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A comparison of the present and last interglacial periods in six Antarctic ice cores

Valérie Masson-Delmotte and the co-authors Team
LSCE, IPSL CEA-CNRS UMR 1572, Gif sur Yvette cedex, France (valerie.masson@cea.fr, +33-(0)6908-7716)

We compare the present and last interglacial periods as recorded in Antarctic water stable isotope records now available at various temporal resolutions from six East Antarctic ice cores: Vostok, Taylor Dome, EPICA Dome C (EDC), EPICA Dronning Maud Land (EDML), Dome Fuji and the recent TALDICE ice core from Talos Dome.

We first review the different modern site characteristics in terms of ice flow, meteorological conditions, precipitation intermittency and moisture origin, as depicted by meteorological data, atmospheric reanalyses and Lagrangian moisture source diagnostics. These different factors can indeed alter the relationships between temperature and water stable isotopes.

Using five records with sufficient resolution on the EDC3 age scale, common features are quantified through principal component analyses. Consistent with instrumental records and atmospheric model results, the ice core data depict rather coherent and homogenous patterns in East Antarctica during the last two interglacials.

Across the East Antarctic plateau, regional differences, with respect to the common East Antarctic signal, appear to have similar patterns during the current and last interglacials. We also identify two abrupt shifts in isotopic records during glacial inception at TALDICE and EDML, likely caused by regional sea ice expansion. During the early optimum of the last interglacial period, the deuterium excess of EDC exhibits an abrupt shift, likely caused by a major reorganization of the atmospheric circulation in the southern Indian ocean sector.

The regional differences are discussed in terms of moisture origin and in terms of past changes in local elevation histories which are compared to ice sheet model results. Our results suggest that, for coastal sites, elevation changes may contribute significantly to intersite differences. These elevation changes may be underestimated by current ice sheet models.

Finally, high resolution stable isotope measurements conducted on the EDC ice core allow to compare the power spectrum of deuterium variability during different interglacials (Holocene, MIS5, 7, and 11).

References :
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