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The dynamic of upper tropospheric CH_4 and CO influenced by the Asian monsoon anticyclone

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The trace gas transport in the upper troposphere through the Asian monsoon anticyclone (AMA) was investigated during the aircraft campaign OMO (Oxidation Mechanism Observations) in summer 2015. The German research aircraft HALO (High Altitude and Long Range Research Aircraft) performed flights over the Arabian Sea, the Arabian Peninsula and the Mediterranean Sea. Here we investigate the distribution of methane (CH_4) and carbon monoxide (CO), measured with the IR-laser absorption spectrometer TRISTAR and simulated with the EMAC atmospheric chemistry climate model.

Due to enhancement of CH_4 mixing ratios in connection with the AMA, a methane threshold was used to separate between background and monsoon influenced air masses. Overall the mixing ratios increase about 72.1 ppb (CH_4) and 20.1 ppb (CO) in the in situ data and about 24.0 ppb (CH_4) and 14.7 ppb (CO) in the simulated data between background and AMA influence. During OMO the position of the AMA can be distinguished into four modes: a central mode, a Tibetan mode and twice a 2-anticyclone mode. The modes are observed in the model data as well as in the in situ CH_4 mixing ratios but less in CO, because the increase is most obvious in CH_4. Additional outflow events out of the AMA were observed, thus air masses with enhanced trace gas concentrations influence the upper troposphere also outside the AMA, which leads to an extended region being impacted by the Indian summer monsoon.