

SCIAMACHY Tangent Height Verification

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On-Ground Verification

- IFOV 0.045° (2.8 km)
- Absolute pointing knowledge error 0.079° (4.6 km)
- Relative pointing knowledge error 0.027° (1.6 km)
- Cycle step size error 0.003° (170 m)

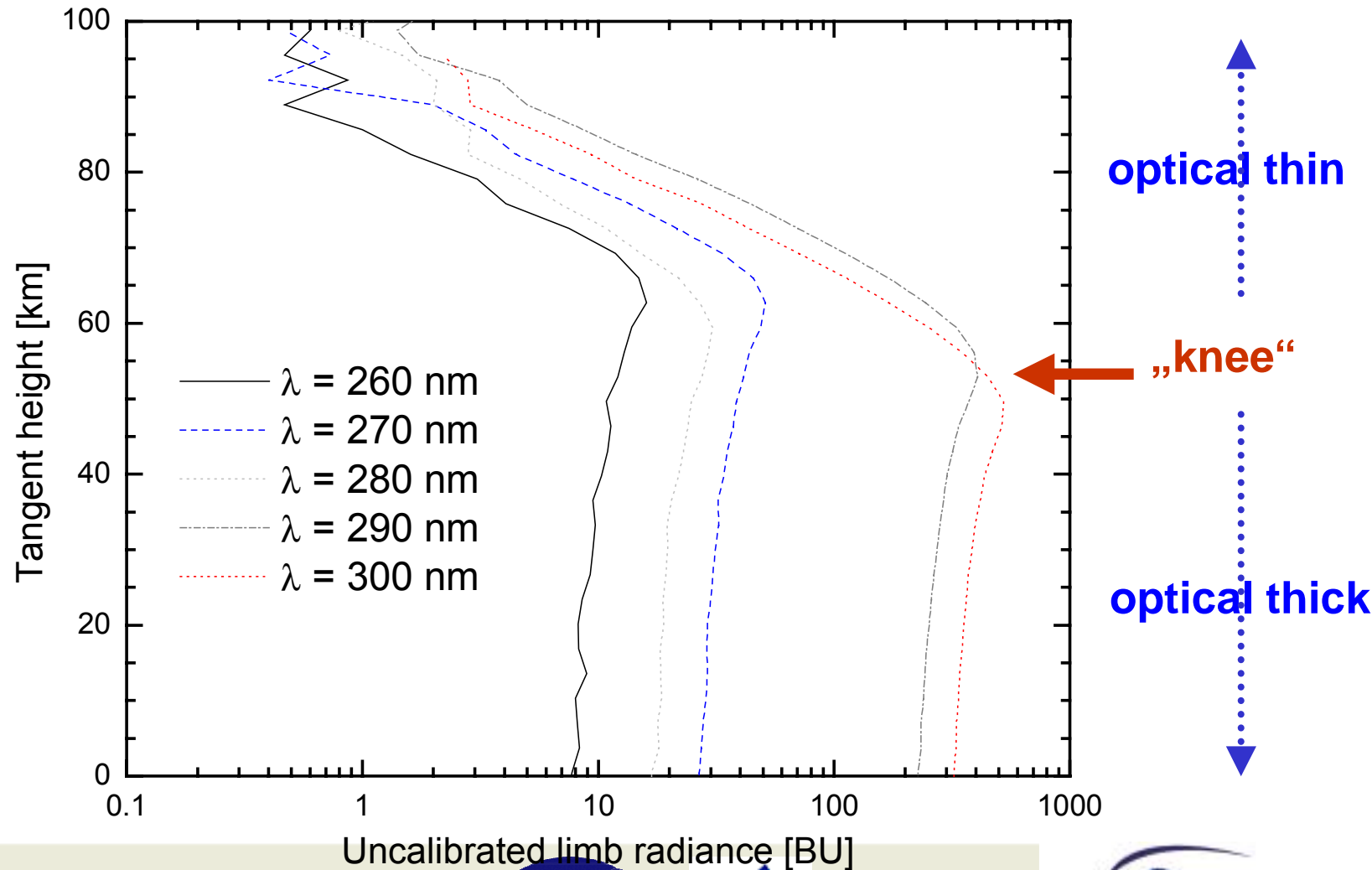
General Approach

- Use features in the backscattered or transmitted radiance with well known height dependence
 - Absorption of O_2 and CO_2
 - Scattering and absorption characteristics at 305 nm around 45 km (so-called „knee“)
- Retrieve tangent height from this „features“
- Compare retrieved tangent height to data from L0/L1

Limb tangent height verification

- Idea: In the UV the backscattered radiance has a maximum („Knee“) in the upper stratosphere determined by dominating Rayleigh scattering (number density) above and (optical thick) Ozone absorption below the maximum (Janz et al. 1996)
- UV-Knee, Sioris et al.
- TRUE (modified Knee), J. Kaiser et al.

UV limb radiance profiles



Tangent Height Retrieval by UV-B Exploitation (TRUE) (J. Kaiser et al.)

- Generalised Knee Method (Janz et al. 1996)
- normalised model spectra (UV-B) for all tangent heights are fitted simultaneously to the measured spectrum by varying:
 - tangent height (mean and step size),
 - O₃ concentration profile
 - pressure profile
- Recommended fit interval 289 – 310 nm (ch. 1b)

TRUE Data Analysis

- Up to now data with 1.6 km step size (26. May 2002) were analysed
- raw data [counts] are divided by the integration time [s] to yield a flux-like quantity [counts/s]
- preliminary dark current correction is performed by subtracting a measurement with 150 km tangent height
- normalisation of all spectra to approx. 32 km tangent height (TH 14) eliminates most of the effects of the solar Fraunhofer structure and multiplicative instrumental artefacts

TRUE Results

- theoretical retrieval precision reaches 100 m for tangent heights 33–54 km
- For 1.6 km step size measurements the following results were observed:
 - mean tangent height error: 0.119 km
 - tangent height step: 1.657 km
 - tangent height step error: 0.012 km
- Method is also sufficient to investigate parallelism of limb azimuth scan
- Results consistent with Sioris et al. (220 m accuracy)
- Report on methodology and first results is available

Summary

- Limb tangent height accurate within 100 – 200 m
- Limb pointing performance seems to be an order of magnitude better than predicted from on-ground performance values (SCIA & ENVISAT)
- Occultation tangent height shows a systematic deviation of approx. 2 km
- Future Work:
 - Systematic analysis of orbit variations in tangent height
 - Data Analysis w.r.t. parallelism azimuth scan of limb measurements based on high data rate data with consolidated β -states ($T_{\text{int}} = 0.375$ s down to 290 nm)
 - Documentation of results