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Regional modeling of Saharan dust events using the RegCM model

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As one of the major components of the atmospheric aerosol, mineral dust plays an important role in the Earth's climate system. Dust has been found to redistribute the radiative energy from the surface to the dust loaded atmospheric column by cooling the surface while heating the dust layer. The resulting stabilizing effect on the vertical structure of the atmosphere can affect cloud formation and the dust production itself. In addition, dust may change the size number of cloud condensation nuclei (CCN) and thus the optical and precipitation properties of clouds. All these impacts are difficult to quantify due to the highly variable spatio-temporal distribution of mineral dust and uncertainties determining its optical and physicochemical properties (IPCC 2001).
The distribution of dust has been modeled in many studies using general circulation models (GCMs). However, because the aerosol effects are especially important at the regional scale, the recent development of high-resolution regional climate models (RCMs) offers useful tools to assess the regional impacts of aerosols. Compared to global climate models (GCMs), the relatively high-resolution and detailed physical parameterizations by RCMs are particularly suitable to describe the complexity of aerosol processes (Solmon et al., 2006). Furthermore, the results from regional models are well suited for comparisons with measurements of individual events.
Dust radiative effects on climate are likely to be especially important at the regional scale, thus RCMs can be particularly useful tools to investigate the regional climate effects of dust outbreaks (Zakey et al., 2006).
In this work, we will use the regional climate model RegCM (Version 3.1), developed at the Abdus Salam International Centre for Theoretical Physics (ICTP), Trieste, to investigate dust event impacts over Mediterranean sites. The Sahara desert is the largest dust source on Earth, providing at least half of the emitted dust (Washington et al., 2003). This dust is mainly transported across the Atlantic, but nevertheless, an immense part of about 80-120 Tg per year is also advected toward the Mediterranean basin and Europe (Collaud Coen et al., 2004).
The main aim of this contribution is to quantify Sahara dust effects on the radiative forcing over different Mediterranean sites. We emphasize that the peculiarity of this work is that it is mainly devoted to study locally the climate effects of aerosols during dust outbreaks occurred over different sites on the Mediterranean.
The effects of Sahara dust events on ground temperatures and precipitations will also represent an important objective of this work.