

Interactive comment on “The Climatology of Brewer-Dobson Circulation and the Contribution of Gravity Waves” by Kaoru Sato and Soichiro Hirano

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Dear Dr. Kaoru Sato,

I very much appreciate your clear response to my comment. I would like to clarify the key points of my review. I fully understand the methodology of the paper and I consider it valid, but I find it necessary to include a discussion regarding the role of assimilation increments in reanalyses, and I recommend including a comparison to the parameterized GWD from reanalyses, as explained below.

Indeed, Okamoto et al. (2011) showed that in a climate model the GWD equals the

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residual of the momentum balance using Terms 1, 2 and 3. However this is not the case in reanalyses because data assimilation produces an assimilation increment, i.e. an additional term in the momentum equation. The working hypothesis of the paper is that most of this assimilation increment is acting to correct for the limitations of GW parameterizations, and thus the residual of the momentum equation can be interpreted as the 'actual' GWD. While I consider this a valid hypothesis, I argue that it should be explicitly stated as such in the paper, because it is not self-evident. There could be model biases having little to do with 'actual' GWD (e.g. in radiative heating) that need to be offset by the data assimilation. Having this discussion in the paper would notably help the reader understand the reasoning behind the methodology.

In addition, in my review I suggest the authors to include an analysis of the parameterized GWD provided by the reanalysis centers. A comparison between the parameterized GWD and that 'estimated' from the balance Terms 1, 2, 3 would be very useful to highlight the limitations of parameterized GWD in reanalyses pointed out in Dr. Sato's comment, especially in the context of an S-RIP paper (e.g. are the differences larger for ERA-Interim which does not have non-orographic GW parameterizations?). It seems to me that such comparison would be useful for the S-RIP community and that the present paper is an adequate place to discuss these issues.

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