

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

### **Anonymous Referee #4**

Received and published: 3 July 2016

#### General comments:

The manuscript presents a study on the role of ocean-atmospheric interactions in modulating the impacts of irrigation on large scale climate.

By linking the atmosphere with the ocean and the land, the paper is within the scope of ESD. However, the manuscript would benefit if the authors would treat the interactions between the modelled components from a more physical perspective and thoroughly discuss the processes and complexities behind the numerical experiments that lead to the differences presented.

I think that with a little expansion of the scope/details of the study the authors could produce a much more informative and well-rounded paper compared to the current, rather short, ‘letter like’ manuscript. Overall, the methods are described very briefly. I

C1

suggest the authors to further elaborate some of the details in the main text instead of just referring to previous studies (e.g. for the irrigation scheme and the model runs (see also specific comments below)).

Authors should investigate/comment of the effects on the oceans of taking all the water from the rivers. I.e. less water reaching the ocean and the effect on ocean temperatures.

The analysis is performed with a focus on spatial impacts, but I think the study would benefit if also some more attention would be given to the temporal effects. I.e. do the impacts change between the different years that were simulated and if so what are the main reasons?

My final concern is that only one model with each of the configurations is being run and analysed, but little consideration is given to the uncertainties associated with the different initial conditions and model configurations. The authors should at least test/discuss if the effects observed from different initial states are larger than the effects one obtains from the presence/absence of irrigation and/or interactive SST.

Based on the comments above and below, I suggest reconsidering the manuscript for publication after major revisions

#### Specific comments:

P1L19: please elaborate on the factors that prevent the deduction of remote impacts based on observations.

P2L7: Please specify the degree of amplification, i.e. was the amplification significant?

P2 1st Paragraph: Were any major reservoirs considered before water was taken from the groundwater resources? Were the volumes of water and groundwater abstractions of the same magnitude as actual measured irrigation? In many countries where irrigation was applied, rice is one of the major crops grown. Have the effects of the cropping methods (e.g. rice paddies result in standing water and therefore into additional stand-

C2

ing water and evaporation) been considered in the model? Please comment/elaborate on these points in the manuscript.

P3L1: the simulations were run for 60 years, however the data available for the SST and the seas ice were only computed for 1996-2004. Does this short time span cover the natural variability of these variables? Please elaborate.

P3 Fig1: I suggest using a different colour scale (not starting with white), as it is difficult to distinguish if for an area no/ little irrigation has been applied. Additionally, please elaborate why certain areas have high amounts of irrigation applied, although it is the season of high precipitation (e.g. India during the Monsoon).

P3L8: Please elaborate why a lag-1 adjustment was performed. What is the physical meaning behind this? Does the system not exhibit any long term memory?

P3L12-15: Why only northern Hemisphere? I would think that the other 8% of irrigation also merits consideration.

P7L5-10: I would suggest moving this to the discussion section.

---

Interactive comment on Earth Syst. Dynam. Discuss., doi:10.5194/esd-2016-23, 2016.