Atmos. Chem. Phys. Discuss., 13, C4521–C4524, 2013
www.atmos-chem-phys-discuss.net/13/C4521/2013/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Frequency of deep convective clouds in the tropical zone from ten years of AIRS data" *by* H. H. Aumann and A. Ruzmaikin

Anonymous Referee #2

Received and published: 5 July 2013

Aumann and Ruzmaikin present an analysis of deep convection in the tropics as observed by AIRS. From a climate science point of view, the focus of the paper is on the partitioning of deep convection between land and ocean, and the question whether there is a trend in this partitioning over the period of AIRS observations analysed here (2002-2012). From a methodological point of view, the paper provides substantial information on what may be classified as "deep convection", or "overshooting convection" in remote sensing data. I welcome the discussion of different metrics, as this is a constant source of confusion in the literature. However, I think it would be possible to somewhat improve the organisation of the paper; in its present form, it is occasionally

jumping back and forth between science results and methodological aspects which, together with the large number of acronyms, tends to confuse the reader. I leave it to the authors how they want to address this issue; a possible strategy is to focus first on the "scientific question" (namely the partitioning between land and ocean) based on the indicator for deep convection the authors consider the most relevant, and then have an extended discussion how these results depend on the definition of "deep", or "overshooting" convection. Below I list some minor comments. I think some further exploration of the connection between seasonality and trends (details below) would be interesting.

Minor comments/suggestions

Abstract: The abstract, lines 10-14, illustrates the problem with the various thresholds: While "threshold 2" is defined (line 6), the subsequent statement is unclear; what is meant when you say that "72% of them are identified as deep convective, 39% are overshooting ..." - what's the criterion for "deep convective", "overshooting"? I understand that these definitions are then given in the text, but as it stands, the information in the abstract is ambigous.

Abstract/L28: Same problem - the range ("0.06%-0.8%") is a full order of magnitude, we should be given some information on what the criteria are, else the information is not really of much use to others.

Abstract/last sentence: This statement is not clear from the context of the abstract. I understand that it refers to P10025/L16ff, but in the context of the abstract it's unclear what you mean (I also have some questions concerning the P10025/L16ff section, see below.)

P10011/L10ff: It is assumed here that the reader already knows exactly what these wavelengths imply; perhaps help the reader with a quick reminder here.

P10015/L12: Which tropopause - lapse rate or cold point? Note that it is known that

NCEP drifts massively at tropopause levels; overall, I would argue that this particular level is also a fairly arbitrary reference level.

P10016/L15: Explain what "DTR" and "DTW" stand for; having an association makes it easier to keep the overview over all the acronyms.

P10018/L21: 20S-20N?

P10019/L20: Is "overlaid" the best word here? Perhaps "calculated separately"?

P10019/L21: Although I think I understand what you want to say, the sentence as it stands makes little sense: How can ocean/land partitioning be "consistent" with the "diurnal cycle ..."?

P10019/24/Figure 4: Can you inform the reader where this seasonality comes from? (I.e. the tropical mean hydrological cycle has very little seasonality. It would be helpful to know whether the observed seasonality arises, e.g., from seasonality in the thermal structure in the TTL, from seasonality in land/ocean partitioning, or whether there is a genuine increase in deepest convection over land and ocean independent of TTL temperatures.)

The question of the seasonality is also highly relevant for your subsequent analysis of anomalies thereof. That is - you find little trend in the tropical average (Section 5.1) because of compensation in changes over land and ocean, yet this seems to not work on a seasonal basis. If the seasonal variations would arise from differences in land/ocean convection, then a shift in land-ocean partitioning should also give a trend in the total. Hence - what does your result imply?

P10021L2: Clarify - if I understand correctly, the sentence should state that "the absolute DCC frequencies *using different criteria to define DCC* differ by ... the trends are very similar".

P10024/L9: No, mass consevation cannot be invoked; the number of deep storms is not a conserved quantity (which is also nicely illustrated by the seasonality). The mass

associated with each DCC can vary, and the radiative cooling can vary (i.e. more ascent can be balanced by more descent - the question is whether the surface energy budget allows this to happen).

P10025/L16ff: I think I understand what that statement refers to, but please write it out explicitly. As of now, it's too vague. If I understand you correctly, you think that the fact that the rates of change differ somehow implies that more extreme events respond stronger. However, I am not sure whether I would believe that; but I don't know whether you really mean this since the text is too vague.

Interactive comment on Atmos. Chem. Phys. Discuss., 13, 10009, 2013.