Desert dust observations: EO needs for assimilation/validation purposes within a high-resolution dust regional reanalysis

Desert Dust Key Factor in Mediterranean region

Desert dust particles transported from the Northern part of Africa is one of the major natural component of the total aerosol load into the Mediterranean Basin. It has been recently assessed that desert dust can be highly risky close to the source regions, but still have societal impacts in the Mediterranean, affecting health, air quality, solar energy and aviation.

Desert Dust in Mediterranean region

Model reanalysis can be a key factor for better understanding and estimating these impacts and their evolution in time, following climate change and desertification processes.

The ERA4CS DustClim (DUST storms assessment for the development of user-oriented CLIMate services in Northern Africa, Middle East and Europe) project aims to make a significant step in this field by producing an advanced and thoroughly evaluated decadal high-resolution dust reanalysis for the Northern Africa, the Middle East and Europe.

Long-term Reanalysis: EO needs and requirements

OPERATIONAL FORECAST MODELS

Each model is defined by 3 main aspects, which rely on modelization parameters and external information sources

- Meteo fields
- Dust Scheme: size distribution
- Emission parameters

Many operational models routinely provide and compare their forecasts under SDSWAS - WMO umbrella

https://sds-was.aemet.es/

REANALYSIS SCHEME

EO data for assimilation

Dust Model

EO data for evaluation

The evaluation dataset allows to check and quantify the improvement due to the assimilation of devoted further EO datasets

Expected improvement in the description of desert dust distribution

General Requirements

- Dust spiecation
- Referenced data
- Long-term dataset
- Open access

+ Dense geographical coverage
+ Temporal coverage following the DA scheme

+ Harmonized datasets
+ High quality data
+ Representative datasets

Dust EO review: gaps identification

A review of the existing datasets has been carried out in the framework of DustClim showing the main gaps into the desert dust EO. One of the main limitation in setting up the reanalysis is the limited number of dust specialized observations useable for the assimilation: long term and well assessed aerosol optical depth are available for space-borne sensors, but only few have in the operational mode a product specific for dust particles.

It is possible to obtain dust optical depth through research mode algorithm in some cases (as for IASI or CALIOP) or estimated under some assumptions for other cases (as for MODIS coarse fraction or MISR aspherical particle component).

EO are also key players for the reanalysis evaluation. The review of the existing ground based observations underlines the needs for long term coordinated observations under international initiative like European Research Infrastructures and collocated in situ and profiling measurements. However, satellite borne EOs are a key player also for the model evaluation because of their spatial and temporal coverage. Even on this aspect the aerosol speciation is essential: many new products give the possibility of investigating the presence of desert dust but there is currently the need of harmonizing the aerosol classification or whenever this is not possible to identifying transiating rules among the wide range of existing classifications.

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