

Geosci. Model Dev. Discuss., referee comment RC1
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Comment on gmd-2020-315

Vincent Huijnen (Referee)

Referee comment on "Impact of IASI thermal infrared measurements on global ozone reanalyses" by Emanuele Emili and Mohammad El Aabaribaoune, Geosci. Model Dev. Discuss., <https://doi.org/10.5194/gmd-2020-315-RC1>, 2021

This manuscript describes an extended evaluation of recent improvements to the radiance assimilation system of ozone observations from the IASI instrument, and compares the results to those from a state-of-the art chemistry transport model (GEOS-CCM) and data assimilation product (CAMSR). While the authors don't present new data-assimilation developments, the evaluations presented in manuscript are very useful to benchmark the current configuration, both compared to observations, and to other products.

The manuscript is well written, and I have only small comments. the only weak point I find is the slightly limited scope of the analyses and evaluations presented here. It could be useful to extend the scope of the evaluation and benchmarking exercise, e.g. in the directions as suggested below.

- The authors now mostly focus on evaluations of zonal mean concentration at five latitude bands (Figs. 2.3), or as zonal mean (Figure 5). In addition it would be interesting to see the performance of the assimilation system for more regional variations, e.g. by plotting presenting evaluations as in Figs 2/3 specific for certain regions (e.g. Europe), or presenting the data as in Figure 5, but (for instance) showing a lon/lat plot averaged over DJF and JJA, at selected altitude levels.
- In Figure 5, in addition to showing the results of IASI-r, why not also present plots for the IASI-a product for reference?
- Can the authors comment on the differences in computational costs for the L1 and L2 assimilation configurations, and discuss the reasons for differences, and potential means to improve on this? Also, it's good to put these differences in costs into perspective, particularly in regard to their comment in the conclusion in the case "IR measurements are already assimilated", (p12, l16)

Furthermore, considering the data-thinning approach (pp 7, line 3), in the current study only a single observation is used in every 2x2 grid box. Can the authors explain a bit more about their data-thinning approach, e.g. do you make any additional check on selecting

representative observations (apart from the dynamic filter)?

Technical comments

General: please don't refer to "C-IFS", which is outdated terminology, but plainly to 'IFS' instead, or plainly to "CAM5". Also, please make more distinction between "model" and "(data-assimilation / model) product", as indicated also below.

p1, l7 "models"-> "products"

p1, l8 "C-IFS" -> CAM5 Reanalysis

l11: C-IFS reanalysis-> CAM5 Reanalysis

l15 "concentration" -> evolution"

l17 'ENSO' : explain acronym

p2, l7 remove "assess"

l24 add 'a' in "found a positive impact"

p3, l16 "and to the CAM5RA chemical reanalysis (Inness et al)" suggest to change to "and to the CAM5 atmospheric composition reanalysis (CAM5RA, Inness et al)"

l18 "satellites assimilation" -> satellite data assimilation

l23 reanalysis experiments -> reanalysis datasets

l25 "chemical"->"chemistry"

l29 "experiments" -> "datasets"

p4, l7 "ACMMIP"->"ACCMIP"

l16 "aerosol schemes(C-IFS, Flemming et al.(2015))" ->"aerosol schemes(Flemming et al.(2015))"

l16 "Within C-IFS" -> "within IFS"

p5, l 23 and 26 "ozonesondes" -> "Ozone sonde" ?

p6, l10 "limit" -> "limitations"

l12 "satellites" -> "satellite retrievals"

p7, l12: please check units (incl upper case, and use of '-1' and '/' in mW/m2/sr/cm-1

p8, l13 "chemical reanalyses" -> "chemistry model and reanalysis"

p11 l32 "modelling experiments" -> "modeling and data assimilation products"