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

Anonymous Referee #2

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This is an overview document for the volume on the intercomparison of stratospheric reanalyses – the Stratosphere–troposphere Processes And their Role in Climate (SPARC) Reanalysis Intercomparison Project (S-RIP). The manuscript is very well written, and achieves its primary goal of a useful description that can stand as reference document for the papers in the volume. In fact, it leaves me looking forward to seeing some results.

I hope the authors consider the following comments to complement the present manuscript.

1) There have been previous intercomparisons of reanalyses, including some discussion of the stratosphere. A paragraph mentioning some of these intercomparisons and

lessons learned would strengthen the context of the current paper.

2) In Section 3, Page 8, it is noted that a key difference between the assimilation systems is the height of the top level of the model and vertical resolution. What is not mentioned in the paper is the treatment of the upper layers of the model. I postulate that the scientific foundation of many of the differences that are revealed will be related to the upper boundary and its treatment. Therefore, it would be useful to tabulate whether or not there is a sponge layer, the depth of the sponge layer and the dissipative methods that are used in the sponge layer – Rayleigh friction, enhanced horizontal diffusion, etc. This information will be especially important in the discussion of the Brewer-Dobson circulation, and diagnostics such as the age of air.

3) Since one of the applications of stratospheric reanalyses is to understand tracer transport, it would be useful to have a table of how the models, in general, treat diffusion – second order, fourth order, Rayleigh friction, etc.

4) In both the text, Page 8, and the tables, the spatial size in km should be given for all of the models. Presently it is in degrees for some models and km for others. Consistent presentation of technical information should be checked throughout.

5) Coming from a numerical background, the equating of "resolution" with "grid cell size" always bothers me. Generally, I live with my idiosyncrasy. However, the statement in Section 3, Page 8, that the "effective horizontal resolution is . . ." is one I cannot let past. Since, effective resolution of weather and climate models is a topic of some controversy, with several lines of research, this is a term than should be used correctly. This is grid size, not the effective resolution, which will be 6 to 10 times the grid size.

6) I would like to see tabulated information on the treatment of CO2 and CH4 (Page 9) and aerosols (Page 10) in the radiative schemes. Since these reanalysis cover a span of time when climate is, definitively, not stationary, the treatment of the greenhouse gases seems fundamental. From the text, the treatment varies greatly from model to model, and I can't differentiate one treatment from another in the current text. As

with the treatment of the upper layers of the model, I would expect the treatment of greenhouse gases and aerosols to have significant impact upon the science-based interpretation of the systems. Hence a quick summary table would be useful.

7) Similar to previous comment, I would like to see more description, table perhaps, of the sea-ice treatment in the models (Page 10). The changes in Arctic are large. There are trends in area of polar isotherms in the upper troposphere and lower stratosphere; more details of the treatment of the Arctic boundary conditions are needed.

8) In the sentences, page 13, the use of the word “attempt” to describe the 3-D – Var and 4-D – Var assimilation systems is peculiar. I assume that they do, in fact, do the optimization calculation.

9) Page 15. Like sea-ice, I could imagine a tabulation of how water vapor (Page 21) is treated in the upper troposphere and stratosphere would be useful for science-based interpretation.

10) Just by chance, I just saw that Jim Pfaendtner’s name is misspelled in the Helfand reference (Page 31). It is spelled as “Pfaentner,” and it should be “Pfaendtner.”

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