Geophysical Research Abstracts
Vol. 17, EGU2015-6418-1, 2015
EGU General Assembly 2015

Climate-aerosol interactions over the Mediterranean region: a regional coupled modelling approach

Pierre Nabat (1), Samuel Somot (1), and Marc Mallet (2)
(1) CNRM-GAME, UMR3589, Toulouse, France (pierre.nabat@meteo.fr), (2) Laboratoire d'Aérologie, Toulouse, France

The Mediterranean basin is affected by numerous and various aerosols which have a high spatio-temporal variability. These aerosols directly interact with solar and thermal radiation, and indirectly with clouds and atmospheric dynamics. Therefore they can have an important impact on the regional climate. This work, located at the boundary between the ChArMEx and HyMeX programs, considers a coupled regional modeling approach in order to address the questions of the aerosol-radiation-cloud interactions with regards to the climate variability over the Mediterranean.
In order to improve the characterization of Mediterranean aerosols, a new interannual monthly climatology of aerosol optical depth has been developed from a blended product based on both satellite-derived and model-simulated datasets. This dataset, available for every regional climate model over the Mediterranean for the 1979-2012 period, has been built to obtain the best possible estimate of the atmospheric aerosol content for the five species at stake (sulfate, black carbon, organic matter, desert dust and sea salt particles). Simulation ensembles, which have been carried out over the 2003-2009 period with and without aerosols, show a major impact on the regional climate. The seasonal cycle and the spatial patterns of the Mediterranean climate are significantly modified, as well as some specific situations such as the heat wave in July 2006 strengthened by the presence of desert dust particles. The essential role of the Mediterranean sea surface temperature is highlighted, and enables to understand the induced changes on air-sea fluxes and the consequences on regional climate. Oceanic convection is also strengthened by aerosols. In addition, the decrease in anthropogenic aerosols observed for more than thirty years is shown to significantly contribute to the observed Euro-Mediterranean climatic trends in terms of surface radiation and temperature.
Besides, an interactive aerosol scheme has been developed in the atmospheric model ALADIN-Climate in order to better understand aerosol processes at the daily scale. This scheme shows its ability to represent correctly the aerosol patterns over the Mediterranean, especially with regards to dust outbreaks that were measured during the ChArMEx/TRAQA field campaign. Moreover, the use of a prognostic aerosol scheme instead of a monthly climatology enables to better reproduce the daily variations of surface radiation and temperature and related extremes. This also leads to changes in the mean climate, insofar as aerosol variations and their effects depend on weather regimes and cloud cover.