J8.3

DC3 Highlights from the Perspective of the German DLR Falcon Aircraft

Tuesday, 8 January 2013: 11:45 AM

More

DC3 Highlights from the Perspective of the German DLR Falcon Aircraft
Room 14 (Austin Convention Center)

***H. Huntrieser**, Deutsches Zentrum für Luft und Raumfahrt, Oberpfaffenhofen, Germany; and M. Lichtenstern, A. Minikin, T. Pucik, M. Scheibe, H. Aufmhoff, A. Roiger, B. Rappenglück, L. Ackermann, and H. Schlager*

The Deep Convective Clouds and Chemistry (DC3) field experiment was carried out in summer 2012 over the central and eastern parts of the United States. The main focus of the project was on thunderstorms and their impact on the chemical composition of the upper troposphere. A number of different platforms, as radars and lightning detection networks, were used to study the electrical, microphysical and dynamical behaviour of deep convection. In addition, research aircraft performed chemical in situ measurements in the inflow and anvil outflow regions of the storms. Three aircraft were operating from a base in Salina (Kansas): (1) the NCAR-GV, (2) the NASA-DC8, and (3) the Deutsches Zentrum für Luft- und Raumfahrt (DLR) Falcon. This paper focuses on the results from the latter German aircraft. Within the time frame 29 May – 14 June 2012, 13 Falcon flights were performed targeting fresh and aged thunderstorm outflow over Colorado, Wyoming, Kansas, Oklahoma, Texas, Missouri and Arkansas. The anvil outflow was mainly probed between 10 and 12 km altitude with a number of in situ trace gas and aerosol instruments. This paper highlights the most interesting results from the measurements of NO, CO, O3, CO2, CH4, SO2, and VOCs. Special interest is dedicated to the contribution of lightning-produced NO to the total upper tropospheric NO budget. Different types of thunderstorm formations were investigated by the Falcon aircraft as multicells, supercells, squall lines, mesoscale convective systems (MCSs), and mesoscale convective vorticities (MCVs). Some of these systems were probed together with the two U.S. research aircraft. According to all aircraft, especially high NO mixing ratios (Falcon measured ~5 nmol mol-1) were observed over an extended area in the fresh outflow from a huge, very lightning active MCS over SW-Missouri/NW-Arkansas on 11 June. Elevated NO mixing ratios (~3 nmol mol-1) were also observed in the fresh outflow from a squall line located over SE-Colorado/SW-Kansas on 12 June and in vicinity of a supercell over northern Texas on 30 May. An unusual high rate of positive strokes was observed within the squall line on 12 June. Most Falcon research flights were dedicated to the fresh anvil outflow, however a few flights were also focusing on the aged outflow. On 8 June, almost whole Kansas was predicted to be covered by aged lightning-produced NO from storms active the evening before over eastern Colorado and western Nebraska. The Falcon probed the anvil outflow ~18-24 hours after the mature thunderstorm activity and observed elevated NO mixing ratios in the range of 1 nmol mol-1 in cloud free air in the upper troposphere. Furthermore, VOC probes can be used as a chemical clock to determine the air mass age more precisely. The elevated NO measured in the anvil outflow is the sum of lightning-produced NO and NO transported upward from the polluted boundary layer (BL) with the convection. Different tracers as CO, CO2, CH4 and partly SO2 and O3, can be used to estimate the amount of NO transported from the BL. The remaining lightning-produced NO amount in single midlatitude/subtropical thunderstorms during DC3 can then be scaled with the actual flash rate and the global lightning frequency to roughly estimate the annual global amount of lightning-produced NO. This number can be compared to our results from previous thunderstorm campaigns carried out in midlatitude, subtropical and tropical regions over Europe, South America, Africa and Australia.
Supplementary URL:

See more of: Initial results from the Deep Convective Clouds and Chemistry (DC3) project III
See more of: Sixth Conference on the Meteorological Applications of Lightning Data

<< Previous Abstract | Next Abstract >>

Start

Browse by Day

At-A-Glance

Author Index

Meeting Information

When:
January 05 - 10, 2013
Where:
Austin, TX