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Atmospheric Chemistry and Physics Discussions

Interactive comment on "The diurnal cycle of rainfall over New Guinea in convection-permitting WRF simulations" *by* M. E. E. Hassim et al.

Anonymous Referee #2

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This study examines the rainfall over New Guinea during the suppressed conditions based on a series of convection-permitting numerical simulations. The authors show that the WRF model simulates well the diurnal variations of precipitation in comparison with satellite observed rainfall, and reproduce the occurrence and variability of off-shore propagating overnight convection north-east of New Guinea. It is also argued that its off-shore propagation is largely controlled by background conditions, and gravity wave plays a critical role in setting its propagation speed. I think the arguments are compelling. Overall, the topic of the paper is very important and suitable for ACP. The manuscript is also very well presented. I have a number of specific comments. I recommend publish the manuscript after minor revision.

Specific comments:

First paragraph, page 11: There is a subtle difference in the phase speed in convective system between TRMM and simulation. The time-distance diagram shows that that TRMM gives faster propagation speed. This may be due to the timing bias in TRMM over land as discussed in Page 10, but could also be simulation bias. Some further discussions may be used here.

Last paragraph, page 6: what is the lower boundary condition over sea? Is it time varying SST or SST at the initial time? This is important since the model domain cover a large area of sea. If the SST is kept constant over time, long simulations would very likely fail because of misrepresentation of the surface conditions. A recent study (Wang, S., A. H. Sobel, F. Zhang, Y. Q. Sun, Y. Yue, and L. Zhou, 2015: Regional Simulation of the October and November MJO Events Observed during the CINDY/DYNAMO Field Campaign at Gray Zone Resolution. J. Climate, 28, 2097–2119. doi: http://dx.doi.org/10.1175/JCLI-D-14-00294.1) has demonstrated this for regional simulations of several weeks.

First paragraph of Page 15: The red box in Figure 7 is different from the region being analyzed. Is it chosen for convenience?

line 12-13, Page 14: Fig. 12b is a remake of Fig. 6a. Why not also mark the rainfall onset the on Fig. 6a?

Line 21, Page 14: delete the last word "does"

Line 9, page 15: is the CAPE calculation based on pseudo-adiabatic thermodynamics or reversible thermodynamics?

2nd paragraph, page 15: moisture convergence is computed within the first 1 km, which is approximately the boundary layer convergence. Figure 7 shows that moisture content within this shallow layer is similar in No-Offshore and Offshore days. So the difference in VIMFC defined in equation (1) can only be attributed to difference in boundary layer convergence (instead of difference in moisture content).

Line 11-12, page 15: this description of the wind speed is not very accurate. Low level wind normal to coast actually shows quite some variations - it varies from -3 m/s at 1 km to 4 m/s at 3 km. This is comparable to the shear strength at upper levels except that the shear layer is much shallower.

Line 21-23, Page 16: It's not clear what difference between Offshore and No-Offshore specifically is discussed.

Line 27, Page 16: The steering has not been discussed before. It's unclear winds at what levels steer the convective systems. Suggest clarify or remove this.

Line 10-12 of Page 18: The dry simulation (top right panel in Fig. 11) shows the signature of n=3 wave, but it's not easy to see the three antinodes in the moist runs at 15 LT.

Line 14 of Page 18: "sub-cloud" is confusing. Typical depth of "sub-cloud" layer is only a few hundred meters above the surface. I guess the manuscript actually means below the thick stratiform clouds.

Figure 11: Cloud layer in the No-Offshore days is substantially shallower than the Offshore days at distance greater than 240 km at all the three times shown in Fig 11. Thus, it appears that the free-troposphere dry conditions in the No-Offshore days (as shown in Fig. 7a) greatly suppress deep convection.

Line 8-11, Page 20: Fig. 12d actually shows there is hardly any propagation of temperature anomaly over land (200 - 450 km) as it is in phase with diurnal cycles, while its propagation over sea (from the bluish area 450- 590 km, 21pm-6am) is slightly faster than 8 m/s. Also from Fig. 12 c and d, it seems that the propagation speed of the temperature anomaly is similar despite the difference in amplitude.

Interactive comment on Atmos. Chem. Phys. Discuss., 15, 18327, 2015.