SCIAMACHY	Operation Change Request	OCR No: 030 Issue: final

Title: Test of limb mesosphere-thermosphere state

Description of Request:

A number of trace gas emissions can be identified in the upper mesosphere in the SCIAMACHY limb measurements, including NO from the gamma-bands, OH at ~ 308 nm, O_2, Mg, Mg^+, atomic oxygen, O^+, Fe, Fe^+, and Na. A retrieval algorithm for mesospheric emission species has been developed at the Institute of Environmental Physics, University of Bremen, and has been applied successfully to NO, Mg, Mg^+ and ozone from the excited-state O_2 bands. However, a number of these species have significant contributions in the lower thermosphere, between 90 – 150 km, above the highest SCIAMACHY limb altitude; this is especially true for O, NO and the metals and metal ions. The thermospheric content of NO, Mg and Mg^+ at the moment is derived from limb-nadir matching. However, if the complete upper mesosphere / lower thermosphere region could be covered by limb scans, two goals could be achieved: the derivation of the mesospheric content of these species could be improved significantly, and also the thermospheric profiles would be available. Thus, it would be possible for example to study the downwelling of atomic oxygen and NO from the thermosphere into the mesosphere, and also to study the ablation of metals from meteors in the lower thermosphere, and the subsequent downward propagation of meteoric material into the middle atmosphere.

Therefore, we request the following test:

- to change the setting of the limb sequence for one to two days to test whether a mesosphere-thermosphere state yields the expected improvement to the mesospheric retrievals and thermospheric content. This new 'mesosphere-thermosphere' state should consist of the same number of tangent height steps as the current state, with the same vertical spacing, but shifted in altitude by 60 km in such a way that the limb-scans cover an altitude range of ~60-150 km. Thus, the density peaks of NO as well as of most of the metals would be covered by this state. The best time of year for such a test would be at the end of polar winter, either in July / August or in February / March, to cover downwelling of thermospheric air into the mesosphere.

Originator: M. Sinnhuber, C. von Savigny, IFE	Date of Issue: 2007-3-26	Signature: MS 2007-3-26

Assessment of SSAG (necessary for requests by scientists):

The proposed measurements will allow unique investigations on the composition of the upper mesosphere and lower thermosphere as explained above. Nevertheless, the proposed modification of the limb state will result in lower coverage of the troposphere and the stratosphere. This is acceptable so far for a few and non-permanent test cases as requested above to generate data to investigate and demonstrate the added value of scanning the upper mesosphere and lower thermosphere. Therefore the request for a few test cases is supported by SSAG, assuming that the impact on nominal limb will be as small as possible.

SSAG: H. Bovensmann, IUP	Date: 13.4.2007	Signature: e-mail, 13.4.2007

Classification of OCR: Category D

OCR Analysis (incl. Implementation Option):
This OCR can be implemented via state parameter table modifications only. Thus it is independent of the planning cycle.

- modify the PET-table for all limb states (28 to 33) to a PET of 1.5 sec in channel 1.
- modify Basic Profile ID 2 (limb scanning pointing) from -237101×10-6 rad (=-13.58 deg, equivalent to a LoS elevation of -27.17 deg, i.e. 3 km below the horizon) to -227504×10-6 rad (= -13.035 deg, equivalent to a LoS elevation of 26.07 deg, i.e. an altitude of 60 km within the orbit range).

Note: During execution of the OCR on July 30th the instrument was transferred to HTR/RF. This was due to an – by then – unknown on-board check of integration times and measurement duration. It was noticed that the co-adding settings for states 30-32 was unsuitable for the selected modified PETs. Therefore the co-adding tables for states 30-32 (tables 3-5) had to be modified as well. The co-adding factors for the channel 1b clusters were all set to 1.

When executing the nominal timelines for the duration of OCR_030 implementation (1.5 days) all limb measurements start at an altitude of 60 km. This should be reported to data processing and the user community.

The modified parameter will be loaded for a period of 1.5 days between orbit 28304 and 28325 (July 30th/31st).

Note 1: If quick analysis of the mesosphere/thermosphere measurements suggest that executing OCR_030 is recommended at a somehow different seasonal phase, we can repeat OCR_030 by temporarily modifying state parameter tables again. The timeline/planning cycle independent approach is rather flexible in that respect.

Note 2: A further approach would be to modify e.g. state ID 55 to become the special limb state and just run this state during the 1.5 day period instead of the nominal limb states. This option is less flexible since it would require generating new timelines such that OCR implementation becomes planning cycle dependent. As a result it could not be ensured to run OCR_030 and of July.

SOST: M.Gottwald ; E.Krieg (ESA, Industry if necessary)	Date: 21/05/2007	Signature: via e-mail, 21/05/2007

Approval of Proposed Implementation:

Originator Approval: C. von Savigny, IFE	Date: 22/05/2007	Signature: via e-mail, 22/05/2007
SSAG Approval: H. Bovensmann, IUP	Date: 05/06/2007	Signature: via e-mail, 05/06/2007

Decision / Approval:
The OCR shall be implemented as proposed by SOST.

DLR Approval: Ch. Chlebek	Date: 25.7.2007	Signature: e-mail 25.7.2007

Implementation by SOST:
4 CTI-files have been created for the implementation of OCR_30 in the timeslot proposed (validity start July 30th, 09:37:00 UTC). Basic profile 2 is modified for 60km altitude and PET for channel 1b of state ID 30 - 32 has been prolonged to 1.5 sec. Starting in orbit 28326 (July 31st) the modifications are reversed by 4 more MCMDs to nominal final flight configuration.

All 8 CTI-files have been transferred to FOCC for execution.

Note: Because of the anomaly described above 14 CTI tables had to be generated anew for repeating the measurements on August 8/9th (orbit 28433-28454).

SOST: E.Krieg	Date: 22/06/2007	Signature: via e-mail, 22/06/2007