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The influence of infrared dust optical properties on the colour of SEVIRI Desert Dust RGB imagery

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Satellite imagery of atmospheric mineral dust is sensitive to the optical properties of the dust, governed by the mineral refractive indices, particle size, and particle shape.
'Desert Dust' RGB images from the Spinning Enhanced Visible and InfraRed Imager (SEVIRI) are widely used to visualise the presence of dust in the atmosphere, using the 8.7, 10.8, and 12.0 micron channels. In order to investigate the sensitivity of the colour of the imagery to assumed dust properties, simulations of mineral dust in the SEVIRI imagery have been performed using the COSMO-MUSCAT (COSMO: COnsortium for Small-scale MOdelling; MUSCAT: MUltiScale Chemistry Aerosol Transport Model) dust transport model and the Radiative Transfer for TOVS (RTTOV) program.
Here we introduce the technique and present comparisons with SEVIRI measurements and retrievals for daytime hours during the six months of the Junes and Julys of 2011-2013. Using the assumption that dust particles are spherical or spheroidal, wavelength- and size-dependent dust extinction values are calculated for a number of different dust refractive index databases. It is found that spherical particles do not appear to be sufficient to describe fully the resultant colour of the dust in the infrared imagery. Comparisons of SEVIRI and simulation colours indicate that of the dust types tested, the dust refractive index dataset produced by Volz (1973) shows the most similarity in the colour response to dust in the SEVIRI imagery. It is also found that the thermal imagery is most sensitive to intermediately-sized particles (radii between 0.9 and 2.6 μm): larger particles are present in too small a concentration, as well as with insufficient contrast in extinction between wavelength channels, to have much ability to perturb the resultant colour in the SEVIRI dust imagery.