Optical degradation in GOME-2 level 2 data products – Results for BrO, NO$_2$, HCHO, H$_2$O, and O$_3$

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GOME-2 Global Ozone Monitoring Experiment

Introduction

VC → Vertical column of trace gas species given in molecules per cm^2, ozone is given in Dobson Units and water vapor in grams per cm^2

RMS → Standard deviation of all selected VCs in a given area, measure of precision

χ^2 → ChiSq, Mean standard deviation of the fit residuals, for the time series plotted, measure of accuracy

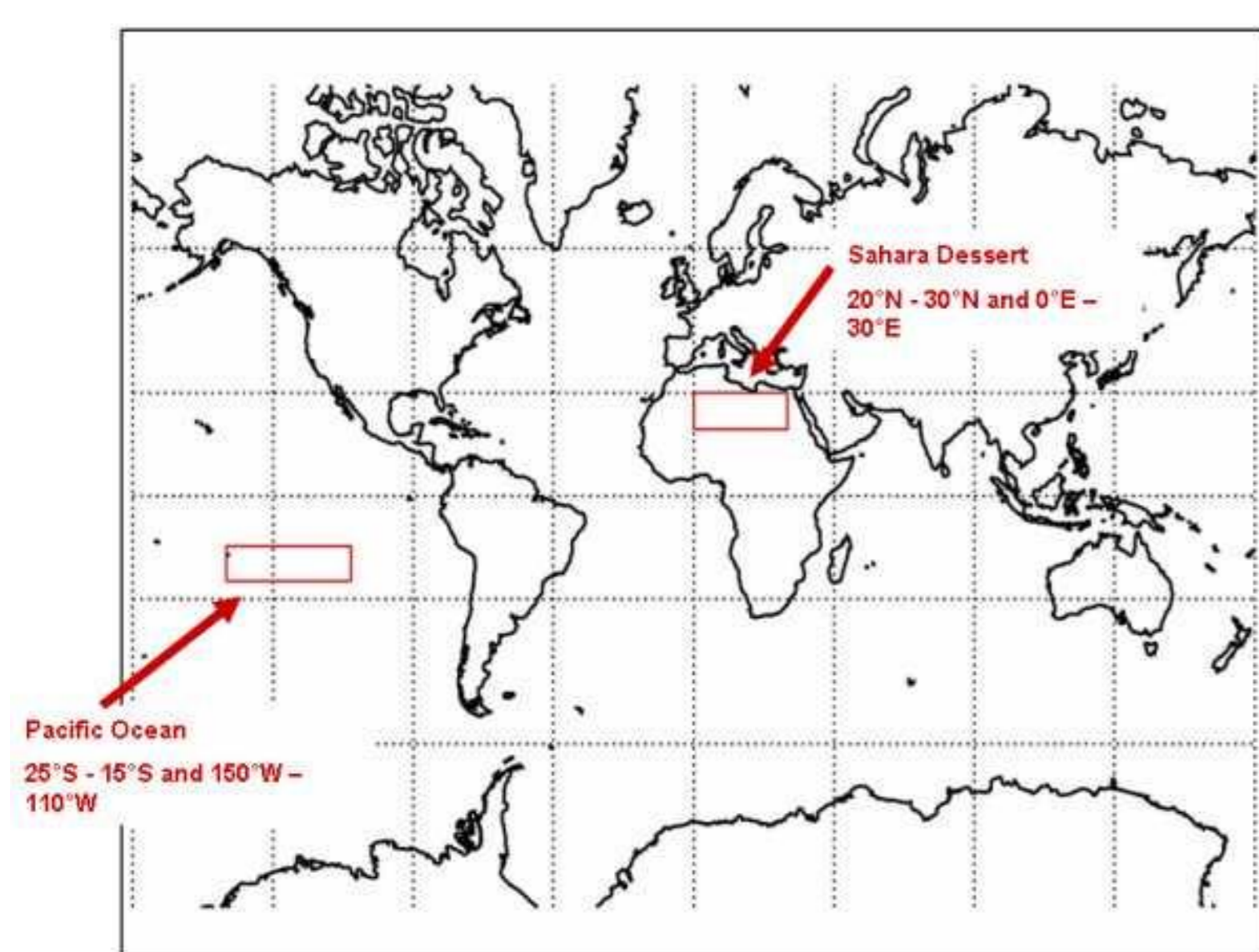INT → Earthshine fit window radiance intensity

