



Retrieval of BrO columns from SCIAMACHY and their validation using ground-based DOAS measurements

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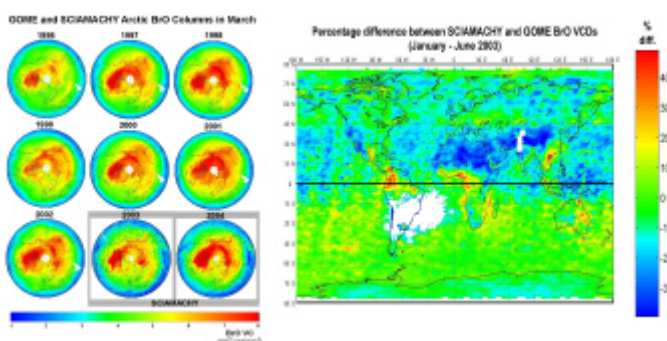
Introduction

Nadir observations from satellite platforms offer the opportunity to monitor the global distribution of total BrO columns in a long-term perspective, thereby allowing to address some important current issues regarding the inorganic bromine budget in both stratosphere and troposphere. In the context of the ESA DUP II TEMIS project, a scientific BrO vertical column product from SCIAMACHY nadir measurements has been developed at BIRA-IASB, based on the expertise previously developed with GOME processing. Ongoing work to validate this algorithm based on the use of correlative ground-based measurements is presented. The algorithm description document and the SCIAMACHY BrO products (Level 2 & 3) are available on the TEMIS website (<http://www.temis.nl>).

SCIAMACHY BrO vertical columns retrieval

- DOAS settings have been optimized in order to overcome problems related to anomalies in the polarization response of the instrument (Fitting interval: 336-347 nm instead of 345-359 nm as used for GOME).
- Daily equatorial earthshine radiance are used as reference spectrum, afterwards an equatorial offset correction is applied.
- As a baseline for operational processing, slant columns are converted to vertical columns using AMFs calculated under the assumption that the tropospheric BrO content is negligible (stratospheric profile).

Comparisons with GOME BrO retrievals



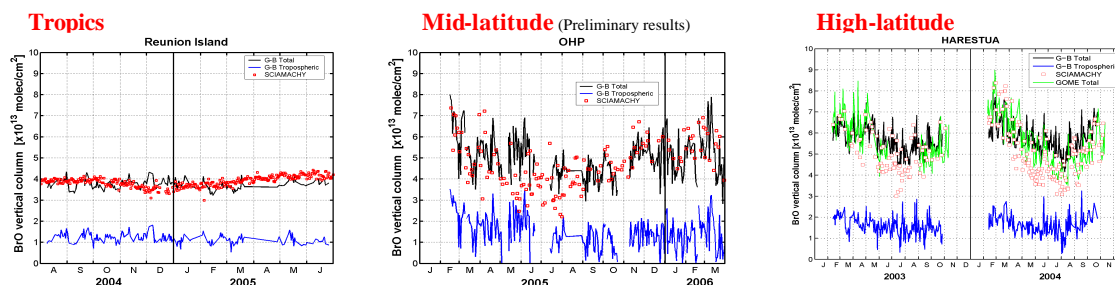
- GOME and SCIAMACHY capture the general BrO features in a consistent way, despite the different sampling and spatial resolutions of both instruments.
- SCIAMACHY retrievals overestimate BrO vertical columns over regions of high formaldehyde emissions, due to a spectral interference between BrO and HCHO absorption structures
- SCIAMACHY BrO columns tend to be underestimated over the Sahara desert and over most of the chain of mountains (e.g. Himalaya)
- There seems to be an asymmetry between both hemispheres

Validation using ground-based measurements

Development of methods to resolve vertically DOAS ground-based BrO observations performed by BIRA-IASB at three locations: Reunion Island (22°S), Observatoire de Haute-Provence (OHP, 44°N) and Harestua (60°N).

1st technique (applied to Reunion Island and OHP obs.): Instrument equipped with a multi-axis system (3°, 6°, 10°, 18° and 90° (zenith) of elevation) which increases its sensitivity to the troposphere. The BrO SCD is a combination of a stratospheric and a tropospheric contribution. Measured SCDs at different elevation angles are fitted to model simulations for the transfer of the scattered radiation in the atmosphere, accounting for the BrO diurnal variation and the different sensitivity to the troposphere of the various elevation angles measurements. This approach allows to derive independent information on the stratospheric and tropospheric parts of the total BrO column. Sets of stratospheric and tropospheric AMFs are generated using the PSCBOX/UVSPEC tool.

2nd technique (applied to Harestua obs.): Instrument measures in a zenith-sky geometry. BrO columns are obtained by integrating BrO vertical profiles retrieved by a profiling algorithm (based on OEM) applied to zenith-sky measured SCDs. The retrieval method is based on the dependence of mean scattering height with solar zenith angle (see poster by F. Hendrick for details).



- Ground-based total BrO vertical columns are photochemically matched to satellite observations
- Total AMFs (accounting for a tropospheric contribution derived from GB measurements) have been applied to satellite SCDs

Conclusions

- SCIAMACHY & GOME BrO total VCDs are in good agreement, despite some systematic features in SCIAMACHY data, in particular a strong interference with formaldehyde
- Good overall agreement between SCIAMACHY BrO total VCDs and GB estimations at three stations. Systematic discrepancies persist however in summer conditions where both satellite and GB retrievals have largest uncertainties
- Satellite and ground-based data are consistent with the presence of a tropospheric BrO VCD of 1-3 x 10¹³ molec/cm² at all latitudes.

