EGUsphere, referee comment RC2
https://doi.org/10.5194/egusphere-2022-904-RC2, 2022

Comment on egusphere-2022-904

Anonymous Referee #2

Referee comment on "Moist available potential energy of the mean state of the atmosphere and the thermodynamic potential for warm conveyor belts and convection" by Charles G. Gertler et al., EGUsphere, https://doi.org/10.5194/egusphere-2022-904-RC2, 2022

In this manuscript the authors extend the traditional view of MAPE into three dimensions, and examine its local variations. They further decompose MAPE to its non-convective and convective components and show that the former accounts for most of the total MAPE, and can be expressed via linear baroclinic theory, in the form of the Eady growth rate. Lastly, the authors show that the maximum potential ascent associated with non-convective MAPE is linked to WCB. Deriving local MAPE is an interesting exercise, and in the context of WCB, it seems that one could retrieve new physical understanding that links Eulerian and Lagrangian perspectives of the mid-latitude flow. It is unfortunate, in my opinion, that the authors do not further investigate such avenue to yield new physical understating of the system. Instead, through most of the paper, the authors focus on results which do not necessarily allow us to learn new physics on the mid-latitude flow, or simply describe how MAPE behaves spatially. Related to the above point, the paper is rather technical, and in several cases repetitive, and the writing is not concise; in several places this only diverts the reader from the main take-home message.

Major comments:

The authors show that mid-latitude MAPE, which follows non-convective MAPE, basically describes the baroclinic zones in the mid-latitudes, which one could also retrieve from Eady growth rate. Why is it thus necessary to thoroughly discuss the derivation of MAPE (separating its convective and non-convective components) and its spatial patterns? What new information have we acquired here on the mid-latitude flow? On the other hand, the results that links MAPE to WCB are interesting, as it allows us to learn how such events are created and how they are linked to the mean state in the atmosphere. My suggestion is to further explore this link, and provide a new piece of physical understating.

The introduction and method sections are considerably long, and include large amount of details. In my opinion this only diverts the reader from the main take home message as the reading becomes cumbersome. For example, in the introduction the authors not only discuss the results but also the methods. Furthermore, that exact algorithm used to calculate the mean state (e.g., divide-and-conquer), is an unnecessary detail in my opinion. There are other examples of that throughout the method section.

Although the authors chose to show results from both DJF and JJA, the discussion on Figs. 3-7 is almost entirely limited to DJF. Either remove panels which you do not discuss, or extend your discussion to JJA as well. Specifically, why does the structure of MAPE in JJA does not follow that of DJF? Why does MAPE maximizes in land?

Minor comments:

- You chose to analyze Era-Interim, what about other reanalysis products? How do you know that your results are not product dependent?

- In several locations throughout the manuscript the term “northern/southern hemisphere” is lacking capital letters (e.g., lines 58-59).

-line 148: recognize - > recognized