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Role of brown carbon in the aerosol absorption over the south-east Atlantic region

Alexandre Siméon, Jean-Christophe Péré, Fabien Waquet, and Isabelle Chiapello
Univ. Lille, CNRS, UMR 8518 - LOA - Laboratoire d'Optique Atmosphérique, F-59000 Lille, France.

The absorption properties of particles are key parameters in the estimation of their climate impact, especially in cloudy scenes. For example, the radiative heating induced by absorbing aerosols over stratocumulus can modify convection processes and alter the vertical development of the cloud. This process, known as the semi-
direct effect, can be important in the South East Atlantic region, where biomass burning plumes are frequently transported above one of the 3 most
persistent stratocumulus layer on the planet. However, this aerosol feedback on clouds is difficult to apprehend by climate models because of the difficulty in accurately representing the aerosol absorption. Recent studies highlighted that some organic compounds called "brown carbon" (BrOC), emitted mainly by biomass burnings, can absorb significantly in the ultraviolet-visible-near-infrared spectrum.
The main objective of this work is to study the role of brown carbon in the aerosol absorption properties, with a focus on biomass burning particles transported above clouds. The methodology uses the coupled meteorology-chemistry WRF-CHEM model associated with a detailed state-of-the-art biomass burning emission inventory and different sets of remote sensing observations. In particular, new satellite inversion algorithms characterizing aerosol absorbing properties in the 340-870 nm spectral range over clear and cloudy atmosphere are used. In a first step, an analysis of the optical clouds and aerosol properties for the summer 2008 over the South-East Atlantic region is proposed. The total and above-clouds aerosol optical thickness as well as the cloud top altitude and cloud thickness are rather well reproduced by WRF-CHEM, suggesting that the transport of aerosols from the sources region over the south-east Atlantic stratocumulus layer is well reproduced. In a second step, the brown carbon content of aerosol plume is specifically analysed. Current literature indicates that brown carbon absorbs more efficiently UV-blue radiation than pure soot (BC). The idea is to exploit this specificity to constrain the proportion of BC and BrOC in the simulated aerosol plume. Specifically, comparisons of the spectral dependence of the aerosol absorption coefficient retrieved from remote sensing measurements in the 340-870 nm to the one simulated for different proportions of BC and BrOC are used to estimate the amount of brown carbon present in the aerosol plume.