



Modelling an exceptional desert dust transport toward Portugal on February 2017

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The terrain surrounding the Sahara desert is formed by some mountains ranges, as the Atlas mountain system in the northern edge of the desert and the Hoggar Mountains in Southern Algeria. Such orography, jointly with atmospheric circulation, plays an important role in the mobilization and transport of desert dust over medium and large distances. This study explores the interaction between complex terrain and atmospheric circulation in order to better understand an exceptional desert dust outbreak affecting Portugal in February 2017. The Meso-NH model is able to represent the atmospheric motions in different scales, and has been implemented with a rather complete parametrization package of physical processes in the atmosphere. The capability of the model to simulate dust emission is also explored. The on-line dust emission parametrization type is taken from the distribution of emitted dust of SURFEX with no need to use chemistry to activate dusts. A set of two simulations was performed for the period between 16 February at 0000 UTC to 24 February 1200 UTC, with the Meso-NH model configured in a single domain at 10 km horizontal resolution and 300x360 grid points. The experiments were defined as a) control experiment (CTRL), and b) dust experiment (DUST). From the large domain simulations, it was possible to assess the source of dust and its mobilization over Western Sahara desert, namely over the Northern part of Mauritania and Mali and Eastern part of Algeria. The formation of a cyclonic circulation at the surface favoured the dust uplifting. Such a surface low merged with a cut-off low that moved southward over the Iberian Peninsula and remained centred in the north of Morocco. Such pattern intensified the northward flow found at 700 hPa toward the Atlas Mountains range, inducing the dust transport above 3 km altitude. As expected, the simulations showed the ability to assess important details about the atmospheric circulation not resolved by low density of observations over the domain considered. Furthermore, the simulations were able to show the way that the atmospheric ingredients were brought together to produce the exceptional transport of desert dust toward Portugal. The orographic effects playing an important role in dust mobilization (convergence and cyclogenesis at the surface) and atmospheric circulation to the maintenance of the dust transport have been highlighted. Such event were responsible for the transport of high amount of dust toward the Iberian Peninsula.

