



EGUsphere, referee comment RC3
<https://doi.org/10.5194/egusphere-2022-197-RC3>, 2022
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Comment on egusphere-2022-197

Anonymous Referee #3

Referee comment on "Impact of an acceleration of ice sheet melting on monsoon systems" by Alizée Chemison et al., EGU sphere, <https://doi.org/10.5194/egusphere-2022-197-RC3>, 2022

The manuscript "Impact of an acceleration of ice sheet melting on monsoon systems" uses the AOGCM IPSL-CM5A to investigate the impact of fresh water input from ice sheet melting over Greenland or the Antarctic on top of RCP8.5 scenario, with a particular focus on the response of global major monsoon systems. It is found that the Antarctic fresh water input has moderate global impact due to dilution by the circumpolar current. However, Greenland ice sheet melting fresh water input is able to significantly slow down the AMOC and shift ITCZ southward due to energy constraint (Schneider et al. 2014). As a result, some regional monsoons closely linked to ITCZ shift are greatly impacted, which include later (earlier) onset of North (South) American monsoon and drying (wetting) North (South) African monsoon. However, the response of the Asian and Australian monsoons, which are weakly linked to ITCZ shift, is not clear.

Monsoon variability and response to external forcings are very important topics in climate science given its impact on a large number of population and yet it is a great challenge due to the complexity of the system that involves interaction of various components. Overall, this is an interesting study and highlights one important driver (fresh water input from ice sheet melting) in the future warming climate that is often neglected in model simulations and projections. I recommend publication after concerns from the reviewer being addressed.

Major comments:

1. The spatial resolution of the atmospheric component (3.75 deg longitude x 1.875 deg in latitude) is relatively low and might not be able to capture some key effect of high orography, which is crucial for some monsoons (e.g the Asian monsoon in Boos and Kuang 2010 and the North American monsoon in Boos and Pascale 2021). The authors need to discuss if the major results are sensitive to the spatial resolution.

2. The study focuses on multiple regional monsoons in response to ice sheet melting fresh water input but lacks some process-based analysis to answer the question of why the response is way it is. Examples of such analyses include moisture static energy (MSE) budget analysis as in Seth et al. 2013, Hill et al. 2017 and Jacobson et al. 2020, which may provide deep insight into the response of monsoons. I recommend the authors conduct similar analysis, or add some discussion on the limitation of the scope of current manuscript if the authors would like to leave such analysis in future study.

Specific comments:

Page 1, lines 16-17: add some references to this statement.

Page 3, lines 69-71: add some references to the statements. Also notice that the confidence on the future projection of East African rainfall can be greatly reduced given the bias of simulation in the current climate (see Yang et al. 2015).

Table 2:

The equation of P_{avj} : "I" doesn't appear in the equation. Do you mean $\sum_{I=1}^I$ by $\sum_{n=1}^I$?

The equation of $SDII_j$: Is "W" instead of "w" the last value in the sigma notation, i.e. $(\sum_{w=1}^W PR_{wj})W^{-1}$ instead of $(\sum_{w=1}^w PR_{wj})W^{-1}$?

Figure 2:

Use consistent latitude format as in other figures (e.g. 20S and 20N instead of -20 and 20).

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