Session: C4 Poster: TH226A

HyMeX and Med-CORDEX projects: Regional climate system modelling of the Mediterranean region at CNRM, a multi-component approach to study climate variability

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The physical characteristics of the Mediterranean area (complex orography and coast line, strong land-sea contrast, small islands, air-sea coupling, regional winds, cloud-radiation interaction and aerosol-radiation interaction) lead to the recent development of a new generation of regional climate models designed to study the past climate variability and its possible future changes: those new models include interactively the various components of the regional climate system: atmosphere, land surface, vegetation, surface hydrology, rivers and ocean. Following the first coupled Atmosphere-Ocean Regional Climate Models (AORCM) dedicated to the Mediterranean area (Somot 2005; Somot et al. 2008; Artale et al. 2010), different modelling centres developed or are developing Regional Climate System Models (RCSM) also called sometimes Regional Earth System Models (RESM) in the frame of the HyMeX and Med-CORDEX projects. We present here the design and evaluation of the Mediterranean RCSM developed at Meteo-France / CNRM. The model is based on ALADIN-Climate with an horizontal resolution of 50 km for the regional atmosphere component, on the ISBA model (50 km) for the land surface, hydrology and vegetation, on TRIP (50 km) for the rivers and on NEMOMED8 (10 km) for the sea. The effect of the Black Sea is parameterized as an additional river using its water budget. The Nile river and the near-Atlantic ocean characteristics are imposed following observed climatology or reconstruction. All the components are interactively coupled daily and simulations over the last 30-year period (1979-2008) have been performed using reanalysis as lateral-boundary conditions (ERA40 then ERA-Interim). These simulations can be considered as "poor-man" coupled regional reanalysis of the Mediterranean climate system providing high-resolution and temporarily homogeneous fields for the various climate components. An evaluation (mean behaviour, interannual variability, trends) of the various components of these regional hindcast simulations is proposed focusing on the Mediterranean Sea water budget, the intense air-sea exchanges and the deep water mass formation, that are among the main scientific topics of the HyMeX project. A preliminary analysis of the climate variability of these physical processes is also presented. Future plans for regional climate change simulations using the CNRM RCSM in the frame of Med-CORDEX are presented.