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Pollution trace gas distributions in the Asian monsoon UTLS derived from measurements of the airborne imaging limb sounder GLORIA during the StratoClim campaign

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We will present trace gas measurements obtained by the airborne imaging limb sounder GLORIA (Gimballed Limb Observer for Radiance Imaging of the Atmosphere) instrument that has been operated on the Geophysica research aircraft in area of the Indian subcontinent with basis in Kathmandu, Nepal during the StratoClim campaign in July/August 2017.

We will show retrievals of two-dimensional trace-gas distributions derived from GLORIA observations in the UTLS (Upper Troposphere Lower Stratosphere) region during the Asian monsoon. Targeted gases are, amongst others, O₃, HNO₃, PAN, C₂H₂, and HCOOH. We will present an analysis of retrieval performance including diagnostics of spatial resolution and an estimated error budget.

In our contribution, we compare these GLORIA measurements with results of the atmospheric models EMAC (ECHAM/MESSy Atmospheric Chemistry) and CAMS (Copernicus Atmosphere Monitoring Service) reanalysis and discuss the influence of non-methane volatile organic compound emissions by sensitivity simulations with the EMAC model. Using trajectories from the models ATLAS and TRACZILLA, measured pollution trace gas plumes are connected to possible sources of origin. Due to the high convective activity in the region of the Asian monsoon, both trajectory sets consider vertical transport by convection, however in a different manner.

We show that there are very delicate structures of pollutant trace gases in the Asian monsoon UTLS, and that atmospheric models have difficulties in reproducing these structures, which is likely to be caused by insufficient vertical transport from convection in meteorological fields or by missing sources in the emission inventories used by the models.