[GMDD]

Interactive comment on "The Brazilian Earth System Model version 2.5: Evaluation of its CMIP5 historical simulation" *by* Sandro F. Veiga et al.

Anonymous Referee #2

Received and published: 25 July 2018

The paper documents the present state of a new version of the Brazialian Earth System Model (BESM) that is supposed to be used in the CMIP6 model intercomparison. The authors describe mean state and variability characteristics comparing the simulated results from 20th century observations and reanalyses. They describe the improvement in relation to an earlier version of BESM and highlight some aspects that are of particular importance for South American climate. The general content and aspects covered are well designed and go along with other description papers published for similar models. However, the paper is not mature enough to be published and needs major revisions.

There are some general issues that need to be addressed:

1. There is no description of the pre-industrial control run. In particular, the coupled

model simulation presented here is done after an extremely short spin-up phase (just 13 years after one cycle of CORE forcing!). Experience tells us that models tend to drift after changing from stand-alone conditions to fully coupled. BESM could be an exception, but it could be that many features seen in this paper are due to incomplete adaptation. It should be documented how the 3d ocean temperature and salinity fields evolve. How does the integrated ocean-atmosphere heat flux evolve? Is there any energy imbalance that could (partly) explain the weak warming in the 20th historical simulation? 2. A documentation of a newly developed couple model should include an estimate of climate sensitivity. The analyses for that should be standard procedure. 3. The discussion of the evaluation with observations/reanalyses is descriptive, but does most often not discuss if the biases are acceptable, larger/smaller than in other models, or which consequences come with them. For example, if we assume that including aerosols into the BESM influences the historical simulation in a similar way as in other models (Figure 2), BESM would severely underestimate global warming in the last century. This should be a matter of concern and lead the authors to look for the origin of this discrepancy. Or is the plan that everything will be better in the next generation of BESM,as somehow implied in the conclusions? 4. The quality of the figures should be improved. At least in my pdf version I could hardly decipher axis and contour labels

Minor comments: Abstract, ln 6: "validation" would mean that you have some measures for when a model is valid, better use "evaluation"

Page 3, ln 6 and following text. The authors say that for an ESM there needs to be an interactive biogeochemical module. But it is not explained later, if or what kind of biogeochemistry model is included and if there are other publications planned on this aspect.

Page 4, ln 1: do you mean interactive aerosols and chemistry or just the ability to use them as read-in fields?

Ln 11: "seamless predictions" is it really used for weather predictions (at which resolutions?) and do you have to apply problem-specific parameterizations?

Page 6, ln 18ff. How does the system behave after switching from CORE to fully coupled. I doubt that the spin-up is long enough.

Page 15: SSTs seem to be generally too warm. Is that also true for surface air temperature in the control run or in the beginning of the historical? Wouldn't that call for some tuning exercise, e.g. looking into cloud parameterizations?

Page 17, ln 21ff. How does AMOC look in the control run, any drift?

―――――――――――――――――――