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Holocene climate variability from ice core records in the Ross Sea area (East Antarctica)

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Past polar climate variability can be documented at high resolution thanks to ice core records, which have revealed significant Holocene variations in Antarctica. Paleotemperature reconstructions from Antarctic ice cores are mainly based on δ18O (δD) records, a proxy for local, precipitation-weighted atmospheric temperatures. Here, we present a new climate record spanning the past 12,000 years resulting from high resolution (10 cm) stable isotope analyses of the ice core drilled at Talos Dome (TD) in East Antarctica from 2003 to 2007 in the framework of the TALDICE (TALos Dome Ice CorE) project. Talos Dome (72°49'S, 159°11'E; 2315 m; -41°C) is an ice dome on the edge of the East Antarctic plateau, where moisture is mainly advected from the Indian and western Pacific sectors of the Southern Ocean. Pacific moisture arriving at TD has been transported above the Ross Sea, where extensive presence of sea ice also occurs during summer. High-resolution δ18O data have been measured using both IRMS and CRDS techniques on 10 cm samples, leading to a mean time resolution of two years. The long-term trend of the TALDICE δ18O profile shows characteristic features already observed in other ice cores from the East Antarctic plateau. Following the approach of Pol et al. (2011), high frequency climate variability has been investigated using a 3000-year running standard deviation on the de-trended record. The results are compared to the same analysis performed on the nearby Taylor Dome ice core δ18O data, which is the single East Antarctic ice core showing a strong Holocene decreasing trend. Despite these trend differences, both sites share common features regarding changes in variance. We also investigate changes in deuterium excess, a proxy reflecting changes in moisture source conditions. Both deuterium excess records show a two-step increasing trend in the first part of the Holocene. Taylor Dome deuterium excess however depicts an enhanced variability since about 7000 years BP. A wavelet analysis shows a change in isotopic variability patterns at 6-7000 years BP at both sites, suggesting changes in regional climate variability attributed to the opening of the Ross Sea area after the deglaciation.

Pol K. et al. (2011). Links between MIS 11 millennial to sub-millennial climate variability and long term trends as revealed by new high resolution EPICA Dome C deuterium data – A comparison with the Holocene. Clim. Past, 7, 437-450.