Geophysical Research Abstracts
Vol. 20, EGU2018-7630, 2018
EGU General Assembly 2018

A new global ocean gridded climatology of the sea-surface temperature during the Last Glacial Maximum

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We present a new ocean climatology of the sea-surface temperature (SST) during the Last Glacial Maximum (LGM) mapped on a global $1^\circ \times 1^\circ$ grid. This is an extension of the Glacial Atlantic Ocean Mapping (GLAMAP) reconstruction of the Atlantic SST. It is based on results of the Multiproxy Approach for the Reconstruction of the Glacial Ocean Surface (MARGO) project and additional data. Following the EPILOG working group, we also define the LGM as the maximum glacial sea-level low stand and orbital minimum of solar insolation during 23,000–19,000 years before present (23-19 ka BP).

Such a new ocean climatology of the SST during the LGM is urgently needed for the visualization of the LGM climate and the evaluation of coupled climate models, as well as as a boundary condition for atmospheric general ciculation models (AGCMs) including water isotopes. For example, a comparison of water-isotope distributions to ice-core data from Greenland and Antarctica and a speleothem dataset revealed a better agreement for an atmosphere-only than for a coupled atmosphere-ocean simulation of the LGM climate. The possible reason is a stronger SST gradient between mid- and high latitudes in the GLAMAP reconstruction than in the simulated SST, but a closer analysis requires an updated and extended SST climatology for the LGM.

The gridding of the sparse SST reconstruction is done in an optimal way using the Data-Interpolating Variational Analysis (DIVA) software, which takes into account the uncertainty on the reconstruction and includes the calculation of an error field. In addition to the SST, we also deal with the reconstructed sea-ice boundaries in the northern and southern hemispheres and the sea-surface oxygen isotope ratio of seawater derived from fossil shells of planktonic foraminifera.

It is planned to use water isotopes as a tool to compare the performance of two different atmospheric models, using a simulated SST climatology as well as our new ocean gridded climatology as lower boundary conditions, thereby isolating the impact of the ocean feedback on the simulated distributions of water isotopes over land, ice and ocean.