Royal Netherlands Meteorological Institute
Ministry of Infrastructure and the Environment

Current status of ENVISAT ozone and temperature profile validation

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The Satellite validation with lidar (VALID) part of the Multi-TASTE phase F project supports long-term multi-mission validation with ground-based lidars. State-of-the-art lidar stations around the globe measure high resolution stratospheric ozone and stratospheric and mesospheric temperature profiles. As part of the Network for the Detection of Atmospheric Composition Change (NDACC), the lidars are dedicated to perform long-term monitoring and regularly have intercomparisons to ensure high data quality and stability. Therewith, the data products provide an excellent means for the validation of satellite retrievals.
Here we present comparisons with MIPAS v7.01, SCIAMACHY v6.00 and GOMOS v6.01 ozone and temperature data of the latest operational versions, with special attention to geographical dependencies and other possible sources of deviation.

Preliminary data (DDS) for MIPAS and SCIAMACHY

Please note that the results presented for MIPAS and SCIAMACHY are for the delta validation datasets and that conclusions for the full dataset may deviate

MIPAS MLPP v7.01 ozone and T

The MIPAS ozone profile data of the version 7.01 DDS give very similar results in comparison with lidar data to the previous version (6) as can be seen in Fig. 2.

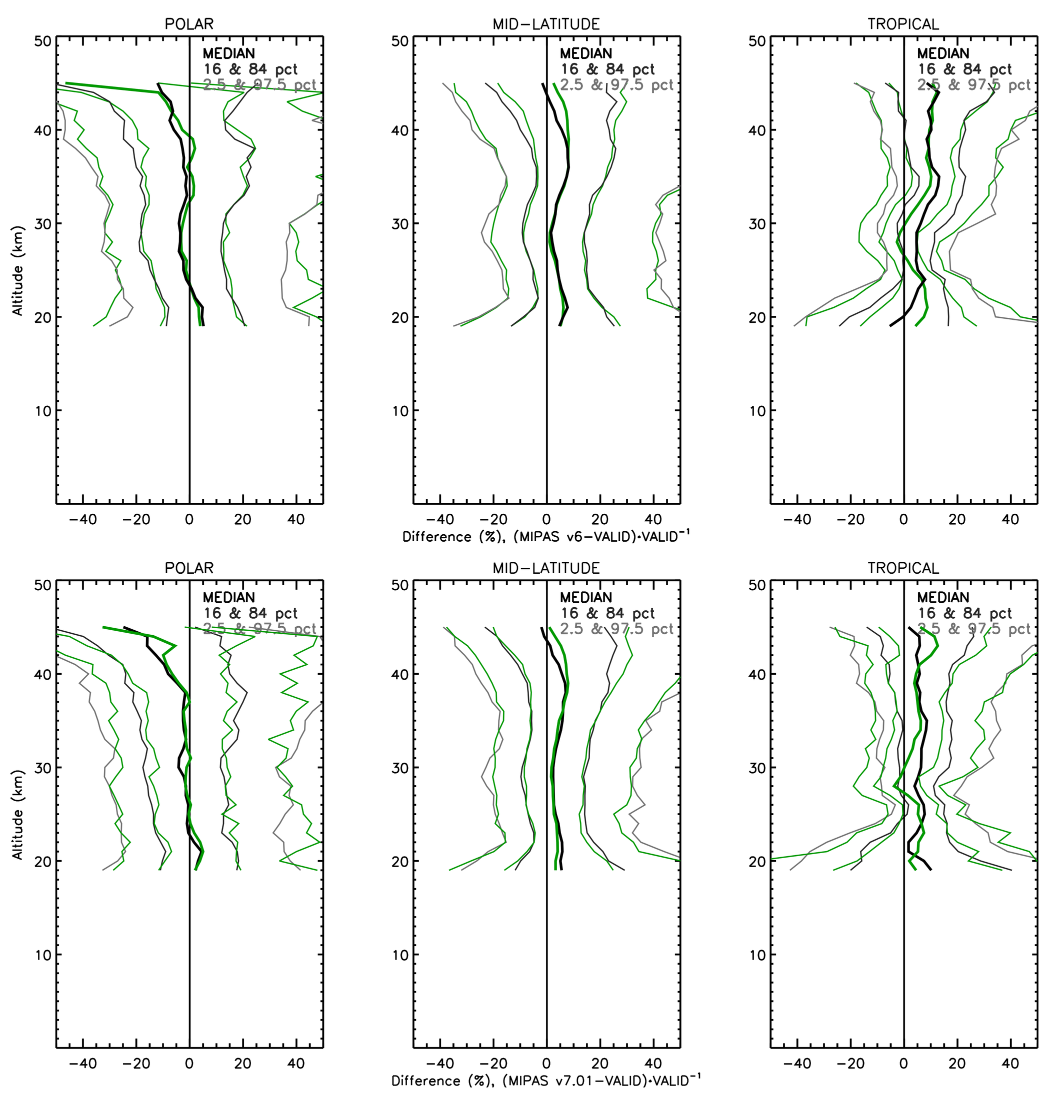

Figure 2. *Validation results in comparison to lidar for MIPAS ozone profiles measured during daytime and **nighttime** for the three main latitude regions: poles (left), mid-latitudes (middle) and tropics (right) and for version 6 (top) and 7.01 (bottom). Shown are the 2.5, 16, 50, 64 and 97.5 percentile relative ozone differences. Note that the extent of the two datasets is not the same, nevertheless the similarity indicates a good sampling strategy for the selection of the DDS.*

Fig. 3 shows the comparison to lidar profiles for temperature. Again, these first results look similar to the previous version.

