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Leads and lags in marine biogenic species in the EPICA ice cores during the last 150000 years: Effects of aerosol deposition or bio productivity

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The European Project for Ice Coring in Antarctica (EPICA) provided deep ice cores from two drilling sites in Antarctica. The Dronning Maud Land (EDML) core at [00˚04'E, 75˚00'S], representing climate variability of the Southern Atlantic Ocean, and the Dome Concordia (EDC) core [123˚21'E, 75˚06'S], mainly reflecting changes of the Indic part of the Southern Ocean. Both cores reach back to at least MIS 5.5, the last warm period.

Measurements of aerosol chemistry allow conclusions on source strength and transport efficiency of sea salt, marine biogenic compounds, dust, volcanoes etc. In the framework of the EPICA project, the aerosol chemistry was and still is analyzed by ion chromatography (IC) in relatively high resolution at both cores.

This poster will show and discuss chemical components in the ice cores originating from biological productivity, i.e. methanesulfonate (MSA) and non sea salt sulfate (nss-SO_4). As so far only for the EDC core an independent age scale has been established, the records were synchronized by matching conspicuous peaks and dips in the dust measurements. The dust record was chosen based on the assumption that dust for both records originates from the same source region (Patagonia).

The shown records are restricted to a resolution of one meter as this can be sustained for the whole core. First comparisons show an overall synchronous temporal change of almost all measured chemical components between the two cores. One of the first significant discernible differences was found in the MSA records of both cores in times of the transitions from glacial to interglacial ages. Here the EDML MSA record lags the EDC ones by several thousand years in Transition I as well as in Transition II. As MSA measured in ice cores is subject to diverse influences, the interpretation of this observed shift is challenging. A shift because of a synchronization error is ruled out due to the common source and the high correlation (r^2=0.77) of both dust records. The observed displacement in MSA could be caused by a simultaneous shift in accumulation, implying varying contributions of wet vs. dry deposition of MSA or a different magnitude of postdepositional loss processes. Also conceivable is a shift in acidity of the ice as estimated from the ion balance which is mainly a composite of sulfate and calcium concentrations. A differing ion balance at EDML compared to EDC could support or diminishing the fixation of MSA in firn. In former studies of Antarctic MSA records, links to sea ice concentration and extent were drawn. As in the last glacial maximum (LGM) sea ice in the Atlantic sector of the Southern Ocean was relatively more extended compared to the present state than in the Indian or Pacific sector, the shift in the EDML MSA might also be a result of differences in bio productivity due to the deviating sea ice conditions.

With this poster, miscellaneous parameters possibly responsible for the observed temporal evolution of the MSA records from EDC and EDML as well as the shift during Transition I and II will be examined.