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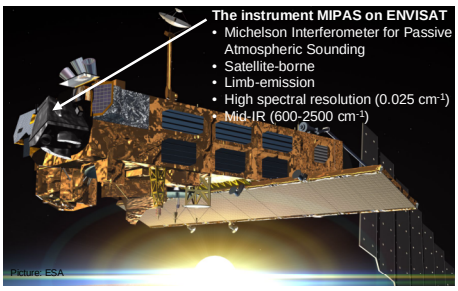
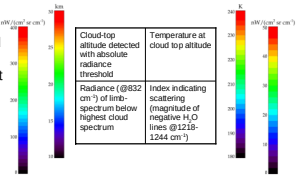
Observation of PSCs with MIPAS/ENVISAT



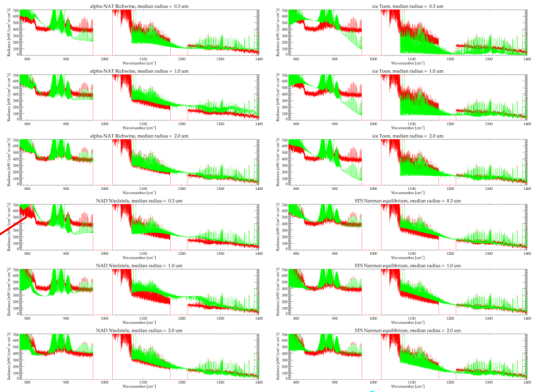
Detection of PSCs with MIPAS
- Limb radiance background is increased due to emission of PSCs and due to scattering of mainly tropospheric radiation into the line-of-sight
- Tropospheric spectral features appear in high-resolution spectra (Höpfner et al., 2002; Höpfner, 2003)

Figures 1: Overview of PSCs detected by MIPAS in December 2002, overlayed over ECMWF temperature at 30 hPa. Limb-scans with no PSCs are white squares. Limb-scans with PSCs are color-coded in the following way:



Data analysis
- Forward radiative transfer including Mie-model and single scattering: KOPRA (Höpfner et al., 2001; Höpfner et al., 2002; Höpfner, 2003)
- Retrieval of particle number density altitude profile for different median radii and fixed width (0.3) of log-normal particle size distribution
- Different optical constants to test composition of PSCs
- Simultaneous fit in 3 microwindows (827-829 cm-1, 947-950 cm-1, 1218-1222 cm-1)
- Broadband radiative transfer calculations for tangent altitude 21 km to compare with measured spectra (? Figures 2, 3, 4)

Figure 2: Comparison of a measured MIPAS spectrum (red) for tangent altitude 21 km (orbit 4040, scan 7) with radiative transfer calculations for different median radii of the particle distribution and different optical constants (green). Richwine: Richwine et al., 1995; Niedziela: Niedziela et al. 1998a; Toon: Toon et al., 1994; Norman: Norman et al. 2002, Norman et al. 1999, Niedziela et al. 1998b.



Discussion
- Early cold stratosphere in December
- First PSCs observed on 1-Dec
- Last PSCs on 29-Dec (? Figure 1)
- At higher altitudes at beginning compared to end of December
- MIPAS PSC spectra can be classified in three groups:
  - A: (Figure 4) strong spectral feature around 820 cm-1 as described in CRISTA spectra by Spang and Remedios, 2003.
  - B: (Figure 2) step around 820 cm-1 with no distinct emission feature as already observed in MIPAS-Balloon spectra (Höpfner et al., 2002)
  - C: (Figure 3) strong slope between 800 and 970 cm-1
- Comparisons with forward calculations indicate the following explanation for the three groups:
  - A: Spectral feature only present in optical constants for alpha-NAT by Richwine et al., 1995. Best fit for particle distribution with 1 µm median radius. However, 820 cm-1 -feature in simulations still underestimated.
  - B: Best fit again with alpha-NAT by Richwine et al., 1995, however, with larger particles of 2 µm median radius. The stronger scattering seems to flatten out the spectral emission feature.
  - C: Best fit gained with optical constants for ice particles of about 2 µm radius.

Figure 3: Same as Figure 2, but calculations for MIPAS spectrum (blue) of orbit 4055, scan 7, tangent altitude 21 km.

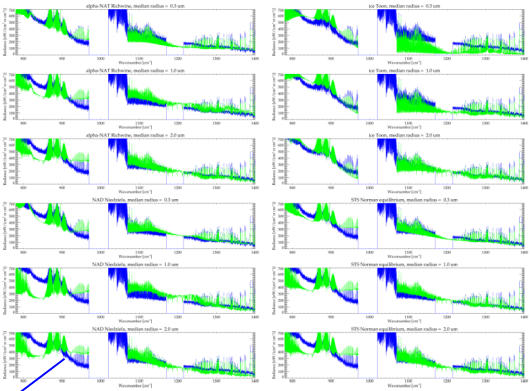
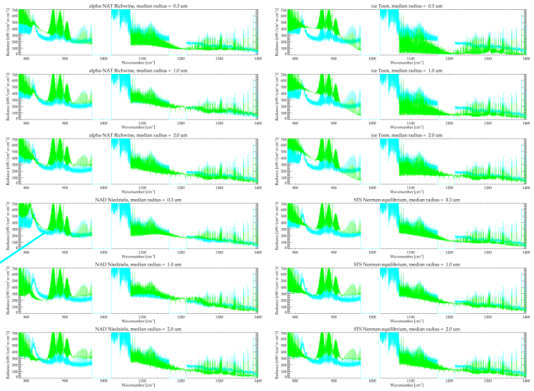


Figure 4: Same as Figure 2, but calculations for MIPAS spectrum (cyan) of orbit 4084, scan 4, tangent altitude 21 km.



Acknowledgement
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