Forschungszentrum Karlsruhe
in der Helmholtz-Gemeinschaft

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RETRIEVAL OF WATER VAPOUR IN THE TROPICAL TROPOPAUSE REGION FROM MIPAS/ENVISAT

Objectives

The tropical tropopause layer (TTL) plays an important role for the transport of tropospheric air masses into the stratosphere. Global measurements in the tropical region, provided by MIPAS/Envisat, will be used to understand the role of the TTL for STE-processes and stratospheric water wapor content:

- combine MIPAS measurements of water vapor and temperature and available cloud information (cloud index) to study the role of the TTL for the stratospheric water vapor content
- use water vapor as tracer for transport processes through TTL.
- determine the location of the hygropause.

MIPAS/Envisat

Envisat has been launched on March 1, 2002. One of the instruments onboard is the Michelson Interferometer for Passive Atmospheric Sounding (MIPAS):

- satellite–borne IR-Fourier-Transform Interferometer
- spectral range: 685 cm^{-1} to 2410 cm^{-1}
- spectral resolution (unapodized): 0.0035 cm^{-1}
- altitude range (standard–mode): 6 to 68 km
- standard measurement grid: 3 km steps, 6 to 42 km, wider above
- data taken in the commissioning phase, preliminary.

Results for MIPAS Retrievals covering the ITCZ

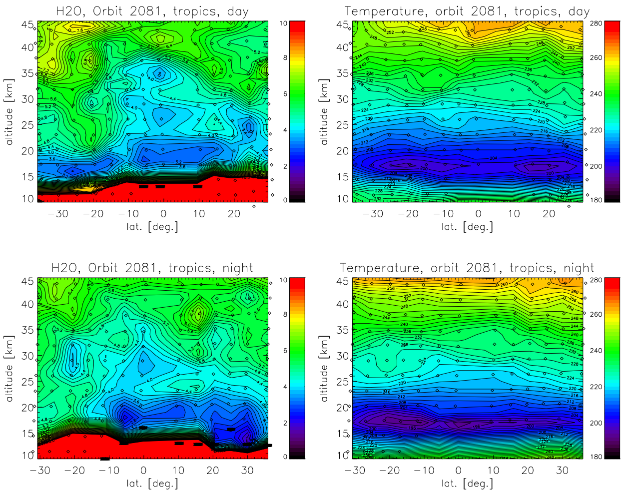

Fig. 2: Water vapor vmr (ppmv) (left) and temperature (K) (right) retrieval results for orbit 2081. Top: scan 15–19, 21–28 (day-side). Bottom: scan 51–57 and 60–65 (night-side). Additionally the tangent point locations of the used spectra are plotted (diamonds)

- in the ITCZ: elevated hygropause
- lower H_2O-vmr in the lower stratosphere over ITCZ compared to subtropics
- low water vapor is related to low tropopause temperatures
- altitude of lowest usable spectral data is determined by the occurence of clouds

Case Study

MIPAS measurements, Orbit 2081 (July 24, 2002), taken between -30 to 30 ° latitude.

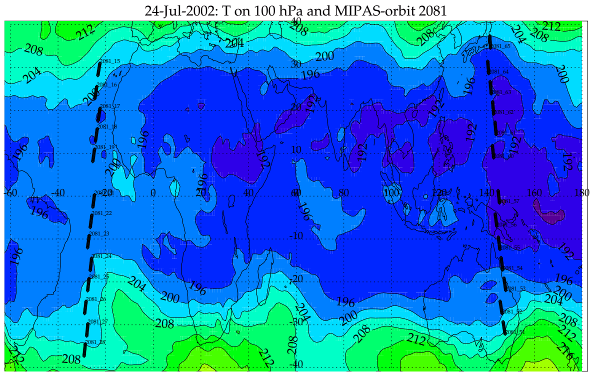

Fig. 1: ECMWF-temperature field on 100 hPa and position of used scans

Retrieval baselines

- 30 microwindows,height dependent, optimized for a joint retrieval of water vapor and temperature
- Retrieval grid: 1 km spacing up to 42 km, 2 km spacing from 44 to 70 km
- Regularisation: height dependent Tikhonov-Phillips 1. order; Regularisation strength $\sim \frac{1}{vmr^2}$

Scan 23

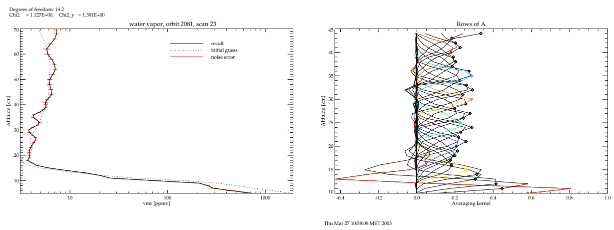

Fig. 3: Result (left) and rows of the averaging kernel matrix (right) for orbit 2081, scan 23, located at about -10° (lat.) and -27° (long.)

- noise error is about 5 %
- vertical resolution: 4 to 5 km
- For cloud free cases: Altitude of lowest usable retrieval height is determined by the saturation of used spectral regions

Outlook

- improvement of the retrieval scheme to reach further down into the troposphere
- obtain complete global and annual coverage with measurements of tropical UT/LS water vapor

Acknowledgements

Temperature field shown in Fig. 1 has been made available by ECMWF.
This work was funded by BMBF via contract no. 07 ATF 43 (KODYACS)