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Interactive comment

Interactive comment on "Early Morning Peaksin the Diurnal Cycle of Precipitation over the Northern Coast of West Java and Possible Influencing Factors" *by* Erma Yulihastin et al.

Erma Yulihastin et al.

erma.yulihastin@gmail.com

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General comment from Anonymous Referee #2 (hereafter Comment) #1: The study combines 17 years of TRMM satellite and multi-sensor rainfall data, reanalysis datasets, and SST observations to investigate the climatology of diurnal rainfall patterns in the region of northwestern Java, the largest east–west-oriented island in the western Maritime Continent. While the focus region is highly localized, the Maritime Continent is an exceedingly complex region, thus warranting study of potentially unique dynamics in different sub-regions. Further, it is possible that the results extend to other regions in the Maritime Continent, to some measure, though further work would be

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necessary to determine this.

Response by Authors (hereafter Response) #1: We greatly thank the Reviewer for giving us the insightful comments. We really appreciated the Reviewer's recogniton of our small contribution and its potential extention to further works that will hopefully lead to better understanding of the building blocks of weather dynamics in the Maritime Continent.

Comment #2: Background context and propagation mechanisms: A growing body of studies argue for the likely importance of gravity waves in governing diurnal offshore rainfall propagation, which often manifests at phase speeds faster than the nocturnal land breeze alone can explain, as ïňĄrst highlighted by Mapes et al. (2003). Two studies that argue for this mechanism in the Maritime Continent are Love et al. (2011) and Ruppert and Zhang (2019). It might be useful to note this mechanism since it is likely relevant to the ïňĄndings.

Love, B.S., A.J. Matthews, and G.M.S.Lister, 2011: The diurnal cycle of precipitation over the Maritime Continent in a high-resolution atmospheric model. Q. J. R. Meteorol. Soc., 137, 934–947, doi:10.1002/qj.809.

Mapes, B. E., T. T. Warner, and M. Xu, 2003: Diurnal Patterns of Rainfall in Northwestern South America. Part III: Diurnal Gravity Waves and Nocturnal Convection Offshore. Mon. Weather Rev., 131, 830–844, doi:10.1175/15200493(2003)131<0830:DPORIN>2.0.CO;2.

Ruppert, J. H., and F. Zhang, 2019: Diurnal Forcing and Phase Locking of Gravity Waves in the Maritime Continent. J. Atmos. Sci., 76, 2815–2835, doi:10.1175/JAS-D19-0061.1.

While propagation is clearly evident in some of the panels, text like the following may not be fully justiïňĄed by the ïňĄgures and results (P.6 L11–12): “It should also be clear that extreme precipitation events that occurred during late-night (Fig. 6a) and latemorning (Fig. 6c) time have *single origin* of either land-based or oceanic convection" (I placed asterisks for emphasis on what I think is dubious). Perhaps the authors would agree, that evidence of propagation does not necessarily mean that the offshore and inland rainfall peaks would not exist without this propagation. Perhaps it is equally plausible that some mechanism(s) favor rainfall in both regions, independent of the propagation (especially when these peaks are quite separate, as in Fig. 6a)?.

Response #2: We thank the Reviewer for the thoughtful comments. For the first part, we agree that it is necessary to also point out about the possible effects of gravity wave to the propagation of rainfall systems. We admit that we missed to mention that in our previously submitted manuscript. Accordingly, we will add the suggested references with brief discussions about the possible role of gravity waves in our revised manuscript.

Secondly, we agree with the Reviewer that *single origin* is not a good wording for the features that we are trying to emphasize from Figure 6 (a-c). The Reviewer's note about possible simultaneous occurrence of precipitation events (over land and ocean) that do not involve propagation is correct and we did not mean to contradict that in our previous statements. We are trying to revise our manuscript with better wordings.

Comment #3: P. 6 L28: "land-ward shifting of precipitation" Again, Figs. 5 and 7a seem to suggest that the SCS-CT favors *offshore* rainfall. I do not understand why the emphasis is placed speciïňAcally on land-ward propagation, based on these ïňAgures alone. Colors in Figs. 5 and 6 are saturated, making it difïňAcult to interpret relative rainfall magnitudes.

Response #3: We thank the Reviewer for the comments. We agree that it is not sufficient to interpret "land-ward shifting of precipitation" only from Figure 5. However, we should clarify that what we actually wanted to mention is that Fig.5c may confirm that "land-ward shifting of (oceanic) precipitation" as suggested by Koseki et al. (2012) is one possible mechanism for the occurrence of morning precipitation over the coastal region of the West Java.

As to color saturation in Figs.5 and 6, we have tried to add contour lines and also to change the levels of shading to render clearer images.

Comment #4: P.4 L24: “-4.5 m-2” I think you mean m s-1?

Response #4: We thank the editor for the typo correction in P4, L24. The text should read -4.5 msˆ(-1) in our revised manuscript.

