Geophysical Research Abstracts
Vol. 12, EGU2010-2849, 2010
EGU General Assembly 2010

Mediterranean Ocean Climate for the Last Glacial Maximum

Uwe Mikolajewicz
Max-Planck-Institut f. Meteorologie, Hamburg, Germany (uwe.mikolajewicz@zmaw.de, +49-(0)40-41173-298)

To correctly reproduce past climate changes is one of the prerequistes for reliably predicting anthropogenic climate change. Here, results from an attempt to simulate the climate of the Last Glacial Maximum (LGM, 21.000 years ago) for the Mediterranean Sea are pesented. For this time slice, precompiled proxy data sets exist.

One key problem in regional ocean modelling for past time slices is to obtain atmospheric forcing data. A multi-step approach is used. A coarse resolution earth system model consisting of coupled atmospheric-oceanic general circulation models (ECHAM5_T31/MPIOM_GR3) with a dynamical vegetation model (LPJ) was integrated for several thousand years to steady state. The surface conditions derived from these model simulations (sea surface temperature (SST), sea ice and vegetation) were used as lower boundary conditions for a short (20 years plus 9 years of spinup) simulation with a high resolution stand-alone atmosphere model (ECHAM5_T106). The continental runoff was calculated using a hydrological discharge model.

This procedure was performed both for the Last Glacial Maximum as well as for a preindustrial control simulation. Atmospheric composition, earth orbital parameters, topography and ice sheet distribution were prescribed following the protocol for the PMIP2 project.

The simulations of the Mediterranean ocean climate were performed with a regional version of MPIOM. The model has a horizontal resolution of approximately 25 km and 29 levels. The surface heat fluxes are calculated with bulk fomulas using the model SST. Freshwater forcing consists of evaporation (calculated from the latent heat flux), precipitation and river runoff. The model uses daily forcing for the atmospheric input derived from the high resolution atmosphere model. In the Atlantic box a restoring to observed hydrography is applied. For the LGM the anomalies from the coupled model are added to observations. This model has been integrated in each of the cases for more than 1000 years until a steady state was approached.

The simulated surface temperature response is strongest in the Gulf of Lions and the Adriatic and smallest in the eastern Levantine. Especially in the western part of Mediterranean the cooling is substantially stronger in summer than in winter. The maximum of the cooling in summer and the strong west-east gradient of the temperature response fit well with estimates of temperature changes derived from proxy data, but the model tends to underestimate the spatial gradients.

Although the net freshwater loss of the Mediterranean is strongly reduced in the glacial simulation, the salinity gradients between the Levantine and the inflowing Atlantic water are enhanced due to the reduced exchanges between the basins, as the sills (Strait of Gibraltar and Strait of Sicily) are shallower due to the lowered sea level during the Glacial.