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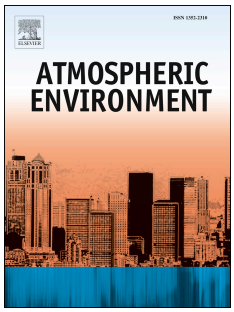

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ACCEPTED MANUSCRIPT

Modeling natural dust emissions in the central Middle East: Parameterizations and Sensitivity

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Abstract

Middle East Area and especially the central part is a dust dominated domain and therefore estimation of natural dust emissions is critical. Aim of this study is to assess the sensitivity of state-of-the art dust modules, utilized in multiple modelling schemes, and especially of their three main components; namely the horizontal mass flux, the drag partition and the sandblasting efficiency. To accomplish this, several simulations with the Natural Emission MOdel (NEMO), driven by the Weather Research and Forecasting (WRF) model, were made for the period April-June 2015 focusing in the central Middle East (CME). First, the meteorological model was evaluated over the study period, as well as during a Shamal event, showing a satisfactory performance on wind speed which is the most important meteorological variable inserted in the dust modules. Second, dust emissions were found to be a few tenths of $\mu g/m^2 s$ on average, while the daily amount exceeds 1000 $mg/m^2 day$. Over the studied period, the fluxes range from 15 to 750 g/m^2. The total emissions in CME were estimated with the NEMO's basic configuration at 139 Tg. The most active areas are associated with clay content ranging between 17-25%, highlighting the importance of soil texture on the definition of the dust sources. During a Shamal event in the second half of June 2015, the mean dust emission fluxes reached up to several hundreds of $\mu g/m^2 s$, contributing 21 Tg in CME. Few such events could cover a large portion of the dust emissions. Finally, concerning the sensitivity of the total emissions, the drag partition scheme has the largest effect, followed by sandblasting efficiency and horizontal mass flux. The total dust emissions budget, among the 16 simulations was found to be in the range of 21-139 Tg, with the choice of the drag partition scheme to be mandatory for the narrowing of the total emissions in CME.

Keywords: desert dust, natural emissions, Natural Emissions Model, WRF, Shamal, Middle East

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