

WCD egosphere-2026-1019 – Diurnal cycles of cloud and rainfall over North-East Queensland during the coral bleaching season (Chapman et al.)

General comments related to the manuscript

This manuscript used a combination of satellite, radar and reanalysis data to investigate characteristics of the diurnal cycles of both cloud and rainfall during the coral bleaching season over NE Queensland, a period of time with higher ocean temperatures which can be influenced by the amount of incoming solar radiation. The authors highlight geographical variability in the diurnal cycles between coastal, land, and open ocean regions, which are modulated by the synoptic environment and prevailing winds, which influence the characteristics of convection propagation. The authors begin with a very neat introduction to the region of study, explanation of the diurnal cycles and how they may affect surface energy fluxes. The methodology and data choices are suitable for the study, and the overall analysis and presentation of it is good. Where gaps are present, relevant citations are provided which support the arguments, support with a reasonable discussion and conclusion to the study.

While the overall manuscript was a pleasure to read, I feel quite the number of elements could be added to bolster its quality. For example, the authors refer to the relevance of this study for the coral bleaching processes/season through influences on radiation, heat fluxes and ocean temperatures, but do not analyse any of these variables – further analysis of this, if possible as suggested in their future work component of the conclusions, would be highly beneficial and provide a nice bridge between motivation and research outcome. I additionally think, while the authors hypothesise many of the associations between thermodynamics and the convective environment, targeted analyses of a particular case study or case studies, as seen in the literature for the MC (for which they cite), could provide deeper understanding of the influences of the wind regimes on the diurnal cycles, and the additional links with orography/land-sea breeze circulations, for which they suggest. Determination of what the broader synoptic environment is doing through usage of the employed reanalysis dataset will provide further reasoning for why the diurnal cycles in each region are doing what they do. Coupling with additional analysis of satellite rainfall products, such as IMERG GPM, if possible, would also provide further validation of the results. In terms of presentation, more consistent referencing to (ideally reordered/replotted) subplots within the figures, as outlined below, will make the arguments flow much more smoothly. Generally, explanations for what each variable indicates in relation to the study (e.g. high and low BTs) should be more succinct, less repetitive, and confined to just a short portion of the methodology.

Therefore, I recommend major revisions for the manuscript to enable the authors to address the technical corrections, figure reproduction, and suggestions I have, though I believe the manuscript remains of a good quality. I have provided specific comments/concerns below along with the technical and/or grammatical corrections, with the relevant line numbers provided for the authors' benefit.

Specific comments

L17 and 72-74: Make it clearer how this links to the coral bleaching season – is this the focus of the work? Or a mere motivation? Could provide further reiteration of the dynamics associated with the coral bleaching season and how extensively this is covered in the literature?

L31: Why might the diurnal cycle be misrepresented? Outline this here.

L194-195: Could you provide support for these dynamical/thermodynamical arguments through plots of cross sections and lat-lon plots using the BARRA reanalysis, rather than make sole inferences from the vertical profiles? Generally throughout this manuscript, more indications of what the broader synoptic environment is doing will be beneficial to both the reader in terms of understanding, and the authors in

terms of reduced 'over-hypothesising' which I feel they may trip up on sometimes – which may purely be a limitation of data availability.

L198-209: See my comments below for suggested changes to Figure 5. This paragraph is generally hard to follow, and it would be more useful to discuss each region, or each regime in turn, with the associated labels for each panel altered so that it follows the order of discussion, for which it is necessary you refer back to, otherwise the reader will lose their positioning. If there are diagnostics you could plot represented the intensity of convection/rainfall which follow the regions of high/low equivalent potential temperature, this would also bolster your argument linking the thermodynamics, with convection.

L218 onwards/Section 3.3/Figure 6: Given you discuss each regime in turn and how they differ between Townsville, Cairns and Wallis, would it potentially be more useful to have the subpanels done for each regime, as in Figure 5, and then overlay different coloured/styled lines for T, C, W, and for Land v Ocean? This would make your argument flow better with reference to your provided figures.

Section 3.4: Similar, discuss the regimes in turn with respect to the ways in which you plot the panels.

When you refer to values of BT, instead of specific values, could plot thresholds in which reflect convection or certain intensities (e.g. where deep vs shallow convection is present)?

L291-293: This statement is hard to justify, particularly as changes to BT with the overlays of precipitation don't distinctly show that propagation, compared to say the northwesterly regime in Figure 7a! How do the propagations link with one another? Can Cairns convection propagation reach Wallis? This is where the usage of IMERG GPM could provide some utility.

Figure 7: This figure could be improved by labelling the precise regions of the Cairns and Wallis radars. Much of the BT propagation is hard to see with the current colorbar choices, and the black contours indicating the 273K threshold, and the lines representing the directions of rainfall/cloud propagation, and the coastline are also very hard to see. I would suggest plotting where the raised elevation over NE Australia is too, to give indications of links with orography. I would also be interested to see how these plots would appear with low level equivalent potential temperature plotted in addition, which would give some further indications of the links between the thermodynamic and convective environments. Overall, reformatting of this figure is recommended.

Technical corrections

L20-21: Sea Surface Temperatures should be in lower case.

L30: You mention extensive research on MC diurnal cycles but do not put the references here – I would suggest placing some of the key MC diurnal cycle citations here (you already mention quite the few, so this should be an easy fix).

L35: 'afternoon-to-early evening'.

L40: 'can extend up to 700 km away from the coast'?

L63-L67: This should be a separate paragraph, before then a paragraph outlining what the study aims to do.

L79: What resolution was the BT data regridded to? The same 2km spatial resolution?

L103-104: Move these lines, perhaps, to the start of Section 2.2, and then removed the 'as described Section 2.2' portion?

L113: Briefly outline how equivalent potential temperature was derived using T and q.

Figure 1: The scatter points for radar and AWS are a bit hard to see., similar with the boundaies of the radar coverage (though this a bit more pedantic). How were reef locations defined/determined for plotting? I'd also put the NOAA (2006) citation for ETOPO2 into the figure caption. 'Hovmoller analyses were conducted?'

Figure 2: The large grey circle outlining the radar range is hard to see in panels a-c.

Figure 3: Could the r axis on the wind-rose diagrams be made uniform for the three radar regions?

L176-182: Portions of this should go into the methodology where you first introduced theta_e.

L189-191: Rephrase this sentence for clarity, otherwise this section reads well.

L191: 'over land, there are modest positive...'

L200: Stronger diurnal modulation is primarily for the lower-troposphere? Make this clear.

Figure 5: Change the colormap and potentially the levels you plot, with specific contours as lines, to really highlight the differences for each region and regime as it is currently hard to decipher the results.

L215: Figure A1?

L220: 'by 19 LT'

L234: 'BT and rainfall diurnal cycles, in the south-easterly regime, over Cairns...'

L308: Figure A2?

L313: Which Figure are you referring to here?

Figure 8: As suggested for Figure 3. Small edit.

Line 331: Coastal enhancement of what?

Figure 9: Maybe state that the gravity waves are inferred from the analysis presented? If the analysis isn't wildly modified. Which supplementary Figure are you referring to – Table A1?