Optical degradation in GOME-2 level 2 data products – Results for BrO, NO₂, HCHO, H₂O, and O₃

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Introduction

VC  ➔ Vertical column of trace gas species given in molecules per cm², ozone is given in Dobson Units and water vapor in grams per cm²
RMS ➔ Standard deviation of all selected VCs in a given area, measure of precision
χ² ➔ ChiSq. Mean standard deviation of the fit residuals, for the time series plotted, measure of accuracy
INT ➔ Earthshine fit window wavelength dependency

Fig. 1: Selection of unpolluted areas for the investigation of degradation effects.

Fig. 2: Spectral fit windows of trace gases retrieved from GOME-2 data.

2nd throughput test results (preliminary)

Sahara
Pacific

BrO

NO₂

HCHO

H₂O

Fig. 3: Daily mean values for BrO and NO₂ over the Sahara desert and the Pacific ocean. Begin and end of 2nd throughput test are marked with vertical dashed lines.

Fig. 5: Time series for O₃, BrO, HCHO, NO₂, and H₂O over the Sahara desert and the Pacific ocean. Shown are values for VC, RMS, χ², and INT (where available). Arrows mark the time of the 2nd throughput test.

Degradation results

BrO

HCHO

H₂O

Pacific

Sahara

Summary

Degradation effects are mainly visible for BrO and HCHO, i.e. for the trace gases that are retrieved from spectral measurements in the UV wavelength region. Ozone is also retrieved in the UV/vis wavelength region but shows less degradation effects as it is a very strong absorber. So is water vapor. In addition it is retrieved in the IR wavelength region thus showing no sign of degradation. Although NO₂ does not show signs of degradation in the VC, its retrieval does also shows signs of degradation in the fit residuals χ².

Heating the sensors as done during the 2nd throughput test frees them of substances accumulated on their surface. The throughput could be increased (shown here: fit window intensity) while heated. After the heating the fit window intensity decreased again and with it the fit residuals of BrO and NO₂ increased to even higher levels.

Selected References

Noël, S., Menich, H. Bovensmann, and J. P. Burrows, Preliminary results of GOME-2 water vapor retrievals and test applications in polar regions, Atmos. Chem. Phys., 9, 1113-1126, 2009
Nießner, M., Wirick, F., Richter, A., Burrows, J. P., GOME-2 observations of oxygenated VOCs: What can we learn from the ratio CH₂CHO to HCHO on a global scale, to be submitted to JGR 2010

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