Validation of the GOMOS high-resolution temperature product (HRTP) using lidar

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ABSTRACT: At the beginning of 2006 the complete GOMOS mission data set, including the high-resolution temperature product (HRTP), covering the time period from July 2002 to March 5th, 2005 became available. Comparing high-resolution temperatures from the pre-processor (GOPR_LV2/6.0d) and the final processor show ca. 2% change in temperature at the upper initialisation altitude and about 10-15% changes in temperature errors (see Fig. 1). Spurious data occurring in the pre-processor analysis GOPR_LV2/6.0d, still have not been removed, which significantly reduces the applicability of the data for studies of the atmospheric.

From 13 lidar sites ingoing in the EQUAL project more than 1500 lidar temperature profiles are available for comparison with 10000 GOMOS profiles taken within 500 km distance from the lidar locations (see Fig. 2 and Tab. 1). Due to the small-scale structures seen in HRTP, validation needs to be performed with relatively strict co-location criteria. We choose 3 hour time difference and 200 h spatial differences, which strongly reduces the number of co-located temperature pairs. At around 35 km a bias of about 2% can be seen. Below 30 km the agreements seems to be better. Further studies need to be performed to conclusively decide weather the temperature oscillations in HRTP profiles are real or measurement artefact.

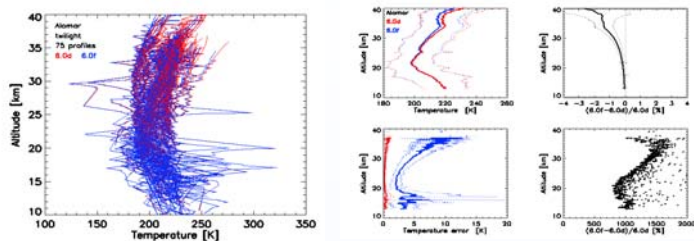## 1. Comparison between HRTP profiles obtained from the pre-processor (GOPR_LV2/6.0d) and the final processor.

Fig. 1: Example of GOMOS high-resolution temperature profiles (left panel), mean temperature profiles and temperature error profiles ± standard deviations (thirds panels from left) and relative changes (right panels) between the data from the pre-processor (GOPR_LV2/6.0d, in red) and the final processor (in red).
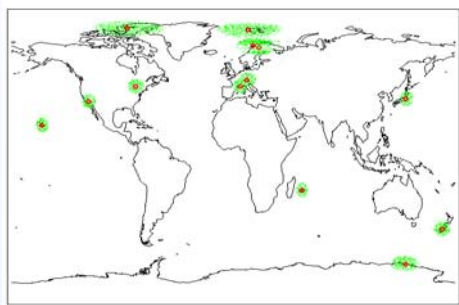
2. Data availability.

Fig. 2: Map of EQUAL validation sites. Red diamonds mark the location of the lidar sites; green dots represent the GOMOS co-located measurements, with maximal distance of 500 km.

Tab. 1. Overview of temperature profiles available at the EQUAL validation sites.

Groundstation	Lat.	Long.	Prof.	HRTP	%	LIDAR	Prof.	first	last
Eureka	80.05	-86.42	1972	874	44	DIAL	23	20040219	20050306
Ny-Ålesund	78.92	11.93	1893	855	45	DIAL	Temperature data not available yet		
Alomar	69.30	16.00	1213	681	56	DIAL	100	20020919	20053041
Esrange	67.88	21.10	1055	565	54	RMR	34	20030113	20041029
Hohenpeissenberg	47.80	11.02	586	320	55	DIAL	241	20020829	20050302
OHP	43.94	5.71	541	317	59	RMR	213	20020926	20040630
Toronto	43.66	-79.40	531	301	57	DIAL	3	20020909	20021031
Tsukuba	36.05	140.13	433	210	48	DIAL	43	20030108	20050131
Table Mountain	34.40	-117.70	491	263	54	DIAL	306	20020828	20050306
Mauna Loa	19.54	-155.58	373	270	72	DIAL	340	20020829	20050305
La Reunion	-20.80	55.50	302	194	64	RMR	214	20020826	20041215
Lauder	-45.04	169.68	524	291	56	DIAL	Temperatures data not available yet		
Dumont d Urville	-66.67	140.01	656	465	71	DIAL	Temperature data not available yet		

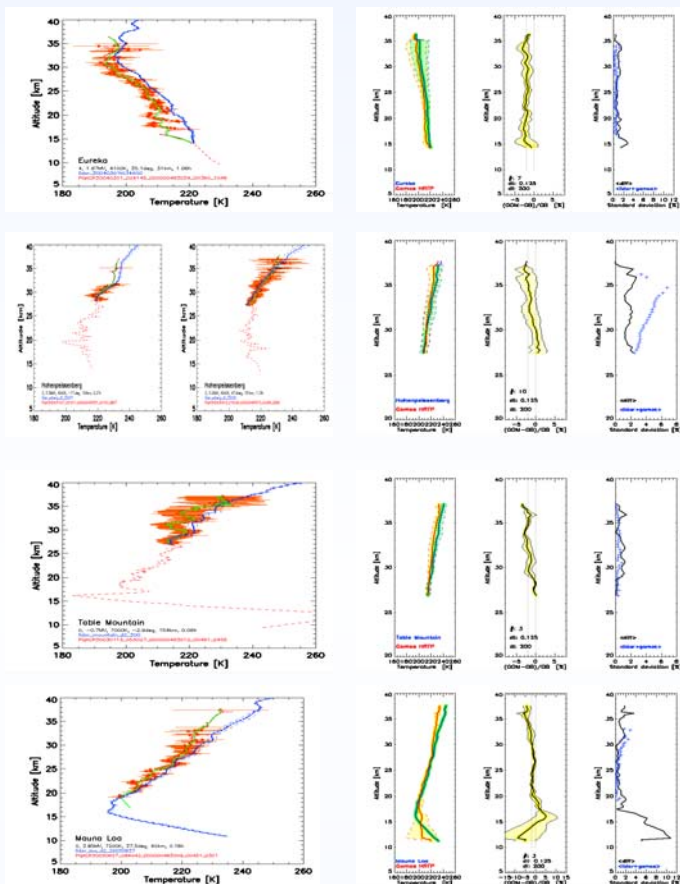## 3. Validation of HRTP profiles with ground-based lidar

Fig. 3. GOMOS HRTP and DIAL temperatures from Eureka (upper row). Hohenpeissenberg (second row), Table Mountain (third row) and Mauna Loa (lowermost panel).

Summary:

- GOMOS HRTP profiles still can not be used for atmospheric science studies (see also ESA's data disclaimer) due to spurious data.
- Validation of HRTP profiles is difficult due to small-scale oscillations requiring very strict strict co-location criteria.
- Although, based on the existing EQUAL lidar data set no statically significant conclusions are drawn yet, some common features can be seen from comparisons at different sites. At around 35 km a bias of about 2% occur. The agreement between GOMOS HRTP and lidar temperatures seems to better below 30 km.

Further studies:

- Internal consistency check of HRTP against GOMOS low-resolution temperatures.
- Comparison with extended lidar and radiosonde dataset as well as ECMWF data.
- Spectral/wavelet-analysis for selected, good correlated, pairs.

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