Review of **Global Ozone Monitoring Experiment-2 (GOME-2) Daily and Monthly Level 3 Products of Atmospheric Trace Gas Columns** by Ka Lok Chan et al.

This paper gives a full description of a new set of daily and monthly Level 3 products created from Level 2 Products (Total Column O_3, Total and Troposphere NO_2, Total H_20, Total BrO, total HCHO, and total SO_2) estimated by using measurements from the Eumetsat GOME-2 instruments on the Metop platforms. It provides a clear description of the choices and statistical approaches used for the different species as well as validation versus ground-based measurements and the original Level 2 products. The paper includes summaries of the strengths and weaknesses for each component together with extensive citations of the literature.

There is always a loss of information in the creation of a Level 3 product in exchange for the filtering, weighting, and selection exercised by the developer. Is there a way to preserve or access the information on the a priori profiles and the viewing geometry for the Level 3 products? If not, then it becomes difficult to determine whether the column values are consistent with comparative profile measurements.

Given the differences in SZAs and local times is it worth separating out the ascending and descending measurements? Can the repeated measurements at high latitudes from ascending and descending portions of the orbits be used to investigate diurnal variations?

It should be possible to identify and flag many of the Level 1 spectra affected by charged particle events within the South Atlantic Anomaly. Is this information available from the Level 2 Products? While the expected effects are an increase in the recorded signal, they will produce noisy retrievals for DOAS algorithms. Is there screening of negative values that could produce a positive bias?

How is the varying coverage at the highest latitudes during a month reported? For example, if a grid point only has values for the last 20 days of the month, is there an associated average date to record this bias?

For NO_2:
The paper describes/cites two possible methods for determining the stratospheric overburden, and then concludes with a reference to a third paper for details. Which method is used to get the tropospheric estimates used here? Is there any information present in the Level 2 products for the tropospheric ozone for the masked regions where is it essentially assumed to be zero? Can the cloudy scenes (say >90%) that do not have information on the tropospheric NO_2 be used to confirm the stratospheric column amounts, that is, recognize that there is only information on the above cloud NO_2 and use the appropriate AMFs? Are the total column NO_2 amounts recomputed after the redetermination of the tropospheric amounts or are the original estimates with stratospheric air mass factors used?

For BrO:
The use of an equatorial offset would seem to mean that the Level 3 cannot provide independent trends for 5°S to 5°N. Do monthly maps confirm this? That is, do they just show the stable assumed BrO levels?

For SO_2:
In Figure 7 and the following text, it is noted that Metop-C retrievals are much less noisy at high SZA and that they are 0.5 DU lower in general. Is this "in general" for a typical measurement or is it for a global average due to the high SO_2 values at high SZA for Metop-A & -B? The color scale is not ideal but I do not see a 0.5 DU difference in the tropics. While the DOAS retrieval for Metop-C is different from the Metop-A & -B one (312 nm versus 315 nm and AMF at 313 nm versus 320 nm), it is not clear how this leads to the much poorer performance of the latter products at high SZA. Are the signal levels of the three instruments much different? (Perhaps some quantitative information on the degradation over time of the signals for the three sensors would be explanatory for some of the features of Figures 6 & 7.) Is it increased noise or bias, that is, I do not see negative values for the SO_2 at high SZA, just large positive ones? Also, what is the source of the higher values for Metop-A in 2019?

Figure 23 shows many negative values for SO_2 but they are not in the scatter plots in Figure 22. Please explain. (This may also be the case for HCHO in Figure 20.) Is any adjustment made to the total least squares regression for the differences in the precision for the satellite data values versus the Pandora data values?

Do major volcanic eruptions create perturbations in the monthly zonal mean products? The color scales chosen for the figures do not reveal any.

Minor edits / Technical corrections

Page 2, L17 irradance → irradiance

Page 2, L28 user friendly → user-friendly

Page 2, L18 Change to

The retrieval of trace gas columns from level 1B data includes spectral retrieval of slant columns of a trace gas and subsequently conversion to vertical columns.

Page 2, L31: includes → include

Page 3, L4: is → are

Page 3, L18: side ways → sideways

Page 4, L14: range.In → range. In

Page 4, L16: NO_2 → An NO_2

Page 4, L19: air mass factor → air mass factors (AMFs)

Page 4, L19/20: Change to

Vertical distribution profiles are essential a priori information used in the calculation of AMFs.

Page 4, Line 21/22: Change to

Based on the initial result of the ozone vertical column retrieval,

Page 5, Line 4: intra cloud → intra-cloud

Page 5, Line25/25: Change to

The initial total VCD is retrieved assuming an unpolluted troposphere. Therefore, the air mass factor is weighted toward to stratospheric NO_2, whereas the tropospheric NO_2 amount is assumed to be negligible.

Page 6, Line 25: Change to

The DOAS fit for water vapour retrievals takes into account O_2 and O_4 cross-sections …

Page 9, Line 21: So_2 → SO_2

Page 9, Line 24: a.s.l. → above sea level

Page 13, Line 7: low quality → low-quality

Page 13, Figure 1: overlayed → overlaid

Page 14, Line 25: data is → data are (twice)

Page 16, Line 11: Change to

Despite the fact that large numbers of observations are …

Page 18, Line 19: low quality → low-quality

Page 18, Line 22: Change to

The noise levels of monthly GOME-2A data are significantly higher than those of GOME-2B and C. This is mainly related to less …

Page 23, Line 13: tropopsheric → tropospheric

Page 29, Line 11: is higher → are higher

Page 35, Line 3: studies shows → studies show & when MAX-DOAS → when the MAX-DOAS

Page 37, Figure 22: Vertical Axis Label -- Occurancy → Occurrence

Page 45, L4: S. ichi Kurokawa → S. Kurokawa

"The scientific results and conclusions, as well as any views or opinions expressed herein, are those of the author and do not necessarily reflect those of NOAA or the Department of Commerce."