Geophysical Research Abstracts
Vol. 19, EGU2017-13404, 2017
EGU General Assembly 2017

Impact of long-range transport pollution on aerosol properties over West Africa: observations during the DACCIWA airborne campaign

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Southern West Africa (SWA) is a region highly vulnerable to climate change. Emissions of anthropogenic pollution have increased substantially over the past decades in the region and are projected to keep increasing. The region is also strongly impacted by important natural pollution from distant locations. Biomass burning mainly from vegetation fires in Central Africa and mineral dust from the Saharan and Sahel-Sudan regions are advected by winds to the SWA region especially in summer. Both biomass burning and mineral dust aerosols scatter and absorb solar radiation and are able to significantly modify the regional radiative budget. Presently, the potential radiative impact of dust and biomass burning particles on SWA is unclear due to inadequate data information on the aerosols properties and vertical distribution.

In the framework of the Dynamics-Aerosol-Chemistry-Cloud Interactions in West Africa (DACCIWA) project, an unprecedented field campaign took place in summer 2016 in West Africa. The ATR-42 research aircraft operated by SAFIRE performed twenty flights to sample the local air pollution from maritime traffic and coastal megacities, as well as regional pollution from biomass burning and desert dust. The aircraft was equipped with state of the art in situ instrumentation to measure the aerosol optical properties (CAPS, nephelometer, PSAP), the aerosol size distribution (SMPS, GRIMM, USHAS, PCASP, FSSP) and the aerosol chemical composition (SP2, AMS). A mini backscattered lidar system provided additional measurements of the aerosol vertical structure and the aerosol optical properties such as the particulate depolarization ratio. The CHIMERE chemistry and transport model has been used to characterize the source area and the long-range transport of dust and biomass burning plumes.

Here, we investigate the aerosol microphysical, chemical and optical properties of biomass burning and dust aerosols transported in SWA. In particular the following questions will be addressed: (i) what are the differences in the aerosol optical properties and vertical distribution in SWA during intense biomass burning and dust events ? (ii) what is the range of mass extinction efficiencies and single scattering albedo for these events and what explains their variability ? (iii) what is the range in aerosol size distribution in biomass burning and dust layers and how does this vary with plume age ?