Measurements of Aerosol Absorption during Ultra-light Global Circumnavigation, Arctic and Mediterranean Campaigns

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We performed airborne measurements of aerosol light absorption with ultra-light aircraft during four flight campaigns: around the world (2012, 2016), over the Arctic (2013), and the Mediterranean (2017). A small ultra-light aircraft operated at altitudes around 3000m and up to 8900m ASL over all continents and oceans.

The aircraft carried specially-developed high-sensitivity multi-wavelength aethalometers, measuring aerosol absorption with high temporal resolution and sensitivity. We present examples from flights, and, using the aerosol absorption dependence on the wavelength, we show that aerosols produced during biomass combustion can be transported to high altitude in high concentrations. We show good agreement between models and measurements for long-range transport of pollution into the Arctic and the transport of mixtures of mineral dust and black carbon (BC) regionally. We show by measurements that the assumption of a simple linear relationship between BC concentration and forcing underestimates the direct forcing by about a quarter.

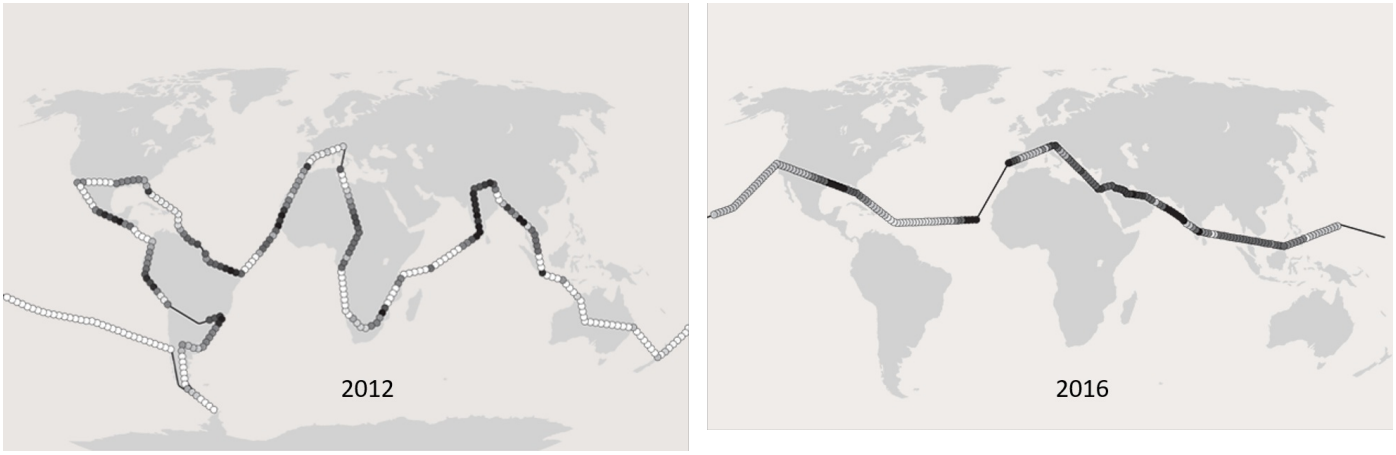

Figure 1. Flights around the world in 2012 and 2016.

Figure 2. A layer of polluted air over the river Congo.