Comment #5: P.5 L12–13: Just to clarify, does Fig. 13a,b show (N-days*17-years) samples, or have they been averaged by month? Please indicate in the text.

Response #5: The author thanks the Editor for the comment. We would like to confirm that the AEP, EMP, and LMP samples were constructed from N-days*17-years. We will indicate that more clearly in our revised manuscript.

Comment #6: P.5 L22–23: Could this be due to sampling? I.e., EMP is greatest since it has been averaged over fewer samples than the other categories?

Response #6: We appreciated the Reviewer for the critical comments. In order to respond to that comments, we have tried to put error bars with the mean amplitude plots in Figure 4, so that the variance of the data can be compared for each bin corresponding to the bar charts. The sampling errors ($\pm\sigma/\sqrt{}$n) are plotted as vertical bars shown in the new Figure 4. While it is true that the number of EMP samples is relatively small, overall spread of the amplitudes are (in our opinion) comparable to other groups of data.

Comment #7: P.6 L36: Should be “In Figures 9b and 9c,...”

Response #7: We thank the Reviewer for the typo correction in P6, L36. We have already corrected the text to “In Figures 9b and 9c,. . .” in our revised manuscript.

Comment #8: Fig. 1: Consider expanding the domain shown to provide a broader context for those less unfamiliar with this region.

Response #8: The authors would like to thank the Reviewer for the comment. We have tried to modify Figure 1 by plotting a larger base map (which is also used in other figures showing maps of wind and SST fields) and put the original Figure 1 as inset. We hope that this can make it easier for readers to understand the geographical context of the studied area.

Please also note the supplement to this comment:
https://www.ann-geophys-discuss.net/angeo-2019-107/angeo-2019-107-AC4-supplement.pdf

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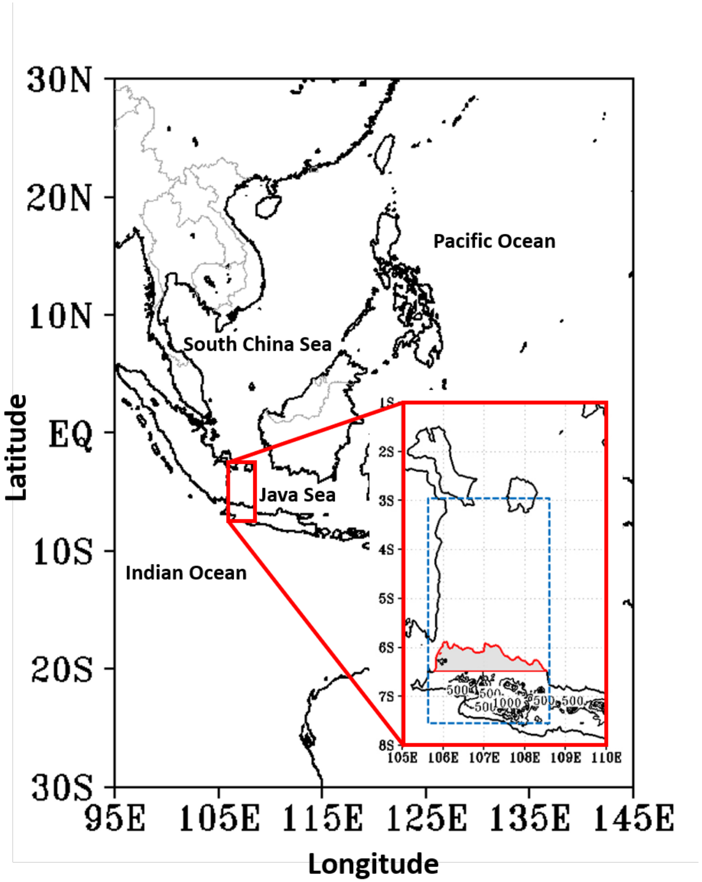

Fig. 1. Figure 1. A map showing the Maritime Continent with insert the main area of interest in this study; with coastlines and topographic contours. Red-line bordered polygon (with land masks over the north

