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Deep convective influence on the UTLS composition in the Asian Monsoon Anticyclone region: 2017 StratoClim campaign results

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The StratoClim stratospheric aircraft campaign, taking place in summer over the Nepalese region, provided a wide dataset of observations of air composition inside the Asian Monsoon Anticyclone (AMA). To improve the understanding of the role of penetrating overshoot in the AMA region, we exploit the TRACZILLA Lagrangian simulations, computed on meteorological fields from ECMWF (ERA-Interim and ERA5) at 3h and 1h resolution and using both kinematic and diabatic vertical velocity approaches. The synergy with high-resolution observations of convective cloud top from the MSG1 and Himawari geostationary satellites is used to individuate the convective sources.

To evaluate the capability of the trajectory system to reproduce the transport in the UTLS we compare the simulations with the observed trace gases concentration. The ERA5 simulations appear to provide a higher consistency with observed data than ERA-Interim and show a better agreement between the diabatic and kinematic results. The best performance is given by the ERA5 with diabatic transport and, adopting this setting, we analyze the transport condition during the 8 flights of the campaign.

The aircraft sampled different convective plumes, often carrying pollutant compounds up to the UTLS level. The highest observed concentration of trace gases had been linked to fresh convective air (younger than a few days) coming from China, Pakistan and the North Indian region.

A vertical stratification is observed in the age of air: up to 15 km, the age of air is less than 3 days and these fresh air masses make up nearly the entire totality of the air composition. Above, a transition layer is identified between 15 km and 17 km (close to the tropopause), where the convective influence is still dominant and the ages range from one week to two. Finally, above this

layer, the convective influence rapidly decreases toward zero and the mean air age increase to 20 days and more.

This study quantifies the contribution of direct injection of deep convection on the UTLS composition based on the aircraft measurements. Preliminary results of the upscale analysis based on the trajectories-satellites system will also be presented.