# Supporting Information for "A Hierarchy of Global Ocean Models Coupled to CESM1"

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**Contents of this file**

1. Figures S1 to S3.

**Introduction** This supporting information provides the following content:

1. Figure S1: The analysis plots showing the air-sea coupled-mode in the equator due to horizontal diffusion coefficient being too small.

2. Figure S2: The analysis plot of ocean mean temperature and AMOC strength time series that help determine the range of time selected to compute the mean of climate response in SIL.

3. Figure S3: The sea-ice thickness distribution of both CTL and SIL.

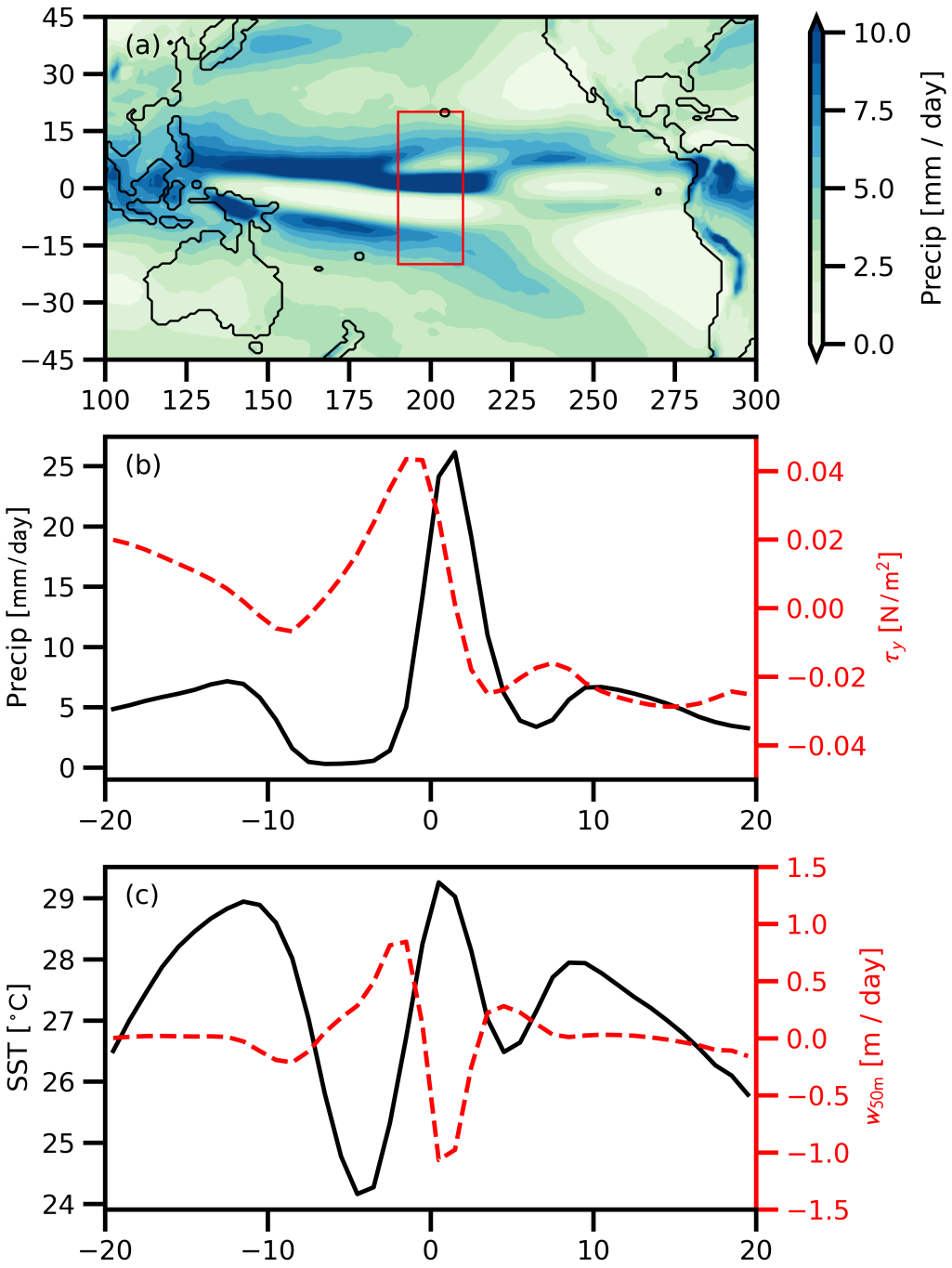


**Figure S1.** The annual mean values of year 30 of CTL_EMOM in which uniform $K_H = 1500\,\mathrm{m}^2\,/\,\mathrm{s}$ is used. (a) shows the precipitation map of tropical Pacific. (b) shows the zonal mean precipitation (left axis, solid black) and zonal mean meridional wind stress (right axis, red dashed, positive means that wind blows northward) of the regions boxed in (a). (c) is the same as (b) but for SST and oceanic 50-m vertical velocity.

