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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Contrasting the Co-variability of Daytime Cloud and Precipitation over Tropical Land and Ocean" *by* Daeho Jin et al.

Anonymous Referee #1

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General comments:

Accurate knowledge of the relationship between clouds and precipitation is a key aspect for climate and earth-system models. Hence, many research studies previously addressed this issue by exploring cloud-precipitation feedbacks using, e.g. numerical and synoptic approaches, on various scales. The manuscript acp-2017-612 revisits this topic and aims at improving the present understanding of daytime cloud-precipitation co-variability by looking at collocated cloud and precipitation observations over a very large spatial domain, i.e. tropical oceans and land, with improved spatial and temporal matching compared to previous studies. The presented method is well suited for analysing this particular coupling and the authors provide an exhaustive analysis based on available data advancing the knowledge on this topic. Many interesting questions

are addressed and the authors draw plausible conclusions such as the stronger positive correlation between cumulonimbus clouds and heavy precipitation over oceans as opposed to over land. The manuscript is generally well written and the results are presented in a good manner. The manuscript fits well within the scope of Atmospheric Chemistry and Physics and I recommend publishing it after the authors have corrected several minor issues. In general, the manuscript contains heaps of detail but it is unfortunately kept very descriptive, and generally lacks more conclusions and practical implications of the presented findings. In addition, it would be highly beneficial if the authors stress the importance of their results and explicitly state what new scientific insights have been discovered by means of their analysis and which previous knowledge could be confirmed / or rejected. The conclusion section should be suitable for this. A critical examination of shortcomings of the method and data sets is quite brief and it is not entirely clear to what extent the individual sensitivity of the chosen data products for clouds and precipitation may bias the results. In specific, would the authors come to similar conclusions with different data products?

Specific comments:

P2 L26: Please provide the motivation for your study already here and explain in more detail what is missing in previous research studies. At this point it is not clear to the reader why this topic needs to be touched 'once again'.

P2 L32: Move this part up accordingly.

P3 L1: What is meant by 'ambiguity' exactly?

P3: Please elaborate in detail why the MODIS and TRMM TMPA were chosen. It would be highly beneficial to discuss and argue why these two data sets are more suitable than other similar data sets for your study. What about other global precipitation products providing 3-hourly rain estimates such as CMORPH (Joyce et al., 2004), PERSIANN (Sorooshian et al., 2000) or others? The sensitivity to precipitation and different cloud types may be very different amongst these products which could poten-

tially strongly affect your findings.

P4 L24: Please be consistent in naming and differentiating between the grid at 1° resolution and a lower resolution grid at 0.25° resolution throughout the paper (grid cell, sub-grid cell, sub-grid, sub-cell, etc.)

P5 L3-11: The spatial and temporal collocation is crucial for this type of study as precipitation and rain patterns may vary quickly. Please provide a better explanation of the temporal matching of both data sets and provide a reference for the time conversion of the MODIS data, if possible. The TRMM TMPA 3B42 3-hourly product provides the satellite observation time for each grid cell. Was this information used for the matching? Note that actual observation times for each grid pixel may vary +-90 minutes within a 3-hourly data file. For example, if the TMPA 3B42 12UTC data file is chosen for collocation with MODIS Aqua data the maximum time difference between the MODIS and TMPA data could be more than 1.5 hours. It is generally not quite clear to the reader how the non-trivial collocation of the data sets is performed across all longitudes.

P5 L19-21: What could be the explanation for this?

P6 L7-9: Why did you choose to consider the MODIS Terra and Aqua as a single ensemble, even though initial results from Fig. 1 point at notable differences in precipitation during the different overpass times? Would you argue that this has no effect on the found cloud-precipitation relationships? Also, it is not clear to the reader how the exact matching of MODIS and TRMM TMPA data is performed. See remark above.

P7 L32-33: Please explain why this is the case for P5 and not for P4 and name the common characteristics with MCS explicitly.

P9 L11: It would be worthwhile to explain the effect of autocorrelation between neighboring grid cells in more detail and how this is accounted for.

P9: How certain are the authors that the calculated correlation coefficients between the cloud types and precipitation data can be interpreted as a 'general relationship'

and not just representing the sensitivity of the TRMM TMPA algorithm to different cloud types?

P13 L2: It would have been quite interesting to see how the correlation coefficients for Fig. 11 change if precipitation frequencies are not progressively added for each bin. Could you provide such a Figure or give a reason why this may not be useful?

P16 L27-28: This sentence sounds a bit strange, suggesting that you might not have chosen the optimal data sets for your study in the first place. It would be better to discuss in more detail how your results could be validated against results derived from other or future data products.

Technical corrections:

P1 L22-23: Please rephrase to make points clearer

P1 L30: 'models' instead of 'model'; or better rephrase the first part of the sentence

P2 L18: Please rephrase very long sentence

P2 L20: 'larger extent' - please state whether horizontal or vertical extent is meant

P2 L26: Please specify references to the datasets used

P2 L33: 'examines' instead of 'examine'

P3 L3: 'Is there a closer' instead of 'Is there more close'

P3 L11: Please provide references for the MODIS instrument and specify the exact name of the dataset.

P3 L22: Please rephrase and/or explain why a lower number of bins was chosen.

P3 L26: leave out 'best'

P4 L1: Specify the overpass time of MODIS Terra and Aqua in local time / equator crossing time.

P4 L14: Please rephrase part with ‘algorithmic variations’

P4 L19: Please rephrase the first part of the sentence

P4 L21-22: Use consistent format of grid resolution, i.e. either 1° or 1x1°

P4 L24: ‘of a histogram’, instead of ‘of histogram’

P4 L24: ‘without missing values’ instead of ‘when no missing values exist’

P4 L32: ‘shows the distribution’ instead of ‘shows distribution’

P5 L3: Please rephrase the sentence, for example: ‘... the TMPA and MODIS observations also need to be matched in time.’

P5 L15: Please rephrase ‘in explaining’

P5 L16: Please rephrase ‘For example’ at the beginning of the sentence

P5 L17: What is meant exactly by: ‘relatively suppressed’?

P5 L28: Please rephrase sentence starting with “This is simply . . .” as this would have been probably possible and could, in fact, provide additional insight, but was not pursued for practical reasons.

P6 L4-7: Please rephrase last part of sentence starting at “with no confusion resulting”

P6 L13: Please explain what it is meant by the co-variability of anomalies.

P6 L27: Replace ‘of no-rain case’ with ‘of the no-rain case’

P7 L3: Please indicate in which section the issue of less rain over land is analysed.

P7 L4: Please make it clearer to reader what you mean by the ‘composite mean cloud and precipitation histogram’

P7 L19: ‘in the P4 group’ instead of ‘due to the P4 group’

P8 L13 and L16: is the increase really linear?

P8 L29: Please rephrase ‘a factor affecting the Fig. 7 results”

P10 L6: Please rephrase ‘the peak negative value is a weaker value of’

P10 L24: Please rephrase the second part of the sentence to make clear what you mean exactly.

P12 L8: Please rephrase ‘but suffice it to say here’

P13 L11: Please rephrase the beginning of the sentence (not start with ‘But’)

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