MODELLING CHANGES IN EASTERN MEDITERRANEAN OCEAN CLIMATE FOR THE EARLY HOLOCENE

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Abstract
We use the ocean general circulation model MPIOM to simulate the changes in hydrography and circulation for the eastern Mediterranean Sea during the early Holocene 'climatic optimum'.
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During the Holocene, a series of changes in the conditions of the Mediterranean hydrography occurred, essentially led by the orbitally-induced changes in the insolation. This study aims to investigate these changes. We focus on the Mediterranean because this semi-enclosed basin has large-amplitude reactions to external forcings. To understand the sensitivity of the Mediterranean Sea to high- and low-latitude climate forcings and to estimate the response to expected global change, we are modelling the Mediterranean Sea at different time slices of the Holocene. We set up a regional version of the general ocean circulation model MPIOM for the Mediterranean (26 km horizontal resolution, 29 levels). We forced the model with atmospheric data derived from equilibrium time slice simulations with the coupled atmosphere-ocean-dynamical vegetation model ECHAM5/MPIOM/LPJ. The experiments are performed for both time periods 6000 years and 9000 years before present as well as for the pre-industrial conditions (500 years of integration for each). Diverse proxy records available from the marine cores are used for the validation of our simulations. The effect of insolation and fresh water input changes on the Mediterranean ocean climate for the Holocene are analyzed. The amplitude of the SST seasonal cycle is stronger, leading to colder winters with a resulting cooling of the deeper layers. The enhanced summer warming is restricted to the very uppermost layers leading to a strong vertical temperature gradient. For 9000 years BP, the increased Nile runoff (due to the enhanced North-African monsoon) is overcompensated by the missing outflow from the Bosphorus and the location of Aegean deep water formation is shifted westward. For the 6000 years BP, the Nile runoff is enhanced as well and the outflow from the Black Sea is reduced due to drier climatic conditions in SE Europe. The model results are compared to available SST/SSS reconstructions derived from paleoproxy data.

References
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