

Weather Clim. Dynam. Discuss., referee comment RC2  
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## Comment on wcd-2021-12

Anonymous Referee #2

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Referee comment on "Characterising the interaction of tropical and extratropical air masses controlling East Asian summer monsoon progression using a novel frontal detection approach" by Ambrogio Volonté et al., *Weather Clim. Dynam. Discuss.*, <https://doi.org/10.5194/wcd-2021-12-RC2>, 2021

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### General Comments

The paper examines the structure and evolution of EASM front and the associated synoptic features. The paper is mostly well written and makes a very worthwhile contribution to the topic. However, in the Introduction the paper discusses the recent work by Parker et al. on the progression of the Indian monsoon and says it will adapt their approach to the EASM to study how competing tropical and mid-latitude airmass control the progression of the EASM. I don't think the paper really achieves this. It doesn't tackle the effects of the airmasses in controlling the way in which shallow convection deepens etc. I was expecting more along these lines. Nonetheless, I found the paper as it stands insightful and original.

### Significant Comments

Section 2.1. Using the rainfall from reanalyses can be a problem as the rainfall is the model-generated rainfall. Have you compared the ERA5 rainfall to GPCP (or something similar)? You say that the patterns of ERA5 rainfall are similar to Kong et al. 2017, but what about the cross-sections plotted in Figs. 8 and 14, and the arguments made about the tri-pole structure?

Section 2.2. The EASM front is define by the meridional gradient in the equivalent potential temperature. But later in the paper, you relate the front to the upper jet through thermal wind. Of course, the thermal wind relates horizontal gradients in the potential temperature (not the equivalent potential temperature) to the wind shear. So, what are the implications of defining the front by equivalent potential temperature rather than potential temperature? How much of the frontal gradient comes from gradients in the moisture and how much from gradients in the temperature?

Section 2.2. The front detection methods is based on the meridional gradient in the equivalent potential temperature. This builds in the assumption that the front is oriented zonally. How true is this? Are there any implications for your study? That the fronts are not zonal shows up in Fig. 7 (as you note).

Section 3.1, Fig. 1. You discuss the position of the front with time, but how does the strength of the front and the slope change with time? You don't explicitly say this, but Fig. 1 shows the EASM to be a warm front.

Figure 2. How reliable is ERA5 for precipitation? How much would this figure change if you used CPCP or something similar? I suspect it would change quite a lot. Also, there are relatively regular bursts in the rainfall prior to June with periods of around 10 days. What are these? I find it surprising that monsoon bursts show up in the composite mean.

Line 230-231. "... a feature that has been shown to be associated with the EASM progression ...". Associated in what way? Be more explicit.

Lines 240-241. You talk about a climatological trough over the Korean Peninsula, but the PV = 2 contour is displaced far poleward in panels c and d. Explain what's going on here.

Lines 243-251. Presumably the EASM front moves because the dilatation axis moves. And the dilatation axis is determined by the strength and location of the WNPSH, among other things. I'd like to see a plot of the deformation and dilatation axes as it would link the EASM to the theory for midlatitude fronts.

Lines 255-262. Why not simply calculate the thermal wind and assess quantitatively how well it holds?

Last paragraph of Section 3.3. As the front weakens does its slope more? The frontal slope diagnostics of Papritz and Spengler 2015 might be useful here.

Line 267. Is there really causality here? The thermal wind relation is diagnostic.

Line 269-270. The front is also in the left exit of the upstream jet, which is even more favourable for precipitation.

Line 272. 1000 hPa is below the ground in many places. Isn't this a problem?

Section 4.2. You start the warm and cold back-trajectories at different heights (900 and 700 mb). Hence much of the difference in the thermodynamic properties of the parcels at the initial time is due to the difference in elevation as opposed to horizontal differences in the properties of the air masses. Why not begin the parcels at a single height, say 850 mb, which is of course the height at which you define the front? How sensitive are your results to this choice?

Line 492. The STWJ doesn't really **control** the variability - does it?

### **Technical Corrections**

Line 70. Insert "which is a" before "consequence".

Line 125. What is  $n$ ? Presumably the number of points identified. Say so.

Line 202 and numerous other places. You refer to the Yangtze River and the valley. It would be helpful to mark this on one of the maps. I (and presumably others) am only familiar with the general location of the Yangtze River and not the specific geography.

Figure 3 caption. mm per what?

Figure 10. Use the same colour scheme as Fig. 9: warm = red and cool = blue. In my pdf, red is too close to brown and blue is too close to green.