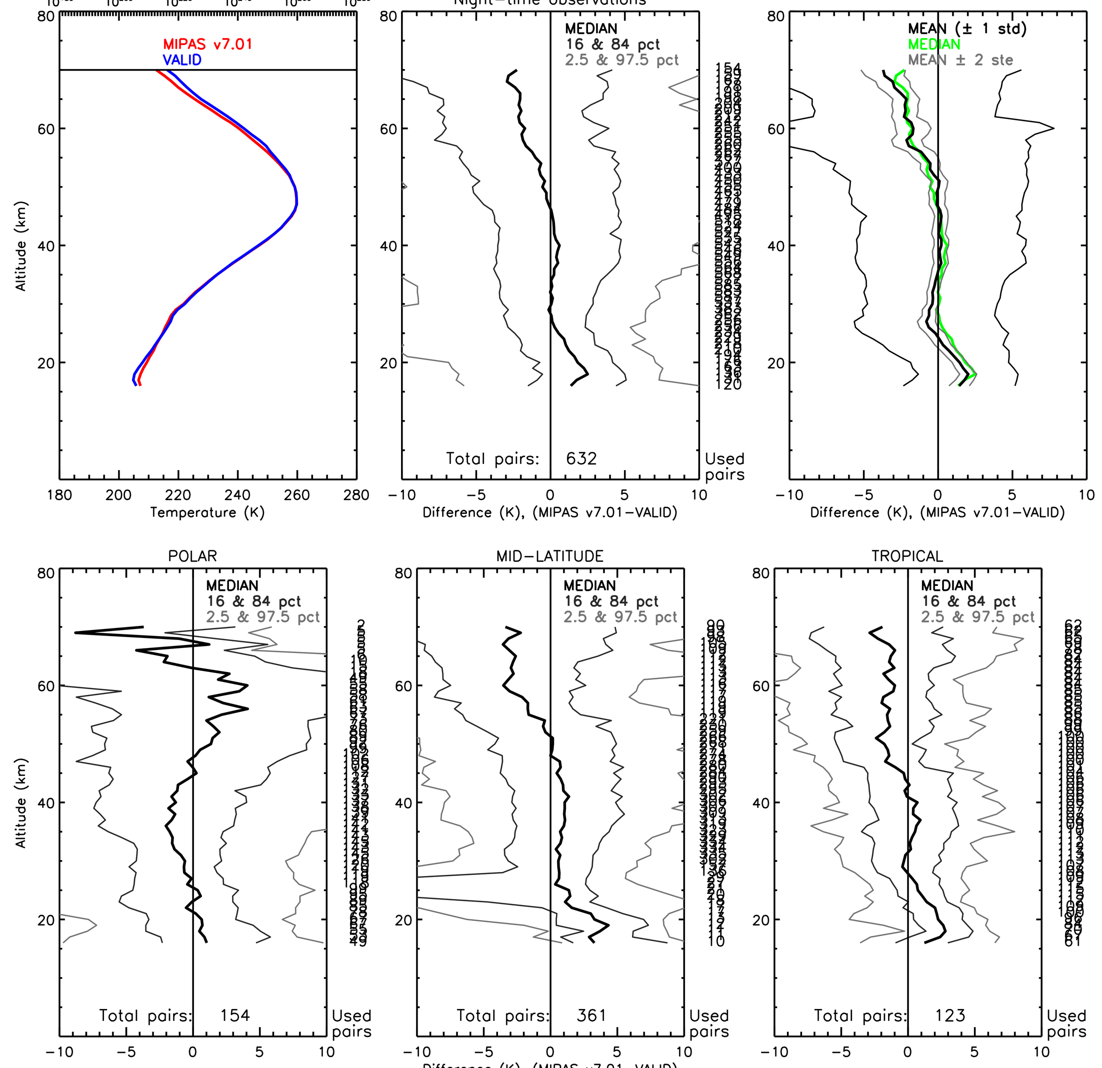

Figure 3. *Top: MIPAS v7.01 temperature profiles compared to lidar. Bottom: Percentile differences for the polar regions (left), mid-latitudes (middle) and tropics (right).*

SCIAMACHY v6.00 ozone

From version 6 onwards, a single SCIAMACHY limb ozone profile is retrieved per state (previously 4 profiles) with an increased altitude coverage.
Figure 4 shows the comparison between the DDS and lidar for three latitude regions.

