Geophysical Research Abstracts
Vol. 19, EGU2017-13308, 2017
EGU General Assembly 2017

Longwave radiative effects of Saharan dust during the ICE-D campaign

Jennifer Brooke (1), Stephan Havemann (1), Claire Ryder (2), and Debbie O'Sullivan (1)

(1) Met Office, Atmospheric Radiation Research Group, Exeter, United Kingdom (jennifer.brooke@metoffice.gov.uk), (2) Department of Meteorology, University of Reading, UK

The Havemann-Taylor Fast Radiative Transfer Code (HT-FRTC) is a fast radiative transfer model based on Principal Components. Scattering has been incorporated into HT-FRTC which allows simulations of aerosol as well as clear-sky atmospheres. This work evaluates the scattering scheme in HT-FRTC and investigates dust-affected brightness temperatures using *in-situ* observations from Ice in Clouds Experiment – Dust (ICE-D) campaign. The ICE-D campaign occurred during August 2015 and was based from Cape Verde. The ICE-D campaign is a multi-disciplinary project which achieved measurements of *in-situ* mineral dust properties of the dust advected from the Sahara, and on the aerosol-cloud interactions using the FAAM BAe-146 research aircraft.

ICE-D encountered a range of low (0.3), intermediate (0.8) and high (1.3) aerosol optical depths, AODs, and therefore provides a range of atmospheric dust loadings in the assessment of dust scattering in HT-FRTC. Spectral radiances in the thermal infrared window region (800 – 1200 cm^{-1}) are sensitive to the presence of mineral dust; mineral dust acts to reduce the upwelling infrared radiation caused by the absorption and re-emission of radiation by the dust layer. ARIES (Airborne Research Interferometer Evaluation System) is a nadir-facing interferometer, measuring infrared radiances between 550 and 3000 cm^{-1}. The ARIES spectral radiances are converted to brightness temperatures by inversion of the Planck function.

The mineral dust size distribution is important for radiative transfer applications as it provides a measure of aerosol scattering. The longwave spectral mineral dust optical properties including the mass extinction coefficients, single scattering albedos and the asymmetry parameter have been derived from the mean ICE-D size distribution. HT-FRTC scattering simulations are initialised with vertical mass fractions which can be derived from extinction profiles from the lidar along with the specific extinction coefficient, k_{ext} (m^2/g) at 355 nm. In general the comparison between the lidar retrieval of aerosol extinction coefficients and *in-situ* measurements show a good agreement.

The root mean square of the brightness temperature residuals in the window region for observations (ARIES) minus model simulations for i) clear-sky, ii) HT-FRTC 'line-by-line' scattering and, iii) HT-FRTC fast scattering are calculated. For the ICE-D case studies mineral dust impacts on the brightness temperature of the background on the order of 1 – 1.5 K.