

Solo Flight Tracks Global Black Carbon

On 8th January 2012 a tiny ultra-light aircraft left Ljubljana in Slovenia on a mission to circumvent the globe using the smallest amount of fuel per distance flown whilst recording ambient levels of Black Carbon (BC) – one of the most important measures of air quality in terms of both human health and climate change. UK based particulate monitoring specialist Jim Mills from Air Monitors says the project, which is known as ‘GreenLight WorldFlight’, “is tremendously exciting because it will, for the first time, reveal data on Black Carbon over an enormous area, and such valuable temporal and spatial data will provide greatly improved insight into the ways in which BC emissions could be addressed.”

“There is a complex interplay between local pollution, regional transport and climate effects and these are major issues that need to be resolved on a global and regional level.”

Black Carbon

Black Carbon (BC) is a term describing the fine particles that are produced as the result of incomplete combustion of fuels. A large fraction of the emitted particles are light absorbing carbonaceous aerosols which exhibit very large optical absorption across the spectrum. The most measured component is aerosol black carbon – a unique primary tracer for combustion emissions because it has no non-combustion sources. BC is inert and can be transported over great distances even though its lifetime in the atmosphere is relatively short and measured in days or weeks. Whilst suspended, it affects the optical properties of the atmosphere, leading to local heating or cooling, depending on the processes involved.

After carbon dioxide, BC is recognised as the second most important cause of anthropogenic global warming; contribution between 20% and 40% with a significant regional heterogeneity. However, BC is particularly important because it only stays in the atmosphere for a relatively short period of time, so efforts to reduce BC could have an almost immediate impact on global warming.

BC is also a major human health issue because despite dramatic

reductions in airborne particulates in recent decades, problems persist and many scientists now believe that finer particles may be the major cause because they are able to travel deeper into the respiratory system.

There is a complex interplay between local pollution, regional transport and climate effects and these are major issues that need to be resolved on a global and regional level. Measurements of BC in global background locations are scarce and only recently have there been in-situ measurements performed by airborne platforms.

‘GreenLight WorldFlight’

Designed and manufactured in Slovenia, the Pipistrel Virus aircraft is being piloted by Matevž Lenarčič, a biologist, environmentalist and photographer. The plane has been modified to include an aerosol inlet for an Aethalometer to measure aerosol Black Carbon. Measurements will be performed throughout the flight and will include regions where very little or no measurements have previously taken place, including parts of Antarctica, Africa and over the Atlantic and Pacific oceans.

The Aethalometer was specially designed by the company Aerosol d.o.o.

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Monitoring global Black Carbon (photo: sz/bobo)

– the manufacturing and development facility behind the Magee Scientific Aethalometers. Magee Scientific is the US company that originally developed the aethalometer technology. Dr. Griša Mocnik, Chief Scientific Officer and Director of Aerosol d.o.o., says “The instrument was equipped with an isokinetic inlet and had to outperform almost anything we had made before; so far, it has measured very low levels over the oceans and sometimes surprisingly high concentrations of light absorbing aerosols over land. So the design was a tradeoff between measuring both low and high concentrations with no user intervention.

“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.”

The raw data with a time resolution of 30 min is available with a time delay of about a day at:

www.cgsplus.si/portals/0/WGF/index.htm

Other Research

The importance of BC has been recognised by the European Commission which is funding a new research project (www.Carbotraf.com) that aims to create a method, system and tools for adaptively influencing traffic flow in real-time to reduce CO₂ and BC emissions caused by road transport in urban and inter-urban areas.

The two host cities Glasgow and Graz, were chosen due to their ability to manage traffic flows and utilise real-time air quality monitoring systems from Air Monitors (UK) and a decision support system provided by IBM Inc.

Further information on the ‘GreenLight WorldFlight’ project is available at www.worldgreenflight.com.



Fitting an aerosol inlet for an Aethalometer to measure Black Carbon

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