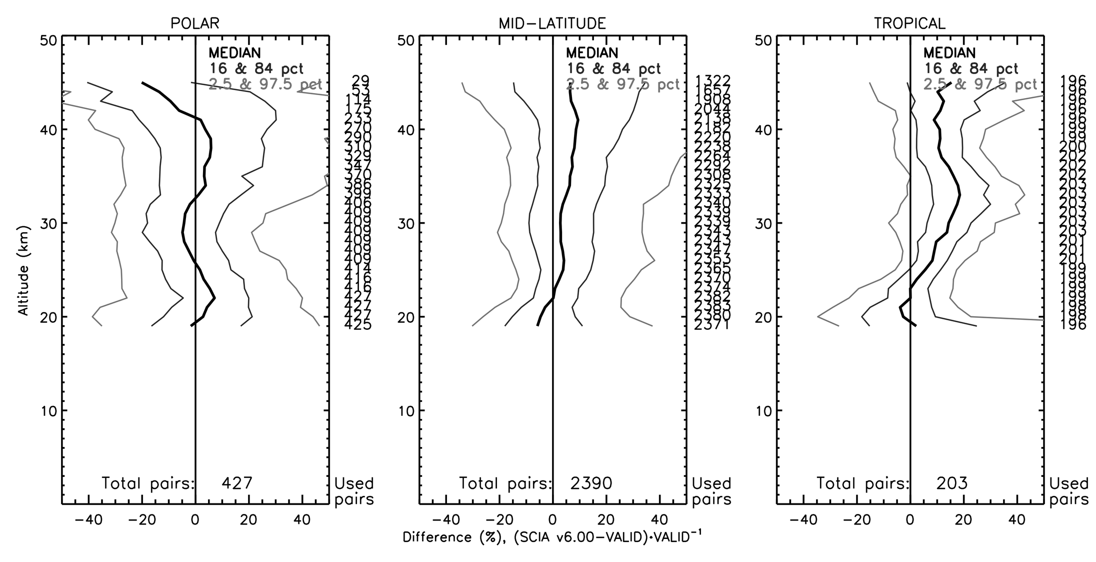

Figure 4. *Percentile differences between SCIAMACHY v6.00 limb ozone profiles and lidar data for the polar regions (left), mid-latitudes (middle) and tropics (right).*

These first results show similarities with v5.02, with some reduced spread and on average a lower ozone concentration in the mid-latitudes and the tropics relative to v5.02.

Fig. 5 splits the mid-latitudes in NH and SH.

A first comparison into the mesosphere with the microwave radiometer at Payerne is shown below (Fig. 6).

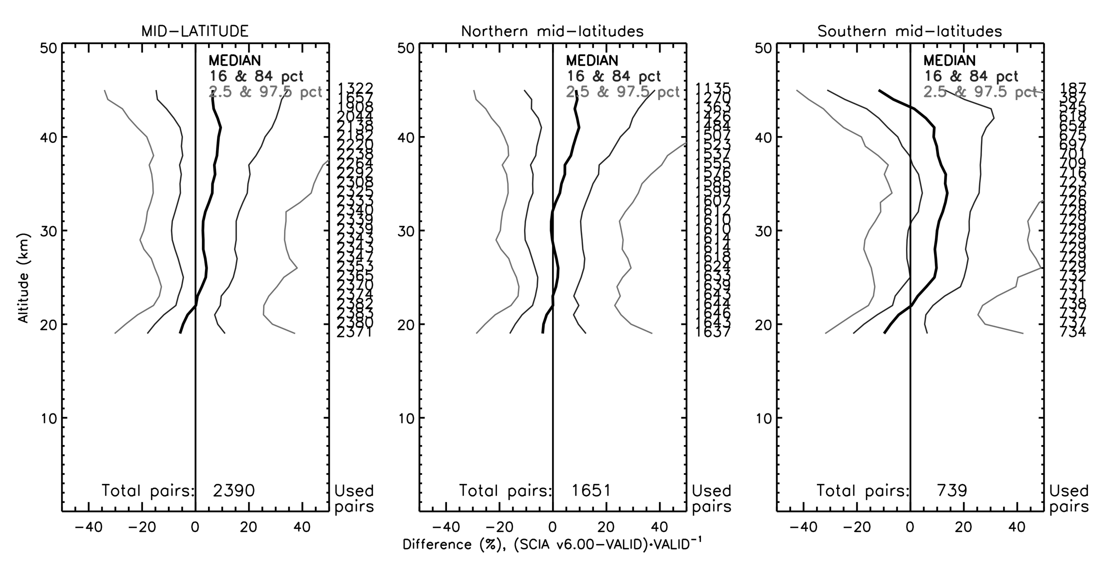

Figure 5. *As Fig. 4 showing both (left), northern hemisphere (middle) and southern hemisphere (right) mid-latitudes.*