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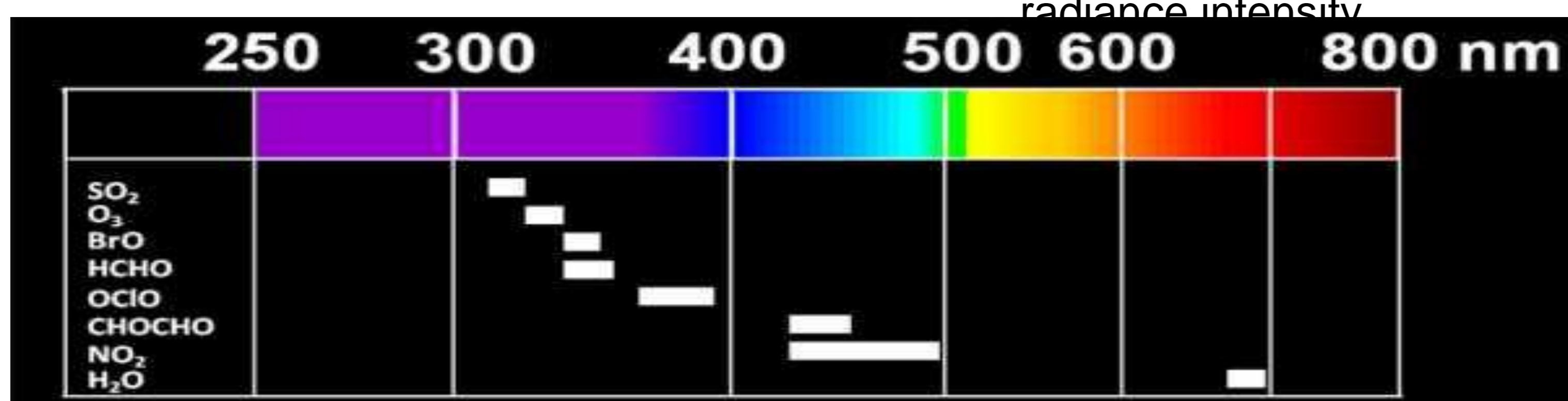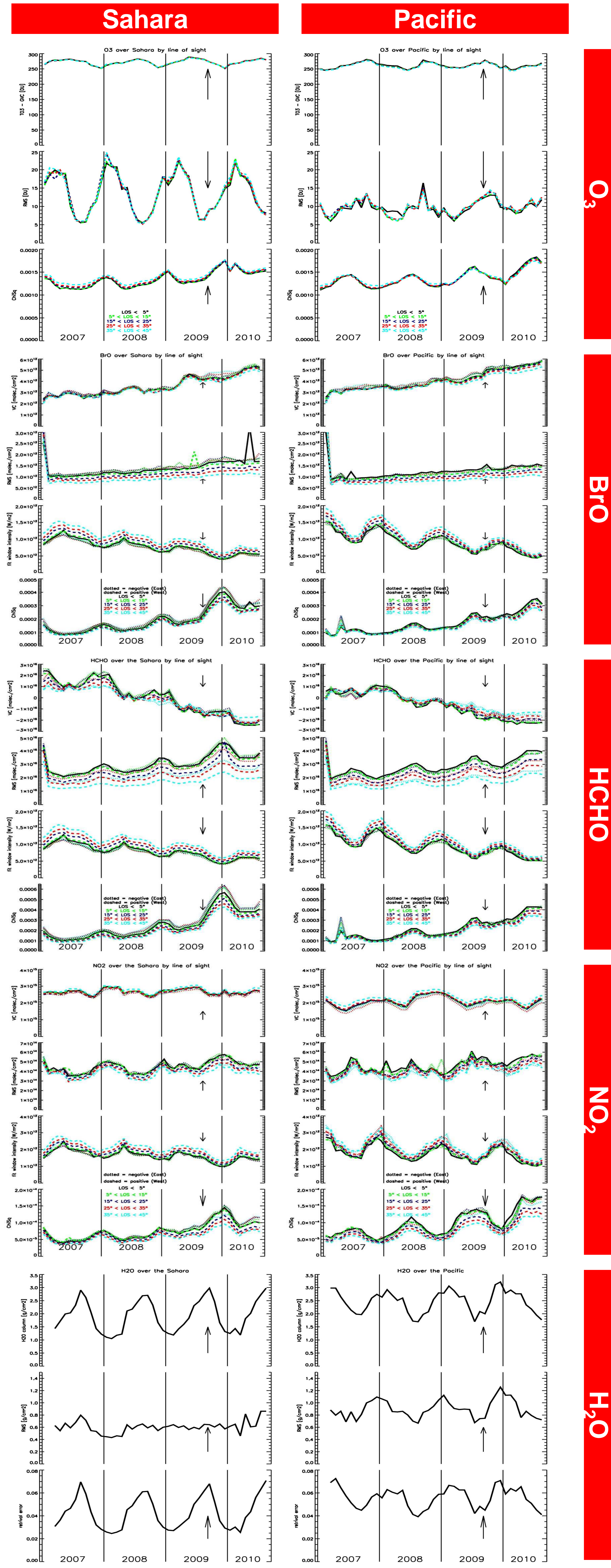

Fig. 2: Spectral fit windows of trace gases retrieved from GOME-2 data.

