Geophysical Research Abstracts
Vol. 21, EGU2019-5683-1, 2019
EGU General Assembly 2019

Optical properties of aged smoke aerosol over the south Atlantic Ocean

Jonathan Taylor (1), Kate Szpek (2), HuiHui Wu (1), Paul Williams (1,3), Justin Langridge (2), Michael Cotterell (4), Cathryn Fox (2), Jim Haywood (2,4), and Hugh Coe (1)

(1) Centre for Atmospheric Science, University of Manchester, Manchester, United Kingdom (jonathan.taylor@manchester.ac.uk), (2) Met Office, Exeter, United Kingdom, (3) National Centre for Atmospheric Science, University of Manchester, Manchester, United Kingdom, (4) University of Exeter, Exeter, United Kingdom

We present a detailed investigation into the links between black carbon microphysics and bulk optical properties in aged biomass burning plumes over the remote South Atlantic Ocean. 28 research sorties were flown out of Ascension Island during the CLARIFY campaign in August – September 2017, using the UK FAAM Bae-146 Airborne Research Aircraft.

A single-particle soot photometer was used to measure black carbon mass and mixing state. These data were then input into different optical models to calculate bulk optical properties including mass absorption coefficient and single-scattering albedo. We compare these bottom-up calculations to multi-wavelength bulk measurements of absorption and extinction using photoacoustic and cavity-ringdown instruments on the aircraft's EXSCALABAR optics rack.

The black carbon in these aged biomass burning plumes was found to be thickly coated throughout the whole campaign. The measured mass absorption coefficients were correspondingly high, with some measurements in the region of 12 m^2g^{-1} at 514 nm, which represents a 50% enhancement compared to expected values for uncoated black carbon. This enhancement was independent of wavelength, and the measured absorption Angstrom exponents were always close to 1, suggesting the enhancement was due to a lensing-type effect rather than absorption by brown carbon. We will discuss the strengths and weaknesses of different optical models such as core/shell, coated spherule, volume mixing, and semi-empirical hybrid models, in achieving optical closure in this environment.