AGU FALL MEETING
San Francisco | 12–16 December 2016

A41C-0051: Vertical Distribution of Black Carbon during DC3 and the Influence of Thunderstorms on the Transport of Biomass Burning Layers into the Free Troposphere

Thursday, 15 December 2016
08:00 - 12:20
Moscone South - Poster Hall

Biomass burning events emit large amounts of black carbon (BC) which can be redistributed vertically by atmospheric processes. Aerosol lifetime increases with altitude, hence the vertical transport of BC further increases its effects on the absorption of solar radiation and on clouds. Here we show BC measurements in biomass burning layers from the DC3 field experiment over the central US in summer 2012. Due to the abundance of wildfires in 2012, biomass burning layers were seen throughout the free troposphere from the top of the boundary layer up to the UTLS region. This enabled us to compare biomass burning layers at different altitudes before and after uplift into the upper troposphere, in some cases from the same fire. Biomass burning layers close to the fires were found to be thick plumes with a sharp upper edge up to 5 km altitude. In the proximity of thunderstorms, the layers reached to higher altitudes up to 7 km. In the upper troposphere, around 11 km altitude, thin, horizontally extended BC-containing aerosol layers were found which were rich in ozone due to entrainment of stratospheric air. We performed comparisons of the microphysical properties of BC in biomass burning layers at different altitude. While the BC mass size distributions in the free troposphere show large variations, the BC mass size distributions found in layers in the UTLS at 11 km altitude are surprisingly similar. We conclude that cloud processing removes predominantly large and thickly coated particles, leaving behind the nearly uniform BC mass size distribution found in the upper tropospheric biomass burning layers. Our observations constrain the possible convective processing of BC-containing aerosol and help scale the potential of thunderstorms to transport BC to the UTLS.

Authors

Katharina Heimerl *
German Aerospace Center (DLR)

Ludwig Maximilians Universität

Bernadett Weinzierl
German Aerospace Center (DLR)

University of Vienna

Daniel N Sauer
German Aerospace Center DLR Oberpfaffenhofen

Daniel Fütterer
German Aerospace Center (DLR)

Michael Lichtenstern
German Aerospace Center (DLR)

Hans Schlager
German Aerospace Center DLR Oberpfaffenhofen

Joshua Peter Schwarz
NOAA Boulder

Milos Z Markovic

Cooperative Institute for Research in Environmental Sciences

Piccaro Inc.

Anne Elizabeth Perring

Cooperative Institute for Research in Environmental Sciences

Johnathan W Hair

NASA Langley Research Center

Carolyn F Butler

NASA Langley Research Center

Marta A Fenn

NASA Langley Research Center

Heidi Huntrieser

German Aerospace Center DLR Oberpfaffenhofen

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