

We thank the editor for his comments. In short, we have accepted all his recommendations. Below are our responses in blue.

Comments by editor

All 4 referees had positive views of your original submitted paper and my impression is that you have answered their comments thoroughly and used good judgement in deciding where revision is needed and where it is not. Therefore I will be pleased to accept your paper for publication in ACP without requesting further opinion from the referees.

We thank the editor for accepting our manuscript.

However I invite you to consider one point further before submitting a final version of the paper. Please provide a very brief response confirming whether you have or have not made the suggested changes.

You make the statement 'Hegglin et al. (2008) introduced the term "geophysical noise"' and (in your revised version) follow that a few sentences later with the sentence 'In other words, process-related coordinates can reduce binned variability (i.e., reduce the contribution from the "geophysical noise"), highlighting a more realistic representation of the geophysical and trace gas variability, and thus helping to elucidate the physical processes controlling it in different regions.'

I am bit concerned by (i) the use of the term "geophysical noise" and (ii) the use of "realistic" in the second sentence.

I thought that it was interesting that Reviewer 1, when referring to this part of the text, did not use the term "geophysical noise" but instead used "geophysical variability". Then when I looked at Hegglin et al (2008) I found that the term "geophysical noise" was used only in the abstract. I suggest that if you are going to use this term then you need to say what you mean by it and why you are using the term.

It seems to me that in other contexts "geophysical noise" is typically used to describe measurement uncertainty that is associated with uncertainty/variability in the geophysical background rather than, e.g. instrumental uncertainty. Typically this is because the

retrieval algorithm, converting the directly measured signal into the required estimate of a particular quantity, needs to make assumptions about the state of the geophysical background, which is unknown. In the context you are describing, your 'geophysical noise' is not limiting the accuracy of individual measurements -- e.g. of mixing ratio of a particular species -- but limits ability to take measurements and use them together to construct a useful picture of the overall state of the atmosphere. So my question is whether you really want to encourage the use of "geophysical noise" -- a term that was apparently used rather casually by Hegglin et al -- in this context.

We have removed all mentions of “geophysical noise” from the manuscript. The sentence discussed by the editor now reads:

For example, Hegglin et al. (2008) discussed this enhanced variability when comparing datasets binned using ...

Whether you do or not, I do recommend that you change the term 'realistic' in the second sentence to something else -- e.g. 'interpretable'. (Whilst I have no argument with the idea that the PV-theta binning of the observations is significantly helpful, I don't think that it adds realism.)

We changed realistic to interpretable

A further very minor suggested change:

Abstract: 'potential vorticity (PV)'. Done