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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Observation of ENSO linked changes in the tropical Atlantic cloud vertical distribution using 14 years of MODIS observations" *by* Nils Madenach et al.

Anonymous Referee #3

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The paper "Observation of ENSO linked changes in the tropical Atlantic cloud vertical distribution using 14 years of MODIS observations" deals with multiple year analysis of cloud vertical distribution parameters over Atlantic Ocean. It uses different data source, but mainly MODIS cloud products and combined radar/lidar data set DARDAR (from CPR/Cloudsat and CALIOP) to demonstrate a connection of ENSO events with cloudiness in Tropical Atlantic Ocean.

The topic meets the aim and scope of the paper.

The paper style is good, and the paper concisely written. The Figures including captions are of good quality.

The methods are clearly described, but some details are missing for the interpretation of the results. I recommend shortening the method sections and to remove the standard description of regression method.

The paper uses parameters describing cloud vertical distribution. In my opinion, the binned cloud fraction products (TCF, LCF, and HCF) are the much more robust parameters to show the trends and to support the main message than averaged cloud top height (CTH) due to its strongly non-Gaussian distribution.

I vote for publication after some minor comments are addressed. None of these comments are critical to acceptance.

Specific comments:

Page 1 Line 23: "Low (optically thick) .. High (optically thin)" gives the impression that low clouds are always thick and high always thin. I would add an "often" or similar. Page2, Section 2.1 MODIS: Which product do you use for the analysis and for the thresholding. The results show later cloud top height products, but the classification seems to make use of cloud top pressure. Please add this to data description for clarity. Page 3 Line 22: "much lower sampling of active lidar and radar": Calipso has footprint size of 70m and Cloudsat of 1km, so this is not much lower. Is DARDAR data set provided with a decreased resolution? Page 3 Line 31: Define TCWV and SST. Page 3 Line 30 subsection AMSR-e and Figure 8: You could have used AMSR-2 on GCOM-W for the period from 2012. This would be particularly interesting for P2 period. Figure 1: I would skip this image because you use only the two cloud pressure thresholds and not COD classifications. Section 3.2: This is for my taste too many details of standard statistical and regression methods. A reference would be sufficient. Section 3.2, page 4 Equation 1: Define variable t. Figure 2: Do you show here MODIS or DARDAR data? Section 4.1, Figure 3: Why is the MODIS and DARDAR averages that different? You discuss this: "positive bias towards higher CF's which can be explained with the higher sensibility of lider for high, optically thin clouds.": But the difference is also big for low

clouds. (0.2 vs 0.45)! Page 7, line 9: lider should be lidar Page 7 Line 6: “The LCF and CTH show a negative correlation. This indicates that the mean seasonal variability of the CTH is mainly related to changes in the vertical cloud distribution.”: I think this is a tautology. The cloud top height is directly taken from the vertical cloud distribution. Figure 7: I cannot see plus signs in the images in my print-out and hardly in the pdf. And they look very similar to the grid lines.

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