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Retrieval of aerosol properties using airborne polarimetric and sun-photometer observations during the AEROCLO-sA field campaign in Namibia.

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Aerosols directly impact the Earth's climate by scattering and absorbing solar and telluric radiations and indirectly by modifying clouds properties and lifetime. In order to improve the retrieval of aerosol and cloud properties, the European Space Agency (ESA) and EUMESAT developed a new spaceborne imaging radiometer with Multi-viewing, Multichannel, Multi-polarization capabilities. This instrument, called 3MI, will be launched in 2021 on-board the METOP-SG satellite. A 3MI airborne simulator, OSIRIS, has been developed at Laboratoire d'Optique Atmospherique (LOA, France) in order to evaluate new retrieval algorithms for 3MI. The total and polarized radiances sampled in several channels by OSIRIS between 440 and 2200 nm, and the new retrieval algorithms, developed by Dubovik et al. (2014), Waquet et al. (2013) and Peers et al. (2015), allow to simultaneously retrieve the aerosol and surface properties over land and ocean, or the aerosol and cloud properties in case where the aerosols are above clouds. The main retrieved aerosol properties are the optical thickness, the single scattering albedo, the particle size, shape and the complex refractive index at different wavelength.

Recent airborne measurements performed over Namibia during the AEROCLO-sA campaign in August and September 2017 allowed to sample aerosol events associated with strong optical thickness in biomass burning aerosols (up to 1.5 at 500 on the 5th of September). These particles were typically observed over bright deserts or above low-level stratocumulus clouds. Mineral dusts were also sometimes observed in the boundary layer. 10 flights have been achieved with the Falcon-20 of SAFIRE during the AEROCLO-sA campaign.

The application of these retrieval algorithms to OSIRIS measurements during these 10 scientific flights is reported in the present study. Aerosols are retrieved for different vertical atmospheric structures and above different scenes including well-mixed plumes or strong stratification as well as decoupled or mixed aerosol-cloud layers. Comparison of different remote sensing sensor observations such as the ones provided by the airborne sun-photometer PLASMA, and the LNG lidar (LATMOS), also on-board the Safire FA20, will allow the validation of aerosol and cloud inversions from OSIRIS measurements. Sun-photometer optical thickness measurements and particles size distribution retrievals (Torres et al., 2017) performed during descents in spiral and above clouds will be notably presented. Comparison with available satellite retrievals (e.g. SEVIRI, MODIS or IASI) will be also considered.