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Review of 'Diabatic processes modulating the vertical structure of the jet stream above the cold front of an extratropical cyclone: sensitivity to deep convection schemes' by Meryl Wimmer, Gwendal Rivière, Philippe Arbogast, Jean-Marcel Piriou, Julie

Anonymous Referee #2

Referee comment on "Diabatic processes modulating the vertical structure of the jet stream above the cold front of an extratropical cyclone: sensitivity to deep convection schemes" by Meryl Wimmer et al., Weather Clim. Dynam. Discuss., https://doi.org/10.5194/wcd-2021-76-RC2, 2022

General comments

This paper is effectively the second part of a previously submitted and published paper, which I also reviewed. As the latter this paper consists of a comparison between three simulations (among a whole ensemble of simulations) of a mid-latitude storm using two different convection parametrisations and no parametrisation at all. The focus in this new paper is specifically on the jet stream. The analysis consists of trajectory analysis combined with the analysis of observations collected during one flight of the NAWDEX field campaign. While no conclusions are drawn as to e.g. which parametrisation yields more accurate results, the work is useful to understand the variety of responses expected from different parametrisations on very specific details in a simulation (the jet stream in this case) rather than on statistical quantities such as forecast skill. As the previous paper, this article is definitely in scope for Weather and Climate Dynamics. It is also well-structured and well-written. I do not have any specific comments, but I do include a set of technical comments that can be considered by the authors to hopefully improve the manuscript. Other than this, I can fully recommend the paper for publication in WCD.

Technical comments

L15: Remove the acronym WCB from the abstract as it's not used there.

L26: Change 'skills' to 'skill'.

L35: Change ‘This’ to ‘It’.

L36: Change ‘Downstream and impact’ to ‘Downstream impact’.

L110-111: Change ‘its Ensemble Prediction System associated’ to ‘its associated Ensemble Prediction System’.

L114: Change ‘Models’ to ‘Model’.

L132: I don’t see the need for the word ‘hereafter’. Can it be removed?

L159-161: The text in these three lines is slightly repetitive. I believe it could be rewritten in a clearer way. If left as is, change ‘which it is close’ to ‘which is close’, in L161.

L201: I suggest changing ‘made available’ to ‘available’.

L201-202: Why was this preferred instead of computing the numerical derivatives in the native model grid? Is the advantage of the high resolution grid not lost by the smoothing associated with the interpolation?

L210: I suggest changing from ‘case to case’ to ‘dataset to dataset’.

L220-223: How sensitive are these results to the exact location of the vertical cross-section? This is, what is the length scale of the features discussed here (for example, the negative PV region or the tropopause fold). Even though Fig. 3 shows horizontal sections, the question remains. For example, are the high PV regions joined in the vertical in all simulations or not?

L227: The cold front is indeed noticeable by the change in mslp contour curvature, but perhaps a more direct indication of the front would be worthwhile (for example, low-level moist potential temperature).

Figure 2: There is no need to include the colour bar twice.

L237-238: I suggest joining these two paragraphs for better text flow.

L253-254: I suggest joining these two paragraphs for better text flow.

Figure 3a: The red sea level contours are missing in this frame.

L269: Change ‘modelized’ to ‘modelled’, or ‘analysed through’ or ‘represented by’.

L291: Can the strong heating of 2 K per hour be attributed to a particular parametrisation?

L291: I hope I'm understanding correctly, but I would call this 'below the freezing level'. Positive or negative only apply to the Celsius temperature scale.

L299: Thank you for using the correct name (abscissa) instead of x-axis! Nothing to change here.

L300: Number of seeds? Why would you have an increasing number of seeds between leg 3 and leg 4? I'm not sure I understand this. Can you expand on the explanation of the trajectory index meaning, or perhaps refer back to the methods section? Furthermore, why do you need to plot against a trajectory index and not against some more physically meaningful quantity such as distance along flight or geographical position?

L301: Is ‘anomaly’ the right word here (and in other parts of the text)? I suppose these are anomalies with respect to the B85 simulation, but to me a more precise word would be ‘difference’.

L323: It is slightly confusing to say that the green dots are on both sides of the jet stream. They are in the plot but geographically they are on the same side. It’s only that the flight legs are unfolded in the figure. Am I interpreting this correctly?

L334: The fluctuation at 11 UTC for leg 2 was actually quite large and indicates a PV-decreasing process of the same magnitude as the process that created it in the first part. Therefore, I’d be slightly hesitant to call it a fluctuation.

L340: What does ‘quasi-systematically’ mean in this context?

Figure 6: I understand the total should be the time derivative (dPV/dt) of the curves in panel a (PV), in which case between 6 and 10 it should be negative for PCMT! On the other hand, panels c-d do correspond with what I would have expected.

L370: Change ‘ascent’ to ‘ascend’.

L382: The latest time shown in Figs. 5a,b is 15 UTC 2 October, but there are several references in the text to later times (e.g. 1545 UTC in this line).

L483: Change ‘level pressure’ to ‘pressure level’.

L496: I suggest changing ‘a sooner’ to ‘an earlier’ and the same for L516.