



Black carbon particles in the northern hemispheric lowermost stratosphere

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In a recently published PNAS article (Ditas et. al, 2018) we demonstrate the impact of wildfires on the abundance and aging of black carbon in the lowermost stratosphere (LMS) measured between Europe and the US. Although these particles underwent a long-range transport in high altitudes at about 10 – 12 km, their influence on the atmosphere is limited by dry- and wet-scavenging. Therefore, in this follow up study we aim to address following questions:

How effective is the longitudinal transport of Canadian biomass burning emissions in the northern hemisphere?

To which degree do wildfires in Siberia influence BC particle properties in the LMS?

Until now, there is no global characterization of black carbon particles in the upper troposphere and lowermost stratosphere. Our new study will deal with 45 IAGOS-CARIBIC flights between the US (between Munich and San Francisco, Mexico City, Los Angeles) and Asia (between Munich and Tokyo, Beijing, Hong Kong, Shanghai). The data, measured with a modified SP2 instrument located in the instrumented airfreight container on board a Lufthansa passenger aircraft, shows clear differences in black carbon mass concentrations, core diameter and coating thickness above the Atlantic Ocean and the Asian continent. Based on different case studies (including related flights in both directions), we found a decreasing influence of Canadian wildfires on the amount of black carbon in the LMS towards the east. Especially, over Europe there seems to be a sink of these large and thickly coated biomass burning black carbon aerosol particles. However, does this mean that low-pressure systems are responsible for the wet-scavenging of these biomass burning emissions? Or are these emissions transported towards the pole or more southern regions with a possible dilution with background air? We will try to address these questions with our regular flights and the extensive data set. But anyhow, it seems that the influence of Siberian wildfires on the abundance of black carbon in the LMS is less pronounced compared to the huge impact above the Atlantic Ocean, and globally the abundance and mixing state of black carbon particles in the LMS strongly depend on region and season.

Reference:

J. Ditas, N. Ma, Y. Zhang, D. Assmann, M. Neumaier, H. Riede, E. Karu, J. Williams, D. Scharffe, Q. Wang, J. Saturno, J. P. Schwarz, J. M. Katich, G. R. McMeeking, A. Zahn, M. Hermann, C. A. M. Brenninkmeijer, M. O. Andreae, U. Pöschl, H. Su, Y. Cheng (2018): Strong impact of wildfires on the abundance and aging of black carbon in the lowermost stratosphere, PNAS, 115, doi: <https://doi.org/10.1073/pnas.1806868115>