

Interactive comment on “Ocean-atmosphere interactions modulate irrigation’s climate impacts” by N. Y. Krakauer et al.

Anonymous Referee #1

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Anonymous reviewer recommendation – “Ocean-atmosphere interactions modulate irrigation’s climate impacts”

This study uses ModelE2 to explore the irrigation’s impacts with and without considering ocean- atmosphere interactions via using a slab ocean model. They found that the ocean-atmosphere interaction amplifies irrigation-driven climate responses in the tropics and midlatitudes, approximately doubling the global mean amplitude of surface temperature changes from irrigation. In general, irrigation’s impacts have been gained lots of attentions recently by using different numerical models both at regional and global scale. However, most of the previous studies used prescribed SST as the boundary forcings. This study pioneers using the slab ocean to explore how the ocean-atmosphere interaction can modulate the irrigation’s impacts. While this study points interesting irrigation’s remote effects, the analysis in this study could be improved in or

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der to support what the authors want to convey. Overall, the findings presented in this paper may be of interest to the community. There are several aspects that the authors may want to consider in the revised version. Please see below for some comments.

1. What is the overall performance of GISS-ModelE2? The global pattern of precipitation/circulation compared to reanalysis data may be useful.
2. The authors have shown the spatial patterns for surface temperature, precipitation, and pressure from the effects of irrigation. How the circulation changes when applying the irrigation?
3. The authors argue that the patterns induced by irrigation forcing are less widespread when SST is fixed, implying that ocean-atmosphere interaction is a key to their propagation and persistence across seasons. However, how do we know the persistence can across the seasons?
4. While the authors find an interesting finding of enhancing the wave patterns from the irrigation forcing when considering the ocean-atmosphere interactions, how about the time series analysis? How does LCLUC affect the interannual variations? Also, will including the ocean-atmosphere interaction affect such variations?
5. The authors use a slab-ocean (without the ocean dynamics) to show the remote effects when considering the ocean- atmosphere interactions. Can the authors comment on what the remote impacts might change if using a fully coupled ocean dynamic model?
6. Why is there some remote impacts over the southern oceans when considering the ocean-air interactions? Wave patterns propagations?
7. Do the simulations reach the equilibrium yet? A plot for the energy balance in TOA might be worth.
8. There is some northward shift of the ITCZ during the winter. Is there any particular reason for this?

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