Geophysical Research Abstracts
Vol. 21, EGU2019-13704, 2019
EGU General Assembly 2019

The influence of the atmospheric environment on the colour of dust aerosol in SEVIRI Desert Dust RGB infrared imagery

Jamie Banks (1), Anja Hünerbein (1), Bernd Heinold (1), Helen Brindley (2), Hartwig Deneke (1), and Kerstin Schepanski (1)

(1) Leibniz Institute for Tropospheric Research, Leipzig, Germany (banks@tropos.de), (2) Space and Atmospheric Physics Group, and NERC National Centre for Earth Observation, Imperial College London, London, UK

The apparent colour of atmospheric dust in SEVIRI (Spinning Enhanced Visible and InfraRed Imager) "Desert Dust" false-colour RGB infrared imagery is dependent not only on the properties of the dust itself but also on the background atmospheric environment. Within this widely-used class of satellite imagery, dust is distinguished by characteristic pink colours, the precise shading of which is dependent on the dust optical thickness, optical properties, and layer heights. The shading is also dependent on the atmospheric water vapour content, and at low dust loadings it is also influenced by the surface thermal emissivity and skin temperature.

In order to investigate the sensitivity of the imagery to the atmospheric parameters, synthetic satellite imagery is created using the dust transport model COSMO-MUSCAT in conjunction with the radiative transfer model RTTOV. These simulate the SEVIRI brightness temperatures at 8.7, 10.8, and 12.0 μm, the channels which underpin the false-colour imagery.

Due to the use of the T_{B120}-T_{B108} difference to define the red beam of the imagery, the red colour component is particularly sensitive to the presence of water vapour. Of the three SEVIRI channels used, the atmospheric transmittance at 12.0 μm is most reduced by the water vapour content, while the atmosphere has its highest transmittance in the 10.8 μm channel. As a result of this, variations in the skin temperature have most influence on the 10.8 μm brightness temperatures compared to the other channels, while variations in the column moisture have most influence on the 12.0 μm channel.

Investigating the sensitivity of the composite imagery to environmental parameters over a six-month summertime simulation period, dust displays its most characteristic pink colours in the synthetic imagery when the atmosphere is dry and when the dust layer is high, both of which boost the red beam of the imagery. When the atmosphere is particularly moist, the red beam is suppressed and hence more murky purple colours are apparent, due to the enhanced discrepancy in transmittances between the 10.8 and 12.0 μm channels through moister atmospheres. Dust at higher altitudes is analogous to dust being in a dry atmosphere, due to the reduced water column above a high-altitude dust layer compared to a low-altitude dust layer. Low-altitude (<1 km) dust is regularly almost invisible in the Desert Dust imagery. Dust is most apparent in the synthetic imagery when the atmosphere is dry and when the dust is at a high altitude. We hope that users of the Desert Dust imagery will find this analysis helpful in understanding the contribution of environmental factors to the colour of dust in the imagery.