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PARALLEL SESSION A : BENEFITS OF DOWNSCALING
A2: MODELS OF THE COUPLED REGIONAL CLIMATE SYSTEM

How can high-resolution representation of the regional seas and aerosols modify regional climate change ? A fully-coupled regional climate system approach to question current CORDEX experimental protocol

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Past and future regional climate change is potentially influenced by many global and regional drivers and, in particular, by various factors within the region of interest such as regional land-sea contrast, high-resolution representation of the topography, regional land-use change, high-resolution sea surface temperature change, regional aerosol load change, ... In the first phase of CORDEX, only part of these regional driving factors has been taken into account in the definition of the experimental protocols for the evaluation, historical and scenario runs. For example, the regional evolution of the SST and of the aerosol load were either not considered (use of constant values) or taken from the low-resolution driving GCMs. Here, we propose to question the limits of the current CORDEX protocol in the frame of historical and scenario simulations, using the Med-CORDEX domain for illustration. More specifically we focus on the impacts of the high-resolution representation of the SST changes and of the aerosol load changes on the projected Euro-Mediterranean climate change.

Twin simulations using the ALADIN-Climate RCM have been performed in addition to the classical CORDEX framework for present and future climate periods. To explore the role of the high-resolution SST changes, a fully-coupled Atmosphere-Ocean-River RCM has been developed for the Mediterranean Sea using an interactive daily coupling frequency. To explore the role of the high-resolution aerosol changes, a fully-coupled Atmosphere-Aerosol RCM has been developed including the interactive representation of the main natural and anthropogenic aerosol species as well as their radiative effects. The results show that the climate change signal of the Euro-Mediterranean region is significantly modified in the twin simulations. For example, the coupled Atmosphere-Ocean-River RCM reduces the Mediterranean SST warming which in turn influences the coastal climate whereas the coupled Atmosphere-Aerosol RCM reveals fine-scale pattern in the aerosol concentration changes inducing regional modifications in surface shorwave radiation and in surface temperature.

Our results question the design of the CORDEX experimental protocol and the preparation of the CORDEX Flagship Pilot Studies. They are also of interest for different communities of regional climate data users (e.g. marine ecosystem-based managers, fisheries, coastal tourism, wind- and solar-energy producers, air quality managers).

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