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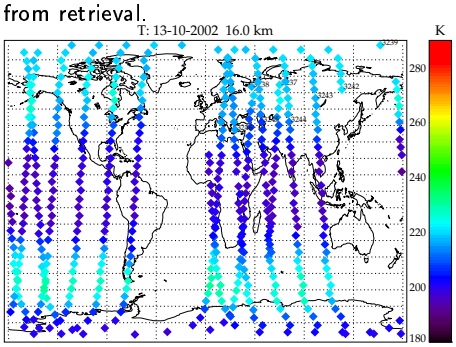
Retrievals of trace species in the UTLS region from MIPAS/ENVISAT

MIPAS measurements and retrievals

- Level-1b data: Orbit 3244, measured on 13 Oct 2002, during commissioning phase.
- Retrievals done with non-operational KOPRA-RCP processing system.
- Retrieval is based on constrained multi-parameter, mult-microwindow least-squares-fitting.
- Constituent retrievals based on temperature/line-of-sight retrieval performed in a preceding step.
- Cloud-contaminated spectra excluded from retrieval.

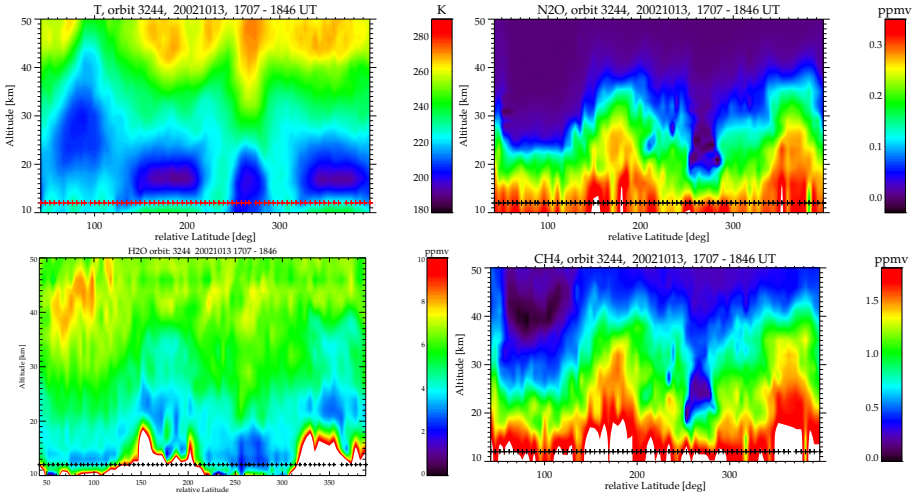


Scan geolocation and retrieved temperature distribution at 16 km altitude on 13 Oct 2002.

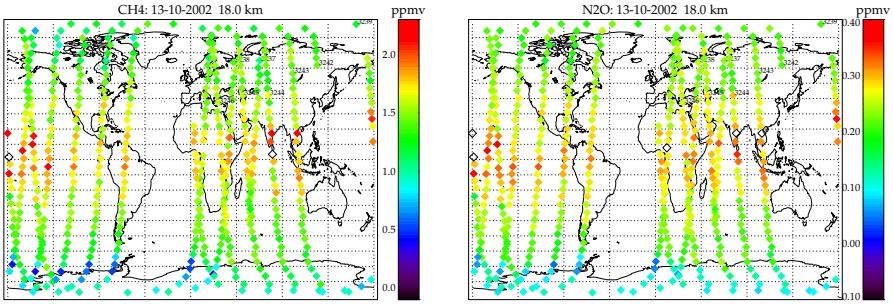
Retrieval artefacts or atmospheric dynamics?

UTLS tangent altitudes often are excluded from retrieval because they trigger errors which are propagated to higher altitudes; here we assess the benefits of their inclusion.

- All source gas profiles show similar shapes → excludes gas specific artefacts in analysis.
- CH_4 and N_2O below $\sim$ 18 km seem biased high; no explanation so far.
- The following candidate reasons for potential retrieval artefacts have already been excluded: non-linear random error mapping; spectroscopic issues; asymmetric field-of-view (FOV) distortions; solar straylight.
- Horizontal temperature gradients are compensated for by retrieving (1-D) the temperature field.
- Currently under investigation: terrestrial straylight; symmetric FOV distortion; undetected clouds; temperature error propagation.
- Geophysical validation has not yet been feasible due to sparse data basis at tropical/subtropical geolocations/altitudes.



Along-orbit distribution of temperature (top left), N_2O (top right), H_2O (bottom left), and CH_4 (bottom right). The relative latitudes are given along orbit 3244 measured on 13 Oct 2003, referring to 90° at North Pole, 270° at South Pole, and 180° and 360° at the Equator. The crosses mark the available MIPAS scans. The tropopause position in the tropics can be approximated by the altitude with lowest temperature, i.e. 16 - 18 km. All trace species show similar large-scale signatures in their altitude-latitude distributions, like upwelling over the Equator, subsidence over the South Pole and sharp steps near 180° and 350° at 20 to 30 km altitudes. Smaller-scale signatures like alternating regions of low and high N_2O/CH_4 vmr between 150° and 210° at 18 to 25 km altitudes, marking regions of strong and less upward vertical transport, can also identified in the water vapour distribution; here, upwelling processes are identified by very dry air. Similar signatures occur although H_2O and N_2O/CH_4 are retrieved from different spectral channels. Below 18 km altitude CH_4 and N_2O retrievals seem to be biased high; this effect is under investigation.



Global daily distribution of CH_4 (left panel) and N_2O (right panel) on 13 Oct 2002 at 18 km altitude. Small scale patterns of high vmr similar in both species are found in the tropics over the Pacific ocean and the Indian ocean. Similar patterns of rather low N_2O and CH_4 vmr are found north of Alaska. Lowest values mark the recovered south polar vortex. The correlations indicate the main features of global circulation as well as smaller-scale signatures of vertical transport. In conclusion, we find significant evidence that distributions of source gases in the UTLS region retrieved from MIPAS are suitable for atmospheric transport processes.

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