Earth Syst. Sci. Data Discuss.,
https://doi.org/10.5194/essd-2017-102-RC1, 2017

Open Access Earth System Science Data Discussions

Interactive comment on "The ESA GOME-Evolution "Climate" water vapor product: A homogenized time-series of H_2O columns from GOME/SCIAMACHY/GOME-2" *by* Steffen Beirle et al.

Anonymous Referee #1

Received and published: 12 October 2017

General Comments:

The paper by Beirle et al. describes a specific water vapour data set, which is based on a combination of existing water vapour products for GOME, SCIAMACHY and GOME-2.

Although the underlying data and methods are not new, the resulting combined and homogenised data set may be useful for future climate studies. The data set is available via the specified link, but only to registered users; therefore download (and the data

Printer-friendly version

Discussion paper

product itself) could not be checked.

The paper is well written and contains (except for the points listed below) all required information for a potential data users, including information about the quality of the data set. However, it is not clear how some of the references especially in the validation section can be accessed (see below).

My main points of criticism are:

1. Scan angle correction:
   It is stated in Section 2.3 that this is not applied for the climate data product because of the smaller scan angle range and the complexity/quality of the correction. However, as shown in Fig. A1, there are especially for GOME-2 significant scan angle effects. Although the scan angle related patterns are (at least partly) removed for the offset correction, they are still left in the climate product (at least in the unsmoothed one). The product contains a corresponding warning flag, but from Fig. A1 it seems that a lot of data will be affected. The impact of not applying a scan angle correction on the data product should be quantified and a clear recommendation should be given to the data users, if the flagged data should be used or not (or, under which conditions).

2. Product errors:
   The climate data product does not contain any TCVW errors. There is no description on how errors of the underlying products are considered. If it is not possible to specify an error for each data point, at least some general information about the expected quality (independent from validation results) should be given. For example, I would expect different quality/errors for the different instruments (and therefore for different time intervals), simply because of the merging of SCIAMACHY and GOME-2 pixels to GOME spatial resolution.

Specific Comments:

1. p. 4, l. 7–10:
   Using the O_2 AMF as proxy for H_2O AMF assumes that the O_2 VCD is known. What is usually known is the O_2 VMR, but the VCD should also depend on (varying) pressure and temperature. The additional correction factor for different profile shapes is only determined from standard atmosphere conditions. Is there a remaining dependency on pressure and temperature? Since this applies to both O_2 and H_2O in a similar way the final impact might be low, but maybe this should be mentioned in the text.

2. p. 4, l. 22–23:
   Where does the range 2–3 km come from – is this related to the 80% O_2 SCD threshold? I assume this should depend also on cloud fraction?

3. p. 5, l. 30–31:
   The along track spatial resolution is given by the product of the along-track velocity of the satellite and the measurement (integration) time (plus along track size of the field of view). Since orbital parameters and along track field of view sizes of GOME and SCIAMACHY are very similar, the main difference is the integration time. Merging the SCIAMACHY data such that the across track spatial resolution matches the one of GOME should therefore result in a quite similar along track spatial resolution. So, actually the merging accounts for the difference in along track extent, which is then even smaller than the mentioned 30 km vs. 40 km.

4. p. 7, l. 10:
   Is there a reason for the larger differences in the tropics? Could this be related to the above mentioned issue that corrections for the different profile shapes are based on average atmospheric conditions or maybe the probably in the tropics larger (and possibly less accurate) saturation correction? Please discuss.

5. p. 10, l. 24–26:
   Why is the smoothing only applied to ocean data? The scan angle dependent artefacts also occur over land (see Fig. A1).

6. Section 5:
   The section on validation mainly refers to a report by Danielczok and Schröder (2017). Where is this report available? If it is not available to the public a bit more information about the validation activities should be given (collocation criteria, averaging procedures etc.).

   Furthermore, from the description it is not clear where the GNSS/ARSA stations are located – I suggest to add a corresponding map. Probably these stations are mostly at land, so how good is the information about the quality of the data product over ocean?

7. p. 11 , l. 18:
   Where is the reference by Grossi(2017) available?

8. p. 12 , l. 10–11:
   'Note that the transitions between the satellite instruments are not visible in the timeseries of the difference to the validation data sets.'

   Is this because of the averaging of data during the overlap times?

9. p. 12, l. 15:
   It should be mentioned earlier (e.g. in the introduction) that the climate product contains monthly mean data at 1 deg resolution.

10. p. 12, l. 28:
    How many data are affected by the Warning_Flag? Looking at Fig. A1 and noting that there is no distinction between time and/or instrument this should be quite a lot. I suggest to add a plot of the Warning_Flag to Fig. A1 and an average number of affected data points to have a better impression on this.

11. Fig. 2:
    It seems that the GOME ground pixels across track have different size (centre pixel is smaller) whereas coadded SCIAMACHY pixels have about the same size. Could this have been improved by different coadding patterns for SCIAMACHY?

12. Figs. 13 & 14:
    Fig. 13 shows a small decrease of the differences towards the end of the time series (probably the reason for the negative stability). This decrease is not seen in Fig. 14, which indicates that it is not related to the satellite data (e.g. due to GOME-2 degradation). Is there any information about the quality of the station data?

13. Appendix A:
    A bit more information should be given about the 'normalised convolution' and how it is exactly applied. What are the limitations for removing gaps (e.g. I assume they cannot be larger than the size of the CK)? How are polar regions / edges of the data set handled? As already mentioned above, why are the climate product data smoothed only over ocean but not over land – if smoothing is necessary, it should be necessary everywhere. How are costal regions (where both land and ocean are in a 1 deg x 1 deg box) handled?

14. p. 24, Section B2:
    If the asymmetry of the SCIAMACHY scan pattern is handled via the spatial merging of the SCIAMACHY pixels, why is the merging pattern symmetric (e.g. 5–6–5, see Section 3.1)? Furthermore, since SCIAMACHY is the reference for the offset correction (Section 3.3), any bias of SCIAMACHY will be in the end product (in contrast to what is written at the end of this section). Or, is there an additional offset correction for SCIAMACHY?

Technical Corrections:

1. Please check bracketing for citations in the text – sometimes brackets are missing or at the wrong place.
2. p. 5, l. 4:
   table → Table
3. p. 7, l. 29:
   continues → continued
4. p. 8, l. 19:
   table → Table
5. p. 23, l. 18:
   TCWV_smooth → make ‘smooth’ an index
6. p. 24, l. 28:
   SCIACHY → SCIAMACHY

Interactive comment on Earth Syst. Sci. Data Discuss., https://doi.org/10.5194/essd-2017-102, 2017.

Printer-friendly version

Discussion paper