Response to Co-editor

We thank the co-editor for evaluating the revision to speed up the review process and also for the comments to further improve the manuscript.

Below are the co-editor's comments in black and our answers to the comments including the changes we propose for the manuscript in red.

1 Specific comments

Line 123 (in the non-tracking version): Please include references for studies using interactive ocean and discuss what you meant by "having consistent results".

We include the references for studies using interactive ocean and also mention what we meant by "having consistent results".

In our manuscript, we have changed the Line 123 to "Nevertheless, our analysis shows that the circulation responses, i.e., the changes in the Hadley cell and eddies, to changes in the rotation rate, are similar to other studies with an interactive ocean (Liu et al. 2017; Cox et al. 2021; Navarra and Boccaletti 2002; Kaspi and Showman 2015)."

The paragraph of line 332: It'll be helpful to include more information on Liu et al. 2017 and Williams et al. 2024. While I understand it is difficult to resolve why different studies have different results, it'll be helpful to include more information on the experimental setups or models used, especially comparing to the current study.

As per the co-editor suggestion, we have included the experimental setups and models used by the previous studies.

In the manuscript, we have modified the paragraph of line 332 to "The changes in the zonal mean cloud radiative effects are similar to those simulated by Liu et al. (2017) in a slab ocean setup using GFDL AM2.1. Both, LW and SW cloud radiative effects decrease from slower to faster rotation near the equator, providing a robust response to Hadley cell changes with rotation rate. The changes in storm systems and associated cloud radiative effects simulated in our experiments are not apparent in Liu et al. (2017). Williams et al. (2024), however, report a similar non-monotony in the SWCRE as simulated by us. Their experiments are performed with a slab ocean setup of the Isca model, where $\Omega/\Omega_e = 1/8$ is at the transition point from eddy-dominated at high rotation rates to mean-flow dominated at slow rotation rates, and such transitional rotation rates appear to suppress cloud formation.

Our reasoning for the non-monotony is very similar to Williams et al. (2024) that the Rossby radius of deformation reaches the size of the planet at $\Omega/\Omega_e = 1/8$, causing the storm tracks to disappear and the SWCRE to drop. While the studies of (Liu et al., 2017) and (Williams et al., 2024) differ in their experimental and model setup compared to our study, these similarities in results suggest that the responses of the circulation and cloud radiative effects to changes in rotation rate are qualitatively robust across models."

Line 68 "... but their effect on the global mean radiant energy budget hasn't been discussed": Related to point 2 above, in addition to analyzing global mean budget, it'll be great if the authors could elaborate more on the missing puzzles in existing literature. The current manuscript acknowledges existing literature, but the introduction can probably make a more convincing case to motivate current study. For example, given the significant influence of rotation rate on clouds and GCMs' large uncertainties in simulating clouds, it's likely necessary to perform more studies on related topics. Is there more information on differences in climate sensitivities and cloud feedback in these models? Or, maybe the authors see the limitations of previous studies' experimental setup? hypothesis? analyses?

As per the co-editor's suggestion, we have elaborated more on the missing puzzles and tried to make a more convincing case to motivate the current study.

In the manuscript, we have included a sentence on habitability at Line 27: "However, there is no comprehensive evaluation of these effects on a planet's global radiation budget and hence its habitability, yet". We have modified the second paragraph starting from Line 28: "Changes in atmospheric radiative properties have been found to affect top-of-atmosphere (TOA) radiant energy fluxes, particularly for slowly rotating to tidally-locked planets. Williams et al. (2024) analyse the TOA energy flux at 23°N to discuss cloud seasonality, and Haqq-Misra et al. (2018) discuss thermal emission at the equator. Both studies highlight the importance of high clouds for TOA radiant energy fluxes in comparison to clear sky fluxes, but only at single tropical latitudes for slower than Earth-like rotation cases. Also for slowly rotating planets, Guzewich et al. (2020) and Way et al. (2018) analyse global averages of cloud radiative effects and water vapour, but emphasise the importance of water vapour changes for the surface temperature response to rotation rate changes. Thus, both clear-sky and cloud radiative effects, which are mainly associated with changing atmospheric circulation, have been found to be important in previous studies". Further, we have rewritten the paragraph starting at Line 69: "Therefore, in this paper we investigate how changes in the Hadley cell and the baroclinic eddies caused by changes in the Coriolis force affect the atmospheric properties such as temperature, humidity and cloudiness, and what consequences this has for a planet's TOA radiant energy budget. As mentioned above, previous studies have discussed some aspects of the influence of the rotation rate on the TOA radiative fluxes, with an emphasis on cloud effects (e.g., Williams et al., 2024; Liu et al., 2017; Haqq-Misra et al., 2018). However, a comprehensive evaluation of this influence on a planet's energy budget, disentangling the effects of both clear-sky and clouds, and the shortwave and longwave parts, is still missing. This is even more the case for faster than Earth-like rotation rates. For this reason, unlike previous studies, we focus mainly on the rotation periods < 32 Earth days and evaluate both the clear-sky and cloud contributions to the total TOA radiant energy budget. As stated above, such an evaluation would provide further insight into the habitability of such faster rotating planets. We therefore perform sensitivity experiments using an aquaplanet GCM with fixed sea surface temperatures (SSTs) for different Coriolis parameters representing rotation rates from 1/32 to 8 times the Earth's current rotation rate, and analyse the effective TOA radiative forcing relative to Earth-like rotation. We explain the resulting forcings in terms of changes in the atmospheric properties mentioned above and their clear-sky and cloud contriubutions, as well as shortwave and longwave components."

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