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Investigating chemical and dynamical processes in the Asian Monsoon UTLS using in-situ and satellite observations of carbon monoxide (CO) and carbonyl sulfide (OCS)

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The UTLS is characterized by significant gradients in trace gas mixing ratios that arise from i) mixing of different fractions of tropospheric and stratospheric air and ii) photochemical processing as air rises from the troposphere to the stratosphere (particularly in the tropics). We use satellite and in-situ measurements of two different tracers to investigate these processes in the region of the Asian Monsoon Anticyclone (AMA): carbon monoxide (CO) and carbonyl sulfide (OCS).

CO is a short-lived tracer with a photochemical lifetime of $\sim$1 – 4 months. CO mixing ratios are sensitive to both photochemical depletion and inmixing of stratospheric air masses. OCS, on the other hand, can be regarded as photochemically inert in the UTLS (significant photochemical destruction of OCS takes place only in the tropical pipe above $\sim$ 22 km altitude). Therefore, OCS is sensitive only to stratospheric inmixing. Based on observed vertical profiles of the two gases in different positions relative to the core of the AMA, we set two hypotheses:

1. In and directly above the AMA core, the composition is dominated by photochemical processing
2. Further away from the AMA core, mixing processes become more important.

This implies significant active net transport/ascend of upper tropospheric air into the stratosphere close to the AMA core and a more bi-directional transport regime elsewhere.