Session: C4 Poster: TH228B

MedCLIVAR, Regional ocean climate change scenarios for the Mediterranean Sea: assessing the uncertainties along the 21st century.

Samuel Somot[†]; Florence Sevault; Michel DÈquÈ; Marine Herrmann; Clotilde Dubois; Roland Aznar; Elena Padorno; Enrique Alvarez-Fanjul; Gabriel Jord‡; Marta Marcos; Dami‡ Gomis
[†] Meteo-France / CNRM, France
Leading author: samuel.somot@meteo.fr

Following the IPCC scenarios (Gibelin and DÈquÈ 2003, Giorgi 2006, IPCC 2007, Somot et al. 2008), the climate over the Mediterranean basin is foreseen to become warmer and drier during the 21st century. In terms of density, these two effects may have an opposite impact on the Mediterranean Sea surface waters (warmer and saltier), the winter ocean deep convection, the Mediterranean thermohaline circulation and the local steric sea level change. In this study, we use a suite of regional modeling techniques for the atmosphere-river-ocean regional climate system to assess the possible evolution of the Mediterranean Sea under a changing climate during the 21st century. Following the design described in Somot et al. (2006), eight 140-year long numerical experiments (1961-2100) have been run with a Mediterranean Sea regional ocean models (OPAMED8 or NEMOMED8) forced by varying the boundaries conditions that is to say (i) the air-sea fluxes coming from 50-km regional climate models (two versions of the RCM ARPEGE-Climate), (ii) the Mediterranean river runoff fluxes and Black Sea freshwater inputs and (iii) the near-Atlantic water characteristics. After the spin-up period, a control run (1961-2000) have been carried out for checking the model stability under present climate conditions. Then scenario runs (2001-2100) have been done under the SRES-B1, A1B and A2 scenario forcings. The regional ocean models (OPAMED8 and NEMOMED8) have an horizontal resolution of about 10 km, the regional climate models (ARPEGEv3 and ARPEGEv4) have a resolution of about 50 km over the Mediterranean Sea. The ocean model is forced daily by momentum, water and heat fluxes at the surface. Explicit river runoff fluxes, Atlantic buffer zone and SST relaxation are the other forcings of the ocean models. For the control run, up to 2000, SST as well as greenhouse gas and aerosol concentration are imposed from observed values. The air-sea fluxes come from the RCM and the other forcings are climatologic. Then, beyond 2000, the SRES scenarios are prescribed and the various forcings are extracted from scenario simulations previously run with low resolution coupled GCMs (near-Atlantic water characteristics, SST for the relaxation) or high resolution RCMs (fluxes, river, Black Sea). The 1961-2100 temporal evolution of the air-sea fluxes, the freshwater inputs, the Gibraltar strait transports, the surface water characteristics, the deep-water formation process, the Mediterranean thermohaline circulation, the heat and salt content and the sea level are analyzed. In addition, the 8-simulation ensemble allows to study the impact of the scenario choice (B1, A2, A1B), the regional atmosphere forcing choice, the river and near-Atlantic forcing choice and the regional ocean model choice. One of the main goal of this study is to assess the robustness of previous results obtained either with only one set of regional models and one scenario (Thorpe and Bigg 2000, Somot et al. 2006, Tsimplis et al. 2008) or with the low-resolution CMIP3 models (Marcos et al. 2008). Next steps towards a more robust assessment of the possible evolution of the Mediterranean Sea during the 21st century are: - the use of more diverse regional ocean and atmosphere models in a coordinated international framework - the use of fully coupled Regional Climate System Models including the high-resolution representation of atmosphere, land surface, river and ocean - the use of eddy-resolving ocean models - a better description of the near-Atlantic influence (in particular for the sea level variability) and of the Gibraltar Strait.