Geophysical Research Abstracts
Vol. 19, EGU2017-10270-1, 2017
EGU General Assembly 2017

Dust aerosol-radiation-clouds-precipitation interactions over the Mediterranean

Chiara Valentini (1), Rocío Baró (1,2), Laura Palacios-Peña (1), Juan José Gómez-Navarro (1), José María López-Romero (1), Juan Pedro Montávez (1), and Pedro Jiménez-Guerrero (1)

(1) Universidad de Murcia, Department of Physics, Murcia, Spain (pedro.jimenezguerrero@um.es), (2) Chemical Weather Forecasts, ZAMG, Vienna, Austria

Dust intrusions from African desert regions have an impact on the whole Mediterranean Basin and its climate. They cause an anomalous increase of aerosol load in the tropospheric column and have the potential to change the energy fluxes in the Earth-atmosphere system by modifying cloud microphysical properties, such as the cloud liquid water path (CLWP), cloud fraction (CFRAC), cloud top temperature (CTT), droplet number concentration (CDNC), or cloud particle size distribution (CPSD). Through aerosol-radiation-cloud interactions, dust can modify convective and large-scale precipitation under certain conditions, thus affecting the hydrological cycle. In this work, desert dust outbreaks occurred in October2010 over the whole Mediterranean Basin has been studied with the objective of quantifying the influence of including dust interactions in a regional on-line coupled climate/chemistry model on several variables: convective precipitation, CLWP, CFRAC and CDNC. The focus is set on characterizing the impacts of aerosol indirect effects on the radiative budget. A set of three WRF-Chem simulations differing only in the inclusion (or not) of aerosol-radiation (ARI) and the aerosol-cloud interactions (ACI) has been carried out. The comparison between simulation results show a satisfying agreement when compared with satellite observations, and supports the skills of the model to estimate the African dust contribution over the Mediterranean. Differences between the ARI+ACI and the base case (not including aerosol-radiation-cloud interactions) suggest variations around +/- 15 mm/day in convective precipitation for several events. For instance, considering ARI+ACI leads to a generalized reduction of the cloud liquid water path (-50 kg/kg over the areas affected by the dust aerosols) and modified patterns of clouds (differences between -65% and +35% in the CFRAC). Also, the low estimated significance of the changes observed between the diverse simulations over certain areas, estimated as the ratio between the change signal (difference between ARI or ARI+ACI and the base case) and the variability modelled in the base case, points to the need for further works to accurately characterize the aerosol-cloud interactions and reduce their uncertainty.