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Observation of dust emission and transport over Iraq and northwest Iran associated with winter Shamal

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Dynamical processes leading to dust emission over Syria and Iraq, in response to a strong winter Shamal event as well as the subsequent transport of dust over Iraq and northwest Iran, are analyzed on the basis of a case study (22-23 February 2010) using a suite of ground-based and space-borne remote sensing platforms together with modeling tools. Surface measurements on 22 February show a sharp reduction in horizontal visibility over Iraq occurring shortly after the passage of a cold front (behind which the northwesterly Shamal winds were blowing) and that visibilities could be as low as 1 km on average for one to two days in the wake of the front. The impact of the southwesterly Kaus winds blowing ahead (east) of the Shamal winds on dust emission over Iraq is also highlighted. Unlike what is observed over Iraq, low near-surface horizontal visibilities (less than 1 km) over northwest Iran are observed well after the passage of the cold front on 23 February, generally in the hours following sunrise. Ground-based lidar measurements acquired in Zanjan show that, in the wake of the front, dust from Syria/Iraq was transported in an elevated 1 to 1.5 km thick plume separated from the surface during the night/morning of February. After sunrise, strong turbulence in the developing convective boundary layer led to mixing of the dust into the boundary layer and in turn to a sharp reduction of the horizontal visibility in Zanjan. The timing of the reduction of surface horizontal visibility in other stations over northwest Iran (Tabriz, Qom and Tehran) is consistent with the downward mixing of dust in the PBL just after sunset, as evidenced in Zanjan. This study shades new light on the processes responsible for dust emission and transport over Iraq and northwest Iran in connection with winter Shamal events. Enhanced knowledge of these processes is key for improving dust forecasts in this region.