



Modelling dust export from the Saharan desert: seasonal variability and climatic influences

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Mineral aerosol is an important player in the global climate system, and impacts on radiation, clouds, and marine phytoplankton, among others. For several single spectacular outbreaks of dust from the Saharan desert the meteorological situation has been studied in detail, while little is known about the synoptic-scale atmospheric processes behind dust mobilisation on seasonal to annual time scales. However, a complete understanding of the meteorological features associated with dust mobilisation is crucial for assessing the impact of past and present climate variability on the atmospheric dust burden, and hence the signal in sedimentary and other paleo-records of dust. Here we present a Lagrangian modelling study of dust export from the Saharan desert to the African coast during the year 2000.

Using ECMWF reanalysis data, a large number of 5-day backward trajectories have been calculated every 6 hours for the year 2000. The trajectories were started on a regular-spaced vertical grid following the coastline of northern Africa. Along the trajectories, dust mobilisation points were determined by means of objective selection criteria, involving atmospheric conditions, soil properties, and vegetation cover. By means of this methodology, dust export was mapped onto a curtain along the North African coast at very high spatial resolution, and the location of associated dust mobilisation areas was identified. In addition, a climatology of mid-latitude cyclones was used in order to identify patterns in the concurrence of dust export and such weather events.

For the year 2000, dust export along different sections of the North African coast is found subject to the respective governing atmospheric features. At the west coast, dust export follows a clear seasonality in magnitude and vertical extent, with several large dust outbreak events superimposed. Dust export along the African west and east

coast is mainly governed by the ITCZ and the East African monsoon, respectively. In contrast, along the Mediterranean coast, dust export is sporadic throughout the year. Several large dust export events are related to upper-level induced southerly flow, and to Mediterranean cyclones moving towards the North African coast. Besides providing detailed insight into the temporal and spatial patterns of Saharan dust export during one year, our study can also contribute to a better understanding of dust signals in proxy records.