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Atmospheric Chemistry and Physics Discussions

Interactive comment on "A study on harmonizing total ozone assimilation with multiple sensors" *by* Yves J. Rochon et al.

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Below are responses to the comments of Anonymous Referee #1. First, we wish to thank the referee for taking time for conducting this review, the comments and the recommendations.

A significant motivation in submitting to ACP was the presence, in this journal, of the 2010 paper on "Multi sensor reanalysis of total ozone" dealing with column ozone bias correction and assimilation, this in addition to various papers on the evaluation of ozone satellite data and their retrievals, and the MACC reanalysis paper.

A concern is the amount of detail and the size of paper. As recommended, the descriptions currently in section 2, and likely for some results, will be reduced. Moreover,

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it is proposed to remove the work and assimilation results associated to the modified background error variances for ozone, reduce the number of figures as proposed by the second referee, and possibly reduce the content of section 3. Note that a re-distribution of the reduced content of section 2 would also be applied if we follow more or less the re-organization proposed in the earlier response to second referee.

Assuming equivalent daily spatial coverage (such as in latitude) and given limited benefit of accumulated reduction in random noise from multiple sources covering the same location, a reason for assimilating column ozone from more than one satellite is to better ensure that data is continually available in the event of occasional to permanent interruption of data availability from specific sources. For near–real assimilation, this does imply the need for contingency planning for transitions of bias correction references. As pointed out by the referee, one does not necessarily need to use data from all instruments either. Data from instruments not used in assimilation can be applied for independent verifications of analyses, as well as non-assimilated data subsets from instruments used in assimilation. The latter can easily be done for total column ozone data from nadir mappers considering the distribution and resolution of the data as well as the model resolution and the spatial variability of ozone field.

As pointed out and implied by Referee #1, improving prediction models is critical in improving forecasts. Given improved initial conditions from intermittent analyses, the photochemical forecasts of column ozone and stratospheric ozone over most latitude ranges can remain of good quality for the duration of at least few days. This is exemplified by the regional changes in column ozone of within about 5% over 2 week periods in Figure 13 in the absence of assimilation. On the other hand, the quality of the ozone amounts near the mesopause, in the mesosphere, and near the ground (when not also in the stratospheric winter pole) could change more rapidly depending on the quality of the photochemistry model. There is also the quality of transport forecasting affecting local ozone concentrations.

In the introduction, it is indicated that having the ability to remove likely infrequent

extreme column ozone biases would contribute in the quality of the UV Index forecasts. The mention of the UV Index was also included for completeness regarding the overall context in which ozone assimilation is intended to being conducted. As pointed out by the referee, changes of a few percent in column ozone forecasts imply errors of only a few percent for the UV Index. As well, individual extreme outlier data would usually be identified in the background check phase and not used in assimilation. As the impact of column ozone bias itself on the UV Index would nearly always be at the level of a few percent, the mention of association of ozone bias correction to the UV Index will be removed.

There is the intention/interest at ECCC of pursuing the added assimilation of partial column ozone profiles from OMPS-NP and SBUV/2 in near-real time, if not also limb profilers such as OMPS-LP.

The issue of using an earlier version of the OMPS data is indicated in section 2. As suggested by the referee, it would be worthwhile indicating that the quality of the different versions of retrieved may differ, with comparisons of the OMPS data from the more recent version retrievals with OMI-TOMS expected to show an increase in quality of the newer dataset. This can be done in the Conclusions section if not elsewhere as well.

As recommended by the referee, lines at the zero points will be added as needed in the figures.

Another set of two panels will be generated for Figure 6 (assuming this the figure intended to identified by the referee instead of Figure 7) to increase the distinction between cases, with GOME-2A and GOME-2B in one pair and the other four in a second pair.

The definition of the 'effective ozone temperature' will be provided in the introduction and be less condensed than what was provided on page 17, lines 1-2.

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