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# Mixing processes in tomographically imaged filaments of Asian Monsoon outflow during the PHILEAS campaign

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The composition of the UTLS, especially with respect to radiatively active trace gas species and water vapor, is a key factor for Earth's climate, as relatively small changes in this composition can lead to large scale changes on the surface temperature. The Asian summer monsoon is an important source of these species, which are transported to the UTLS and are mixed into the LS as a result of eddy shedding.
The airborne limb imager GLORIA is capable of observing the three-dimensional mesoscale distributions of trace gases, aerosols and temperature in the UTLS with high resolution. GLORIA was part of the scientific instrumentation on the German research aircraft HALO throughout the PHILEAS (Probing High Latitude Export of Air from the Asian Summer Monsoon) campaign. PHILEAS aimed at investigating the chemical composition and mesoscale structure of the Asian monsoon outflow and the subsequent mixing into the LS from August to September 2023. Employing forecast model supported flight planning, two flights aimed at meeting filamented air masses over the Northern Pacific on two consecutive days were performed to observe the dynamical changes of their mesoscale structure. The selected air masses were measured along a hexagon path to allow for tomographic retrievals.
We present the tomographic retrievals of the matching flights, which provide the 3d resolved volumes sampled inside the hexagons. Measurements of peroxyacetyl, ozone, water vapor and nitric acid are presented. We examine the evolution of these volumes using trajectory calculations and subsequent matching of these trajectories with our observations. A novel classification method is presented to identify the UT, LS and even mixed states and to illustrate the present mixing processes and strengths. From this classification we derive a visible correlation to the origins of the air parcels.

GLORIA is an airborne demonstrator for the European Space Agency Earth Explorer 11 candidate CAIRT, currently selected for Phase A. GLORIA observations offer an outlook on how exploring global processes in the UTLS would be possible using CAIRT.

**Primary authors:** KAUMANNS, Jan; UNGERMANN, Jörn (FZJ); JOHANSSON, Soeren (KIT)

**Co-authors:** KLEINERT, Anne (KIT); SINNHUBER, Björn-Martin (KIT); PIESCH, Christof (KIT); KRETSCHMER, Erik (KIT); FRIEDL-VALLON, Felix (KIT); Prof. PLÖGER, Felix; SCHARDT, Georg (FZJ); MAUCHER, Guido (KIT); NORDMEYER, Hans; RONGEN, Heinz (Forschungszentrum Jülich, ZEA-2); Dr GROOSS, Jens-Uwe; RETZLAFF, Markus (FZJ); RIESE, Martin (FZJ); DICK, Michael (INM-6, IAS-6, PGI-1); HOEPFNER, Michael (Karlsruhe Institute of Technology IMK-ASF); BRAESICKE, Peter (KIT, IMK-ASF); PREUSSE, Peter (FZJ); RHODE, Sebastian; GULDE, Thomas (KIT); NEUBERT, Tom (FZJ); Dr WOIWODE, Wolfgang

**Presenter:** KAUMANNS, Jan

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