

A chemical characterisation of North American pollutant plumes over Europe and a 15-year climatology of global warm conveyor belt transport

A. Stohl, H. Huntrieser, O. Cooper, S. Eckhardt, C. Forster, P. James, J. Heland, H. Mannstein, H. Schlager, W. Junkermann, F. Arnold, H. Aufmhoff, S. Wilhelm

Warm conveyor belts (WCBs), associated with mid-latitude cyclones, are the major mechanism of lifting airmasses from the boundary layer into the upper troposphere in the extratropics. The talk will present a 15-year global climatology of the distribution and frequency of WCBs and their variation with climate indices, such as the North Atlantic Oscillation index. It is found that WCBs often draw their inflow from the polluted continental boundary layers of Asia and North America. The pollutants, once transported into the upper troposphere, are then exposed to fast intercontinental transport.

During the project CONTRACE, aircraft measurements with the research aircraft Falcon were done over Europe in order to detect pollution plumes from North America that were lifted by WCBs and were subsequently transported in the middle and upper troposphere to Europe. North American pollution layers were detected several times during the first CONTRACE campaign, allowing – for the first time – a detailed chemical characterization of intercontinental transport plumes lifted by WCBs. CO and CO₂ were strongly enhanced, and ozone was also increased by 5-10 ppb in these plumes. In contrast NO_x and NO_y were very low. Concentrations of hydrocarbons and other chemical constituents are currently analyzed.