**Atmospheric
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Discussions

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Interactive comment on "Trends in stratospheric ozone profiles using functional mixed models" by A. Y. Park et al.

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This paper, while not the first to utilize the element of principal component analysis (PCA) in ozone profiles, offers a significant extension of the methodology and we anticipate that it will have increased usage in the community. Especially, the notion of utilizing variable variance. Having said that, I offer a few comments for consideration:

1. There is no mention of the work done with the total column ozone. As this is the integral of the ozone profiles the two should result in a common solution. I would like to see this addressed.

2. The use of the PCA for the qbo term has been demonstrated to be able to account for the lead/lag with latitude. Hence, I see no need to put in a 4 month fixed lag.

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3. The semi-annual oscillation. In my experience the source of this variability in the mid-high latitudes of the northern hemisphere is the dynamic variability associated with the mid-winter stratospheric warming. This event occurs, virtually, every year in the mid-upper stratosphere though the timing is variable, December-February. A "major" mid-winter stratospheric warming occurs less frequently and the difference is that the warming impact does/does not extend below 30 km altitude. A better variable to help account for this phenomenon is the use of the Eliassen-Palm flux at 100 mb with a lead of 1 month. Data are available from several sources, including the NWS Climate Prediction Center or can be computed from a re-analysis.

4. On page 12353 the authors assert that changes in dynamic parameters . . . will be associated with climate change processes . . . and need to be studied further. Actually, the possible changes associated with climate change are far more complicated than the dynamics and are related to the entire complex of greenhouse gases as well as the radiative effects.

5. Lastly, the notion that the data at Arosa are not up to the task leaves us hanging, especially since there are fewer missing months at Arosa than at Boulder. As this paper is quite lengthy with its extended discussion of methodology, it may not be the best place to go into a detailed discussion of the issue of Arosa. I suggest a short companion piece that explains why Arosa can't be used. Is the methodology that sensitive that it precludes its use at some sites? What of all the other Umkehr locations? As I say, we are left hanging.

There are a couple of typographical errors that do not impact the paper, but should be corrected. a) P 12344 line 24 too should be to b) P 12349 line 24 the subscripts are both i1. Should be i1 and i2.

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