Atmos. Chem. Phys. Discuss.,
doi:10.5194/acp-2016-652-AC1, 2016

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Introduction to the SPARC Reanalysis Intercomparison Project (S-RIP) and overview of the reanalysis systems" *by* Masatomo Fujiwa et al.

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Received and published: 5 December 2016

We thank referee #1 for their comments, which motivated a more substantive discussion of how various aspects of reanalysis systems influence reanalysis products, particularly in the middle atmosphere. At the referee's request, we have also included a brief summary of these issues in the final section of the manuscript. Referee #1 also suggested that project plans for S-RIP should be removed from this paper. Please see the second item below for our response to this suggestion.

I would like to see some of the very nice comments sprinkled throughout the text about how the reanalysis system structure impacts the stratosphere put into the conclusions.

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We have expanded this part of the discussion, and have also included a few additional points along these lines. See p.9, l.11–16; p.12, l.20–24; p.20, l.27 through p.21, l.2

The title might be better as "Overview of the reanalysis systems in the stratosphere for the SPARC Reanalysis Intercomparison Project (S-RIP)"
We have discussed this internally and have chosen to keep the original title because this paper also serves as the introductory paper for the S-RIP special issue and, as such, should briefly outline the mission and structure of the S-RIP project. We have also discussed the option of separating the paper into two parts, a short paper introducing S-RIP (and the special issue) and a longer paper reviewing the reanalysis systems (which would then take this or a similar title). This approach has its appeals, but would involve technical and logistical issues that we prefer to avoid unless the referees and the editor in charge have strong preferences for it.

Table 1 could be deleted.
Table 1 has been deleted.

Figure 1 is probably not discussed enough to be necessary.
Figure 1 is retained, to support the component of the paper that is intended to introduce the S-RIP special issue.

P2, L25: I think it would be wise to spell out the Acronyms where they first appear, as is typical custom. That is an editorial decision for ACP.
After consulting the editor in charge, we have updated the manuscript to introduce more of the acronyms within the text. The modified approach is outlined at the end of the first paragraph of section 1 (p.2, l.28–30): "A key for all acronyms used in this paper is provided in Appendix A. Acronyms representing the names of institutes, models, satellites, and other entities are in most cases only provided in the appendix; all other acronyms are both introduced in the text and included in the appendix." The rationale is that many of these entities are already well known by 'brand name' acronyms. Given the length of the paper, we feel that readability is better served by brevity in these

cases.

P3, L7: A list of 13 papers as examples is not really necessary. Probably just citing examples in Fujiwara et al 2012b is appropriate, unless you want to specifically describe any examples in a sentence.
We have replaced this with "a list of recent examples has been provided by Fujiwara et al., 2012; see also the contents of this special issue" (p.3, l.15–16).

P3, L22 through P4, L14: Describing a report is not helpful or necessary. These paragraphs, table 1 and figure 1 could be deleted.
The discussion here has been modified somewhat to remove unnecessary terminology (e.g., "basic" vs "advanced" chapters) and make the presentation more general. We have also added references to certain chapters of the interim report where more information is provided (p.12, l.8–9; p.25, l.20–22; p.26, l.21–22).

P5, L6: Since the NOAA/NCEP systems are the oldest, maybe section 2.4 should be placed first in section 2.
To account for the staggered release dates of the reanalyses, we have retained the original order: alphabetical by reanalysis centre, then chronological within each centre.

P15, L5: here is a good summary about what impact assimilation and reanalysis system structure may have on results: suggest this result and other similar ones be part of the conclusions.
The potential for assimilation increments to generate spurious wave activity / instabilities is now repeated in the conclusions (p.26, l.4–8).

P17, L6: Is this the only mention of Figure 6? Suggest deleting it. All the figure shows is the 'deep vertical weighting functions' you mention.
Figure 6 (now 7) is referenced multiple times in the revised text (p.19, l.33; p.20, l.29–31; p.26, l.15–18). This figure is particularly useful for illustrating the issues involved in the TOVS–ATOVS transition, which we have emphasized in the revised text as an example of the impacts that changes in the observing system can have on reanalysis

products. This is a well-known issue amongst experts in the field, but not necessarily amongst the general climate community for whom this paper is intended.

P18, L25: What is homogenized data?
We have added brief explanations to the text at p.18, l.16–17 ("in which observations from different launch sites and instrument suites are post-processed to remove biases, drifts, and jumps in the data record") and p.26, l.22–23 ("in which observations collected by different satellites are cross-calibrated to reduce biases and eliminate discontinuities in the data record"). The introduction to homogenized satellite radiances data on p.20 also mentions that homogenization in this context refers to "post-launch inter-satellite calibration".

P19, L22: State why GPS-RO is unbiased in a sentence or two.
A brief explanation has been added on p.22, l.25–27: "GNSS-RO occultations are based on radio waves that are calibrated against on-board atomic clocks, and are therefore exceptionally stable both in time and across satellite platforms (Poli et al., 2010). The resulting retrievals have small random errors (equivalent to 1 K) and very small systematic errors (less than 0.2 K)."

P21, L33: What is the impact of the simplified H2O treatment on the stratospheric analysis?
This is an open question, which we hope to address during S-RIP. In the meantime, we have added a paragraph at the end of section 6.2: "In general, reanalyses do not provide physically meaningful estimates of water vapour above the tropopause, although it should be noted that observational datasets used for comparison to the models have their own rather large biases in this region (Hegglin et al., 2013). Given the importance of water vapour in the upper troposphere and lower stratosphere (UTLS) for radiative forcing (e.g., Forster and Shine, 2002; Randel et al., 2007; Gettelmann et al., 2011; Riese et al., 2012), large biases in the representation of the water vapour gradients across the tropopause and in the lower stratosphere may lead to non-negligible radiative and dynamical impacts in reanalysis systems. The magnitude of these impacts

in the different reanalyses is not yet quantified, but is under investigation within S-RIP. Regardless, we emphasize in no uncertain terms that reanalysis humidity products in the upper troposphere and stratosphere should be used only with extreme caution."

P22, L10-12: How are each of these affected by the reanalysis systems themselves? This would be a good place to spend a few paragraphs in summary
We have described several examples that relate specifically to how data assimilation techniques, bias correction procedures, and changes in assimilated data may impact reanalysis products (see summary from p.26, l.1 through p.27, l.10). The core purpose of the S-RIP activity is to evaluate and document how each of these features are affected by the reanalysis systems. Many of these evaluations are currently in progress, but are not yet documented. We therefore defer a more systematic summary of how these features and regions of the middle and upper atmosphere are affected by the reanalysis systems to synthesis papers that will be written and submitted once the S-RIP report is completed.

P22, L15-31: I don't think project plans for SRIP belong in ACP
Please see response to title suggestion above.

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