

Reply to SC3: 'Recommendations for clarifications on the calculation of some of the diagnostics listed', I. Simpson

We thank Isla Simpson for these valuable comments on the manuscript, and respond in line below (I. Simpson comments in italics, our responses in plain text).

*(1) line 166 on the calculation of the TEM diagnostics. It is stated that "It is important that these calculations be performed on the native grid of the model (or as close as possible), before being interpolated to standard levels for archival purposes." It's clear in the appendix that these diagnostics are to be calculated on pressure levels, but it's not clear here. In fact it sounds like the calculations should be performed on the native grid, which will not be pressure levels everywhere for most models. I suggest "It is important that these calculations be performed on THE PRESSURE LEVELS AS CLOSE TO THE NATIVE GRID AS POSSIBLE."*

Yes, this is important, and we follow your advice to make this explicit, both within the main text and within the appendix.

*(2) line 278 on the calculation of fluxes. I think it should be emphasized here that the fluxes need to be calculated using instantaneous fields e.g., people may use 6-hourly averages. Suggest "computed from INSTANTANEOUS high frequency data"*

Yes – we made the suggested change.

*(3) line 283 on the calculation of zonal averages. I suggest being more explicit about the proposed best practise for calculating zonal averages. I think it would be much less useful if zonal averages appear as NaNs at any pressure level that intercepts the surface at some point in the longitude circle. For example, that would mean in the Northern Hemisphere, we probably couldn't see the vertical E-P flux below about 600hPa in the mid-latitudes, even though it is a small portion of Asia that is below the surface here. I would suggest either taking a representative zonal average only over the longitudes that are above the surface or performing extrapolation below the ground of the variables that make up the fluxes, using some standard practise e.g. Trenberth, K. E., Berry, J. C. and Buja, L. E. (1993) Vertical Interpolation and Truncation of Model- coordinate Data, NCAR Technical Note NCAR/TN-396+STR, doi:10.5065/D6HX19NH. I expect it is a bit much to ask all modelling groups to perform the latter, so perhaps it is best to ensure that everyone uses a consistent methodology. In which case, the representative zonal average over all longitudes that are above the surface may be the best option.*

This is a very important point that we had overlooked. We now recommend extrapolation to avoid any missing data, but also allow for modeling centers to take representative zonal (and time) averages in cases where data is missing from subset of the zonal (time) points. We suggest that if more than half of the data is missing, however, then it would be best to report the data as NaN.

*A second point about the calculation of zonal averages. Line 284, suggests that this can be done online and modelling groups may interpret this as the fluxes etc can be calculated online on their model levels but, unless I'm mistaken, this isn't the way it's*

*supposed to be done. Is it necessary to make the online or offline statements, since this may lead to confusion in that respect?*

We meant that an online calculation might be possible for models that use a pressure coordinate, but we agree this was overly complicating the situation. We've now removed the discussion of online/offline calculations, and simply ask that they be done on instantaneous data sample at least 4 times a day.

*(4) Table 5. Perhaps this is just a confusion on my part, but is the "tendency of air temperature due to diabatic processes" supposed to be the TOTAL tendency due to diabatic processes i.e., this will be the sum of moist processes, short wave, long wave, turbulent diffusion, temperature tendencies due to gravity wave drag, tendencies due to any other diffusive processes and energy fixers? If so, then I think would be clearer to call it "Total tendency of temperature due to diabatic processes". It's confusing to have "tendency of air temperature due to diabatic processes" "tendency of air temperature due to longwave heating" "tendency of air temperature due to shortwave heating" since longwave heating and shortwave heating are also diabatic processes, so I think added "Total" in front of the first one would be clearer.*

We have clarified this in the text and table to clarify that we are asking for the total tendency from all processes.

*I'm also confused about this based on the text at line 196 because it's stated that the set of diagnostics allows us to understand the interaction between radiation, moisture and the circulation. If the first variable in the table is the Total tendency due to diabatic processes, then it's not actually possible to isolate the effect of moisture alone since the total will include other aspects such as turbulent diffusion. This made me wonder whether the first variable in the table is actually supposed to be the "tendency of air temperature due to moist processes"? Either way, I feel like some clarification would be helpful on this variable.*

We agree that the scientific logic was unclear here. In response to another comment, we do believe that the total diabatic tendency is important, as it will allow for a careful budget analysis. But to understand the impact of moisture, it would be valuable to quantify the impact of moist processes alone. We have therefore requested this (but at priority 2, as not to overtax modeling centers who initially agreed to the total tendency).