Results from ORACLES-2016: observed biomass burning aerosol properties over the southeast Atlantic Ocean and the relationship to meteorology

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The Southeast Atlantic Ocean (SEA), with seasonal biomass burning (BB) smoke plumes overlying persistent stratocumulus cloud deck, offers an excellent natural laboratory to make the observations necessary to understand the complexities of aerosol-cloud-radiation interactions. The first field deployment of the NASA ORACLES (ObseRvations of Aerosols above CLouds and their intEractionS) campaign was conducted in September of 2016 out of Walvis Bay, Namibia. During this deployment, two NASA aircraft (a P-3 and an ER-2) were flown with a suite of aerosol, cloud, radiation, and meteorological instruments for remote-sensing and in-situ observations.

In this talk, I will first present results from an intercomparison of the different instrument retrievals for the 2016 flights, with a specific focus on the measures of aerosol absorption. In ORACLES, data collected by eight different instrument teams are used to derive aerosol properties over this region by independent methods. We focus on the single scattering albedo (SSA), a measure of the relative absorption versus total extinction by aerosols, as the main comparable property between all methods. I will also discuss comparisons of the retrieved aerosol absorption parameters, as well as the agreement and the variability seen between different instruments, and spatially over the study region.

Another important factor in understanding aerosol radiative effects is how the magnitude of these effects may be modified by meteorological conditions. I will next describe observations collected from the P-3 aircraft (from near-surface up to 6-7km) which show a strong correlation between the in-situ pollution indicators (carbon monoxide and aerosol properties) and atmospheric water vapor content, seen at all altitudes above the boundary layer. This condition is seen to persist over all flights, with minimal detrainment during advection from the continental source. In exploring the potential causal factors behind and implications of this relationship, we see indications that convective dynamics over the continent likely contribute to this elevated signal, but neither meteorological reanalysis nor trajectory analysis fully capture the magnitude and vertical structure of the observed elevated signal. Finally, I will discuss the radiative implications of the observed correlations, a topic of ongoing analysis in ORACLES: understanding the mechanisms which cause water vapor to covary with plume strength is important to quantifying the radiative effects (direct and semi-direct) of biomass burning aerosol in the region.