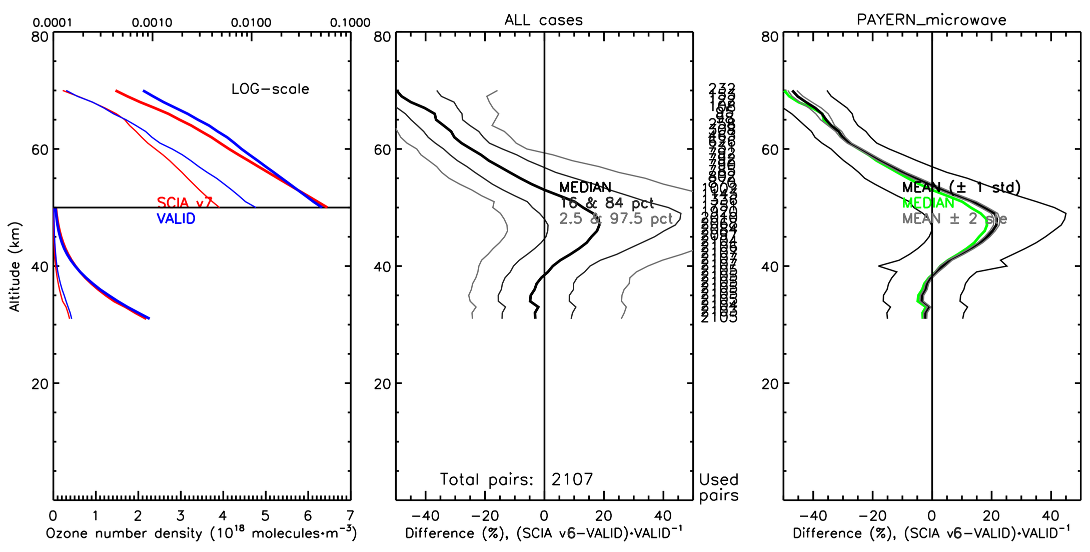

Figure 6. *SCIAMACHY v6.00 limb ozone profiles in comparison to the microwave radiometer at Payerne. Average ozone concentrations are shown on the left together with the standard deviations (thin lines); percentile differences are shown in the middle panel and the mean/median differences are shown in the right panel. SCIAMACHY data were smoothed over a 10 km window.*

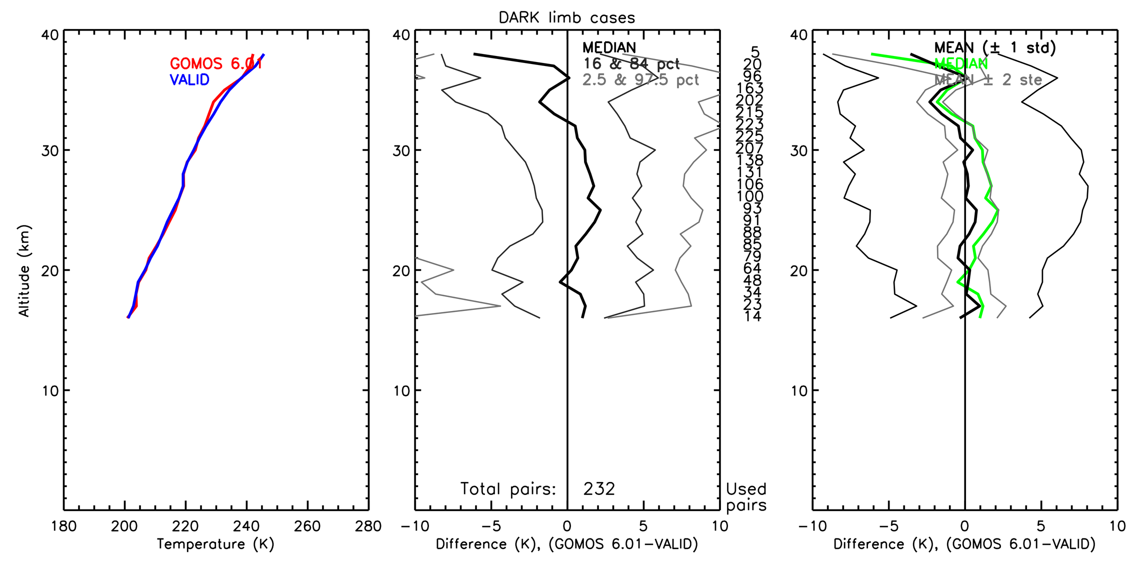

Figure 1. *GOMOS HRTP in comparison to lidar. Left panel shows the mean temperature profiles (GOMOS in red, lidar in blue) as a function of altitude. The middle panel shows the percentile differences (2.5, 16, 50, 84 and 97.5%) with the number of collocations per altitude on the right axis. The right panel shows the median difference (GOMOS-lidar), and the **mean** differences together with the mean ± one standard deviation (thin lines) and two standard errors.*

