

## ***Interactive comment on “A 17 year climatology of convective cloud top heights in Darwin” by Robert C. Jackson et al.***

### **Anonymous Referee #2**

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**General Comments** This study aims to define characteristics of monsoon phase (break vs active) within context of MJO phase over Australia for northern AU region. 17 years of radar data are used to increase sample size and develop statically significant results. Overall I think this is an interesting study that shows the impact of MJO phase on cloud top heights for active and inactive periods drawing on precipitation and thermodynamic characteristics to explain the results.

My major criticism is that the description is confusing and hard to follow in parts of the statistical analysis (Sec. 4.1) and diurnal cycle (Sec. 4.2) sections as described in the specific comments below. The confusion is due to 1) combination of too many variables to consider when trying to correlate interpretations stated in the text to results shown in selected figures: active vs inactive monsoon, MJO phase, day vs night, ocean vs land;

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and 2) the text is not always explicit in terms of which panel of a figure is being used to advance the argument. In consequence, I as the reader, have sometimes come to a different conclusion when interpreting the figures in question compared to the authors. I have also noted these instances below.

A more modest critique concerns the spectrum width thresholding technique used to discriminate echo top height as opposed to a minimum reflectivity threshold. On the bright side, the method appears to work reasonably well. However, the end results is that there does not seem to be any real difference in the results when compared to simply applying a minimum reflectivity threshold (which is the traditional approach) so I am left scratching my head when trying to understand the real advantage of the methodology.

Specific Comments 1. P. 4, line 12; please define gate spacing and resolution 2. P. 5, line 7: What is the spatial resolution of the satellite data? If it's less than radar resolution it's not clear what a relative comparison tells us regarding the performance of the radar-based ETH algorithm. 3. P. 5, line 15: similar to previous comment - to understand the differences in cpol vs satellite – what is satellite brightness temp keying off of – what depth of cloud is considered? 4. P. 5, line 17: cc of 0.49 is not very good 5. P. 5, line 20: this statement assumes the satellite is capturing the variability... 6. Fig. 3 please state in the caption what the color shading represents 7. P 6. Lines 25-30: In references to Figs 4-5, seems like the big differences are between monsoon phase instead of MJO phase? 8. P. 7, line 7 – There are several other older references that show this behavior: Cifelli and Rutledge 1994 (JAS); 1998 (QJRMS) 9. P. 7, line 27-28: some hint of trade wind layer in MJO=3 for break (Fig. 6)? 10. P. 8, line 8: This is a minor point but it should be noted that the heights of the different modes that are stated here are approximate. For example, in Fig. 7c the height of mode 2 does not appear to actually reach 15 km... 11. P. 8, line 12-18: there is some confusion looking at Fig 7. My read of the red line ( $A=congestus$ ) in MJO phases 4-7 is  $\sim 0.05 - 0.6$  for break (Fig 7b) – not 0.8-0.5 as described - and  $\sim 0.1-0.4$  for monsoon (Fig. 7d) –

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not  $> 0.9$  as described. Also, the statement on line 14 about unimodality is confusing: Fig 7b,d show that there is a significant contribution from the congestus mode in break conditions while the MJO is over AU (Fig. 7b, MJO phases 6,7). Similar in monsoon conditions for MJO phase 6 – see Fig 7d. I think the confusion noted above could be avoided by stating more clearly which features in specific figure panels are being referred to. 12. Fig. 8 – please state in the caption and the figure that this is for break conditions 13. P. 9 -please call out panels explicitly in reference to Figs. 8-9 14. The discussion jumps to Fig 10 before discussing Fig. 9 15. P. 9, line 24: which panel of Fig 10? My read of comparing Fig 10 a and Fig 10b is that during the day there is a higher frequency of deep convection when the MJO is over AU (assume that includes Tiwi islands as well) compared to when MJO is elsewhere. 16. P. 9, 25-26: I don't understand the point about what is being extended in this study vs previous work.. 17. P. 10 lines 11-12 – where do the number of days come from?

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