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Implementation of a new emitted dust size distribution in a RCM over the Mediterranean region: application to the impact of aerosols on the Mediterranean climate

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Aerosols can have very important effects on the climate through radiative forcing. Given their huge spatial and temporal variability, studies need to be done at a regional scale. This study focuses on the Mediterranean basin, which is a region where aerosols of different sources accumulate: industrial and urban aerosols from Europe, biomass burning from Eastern Europe, dust and carbon aerosols from Africa, and sea salt from the sea. The present study has been carried out with the regional climate model RegCM 4, which contains an interactive aerosol scheme.

Since dust aerosols are prevailing in terms of mass over this region, dust parameterization is essential. The dust emission scheme consists of two processes. First, wind lifts and transports the largest particles, which is called saltation. Then, when these saltated particles fall down, their impact ejects dust particles from dust aggregates in the soil, which is called sandblasting. In the initial parameterization, the emission depends on the individual kinetic energy of the aggregates striking the surface. However, this parameterization tends to overestimate fine dust fraction. A new emission distribution based on an analogy with the fragmentation of brittle materials is tested.

Two simulations have been carried out over the year 2008, in order to study the difference between both distributions, for episodic dust outbreaks over the Mediterranean Sea and for seasonal means. As a result, comparisons between these RegCM simulations, satellite data (from MODIS and CALIOP) and in-situ observations (from AERONET network) have shown more relevant results with the new distribution in terms of Aerosol Optical Depth, both at the episodic and seasonal scales. This new distribution can therefore be used to estimate the impact of aerosols on the Mediterranean climate. With a longer simulation (over the period 2000-2009), we will present the consequences on direct radiative forcing, as well as on surface climate variables (shortwave radiation, temperature and precipitation).