

Interactive comment on “Strengthening of the hydrological cycle in future scenarios: atmospheric energy and water balance perspective” by A. Alessandri et al.

Anonymous Referee #2

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General comments:

This study investigates the energy and hydrology changes associated with two future climate scenarios (i.e. a low mitigation one, A1 versus an aggressive mitigation one E1), as defined in Johns et al. (2011). The authors try to understand the physical mechanisms behind the two different scenarios particularly in terms of the atmospheric energetics, the hydrological cycle and the links between them. This study gives a novel contribution by showing that for an aggressive mitigation scenario (E1) the hydrological cycle will continue to strengthen for most of the 21st century more than the low mitigation one A1. Although the description of the scientific methodology is a bit confusing, I

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recommend this paper for publication in ESD after some revisions, particularly of Sec. 2.3

Specific comments:

1) Abstract/Introduction/Conclusion: I suggest the authors to make more clear what are the aims of this study in the abstract/Introduction and to strengthen the conclusions by stressing what are the new findings of this study. Of course this is somehow a subjective issue, but I found that there were a bit “hidden” in the text and this doesn’t do the paper justice;

2) Is there any reason to describe in such details the SILVA models with respect to the other components of the C-ESM model??

3) Fig.3 and 4 introduced in the text before Fig.2;

4) Section 2.3. This section, describing the water/energy equations should be dealt with more carefully. In Eq. (2) Q is a vector as V , isn’t it? In eq. (5) what you call “ E_{int} ” is, as far as I understand, the total potential energy? Why can you neglect changes in kinetic and potential energy? Please be a bit more accurate on these points and check the equations in the literature, e.g. Peixoto/Oort. Also I’d avoid the nabla symbol to represent something which is not what it really is: a differential operator;

5) In eq. (6) you consider as the same the meridional transport (of dry static energy?) and the vertical turbulent fluxes at the surface. Since they are associated with very different processes (large scale horizontal transport vs. small scale surface layer turbulence), it would be helpful to comment on this;

6) the authors assume that the model conserves energy and water when they say that the time mean is practically zero; GCMs can unfortunately have biases in the energy and water budget. Have they checked how well the C-ESM model conserves these quantities?

Finally I have to point out the sloppiness of the English and the presence of too many

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minor English mistakes (e.g. "changes in whole atmospheric.." / changes in the whole; "last decade of 21st century"/ last decade of the 21st century and so on), which makes the manuscript painful to read and sometimes even fairly irritating. Therefore I suggest the authors to ask a native english speaker to check the English before resubmitting.

Interactive comment on Earth Syst. Dynam. Discuss., 3, 523, 2012.