DO 4.11.20

Response to Referee #3

Editorial comment for paper acp-2020-89 as of 30 Oct 2020

We thank the referee for his additional and interesting comments!
Again, changes in our manuscript are marked in red, and replies to the Referee's comments are given below *in italics*.

General Comments:

We respond to #2 first:

2) **The potential role of the land surface model.** There is still not enough specific information in
the paper (nor in the reply document) for the reader to understand the setup of the land surface
model used in your simulations. This point is important because in case of an interactive coupling
of the atmosphere with the land surface model, this might be a potential cause for the oscillations.
You write that "The land component of the models has been kept constant" but this is not clear
enough. Most likely your land model has a seasonal cycle of vegetation and of soil moisture? Soil
moisture is an important parameter here; is this variable interactively coupled to the atmosphere
(as in normal GCMs) and therefore can there be interannual variations in soil moisture and landatmosphere
interactions? Did you maybe even use a dynamic vegetation model? These aspects are
very important to clarify. I fully acknowledge that your expertise is not with the land model, but
for this particular study more detailed information about this aspect of the model setup is essential.

Thank you for detailing on this point! You are right: we cannot exclude land surface influences on our oscillations (as yet)! We have therefore changed Title, Abstract, and text throughout, as you suggest in #1. I hope that you will find these modifications satisfactory. They are marked in red, see especially Section 2.2, 2nd Paragraph, and Section 4.1, 1st Paragraph.

Section 2.2, 2nd paragraph

…As concerns the land parameters, part of them were also kept constant (vegetation

parameters as leaf area, wood coverage) and ground albedo. Others were not (e.g. snow and ice on lakes). Hence, some influence on our oscillations cannot be excluded. We, therefore, put the expression "self-excited" in quotation marks in this paper.

Section 4.1, 1st paragraph….. Therefore they are supposed to be self-generated oscillations. However, as said in Section 2.2, some influence of land surface perameters cannot be excluded. A corresponding analysis is beyond the scope of this paper, though. and is planned for the future. As a reservation, the expression "self-excited" is used with quotation marks in this text….

The essential point of our paper are the long-period oscillations and their various properties. Self-excitation is only part of them, and it is difficult to prove, indeed. We always said that we "suspect, suppose , interpret" it. As a warning for the reader we put "self-excitation" in quotation marks now.

As concerns land surface influences we have started to work upon them (in the Southern hemisphere). This is a lot of work, and beyond the scope of the present paper. It should be discussed in a future paper, together with the other future analyses needed to determine the nature of these oscillations. We say this in the text, Section 4.1 (see above) and Section 5:

Section 5. 3rd paragraph…. Land surface influences in addition need to be studied in the future.

First preliminary results of this intended work do not show essential land surface contributions. It is too early, however, to discuss this in this paper.

1) **Origin of oscillations.** In your last reply document, you write "This is a misunderstanding: We
did not claim an atmospheric origin of the oscillations, but we said that the oscillations are
atmospheric properties. We do not know yet the origin of the oscillations, as was stated several
times in the paper." To me this is completely inconsistent with the paper. The title of the paper is
"Self-excited oscillations in the atmosphere", which I cannot read differently than these are
oscillations that are generated / excited by atmospheric processes! So how can you now say that
you don't claim an atmospheric origin, I am very confused. If your reply reflects what you would
like the reader to get from your study, then you must change the title, the abstract and many parts
of the paper. Please also note that the first sentence of your conclusions reads "The structures
analyzed in this paper are believed to be oscillations that are self-generated in the atmosphere."
This is radically different from your last reply. This essential aspect must be made consistent from

the title to the last line of the paper.

I am really sorry that "in the atmosphere" versus "by the atmosphere" poses such a problem. I thought that this is a semantic problem, only, but maybe I am wrong as I am not a native English speaker. By "in the atmosphere" I meant something like "tides in the atmosphere" or "waves in the ocean". Neither of these are excited by the atmosphere or by the ocean.
Or another example from the atmosphere/ocean system and its complicated feedback processes: Is the AMOC (Atlantic Meridional Overturning Circulation) excited "in" the atmosphere/ocean system or "by" the atmosphere/ocean system? I would rather say: "in".
I believe the solution lies in the word "feedback". If an oscillation is seen in a system that is caused by some feedback process one would not say "The oscillation is excited by the system", but "by the process in the system". Do you agree?
Indeed, I am afraid that our oscillations are due to some feedback mechanisms. It will be part of the future analyses mentioned to clarify this! Corresponding sentences have been added to Section 4.1, 2nd Paragraph, and Section 5, 1st sentence:

This may indicate three-dimensional atmospheric oscillation modes excited by some feedback mechanisms.

The atmospheric structures analyzed in this paper are supposed to be oscillations that are self-generated by some feedback mechanisms.

3) A minor remark: In the short summary you write "However, a GCM can be changed arbitrarily!"
Hopefully not. I think I understand what you like to say, but "arbitrary changes" sounds like unphysical model modifications

We have now written "selectively" instead of "arbitrarily". Does this sound better to you?