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Comment on acp-2021-1014

Anonymous Referee #2

Referee comment on "Interaction between cloud–radiation, atmospheric dynamics and thermodynamics based on observational data from GoAmazon 2014/15 and a cloud-resolving model" by Layrson J. M. Gonçalves et al., Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2021-1014-RC2>, 2022

The manuscript "Interaction between cloud-radiation, atmospheric dynamics and thermodynamics based on observational data from GoAmazon 2014/15 and a Cloud Resolving Model" general goal, as stated, is to understand the interactions between the dynamic and thermodynamic variables of the atmosphere and cloudiness in Central Amazonia.

For that, the authors used a set of observational data collected during GoAmazon IOP's (dry and wet seasons) and carried out a set of simulations using a Cloud Resolving Model considering different spatial resolutions.

The first results are focused on the comparison between observed and modeled atmospheric variables (cloud fraction, rain rate, radiative fluxes, temperature, relative humidity, vertical velocity) looking at daily and diurnal variability.

The authors concluded that the model consistently simulated the observations

For the second part of the results, also focusing on the comparison between observations and modeling, the authors explore the relationship between cloud fraction and the atmospheric variables (short and long wave radiation, temperature, relative humidity and vertical velocity and liquid water content).

The authors concluded that shallow and deep convection clouds have significant impact on radiation fluxes in the Amazon region during wet and dry period, and that memory of previous day large-scale features (based on temperature, RH, and vertical velocity anomalies) have a good correlation with cloud fraction.

I would recommend authors to carry out a careful revision of the manuscript; it seems that several grammatical corrections are necessary.

Introduction

The introduction and the problem contextualization are somehow dispersed, the authors mention several aspects related to the importance of clouds and their interaction with radiation, in some points they mention aspects of large-scale atmospheric dynamics, little talk about thermodynamic aspects, they mention the types of models, but again there is a lack of connection between the contents that points to an objective characterization of the problem to be studied.

As the authors suggest developing and adjusting the parameterizations related to the cloud cover fraction, it would be interesting to discuss what are the limitations that they want to target, and the aspects that the proposed study would help to improve.

Methods

Little is said about the site, about the presence of the city of Manaus, the characteristics of the region, circulation pattern, among other relevant information to reinforce the importance of the site. GoAmazon included several sites, each site was designed to meet different characteristics within the context of the interaction between the city of Manaus and the Forest, it would be interesting if the authors could describe a little more about the ARM site in the context of GoAmazon.

In the method topic, the variables used are barely contextualized in the dataset description, The authors need to specify the macro and microphysical data that they are referring to.

Try to maintain consistency in relation to the description of the objective of the study, in the methods topic it is understood that what is intended is an analysis of the cloud-radiation interaction, but in the introduction the focus of the study is described as to understand the relationship between dynamics, thermodynamics and the cloud-radiation interaction.

Results

The first part of the results focuses on evaluating the performance of the different model resolutions in relation to observation. I think that a statistical analysis to summarize the performance of each resolution would be helpful. And it seems that an analysis separating different atmospheric scenarios, especially in the wet period, might bring interesting results. For example, in Figure 4 one can see that all resolutions fail in relation to the frequency of cloud cover fraction close to zero in the wet period, but at the other extreme, cases with a coverage fraction closer to 1 there is a resolution that seems to perform better than the others.

Regarding the two study cases, the analysis focused on two days seems to me limited in relation to the objective of extracting consistent and robust relationships between the atmospheric characteristics of the previous day and the properties of the clouds. The authors should evaluate a more robust alternative.

To achieve the objective of "integrating modeling as an element to understand the interaction between dynamics, thermodynamics, clouds and radiation, it seems that the model needs to be further explored. The presented design and analysis of the model output consisted essentially of an evaluation against observation.

The discussions of the relationships between cloud fraction and the remaining atmospheric variables, in general, were focused on expected features, which make it difficult to identify a clear contribution regarding the needed development and improvement in cloud parameterization stated in the goals of the paper.

Therefore, I found that the current manuscript needs major revision before it can be considered for publication.