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Geoscientific Model Development Discussions

Interactive comment on "Description and basic evaluation of simulated mean state, internal variability, and climate sensitivity in MIROC6" *by* Hiroaki Tatebe et al.

Anonymous Referee #1

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General comments

This paper describes MIROC6, a new climate model aiming at participating in CMIP6, by developing the previous climate model MIROC5 that participated in CMIP5. Following the description of the model formulation focusing on the changes from MIROC5 together with the model's tuning procedure, the model's mean climate and variability in the preindustrial experiment are presented. Furthermore, climate sensitivity of the model and reproducibility of the past climate change are also evaluated. Although the manuscript is comprehensive, it is well-constructed and well-documented. Climate variabilities of the model has also been widely evaluated, which brings many useful

scientific knowledges for future studies using this model. In addition, model tuning procedure is also described in detail, which contains very useful information to be helpful for climate model developers. It is recommended that it will be published after minor revisions.

Specific comments

L.355: The main parameters . . . in which the uncertainty of the climate sensitivity . . .

Does this mean that the model is tuned for a climate sensitivity as a result? If so, it is desirable to describe what is the target climate sensitivity (2.5 K?) for the tuning.

L.374: interactions between anthropogenic aerosol emissions and . . .

"emissions" do not interact with cloud-radiation processes. Do you mean "aerosol-cloud interaction"? Rephrase it.

L.380: a present-day run

Is the run a fixed SST? Since the value of –0.9 Wm–2 by IPCC (2013) is for ERF, it should be evaluated by radiation change under the condition that SST does not change. Please explain.

L.397: the global-mean ocean temperature shows a larger trend of . . .

On average there is 1.1 Wm–2 heating. Are these trends consistent with the radiation budget?

L.477: consistent with the observed value of –0.81 Wm–2.

The observed value is –0.8 Wm–2 because the system is warming in the present-day conditions. Ideally it should be 0 W m–2 in the preindustrial conditions. The radiation imbalance of –1.1 Wm–2 is in the marginally acceptable range.

L.542: increase in precipitation (Figs. 8ce)

Increase in precipitation is found only in the North Pacific.

Fig. 13 and 14

It is easy to understand if the biases are indicated by color shadings.

L.595: the Pacific sector (Figs. 13a-c)

→ “the Atlantic sector (Figs. 13a-c)” or “the Pacific sector (Figs. 14a-c)”

L.622: better representation of cloud physics

How does cloud physics relate to trade wind? It seems to me that they are incoherent.

L.648: present-day conditions

Specify the years of the observation. (1980-2009)?

Figure 18

Adding a plot for the observed sea surface height will be helpful.

L.687: strengthening of the Aleutian low lead to increase in southward transport . . .

I could not understand why the strengthening of the Aleutian low lead to increase in southward transport along the west coast.

L.919: first 20 years

By the CMIP6 protocol, 150 year-long simulations are requested. ECS may change according to the length of analysis period. Describe why you made analysis for the first 20 years.

L.939: are consistent with . . .

→ “are correlated with”

L.998: subarctic (tropical) region are underestimated (overestimated) in MIROC6 (MIROC5)

“subarctic (tropical) region are underestimated in MIROC6 (MIROC5)” or “subarctic

region are underestimated (overestimated) in MIROC6 (MIROC5)”

L.1053: which is consistent with . . . in observations.

→ which is in the acceptable range.

Technical corrections

L.185: is insufficient

→ delete.

L.229: in order to to

→ in order to

L.433: , which has a shallow . . .

It is unnecessary as it already described in section 2.1.

L.481: 2.9 (3.1) Wm-2 in MIROC5.

→ 2.9 (–3.1) Wm–2 in MIROC5.

L.490: better simulated in MIROC5

→ better simulated in MIROC6

L.922: -1.5 Wm–2

→ –1.5 Wm–2K–1

L.987: , qualitatively

→ delete.

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