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Use of visible normalized SEVIRI images in a WMO Sand and Dust Storm Warning System

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During sand and dust storms, large amounts of dust are mobilized and transported far away from desert sources. The most prominent example of this transport is the export of desert mineral dust, under favourable conditions, from the Sahara desert to zones as far as the Amazon region. Sand and dust storms represent serious natural hazards, causing numerous negative impacts. There are impacts of dust on aviation safety, health, ground transport, agriculture and climate.

In 2006 the World Meteorological Organization has established the Sand and Dust Storm Warning System (SDS WS) to improve capabilities for more reliable sand and dust storm forecasts and monitoring. The main objective of this project is to establish a WMO-coordinated global network of SDS forecasting Centres delivering products useful to a wide range of users for reducing the impacts of SDS. Spain is implementing the WMO for SDS WS Regional Centre for Europe, North Africa and Middle East. This Regional Centre will deal with both operational and scientific aspects related to atmospheric dust monitoring and forecasting.

The Dust Regional Atmospheric Model (DREAM) provides daily dust forecasts for North Africa and Europe. Satellite observations are used to monitor dust source regions and dust plume intrusions. Some problems have been identified when satellite images are used to detect dust. The main one is that it can be confused with water/ice clouds. On the other hand, the Visible/IR images of SEVIRI (Spinning Enhanced Visible and Infrared Imager), on board Meteosat Second Generation (MSG), are not as optimal for the viewing of dust as SEAWIFS and MODIS ones with their additional short-wavelength channels. However, the SEVIRI 15-minute loop images can detect small dust plumes as subtle changes from one image to the next.

The reflectivity on visible wavelengths is hampered by the fact that land surfaces are highly variable in nature and are characterised by a wide range of albedos. Moreover, there are seasonal variations according with the vegetation cover. Thus, correlation of spatial patterns at different times is proposed to obtain reflectance's masks. First, the radiances of 0.6, 0.8 and 1.6 μm SEVIRI are normalised in order to obtain the same illumination conditions. Then, the mean and deviation masks are built. Finally, these masks help to enhance the VIS images providing an indirect measure of the presence of atmospheric aerosols. The enhancements of the three SEVIRI channels will be used in the SDS operational monitoring as, for example, in the composition of RGB images.