Measurements of Black Carbon during the Green Light World Flight 2012

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Combustion of carbonaceous fuels for the production of energy inevitably results in the emission of gas and particulate air pollutants. A large fraction of the emitted particles are light absorbing carbonaceous aerosols. These exhibit very large optical absorption across the spectrum. The most measured component is aerosol **black carbon** – a unique primary tracer for combustion emissions as it has no non-combustion sources. It is inert and can be transported over great distances (Bodhaine, 1995; Sciare 2009), even though its lifetime in the atmosphere is relatively short and measured in days or weeks. Black carbon affects the optical properties of the atmosphere when suspended, leading to local heating or cooling, depending on the processes involved (Menon 2002, Hansen 2000). It is recognized as the second most important cause of global warming with a contribution between 20% and 40% with a significant regional heterogeneity (Ramanathan 2008). There is a complex interplay between the local pollution, regional transport and the climate effects. These are major issues that need to be resolved on a global and regional level. Measurements of black carbon in global background locations are scarce (Bodhaine 1995, Hansen 1989) and only recently have there been in-situ measurements performed by airborne platforms (Spackman 2011).

We will demonstrate that a lightweight aircraft can provide valuable information on black carbon concentrations, their regional heterogeneity and vertical profiles with a minor payload and for a fraction of the cost associated with large airborne platforms. We have modified the aircraft to include an aerosol inlet and will use an Aethalometer to measure black carbon. Measurements will be performed throughout the flight and will include regions, where no or very little measurements have taken place, such as Antarctica, Africa and over the Atlantic and Pacific oceans. Several Global Atmospheric Watch stations lie close to the flight path. Black carbon concentrations from the Aethalometer onboard the aircraft will be compared to the ones at these stations. Plumes of pollution will be encountered and using back trajectories possible source regions will be identified. The results will therefore be not only the concentrations of black carbon at the elevation of the flight but also the source locations.

References

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