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New in-situ measurements of microphysical cloud properties in West Africa – Impact of aerosol on low level clouds

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Southern West Africa is currently a region of major socio-economical changes. Population increases, urbanization and economic growth in this region are accompanied by increasing anthropogenic emissions of trace gases and aerosols from domestic fires, industry and biomass burning. This not only gives rise to negative health effects, but could also have an imprint on atmospheric composition and clouds, weather and climate. To examine the role of Dynamics-Aerosol-Chemistry-Cloud Interactions in West Africa, the DACCIWA campaign (Flamant et al., BAMS, 2017) took place in West Africa in 2016, combining aircraft and ground based measurements, satellite remote sensing, as well as weather and climate modeling activities. During the aircraft campaign in June and July 2016 the three research aircraft the DLR Falcon, the SAFIRE ATR 42 and the BAS Twin Otter were based in Lomé (Togo) and performed measurements of cloud properties, aerosols and trace gases over a region for which thus far only very little atmospheric in-situ data is available. Here we report on new in-situ measurements of trace gases (CO), aerosol and microphysical cloud properties (concentration and size) over Côte d'Ivoire, Ghana, Togo and Benin to investigate the aerosol effect on low level clouds. Enhanced concentrations of CO and accumulation mode aerosol were measured within the boundary layer and the lower troposphere downwind of the major cities Lomé (Togo), Abidjan (Côte d'Ivoire) and Accra (Ghana). Continental inland measurements off the Togolese and Beninese coast show a significant contribution from the densely populated rural areas in the hinterlands to the anthropogenic emissions in that area. Those emissions affect cloud microphysical properties of low clouds. Data from the Cloud and Aerosol Spectrometer (CAS) onboard the DLR Falcon show an increase in cloud droplet number density and a decrease in cloud particle effective diameter in the polluted city and urban outflow area. This novel cloud, aerosol and trace gas data set can be used for validation and evaluation of weather prediction and climate models in the West African region.