oerter H., Pol K., Pollard D., Ritz C., Schlosser E., Sime L. C., Sodemann H., Stenni B., Uemura R., Vimeux F., 2011. A comparison of the present and last interglacial periods in six Antarctic ice cores. Climate of the Past, 7, 397-423.

Veres D., Bazin L., Landais A., Toyé Mahamadou Kele H., Lemieux-Dudon B., Parrenin F., Martinerie P., Blayo E., Blunier T., Capron E., Chappellaz J., Rasmussen S. O., Severi M., Svensson A., Vinther B., Wolff E. W, 2013. The Antarctic ice core chronology (AICC2012): an optimized multi-parameter and multi-site dating approach for the last 120 thousand years. Clim. Past, 9, 1733–1748.