

## ***Interactive comment on “A model intercomparison analysing the link between ozone and geopotential height anomalies in January” by P. Braesicke et al.***

**P. Braesicke et al.**

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### **We would like to thank reviewer 1 for his supportive and constructive criticism.**

As rightly mentioned in the review, statistical significance is an issue with only 20 years of data in each sample. Nevertheless, it is encouraging that understanding, based on physical processes, is consistent with many aspects of the correlation structure which we diagnose. We are happy to add an explicit statement about statistical significance in the revised paper.

1. Table caption 2 was slightly misleading in only mentioning the large number of points. It did not mention the problem of determining the correct number of degrees of freedom explicitly. Actually, we are really only looking for some crude measure of pattern similarity, so that statistical significance is not the important

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measure. We will revise the caption.

2. We assessed the separation of the EOFs by controlling the separation of the associated Eigenvalues (they should be discriminable and strictly monotonic decreasing between EOFs 1, 2 and 3). This separation in the model data works best in January (a pragmatic reason why we assessed January). The clear separation of the PNA pattern (EOF 2) lends confidence to the right order of EOFs in the lower atmosphere. Nevertheless we might still be fortunate in the upper atmosphere, helped by the fact that the early- to mid-1990s had relatively cold, undisturbed mid-winter vortices and that the prescribed boundary forcings (in particular SSTs) are pushing the models toward the observed "quiet" state (this does not mean to imply that the models follow observations). In addition, it is worth noting that even the phase of planetary wave number one (as obtained by e.g. a Fourier decomposition) commonly reveals significant phase differences between models and observations.
3. Yes, this is what we do. As explained on page 15416, paragraph 1 we use deliberately a simple approach to illustrate the "tropopause-ozone" coupling and assess later in how far our results correspond to a (full) coupled mode analysis as found in the literature. The agreement is very good. It is certainly right to point out that the zero lines are dictated by the underlying EOFs, but from a comparison point of view we are just assessing the fact in how far the models are similar in a particular defined quantity (here we try to highlight a basic concept of local vertical coherence, as it is used in statements about changes in tropopause height and their relation to ozone changes in mid-latitudes). As suggested by reviewer 2, we are happy to drop figure 3 and the accompanying discussion and to amend the motivation to better explain the use of this concept (in line with reviewer 2's recommendation to add a discussion of Ambaum et al., 2001).

**Reply to minor comments:**

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- The text will be rephrased in-line with point 3 above.
- The trend is considered.
- Multiplied with 100 the numbers would correspond to percent. As discussed above figure 3 will be excluded in the revised manuscript.
- 5.1.1 will be shortened significantly (see above).
- Thank you for pointing us to Christiansen (2002). We will include a discussion of those results in conjunction with the discussion of figure 6.
- Will be changed in the revised manuscript.
- A lower wave number cut-off often implies that more energy is carried in the large-scale waves; this might imply that related statistical indicators of large-scale circulation might become relatively more important. Admittedly a simple assumption, which we are happy to drop from the manuscript.
- As far as I can tell, we are in agreement with the reviewer.
- The final statement is certainly true for mid-winter. As motivated in the paper the mid-winter period is central in setting up the ozone dilution and we will add a further comment about chemical processing in spring, when sunlight returns to the pole.

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Interactive comment on Atmos. Chem. Phys. Discuss., 7, 15409, 2007.

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