Saharan dust intrusion monitoring. Part 2: Evaluation of potential dust impact on surface

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ABSTRACT

A general work focused on the study of Saharan dust intrusions is presented as a case study of air masses advected from the Saharan region to the Canary Islands and the Iberian Peninsula (IP). This work is divided in two parts in order to examine two relevant and different aspects of this study. Each one is separately submitted. This second one presents the evaluation of potential dust impact on surface once the Saharan dust intrusion arrives at the Southern IP. In this case, ground-level in-situ measurements together with AERONET columnar-integrated data and closest-to-surface backtrajectory analysis, as well, are used for that purpose. The dust detection, identification and vertical structure analysis were described in the part 1.

The observations were performed on 14 March 2008 (1-day dusty episode) in two of those three Spanish stations, where the dust intrusion coming from the Saharan region was monitored (see Part 1). Both of them are located in the Southern IP within the dust-influenced area: the Atmospheric Sounding Station 'El Arenosillo' (ARN) at the SE and the Granada station (GRA) at the SW of the IP.

Backtrajectory analysis reveals that the closest-to-surface air masses are coming directly from Northern Africa, whereas those masses ending at 3-km carrying the dust plume are coming from the considered Sahara-Tenerife-IP pathway (see Part 1). Rather low particle sedimentation is expected to occur directly from the dust 3-km height plume. Therefore, dust particles registered at ground level are not related to deposition processes for particles of that dust plume with low potential impact on surface. However, dust incidence exists, being more significant in the SE region (GRA) respect to the SW area (ARN). Differences on particle deposition processes are observed in both sites by using the temporal evolution of the total volume particle concentration for discrete size ranges. They are due to the particular dust transport pattern occurred over each station: particles detected in ARN would be the result of a gravitational deposition process, while those in GRA would be mostly influenced by their horizontal movement. AERONET volume size distributions ($VSD^{AERONET}$) were compared to those obtained from the most coincident in time ground-level in-situ measurements (VSD^{GL}). The effective radius was calculated for each VSD datasets. The obtained results ($r_{eff}^{AERONET} > r_{eff}^{GL}$) are opposite to those reported by Müller et al. (2010) ($r_{eff}^{AERONET} < r_{eff}^{GL}$), where AERONET and airborne (at 2-3 km height) in-situ measurements were performed. Differences between AERONET and in-situ measurements show a clear dependence on height of the dust particle VSD. That is reflected by the different in-situ measurements platform used, either ground-level or airborne. Further vertical size-resolved observations are needed for evaluation of the impact on surface of Saharan dust arrivals to the IP.

REFERENCES

Müller et al., J. Geophys. Res. 115, D07202, doi:10.1029/2009JD012520, 2010.