First of all, thank you so much for helping us to improve our manuscript with your suggestions.
Our point-to-point responses are as below.
The original review comments are shown in blue, and our responses in **black**.

Major Comments:

- ✓ Results on ITF are not well connected with the rest of the manuscript. In other words, why should we care about the ITF in the Pliocene simulations (considering that we do not have proxy data to provide sufficient constraints on the model results)? In the current form of the manuscript, ITF is described separately from the SST and hydroclimate variables. Although, in the introduction, the author did cite literation on how the ITF is linked to coupled ocean-atmosphere variability and how the ITF may influence the monsoons. However, the authors results on ITF do not make any of the connection or mechanistic analysis. Given this disjoint, I am wondering whether the author should consider cutting the ITF results and focus on the regional SST and hydroclimate over the Maritime Continent instead.

A: After consideration we still plan to to keep the results on the ITF into this study. The ITF is a factor that can influence and be influenced by the rest of climatic factors described in the manuscript. Regarding the disjointedness, we will try to integrate these sections better by putting a paragraph in the beginning of each section highlighting the linkages. Moreover, we will also add correlation analyses on the ITF strength to some variables such as temperature gradient across the Indian and Pacific Ocean, salt gradient and zonal wind strength and add more figures and analysis in the manuscript.

- ✓ In the Discussion (Section 4.3), the authors stated that "but even models of the same model family may still produce different climatic signals depending on the analysis region or the studied climate characteristic." Can you provide explanation for this interesting result? Is it because of the potentially different model resolution, or details of the boundary condition implemented by different authors, or internal variability?

A: In the revised paper we will explain the differences between, for example, CESM2 and other CCSM4 models with different parameterization and schemes. Although some models can be categorized into the same family, they are not identical; they have differences in resolution, parameterizations, or model components. These differences can result in different climatic signals. As for the boundary condition implementation, all the models run the simulations with the same boundary conditions (except HadGEM3 run Eoi400 with different land-sea mask than other models), and so in our study it is likely less important for causing the differences.

- ✓ Are there available proxies on the hydroclimate (precipitation /evaporation and sea surface salinity) and ITF in the region? If yes, please include results and discussion on these comparisons. If no, please state it explicitly in the manuscript (that there is no available proxy for

benchmarking models).

A: We have collected published proxies that indicate the wet/dry conditions in the study region and we will include them in Figure 5b.

✓ Please consider adding a summary of model-proxy comparison of SST in the abstract.

A: We will insert text similar to that below, in the abstract:

By comparing model results with data it has been found that models, which reproduce modern climate well, are not always good at simulating the mid-Pliocene climate anomaly of the MC. In addition, the MMM reproduces the preindustrial SST of the reanalysis better than most individual models, and produces less discrepancy with reconstructed SSTAs than most individual models in the MC.

Minor comments:

✓ Lines 23–25: Rewrite and change into "A large amount of rainfall releases large quantities of latent heat into the atmosphere, which is an important driver of global atmospheric circulation".

A: We will rewrite this line.

✓ Many of the multi-panel plots are not labeled with subplot label (such as (a) and (b). Please check and make sure all the subplots are properly labeled.

A: We will check all the subplots and label them.

✓ Information should be provided on how the ocean salinity was initialized in the simulations. This information is needed because the authors examined the sea-surface salinity changes in the PlioMIP simulations (e.g., Figure 5d), and it is not clear whether the ice-volume effect has been accounted for in the simulations and has an imprint in Figure 5d.

A: The initial conditions of ocean salinity are either derived from (Levitus and Boyer 1994), an equilibrium state of the modern (control) simulation, or the end of the PlioMIP1 experiment (Haywood et al. 2011). Ice sheets have been accounted as boundary conditions in the experimental design. But, since ice sheet changes were prescribed, the PlioCore experiment will be in equilibrium with the ice sheets (Haywood et al. 2020). So the ice-volume effect won't have an imprint in the salinity. We will double check this with simulation groups at the revision stage, and we will include this information in section 2.2.

✓ Line 266: "the relationship is not exactly linear."

A: We will rewrite this line.

✓ Figure 10: cluster 5 (GISS) looks weird. The model resolution is ~2 degree (Table 1). It is hard to believe the precipitation anomaly has such a rich fine structure. Please double check and make sure calculation has been done correctly.

A: For visualisation of the clustered groups, we regridded all the individual models'

results into 1x1 degree so that we can combine models with different resolution.

Reference:

Haywood, A. M., H. J. Dowsett, M. M. Robinson, D. K. Stoll, A. M. Dolan, D. J. Lunt, B. Otto-Bliesner, and M. A. Chandler, 2011: Pliocene Model Intercomparison Project (PlioMIP): experimental design and boundary conditions (Experiment 2). *Geosci. Model Dev.*, **4**, 571–577, https://doi.org/10.5194/gmd-4-571-2011.

Haywood, A. M., and Coauthors, 2020: The Pliocene Model Intercomparison Project Phase 2: large-scale climate features and climate sensitivity. *Clim. Past*, **16**, 2095–2123, https://doi.org/10.5194/cp-16-2095-2020.

Levitus, S., and T. P. Boyer, 1994: World Ocean Atlas 1994. Volume 4. Temperature. US Government Printing Office.