Geoscientific
Model Development
Discussions

Interactive comment on "MIROC-ESM: model description and basic results of CMIP5-20c3m experiments" *by* S. Watanabe et al.

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The manuscript by Watanabe et al. describes the MIROC Earth System Model with a small set of CMIP5 experiments and some validation of the model against observations. I like the fact that the method for spinning up the model is described as this is tricky and usually not well documented procedure. Overall the manuscript is appropriate for GMD and I recommend publication after the following comments are addressed.

Many Earth System modelling groups have chosen to refer to their model using numbered versions, eg MIROC-ESMv1 could be composed of MIROC-AGCMv2, SPRINT-ARSv3.1, COCOv2.1 etc... Have the authors considered doing something similar?

The description of some of the model components is a bit succinct. The authors should

consider giving more details, eg for the NPZD model. There is relatively little on how the C fluxes between the different reservoirs have been parametrised. In places a few equations may help.

What is particularly important in an ESM is not just the model components, but also how they have been coupled together. Sometimes this information is provided, eg deposition of BC on snow, sometimes not, eg do DMS emissions depend on the ocean biogeochemistry or not? The manuscript could give more details on the coupling strategy (what is coupled and what is not, and why these choices have been made). Are there any coupling between the C cycle and the atmospheric chemistry? Eg does vegetation changes affect SOA? Or dust emissions? Etc...

One problem of spinning up the chemistry model separately from the C cycle model is that chemistry can affect the model climatology, which in turn affects the C cycle. Was that not a problem?

The validation focuses on comparing some of the model variables with observed quantities or in some cases reanalysis products. However the strength of an ESM is in the couplings between the model components and these are not really validated. Can the authors comment on this?

Other comments:

P1066, l6: change to "river routine" to "river routing scheme"

P1066, l14: delete "time"

P1067, l7: is the advection scheme conservative?

P1068, l18: f_{liq} might be better suited as a variable. Are the equations correct? I would expect all water to be liquid when T exceeds a threshold, not the other way around. Is

there a discontinuity when $T = T_m$?

P1068, l22: can you say a bit more? Is the diffusion not adapted or not applied to tracers?

P1073, l16: what is the unit of the absorption coefficients?

P1077, l1-3: sentence not clear. What was done?

P1077, l8: was the stratospheric aerosol climatology superimposed on the SPRINT-ARS stratospheric aerosols (from non-volcanic emissions).

P1082, l11: How was the RF calculated (double radiation call or quasi-forcing)? why is the RF strongly positive over the Sahara? Is it because of changes in dust or absorption by BC/biomass burning advected from adjacent regions?

P1083, l5: this is a bit of a circular argument. MIROC matches the IPCC estimate which relies on models like MIROC.

P1103: can table indicate which biogeochemical fluxes are passed from the surface models to the chemistry?

P1107, Fig 2: this diagram underplays the importance of the C cycle (both land and ocean). Could the diagram be amended to reflect the coupling between the C cycle and the other components?