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High Resolution Paleoclimate Simulations with the COSMO-CLM Model in the Eastern Mediterranean and Middle East

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The Eastern Mediterranean and Middle East region is influenced by multiple large-scale atmospheric circulation patterns including the Indian Summer Monsoon the North Atlantic Oscillation (NAO), the East Atlantic / Western Russia and Scandinavian patterns. The area offers a broad spectrum, both in time and space, of long high-quality instrumental time series, documentary information and natural archives. Yet, recent reviews revealed that paleoclimate modelling with low horizontal resolution cannot fully help to understand the interactions of the multiple atmospheric patterns, the Mediterranean SSTs and connect potential climate impacts that may trigger or contribute to major social-historical events. Thus, there is a need to integrate high-resolution regional climate modelling into paleo applications. Furthermore, such integration will close the gap between the coarse resolution of climate models and the regional to local scale that is covered by the proxy and historical evidence and will enable a better data-model comparison. We use the regional climate model COSMO-CLM (CCLM) in an adjusted (orbital, solar and volcanic forcing, greenhouse gas concentrations and land-use changes) paleoclimate version. Simulations are performed with 0.44° and 0.11° spatial resolution on a domain including the Eastern Mediterranean and the Middle East in time slices of the past 2000 years. Simulations of the present (1979-2019) with this paleoclimate version of CCLM forced by ERA-Interim reanalysis data have shown promising results compared to observational and reanalysis data sets. The mean annual cycles of precipitation and temperature of the Mediterranean are correctly shown with high temperatures and low precipitation during the summer months and lower temperatures and higher precipitation during the winter months. Additionally, the effect of climate change is simulated with increasing temperatures during the last 40 years. Simulations of the present (1979-2019) and past periods (525-575 CE and 1220-1290 CE) forced by the MPI-ESM-LR 'past2k' simulations performed under the CMIP6 protocol will be performed at the next step and first results will be shown in the frame of this conference. The periods are chosen because of high volcanic activity and to study the volcanic influence on climate. Those results are going to be used to link historical events with the regional climate and contribute to a better understanding of the indirect and complex association between climate and society.