GOMOS v6.01 HRTP and ozone

Figure 1 above shows the comparison for all high resolution temperature profiles from GOMOS version 6.01 grouped together. Agreement with the lidar data is very good (not significantly different/within the standard error up to ~33 km) although the number of collocations is not very large. Too cold (GOMOS) outliers occur.occasionally.
Fig. 7 shows comparisons for ozone profiles grouped by stellar properties and stray-/twilight flagging

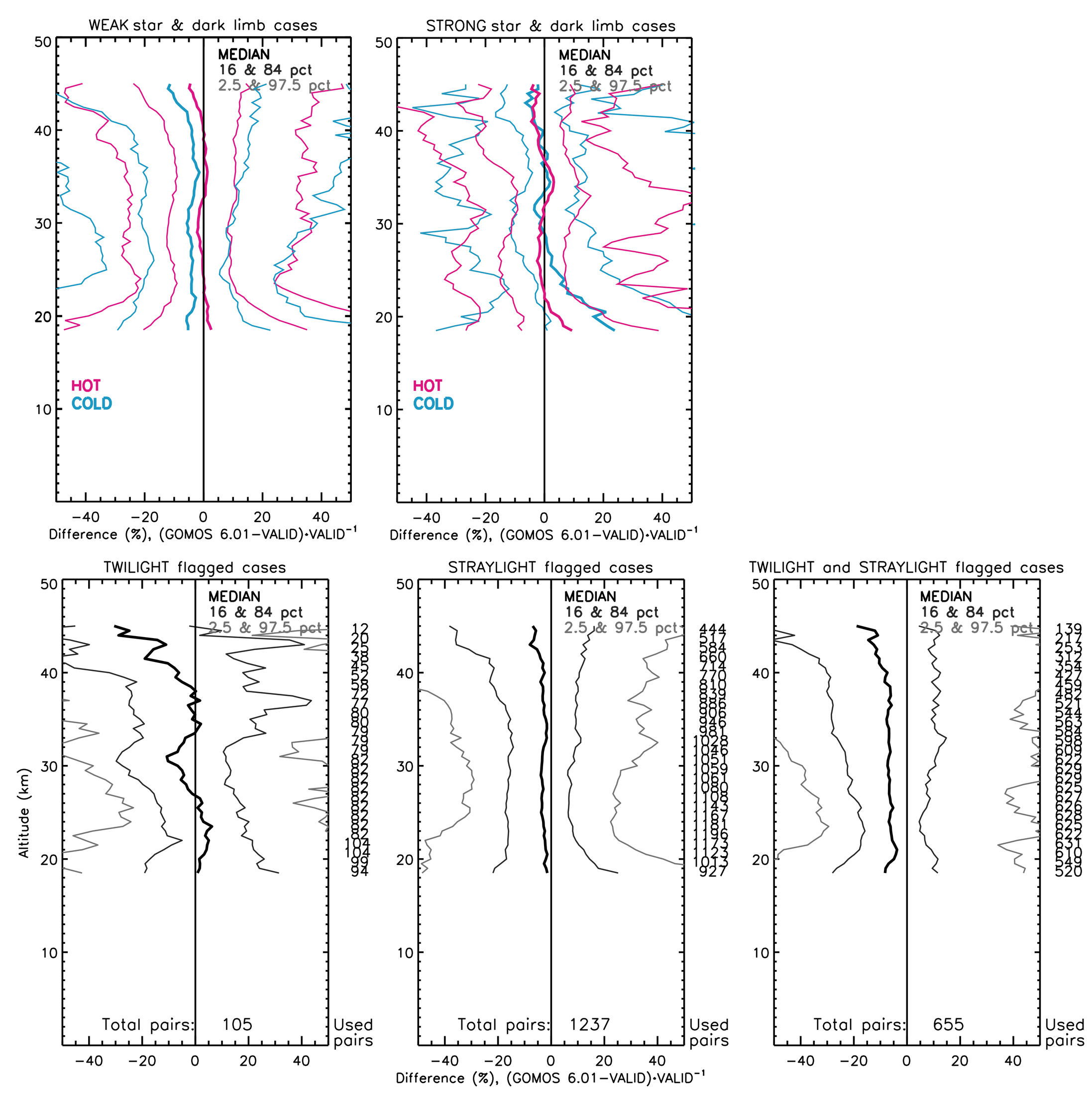

Figure 7. *Top: GOMOS ozone profiles compared to lidar categorised by stellar magnitude and brightness for SZA >109°. Bottom: straylight and/or twilight flagged comparisons.*

GOMOS FMI bright limb v1.2 Ozone profiles

