4.086 OH and HO2 concentration observations in the upper troposphere inside and outside of Asian monsoon influenced air..

Early Career Scientist

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Abstract:

The Asian monsoon convectively transports pollutants like volatile organic compounds (VOCs), NO_X, and SO_2 from the boundary layer over South Asia into the upper

troposphere where they can potentially enter the stratosphere, or be dispersed globally throughout the troposphere. Therefore, it is crucial to understand the oxidizing capacity of this system and its impact on pollutant degradation and aerosol formation. The Hydroxyl radical (OH) plays a central role and is the most important oxidizing molecule in the atmosphere. During the OMO-ASIA campaign in the summer of 2015, HO_X (OH and HO_2) was measured onboard the High Altitude Long-Range Research Aircraft (HALO). Two laser-induced fluorescence instruments based on the fluorescence assay by gas expansion technique (LIF-FAGE) were installed, the AIR-LIF instrument from Forschungszentrum Jülich GmbH and the HORUS instrument from the Max Planck Institute for Chemistry, Mainz. To measure the chemical background of OH potentially produced inside HORUS from highly oxidized VOCs, an Inlet Pre-injector (IPI) system was used. This was the first time an IPI system was implemented within an airborne LIF-FAGE instrument measuring HO_X. Inside the Asian monsoon outflow total HO_X concentrations did not increase significantly compared to outside. However, OH concentrations were on average 37% higher inside the anticyclone. This is mainly attributable to increased NO_X levels within the anticyclone with a significant NO source from lightning. This strong shift of HO_X towards OH results in accelerated oxidation rates of pollutants, implying that the Asian monsoon anticyclone acts like an atmospheric purifier in addition to a pollution pump. The CAABA-MECCA box model was used to test our current understanding of HO_X chemistry in the upper troposphere. Constraining the model with measurements from OMO-Asia has provided insight into the extent of differences in the contribution and composition of HO_X sources, sinks and cycling in and outside the anticyclone.