Comment on essd-2022-315
Anonymous Referee #1


Chan et al. presented a new suite of L3 GOME-2 product including total O3, total and tropospheric NO2, total H2O, BrO, HCHO, and SO2. They inter-compared data from 3 sensors and evaluated the dataset with ground-based observations. The gridding strategy for producing L3 data is also documented. A user-friendly and well-documented L3 product presented is extremely valuable for the community and for wider usership. The paper is clearly written but additional information that guides a potential user may be added to improve the manuscript. I recommend the paper and data to be published in ESSD if the following comments are addressed.

Main comments
As the intended users for the L3 data include non-expert users, it would be useful for authors to provide advices or guidelines (including recommendations and/or cautions), but this is in general inadequate in the current manuscript. For example, do you recommend to use monthly average or daily data for a specific species, based on the evaluation? Is the current evaluation adequate the characterize the error statistics?

Performance statistics are important information for a user. However, very different amount of ground-based data are used for evaluation. Some are from global network, and some other are from only one site (e.g., Mexico city for SO2). I’d suggest to comment on how representative the derived bias & correlation are, and make proper recommendations to authors about the uncertainty.

Specific comments:

Page 5 Line 30: Unclear whether the stratosphere-troposphere separation is done on the initial total vertical columns or total slant columns
Page 12 Line 29: Here observation at Mexico City is used for evaluation, but the above L2
description stated that retrieval algorithm assumes SO2 from volcano. What is the implication of this inconsistency?

Page 14 Eq (2) & Eq (3): I do not see any results related to Eq (2) and (3) presented in the manuscript. Are they included in the L3 product?

Table 2 does not appear to have enough information. Can merge with Table 4

Section 5.1.1 & 5.1.2: Use separate paragraphs for each species. So readers can find information on species of interest easily.

Table 3: It would be helpful if you also list relative metrics for biases.

Page 25 Line 9. Discrepancy appears to be large also in Northern mid-latitude based on fig. 7.

Page 34 Line 7-8: does this indicate that a user should use monthly HCHO data for analysis, or daily data should be used with caution?

Table 4: Are reported metrics derived from daily products or monthly products? Consider to report as accuracy (bias) and precision, as these are often useful metrics when model-satellite comparison is done.

Minor text edits:

Page 2 Line 12-13: "Together with its successors, Global Ozone Monitoring Experience 2 ...". I’d suggest to rephrase. It reads like GOME-2 and its successors (that would be GOME-3...).

Page 2 Line 28: In order "to"

Page 2 Line 31: includes -> include

Page 9 Line 21: capitalize O in So2

Page 21 Line 25; Page 22 Line 2; Page 23 Line 1; Page 29 Line 21 and elsewhere: "result" -> "result in"

Figure 7: Texts are too small to read. May consider to remove repeated color bars for 1st and 2nd columns and increase the font size of the 3rd column.