Atmospheric Measurement Techniques Discussions

Interactive comment on "An improved NO$_2$ retrieval for the GOME-2 satellite instrument" *by* A. Richter et al.

Anonymous Referee #1

Received and published: 18 January 2011

The manuscript describes some significant improvements for the retrieval of NO2 from GOME2 measurements. It is well written and should be published on AMT after some minor revisions.

Introduction: Please explain the acronyms (GOME etc.).

p271, line 23: I was confused here. I suggest (if I got the logic correctly) "the settings of the operational product (Valks et al., 2011) are very similar to those of the Bremen standard retrieval. Therefore, the improvements discussed below will likely be analogue if applied to the operational product."

p218, line 3: "... spatial detail": please give the ground pixel sizes of SCIAMACHY and GOME2 here.

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p218, Monthly Mean Comparison: are the monthly means calculated independently for both instruments, or is there a selection of collocated measurements? Would the latter make a difference? Please specify also for Figs. 10 and 11.

Section 3: How sensitive are the results on the fit parameters (fit window, polynomial degree)?

p221, line 1: Why is vibrational Raman scattering not considered explicitly? How would the fit results change if it would be included?

Are the additional absorption spectra for water and soils fixed with respect to their wavelength calibration, or has the fit the possibility to shift them? I would expect some impact on the results from this setting.

p222, 2nd paragraph: It is written that the fit can not distinguish between water and soils, unless there is a strong contribution from one of them. However, Fig. 7 looks quite reasonable (values about zero for most vegetation areas). Does the retrieval shown in Fig. 7 include liquid water as well?

I recommend to show an additional map of the results for the liquid water absorption analogue to Fig. 7.

The empirical correction for sand/soils is quite impressive, but should be discussed in some more detail:
- Where and when both spectra have been measured exactly?
- Why can the soil signature be determined from two spectra both over desert?
- What is different for both measurements (viewing geometry, light path proxies as Ring and O4, or even the liquid water response!?)?
- Is it possible that there are contributions from vegetation in the denominator spectrum?
- Are there any absorption spectra of sand in literature?
- Have you tried to reproduce the sharp bend at 480 nm in the lab?

Section 4: The Spike-removal seems to be a powerful method for reducing the noise in the SAA. Did the authors try to apply this method also for the SCIAMACHY retrieval? Though the fit window is smaller, narrow spikes still might be successfully removed without losing too many detector pixels.

p227, line 3: Please be more specific: "We recommend to use the daily solar spectra for studies on..." Which solar spectrum will be used in your GOME-2 product? Or will you provide both datasets?

Please comment more on the GOME-2 degradation. How does the scatter over the Equatorial Pacific and the average fit residual evolve with time?

References: Dikty et al.: Please provide this poster via web-link.

Figure 2: What is shown on the x axis? It must be some kind of normalized (tropospheric?) VCD (Fig. 1 shows values of about 1e15 in this area).

Figure 4: It migh be interesting to show the same map for the improved algorithm as well.

Figure 5: The H2Oliquid absorption looks quite different than that shown in Pope and Frey. I assume that some high-pass filtering has been applied? Please specify.

Figure 6: How was the ratio smoothed without losing the sharp bend?

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