Figure 8 shows the comparison between GBL v1.2 data (filtered with a maximum Chi^2 of 1) and lidar for the three latitude groups.

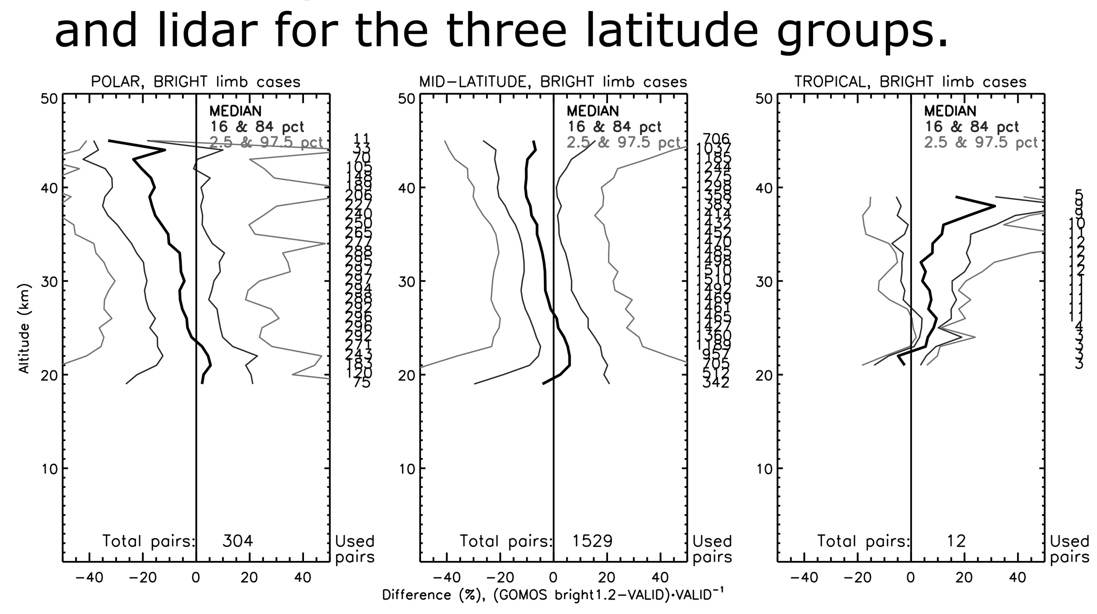

Figure 8. *GOMOS bright limb (GBL) version 1.2 in comparison to lidar (max. $X^2 \leq 1$) for the three latitude regions. Note that in the tropics the number of collocations is severely limited.*

Methodology

Collocations were sought within 800 km and 20 hours (5 hours above 50 km) for ozone and within 300 km and 5 hours for temperature. Product quality flags were used to filter the ENVISAT data. Lidar data were restricted based on the reported uncertainties. No AVKs have been applied.

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