Geophysical Research Abstracts
Vol. 18, EGU2016-5547, 2016
EGU General Assembly 2016

Dust emission and transport over Iraq associated with the summer Shamal winds

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In this study, we investigate the diurnal evolution of the summer Shamal wind (a quasi-permanent low-level north-westerly wind feature) and its role in dust emission and transport over Iraq, using ground-based and space-borne observations together with a numerical simulation performed with the
mesoscale model Meso-NH. A 6-year dataset from the synoptic stations over Iraq allows establishing the prominence of the link between strong near surface winds and reduced visibility in the summer.
The detailed processes at play during Shamal events are explored on the basis of a Meso-NH simulation for a given, representative case study (25 June-3 July 2010). The Shamal exhibits an out-of-phase relationship between the surface wind and winds in the lower troposphere (typically 500 m above ground level), the maximum surface wind speeds being observed during the day while in altitude the maximum wind speeds are observed at night. The daytime near surface winds, at the origin of dust emission, are associated with the downward transfer of momentum from the nocturnal low-level jet to the surface due to turbulent mixing after solar heating commences each day. For the first time, an estimate of the dust load associated with summer Shamal events over Iraq has been made using aerosol optical depths derived from the Spinning Enhanced Visible and Infrared Imager, the Moderate Resolution Imaging Spectroradiometer, and the simulation. The dust load exhibits a large diurnal variability, with a daily minimum value of 1 Tg around 0600 UTC and a daily peak of 2.5 Tg or more around 1500 UTC, and is driven by the diurnal cycle of the near surface wind speed. The daily dust load peak associated with the summer Shamal over Iraq is in the same order of magnitude as those derived from simulations downstream of the Bodélé depression in Chad, known to be the world's largest dust source.
Keywords: Dust, Low Level Jet, Shamal winds, Middle East, dust sources.