

Interactive comment on “Stratospheric and tropospheric SSU/MSU temperature trends and compared to reanalyses and IPCC CMIP5 simulations in 1979–2005” by A. M. Powell Jr. et al.

Anonymous Referee #4

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This paper presents a comparison of global temperature variations in the stratosphere and troposphere between satellite measurements (SSU + MSU), reanalysis data sets, and CMIP5 models. The focus is on comparing interannual variability and trends among the data sets, and direct comparisons are made by constructing weighted averages of the reanalysis and model temperatures to approximately match the SSU and MSU weighting functions. While such comparisons are valuable, there are several fundamental problems in the interpretation of these comparisons in this paper, and the paper needs a complete and major revision before it is acceptable. The major problems are discussed below:

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First, the STAR SSU data are a relatively new product, and comparisons with the previous version of combined SSU data (from the UK Met Office) show substantial differences regarding trends (as highlighted in the recent paper of Thompson et al, 2012, Nature). The cause(s) of these differences are currently not understood, but any stratospheric comparisons using SSU data should highlight these uncertainties (and include both versions of the SSU results, in my opinion). The authors should note that the comparisons with CMIP5 data were explicitly shown in Thompson et al (2012), including global average time series and latitudinal trend profiles, and the results shown in this paper basically duplicate those comparisons.

The second key point is that the authors do not seem to appreciate that CMIP 5 models are free-running climate models, and the tropospheric temperature variability in each of these models mainly reflects ENSO variability in the models arising from internal atmosphere-ocean dynamics. There is less internal variability in the stratosphere, and the models are mainly responding to forced changes in radiative gases and volcanic events. While the tropospheric temperature variability in MSU and reanalysis data sets should be highly correlated (as they are), the CMIP5 models will each have their own tropospheric variability that is not expected to match past observations in any detail. This is the origin of the poor tropospheric time series correlations with the model results shown in this paper (e.g. Table 3, Fig. 6), but has no bearing on evaluating the quality of the models.

If the authors wish to revise this paper, I would recommend taking account of the two main points noted above. A careful comparison between the satellite data sets (including both the NOAA and Met Office SSU data) and the reanalysis data sets could be valuable, although differences in the stratosphere will be difficult to evaluate given the disagreement between the two SSU data sets. The current paper highlights the obvious problems of the CSFR reanalysis in the stratosphere (which occurred due to separate restarts of the assimilation system), and these data are almost useless for evaluating actual stratospheric temperature variability. Any comparisons with CMIP5

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data should take into account that these are free-running climate models, and furthermore avoid duplicating the previous stratospheric comparisons shown in Thompson et al (2012).

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