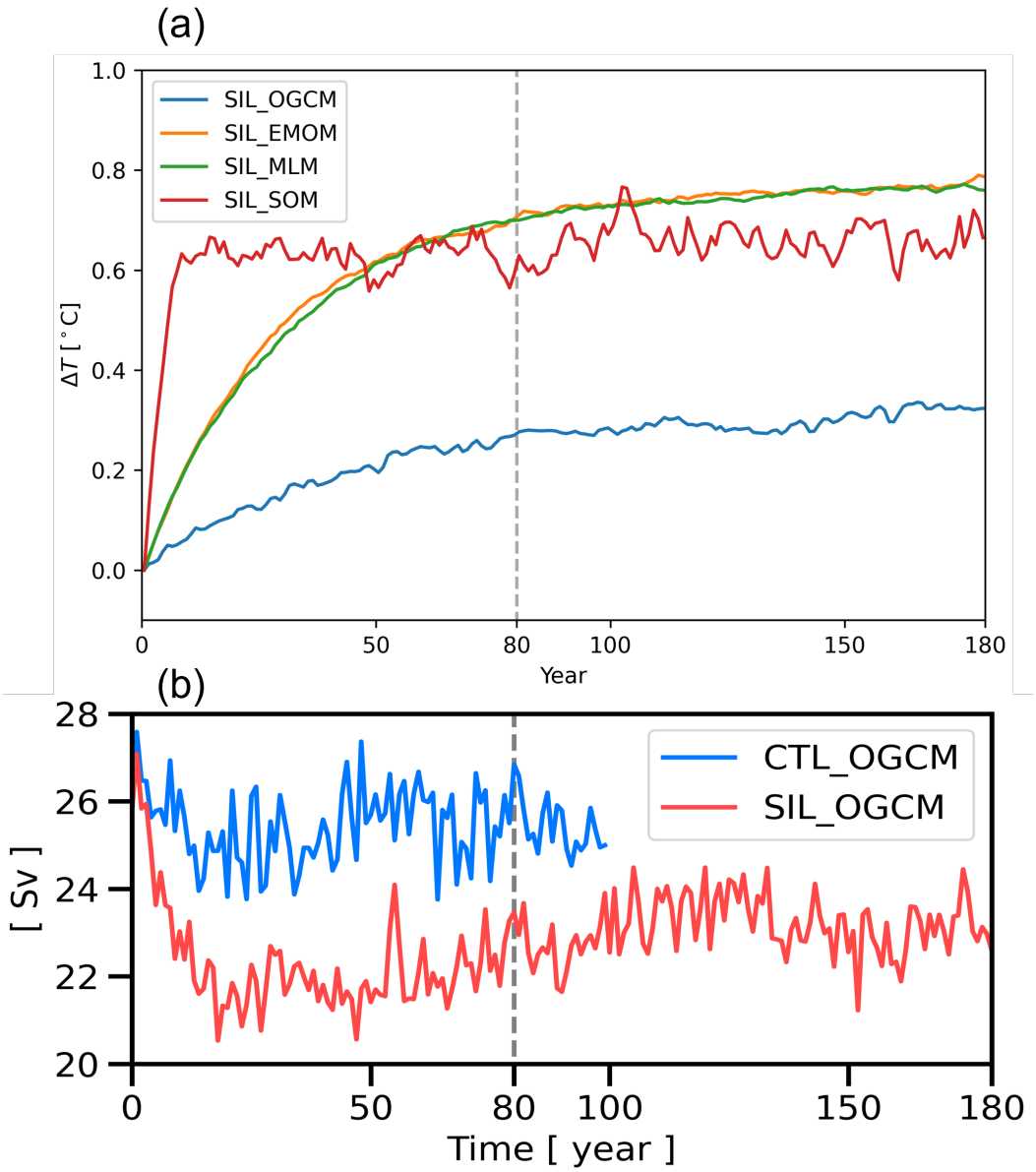


**Figure S2.** (a) The temporal evolution of mean ocean temperature in top 503.7m in SIL relative to the beginning year of each trajectory. Time window year 80–180 during which SIL data are used for statistics is labeled. Notice that the mean ocean thickness of SOM is about 100 meters so there are more temporal fluctuations. (b) The temporal evolution of AMOC intensity measured in Sv.

**Figure S3.** The blue shading shows the regions where the annual mean sea-ice thickness is greater than 1 m in control run. The red shading is the same but with data derived from RCP 8.5 year 2081–2100 of CMIP5.