Improved algorithm baseline for the generation of total ozone climate data records: application to GOME and OMI

C. Lerot(1,2,3), T. Danckaert(3), R. Spurr(2), D. Loyola(3), M. Coldewey-Egbers(3), M. Koukouli(4), D. Bali(4), M. Van Roozendael(1)
(1) BIRA-IASB, (2) RT Solutions, Inc., (3) DLR-IMF, (4) AUTH, christl@oma.be

Abstract

The direct-fitting total ozone retrieval algorithm GODFITv3 developed at BIRA-IASB has been applied in the past years on nadir observations from the instruments GOME, SCIAMACHY, GOME-2A/B and OMI to generate climate data records characterized by a high level of accuracy, temporal stability and inter-sensor consistency (Lerot et al., JGR, 2014). Those data sets are publicly available on http://www.esa-ozone-cci.org.

As part of the ongoing activities within the Ozone_cci project, new algorithmic developments have been carried out. A new a priori total column-classified ozone profile climatology released by Labow et al. (2015) is now used. Covariance matrices associated with this climatology have been constructed and are used to estimate modeling errors on a pixel-basis. Also, a better treatment of the instrumental slit functions and their time variation has been implemented, as well as an optimized correction for the \( \tau_2 \) effect. We use now the ozone cross sections measured by Serdyuchenko et al. (2014) of which the temperature dependence is better characterized. This improved baseline has been used to reprocess the full GOME/ERS-2 and OMI/Aura emissions and we present here the new version of the corresponding GODFIT total ozone data sets. The quality of the products is evaluated by comparisons with other total ozone products, such as OMI-TOMS, OMI-DOAS, SBUV v6.6 and also with the previous version of the CCI data sets. In the coming months, SCIAMACHY and GOME-2A/B will be reprocessed to generate a new version of the multi-sensor L2 and L3 total ozone data records.

New algorithmic features

- GODFIT v3: Total column-classified climatology TOMSv8 (Mc Peters et al., JGR, 2007) combined with the tropospheric column climatology from OMI/MLS (Ziemke et al., ACP, 2011).
- GODFIT v4: The total column-classified climatology recently released by Labow et al. (JGR, 2015), also in combination with the OMI/MLS tropospheric climatology.
- Smoothing errors: errors due to the a priori profiles. They can be computed as \( \tau = \sqrt{\Delta T^2} \), where \( \Delta T \) is the total column averaging kernel and \( S \) is the covariance matrix of the climatology.

Conclusions

- New developments have been carried out in the algorithm GODFIT used to generate the total ozone ECV within the Ozone_cci project. In particular, a new total column-classified profile climatology based on MLS and sondes measurements has been tested. Instrumental slit functions, as well as their possible time evolution, are better characterized. The \( \tau_2 \) cross sections measured by Serdyuchenko et al. (2014) are now used with an improved treatment of the solar \( \tau_2 \) effect.
- Once applied to GOME/ERS2 and OMI/Aura, this new baseline leads to excellent total column data products. Overall, the new OMI data set agrees well with the OMI-TOMS and OMI-DOAS products as well as with the merged SBUV v6.6 record. The OMI/GODFITv4 ozone columns are 1.2% larger than the other products. A possible small drift in the ozone columns in the last years of operation is to be investigated.
- In the coming months, GOME and OMI will be combined as a long-term reference to soft-calibrate other sensors (SCIAMACHY, GOME-2A/B), which will be reprocessed afterwards.