

## ***Interactive comment on*** **“Stratosphere-troposphere separation of nitrogen dioxide columns from the TEMPO geostationary satellite instrument” by Jeffrey A. Geddes et al.**

### **Anonymous Referee #1**

Received and published: 9 August 2018

This paper presents a standard stratosphere-troposphere separation algorithm for the observations of NO<sub>2</sub> from the TEMPO (Tropospheric Emissions: Monitoring of Pollution) satellite instrument. TEMPO, which will be launched between 2019-2021, will provide space-based measurements in geostationary orbit with a field of regard over North America from southern Canada to Mexico City and the Bahamas. Algorithm developments include the use of independent satellite observations (OMI and GOME-2) for identifying likely locations of tropospheric enhancements and for spatial context, the consideration of diurnally varying partial fields of regard, and a filter based on stratospheric to tropospheric air mass factor ratios. This algorithm is tested with Low Earth Orbit (LEO) from the OMI and GOME-2 satellite instruments. The potential information

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penalty associated with the limited TEMPO field of regard compared to an identical global algorithm is also examined.

This study fits well with the scope of AMT and the manuscript is well written and clearly structured. Figures are also of very good quality. I recommend publishing the paper in AMT after addressing the following comments:

General concerns:

1/In the absence of daily independent satellite observations for the near-real-time processing, the back-up solution will be to use a climatology built on satellite observations or model data. Then, what will be the level of homogeneity/consistency of the retrieved TEMPO NO<sub>2</sub> column time-series since they will consist in a combination of retrievals performed using different sources of ancillary data? Do you foresee an off-line reprocessing based on a unique source of ancillary data? Or this is something which is not needed since this effect will be within the typical stratospheric error due to stratosphere-troposphere separation methods?

2/The validation of the separation algorithm is not discussed at all in the paper. I think that at a later stage, it will be useful to compare the stratospheric NO<sub>2</sub> column estimates with independent reference measurements, e.g. from ground-based DOAS UV-visible spectrometers. As first verification, maybe it would be interesting to compare within the anticipated TEMPO field of regard the estimates of the stratospheric NO<sub>2</sub> vertical column with those included in the OMI and GOME-2 data products used in this study.

Both points 1/ and 2/ should be further discussed in the paper.

Specific comments:

Page 6, line 5: a short justification is needed about the fact that data are restricted to SZA smaller than 80°.

Page 7, line 1-4: Monthly mean of GOME-2 tropospheric NO<sub>2</sub> columns is used as

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initial a-priori tropospheric NO<sub>2</sub> estimate. How is it done in practice ? Are the GOME-2 data first gridded on the same 0.1°x0.1° regular grid as OMI ? A clarification would be helpful here or at the end of the description of the GOME-2 data in Section 2. Also, since the tropospheric NO<sub>2</sub> column can show strong diurnal changes, is the GOME-2 tropospheric column a good estimate of the column at the OMI overpass time ?

Technical corrections:

Page 3, line 6: 'Richter et al., 2005' instead of 'Richter et al. 2005'. Similar corrections should be done on the same page at lines 7, 13, 14; on page 3, line 3; on page 4, line 20; on page 6, line 2.

Page 4, line 19: 'available' instead of 'avialable'

Page 7, line 30: one bracket should be removed after '2013'.

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