2nd throughput test results (preliminary)

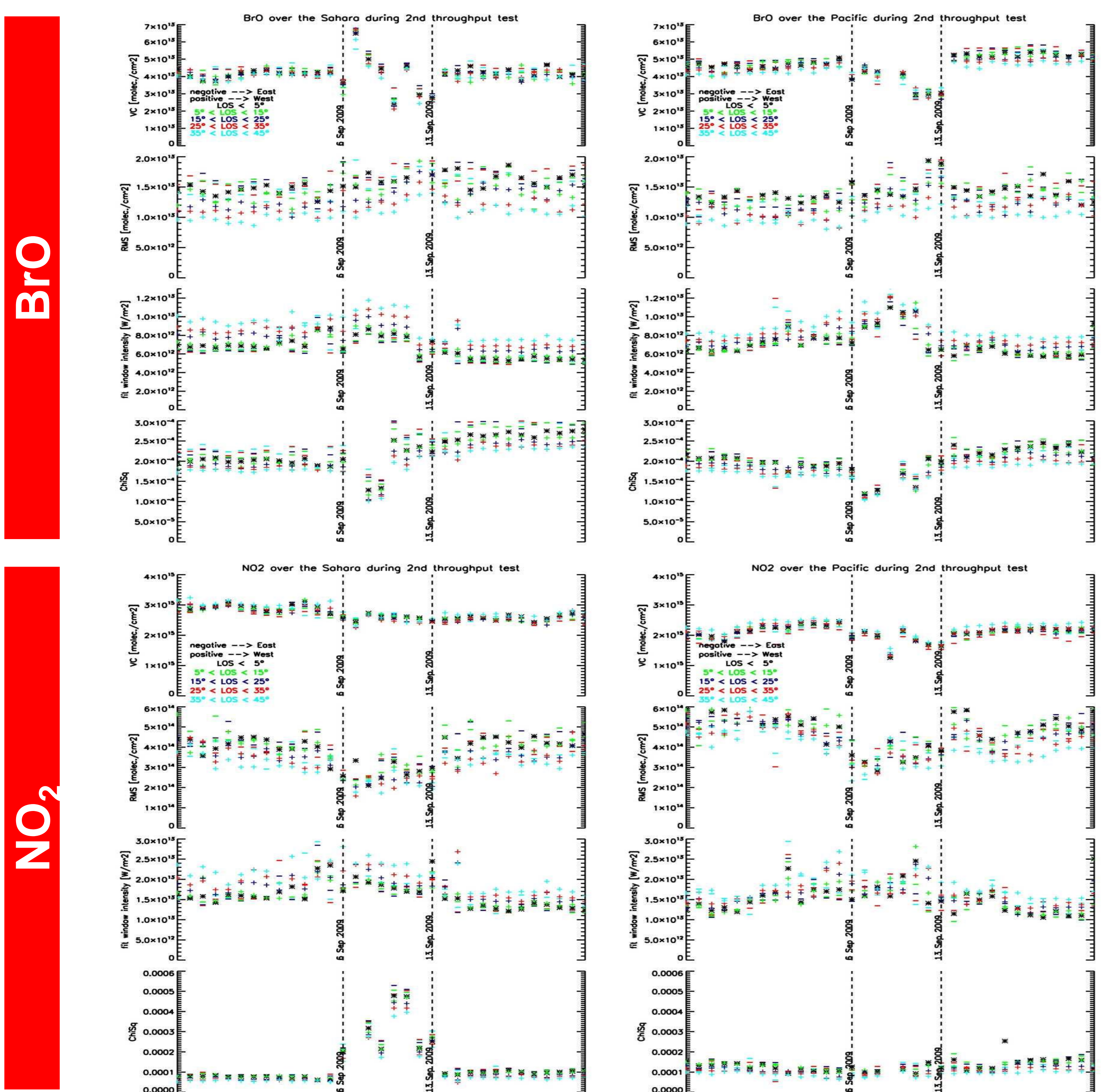### Sahara   Pacific

BrO

NO$_2$

Fig. 3: Daily mean values for BrO and NO$_2$ over the Sahara dessert and the Pacific ocean. Begin and end of 2nd throughput test are marked with vertical dashed lines.
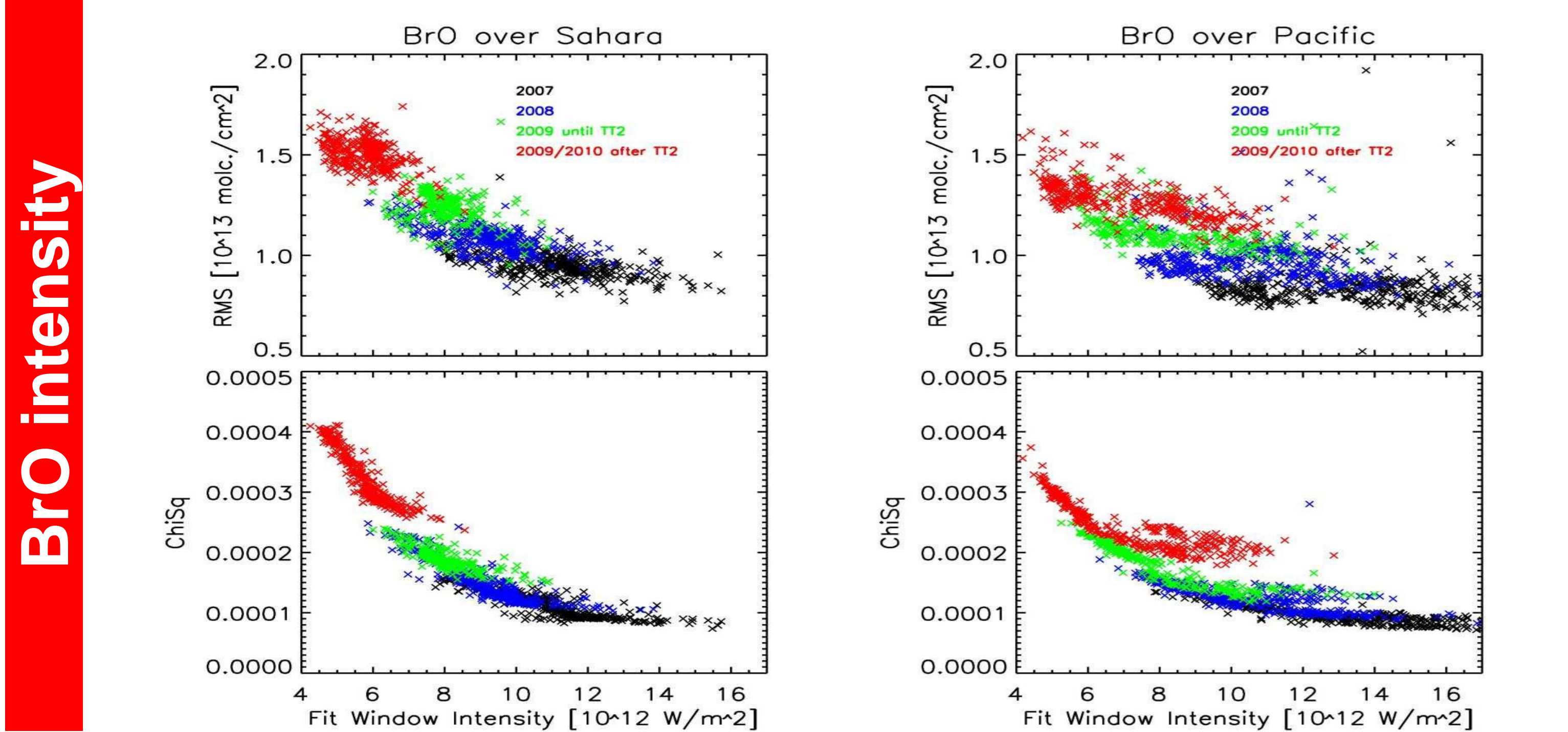
BrO intensity

Fig. 4: χ^2 and RMS dependent on fit window intensity. Shown for BrO over the Sahara dessert and the Pacific ocean separated into annual bins (color code).

Degradation results

Sahara   Pacific

O$_3$
BrO
HCHO
NO$_2$
H$_2$O

Fig. 5: Time series for O$_3$, BrO, HCHO, NO$_2$, and H$_2$O over the Sahara dessert and the Pacific ocean. Shown are values for VC, RMS, χ^2, and INT (where available). Arrows mark the time of the 2nd throughput test.

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 NO$_2$ does not show signs of degradation in the VC, its retrieval does also show signs of degradation in the fit residuals χ^2.

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 NO$_2$ increased to even higher levels.

Selected References

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