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Airborne measurements of Black Carbon using miniature high-performance Aethalometers during global circumnavigation campaign GLWF 2012

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While ground-level measurements of atmospheric aerosols are routinely performed around the world, there exists very little data on their vertical and geographical distribution in the global atmosphere. This data is a crucial requirement for our understanding of the dispersion of pollutant species of anthropogenic origin, and their possible effects on radiative forcing, cloud condensation, and other phenomena which can contribute to adverse outcomes. Black Carbon (BC) is a unique tracer for combustion emissions, and can be detected rapidly and with great sensitivity by filter-based optical methods. It has no non-combustion sources and is not transformed by atmospheric processes. Its presence at altitude is unequivocal. Recent technical advances have led to the development of miniaturized instruments which can be operated on ultra-light aircraft, balloons or UAV's.

From January to April 2012, a 'Pipistrel Virus' single-seat ultra-light aircraft flew around the world on a photographic and environmental-awareness mission. The flight track covered all seven continents; crossed all major oceans; and operated at altitudes around 3000 m ASL and up to 8900 m ASL. The aircraft carried a specially-developed high-sensitivity miniaturized dual-wavelength Aethalometer, which recorded BC concentrations with very high temporal resolution and sensitivity (see Reference below). We present examples of data from flight tracks over remote oceans, uninhabited land masses, and densely populated areas. Back-trajectories are used to show transport of polluted air masses. Measuring the dependence of the aerosol absorption on the wavelength, we show that aerosols produced during biomass combustion can be transported to high altitude in high concentrations.

1. ___, Carbon Sampling Takes Flight, Science 2012, 335, 1286.
2. G. Močnik, L. Drinovec, M. Lenarčič, Airborne measurements of Black Carbon during the GLW Flight using miniature high-performance Aethalometers, accessed 8 January 2013
http://www.cgsplus.si/portals/0/WGF/wglfPage.htm