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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.

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Referee's Comments:

This paper is a highly significant numerical study of deep convection generated over New Guinea forming squall lines that propagate Northeastward during the suppressed phase of the Madden-Julian Oscillation (MJO). Moreover this is a truly timely venture: the Maritime Continent is in the process of being selected as a focal area for an international field campaign that involve individual scientists, the U.S. DOE ARM program (perhaps), and the WMO. The field campaign is in the process of being designed. This unique high resolution series of simulations will be valuable both in its own right and for the honing the field campaign design. It is noted that the simulations reasonably agree

with the TRMM measurements.

Squall lines propagating off the New Guinea highlands were observed during the MONEX field campaign conducted several decades ago. In a general sense this series of simulations are in agreement with these observations, and give a quantitative analysis of the mechanisms involved and, in particular, the diurnal cycle of precipitation. Note that global weather models (global climate models in particular) are incapable of representing propagating convection and its its role in modulating the diurnal cycle of precipitation. The reasons are that the model resolution is insufficient to directly simulate the squall lines and the cumulus parameterization used in these models fail to represent organized dynamics. The latter was a highlight of the WCRP/WWRP-THORPEX Year(s) of Tropical Convection (YOTC) project correctly referred to in the manuscript.

The results reported in the manuscript are relevant to the findings of Mapes (1993) on offshore propagating systems that were based on with gravity-wave mechanisms. These results significantly extend the Mapes findings, e.g., by showing that the deep convection over the mountainous regions, together with coastal effects, rather than just the low-level heating over the elevated terrain, that governs the development and propagation of the squall lines and their subsequent vital effects on the diurnal cycle of precipitation. Finally, the remarkably high standard of the figures go a long way towards explaining the complex physics and dynamics of the convective organization.

Authors' Reply:

The authors thank Mitchell Moncrieff for his review. We are particularly grateful to him for highlighting that squall lines propagating off the New Guinea mountains have indeed been observed in early tropical field campaigns. Both Mitch Moncrieff and Stefan Tulich (Referee 1) raised an important point on how our results could potentially help in the design of the observational network for the planned Years of Maritime Continent (YMC) field campaign in 2017-18 (e.g., the locations of radiosonde launch sites or ground-

based doppler radar in order to observe in more detail the phenomena captured by the simulations). The revised text now includes the following statements: “Clearly, understanding these systems would benefit from increased observations. For example, radiosonde launch sites located about 150 km offshore would be highly useful. In addition, radars at coastal sites and/or on ships could also observe the passage and structure of convective systems from land through to ocean. Such observations should form part of future field campaigns like the YMC (Years of Maritime Continent)”

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