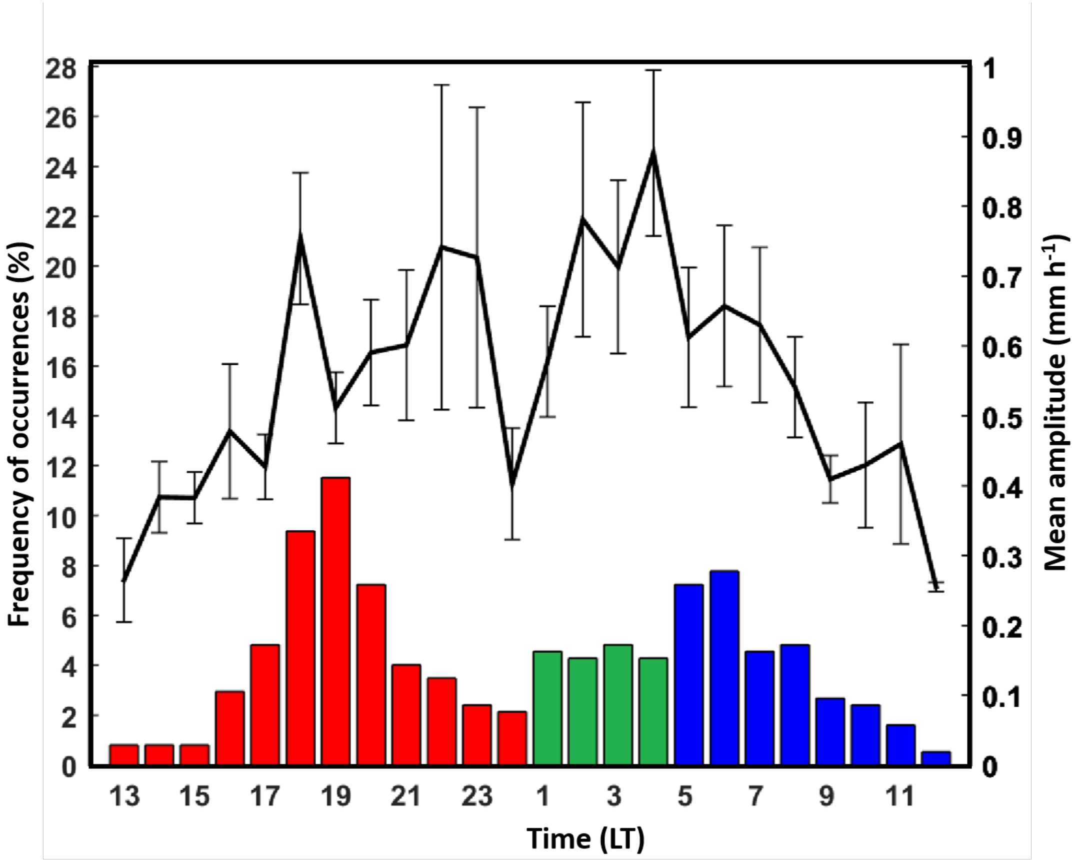

Fig. 2. Figure 4. Diurnal distribution of the mean amplitude of the first harmonic components (solid black line) and frequency of occurrence of the peak precipitation time (coloured bar chart) differentiated

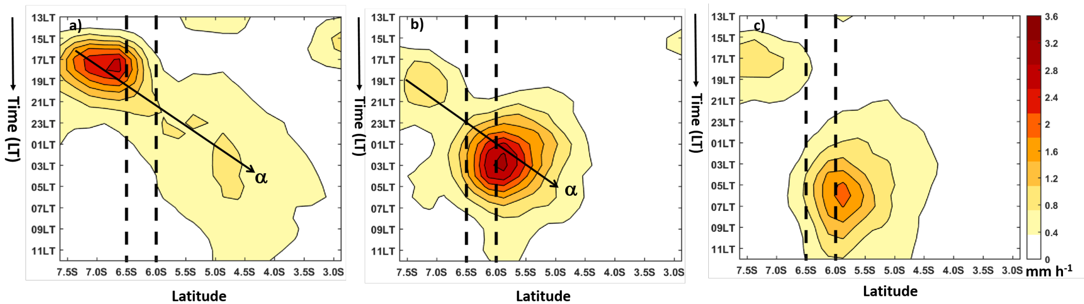

Fig. 3. Figure 5. Hovmöller diagrams of composite diurnal precipitation; similar to Figure 2 except data are classified by the phase or the timing of peak precipitation (as in Fig. 3): (a) AEP, (b) EMP, and (

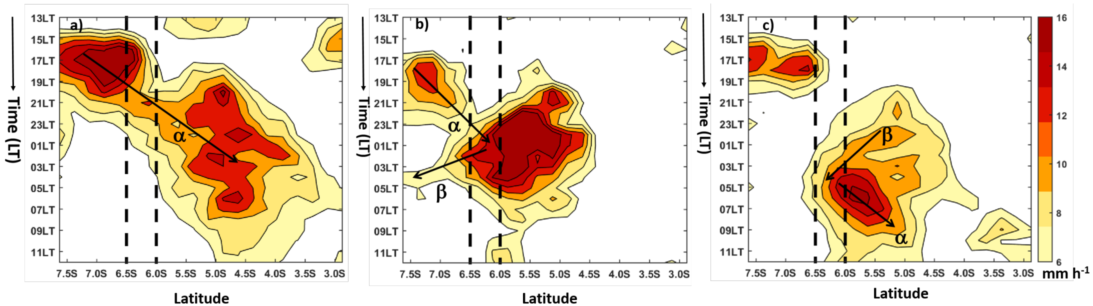

Fig. 4. Figure 6. Hovmöller diagrams, same as Fig. 5, except averaged data are the 99th percentile (P99) values of the gridded hourly precipitation.

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