



## **Estimation of Dust Emission from the Western Coastal Plains of Arabian Peninsula**

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This study is aimed at quantifying local-scale dust emission from the coastal areas of western Arabian Peninsula. The dust emitted from these areas is frequently deposited directly to the Red Sea, acting as an important component of the nutrient balance of marine ecosystems. Most chemicals including iron, phosphorus, and nitrogen are introduced to the Red Sea with airborne dust. This process is especially significant for the oligotrophic northern Red Sea, where nutrients from the Indian Ocean cannot reach and the nutrient supply from land river discharge is negligible.

The dust deposition to the Red Sea associated with major dust storms was recently estimated to be about 6 Tg/yr, but this estimate does not account for local, small-scale dust outbreaks occurring during fair weather conditions or moderate winds. The seasonality and the magnitude of this nutrient supply are largely unknown. In the present study, we quantify dust emissions using the fine-scale off-line version-4 of the Community Land Model (CLM4) with the high-resolution datasets as input parameters. We examine the model sensitivity to the spatial resolution of input land cover and vegetation data, and compare the results with weather station observations and reanalysis to choose the best model configuration. The model results are shown to be in reasonable agreement with station visibility measurements and the frequency of dust event reports. To improve the spatial characteristics of dust emission, we apply two state-of-the-art dust source functions. We found that the source function based on measurements from SEVIRI satellite substantially improves the simulation results, being in good agreement with both reanalysis data and station measurements.

We identify the major dust source hot-spot areas over the coastal plain and analyze the seasonal and diurnal variability of dust emissions. The annual dust generation from the 145000 km<sup>2</sup> coastal area reaches 6 Tg/yr. Roughly half of emitted dust could be deposited to the Red Sea, which is comparable to the deposition from major dust events. A substantial part of this dust is generated in the northern coastal plain and is predominantly deposited to the northern Red Sea, providing essentially the sole supply of nutrients to the oceanic ecosystems.