

## Response to the two Requests of the Co-Editor.

### First Request

“PV on pressure vs. isentropes: I agree that the PV structure "at a given instant can be portrayed in various vertical coordinate systems, and each would be self-consistent". However, my actual point, namely that claims about necessary condition for instability (relevant for the 2nd part of the study) demand the use of isentropic surfaces (or, at least, quantification of the PV gradient along isentropes), still stands. I take it that the authors simply opted for a portrayal as is customary in conventional synoptic analysis (i.e., based on pressure coordinates), perhaps so as to highlight the SSS features. Nevertheless, if the targeted audience is (at least in part) researchers in stratospheric dynamics, then showing PV on pressure surfaces is far from conventional (as far as I can tell, essentially all of the more recent papers, i.e. from the last ~20-30 years employ an isentropic framework). Note that I'm specifically referring to PV, conventional meteorological fields (geop. height, winds, temperature) are indeed often shown in pressure coordinates.

In addition, as the authors also state, the time-development is more appropriately shown in isentropic coordinates (related to what is often called "PV thinking"). So it's still confusing to me why the authors maintain to opt for showing the time-development of case 1 (NH winter of 2004/5) in pressure coordinates, while they adopt isentropic coordinates for the time-development for cases 2 & 3. This way, cases 2 & 3 appear portrayed more appropriately than case 1 and the reader is left wondering why.

Having said all this, I don't see any major flaw with keeping the portrayal of PV on pressure surfaces. Nevertheless, a few additional minor changes to the text are still necessary I think: line 125 "where appropriate" at the least needs to be elaborated on for the reasons stated above (i.e., why appropriate for cases 2 & 3, but not case 1?), line 126 "in a conventional fashion" should be deleted.”

### RESPONSE:

Expressions “*where appropriate*” and “*in conventional fashion*” now deleted”.

To harmonize the text in line with the above remarks the following additions have been inserted in the text:

(i) Line 125-127

“*To this end the instantaneous scale and structure of the PV features is first illustrated at a vertical series of pressure-level charts. In addition, for two of the three case studies, we exploit the PV perspective (Hoskins et al 1983) by displaying a time-sequence of displays on pertinent isentropic surfaces to capture :- “*

And (ii) Lines 214-217

“*Note that the panels in Fig. 4 display the PV pattern on the 2hPa surface. This renders ready comparison with the patterns of other variables shown on the 2hPa surface in Figures 2 and 3. In the subsequent case studies the evolution of the PV pattern is shown on the dynamically more instructive isentropic surfaces.*”

### Second request

line 27: apparent misunderstanding of my previous remark: you cite two Harvey papers here but only one of them appears in your reference list - please add the other ref. there as well

RESPONSE: Missing reference now included