



Estimates of aerosol black carbon concentrations at the tropopause, from measurements taken on board commercial aircraft

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Absorption of sunlight by aerosol black carbon in the atmosphere leads to major climate forcing. Black carbon (BC) is emitted from all combustion of carbonaceous fuels and there are extensive measurements of BC concentrations at ground level, demonstrating its extreme spatio-temporal variability. However, the distribution of BC in the vertical column is not routinely measured due to the expense and complexity of operating a research aircraft, although this information is critical for detailed modeling of BC's contribution to climate change.

Black carbon is a major component of aircraft engine exhaust. Most long-range aircraft travel at cruise altitudes in the range of 10 to 12 km: consequently, there may be considerable release of BC into this layer of the atmosphere from which the rate of removal may be slow. By use of a "micro Aethalometer", it is possible to measure BC in real time in the passenger cabin of a commercial aircraft during flight. Since there are no combustion sources of BC within the cabin, the measurements represent a lower limit on the concentration of BC in the outside air which is compressed and pumped into the passenger cabin to provide ventilation during flight.

After aggregation of data collected during many long-distance flights, we present results to estimate lower bounds on the concentration of BC in this altitude range of the atmosphere that is selectively impacted by aircraft exhaust emissions.

Keywords : Aerosol Black Carbon; Vertical Profile; Upper Troposphere, Lower Stratosphere