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Modelling Mediterranean Climate for mid and early Holocene Time Slices

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During the early Holocene, the Mediterranean circulation has undergone big changes. These changes are reflected in the occurrence of organic-rich marine sediment layers (sapropels) in the eastern Mediterranean, which indicate the presence of oxygen depleted deep waters.

The relative isolation of the basin together with a good coverage of available proxy data make this region an ideal testbed for modelling past climate changes. The work presented here is a first step towards elucidating the mechanisms responsible for the formation of the sapropels.

A regional version of the ocean general circulation model MPIOM has been set up for the Mediterranean. This model was forced with atmospheric data derived from quasi-equilibrium time slice simulations with the coupled atmosphere-ocean-dynamical vegetation model ECHAM5/MPIOM/LPJ. Time slices available are 6000 and 9000 years before present. The model derived river-runoff and ocean hydrography were used as additional forcings, the latter used as boundary condition at the Atlantic margin of the regional ocean model.

The model has been integrated for more than 100 years starting from climatology. The effect of insolation changes on Mediterranean ocean climate is analyzed. Due to the limited length of the simulations, only the upper few hundred meters are in equilibrium with the implied forcing. The increased runoff from the Nile due to the enhanced African monsoon leads to a substantial reduction of the salinity in the Levantine basin. The amplified seasonal cycle with reduced incoming short-wave radiation in winter leads to a general cooling of the upper few hundred meters of the ocean. The effect of the enhanced summer insolation is restricted to the upper ocean. The amplitude of the seasonal cycle of SST is larger. The model results are compared to available proxy data.