#EGU22-8603

HOW CERTAIN ARE WE ABOUT THE MODEL-BASED ESTIMATIONS OF GLOBAL IRRIGATION WATER WITHDRAWAL?

Arnald Puy, ***Razi Sheikholeslami*** [1,2], Hoshin V Gupta, Jim Hall, Bruce Lankford, Samuele Lo Piano, Jonas Meier, Florian Pappenberger, Amilcare Porporato, Giulia Vico, and Andrea Saltelli

1 School of Geography and the Environment, University of Oxford, Oxford, UK
2 Environmental Change Institute, University of Oxford, Oxford, UK

SoGE | School of Geography and the Environment
UNIVERSITY OF OXFORD

EGU General Assembly 2022

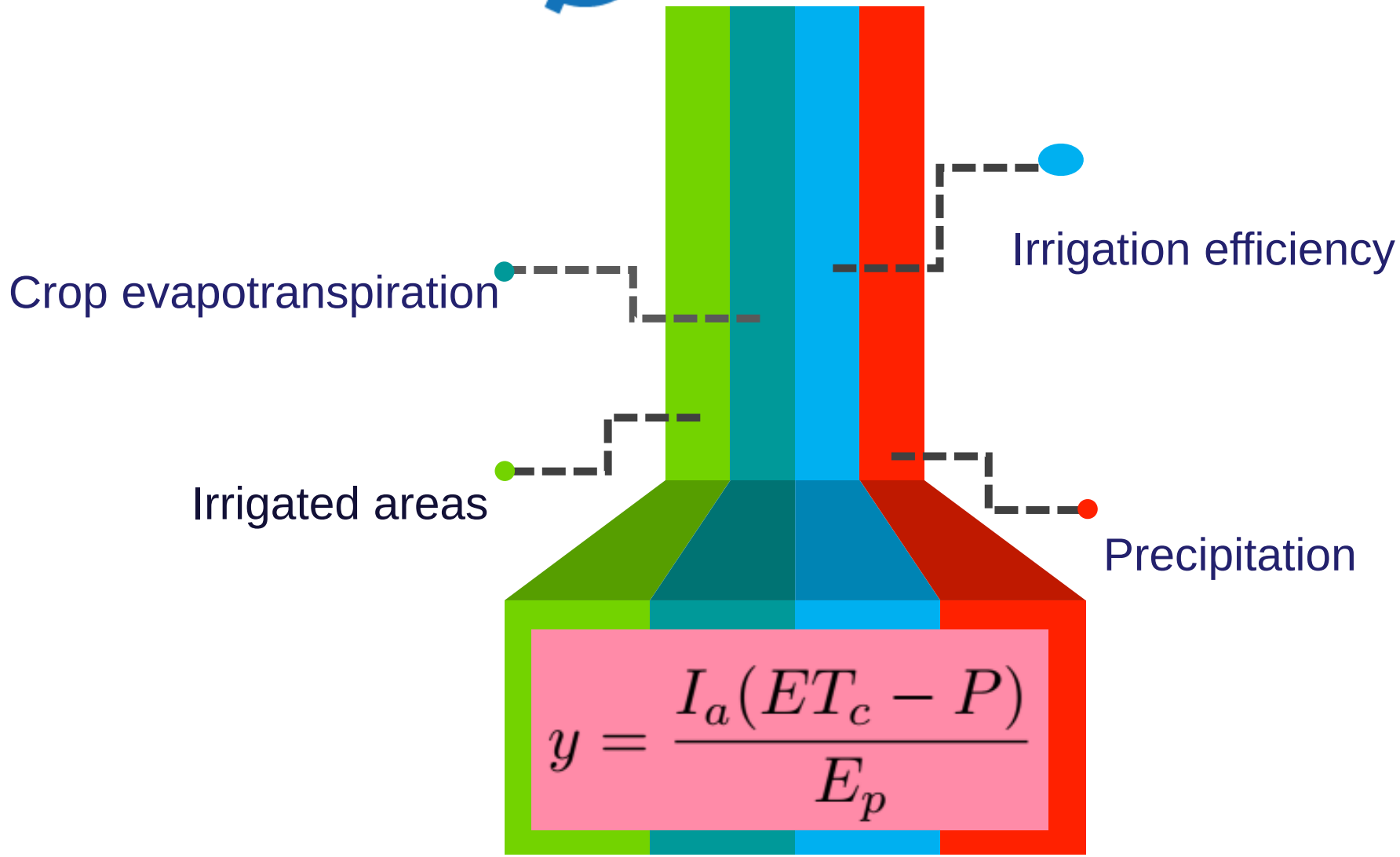
MOTIVATION/SIGNIFICANCE

The total amount of water allocated to irrigation is estimated with Global Hydrological Models (GHM), spatially-distributed algorithms.

GHM-based estimates are often used to inform the Sustainable Development Goals (SGDs) at the water-food interface and high-level policies.

The irrigation water withdrawal, which is the largest consumer of freshwater and a key actor conditioning water pollution, aquifer exhaustion, soil erosion, yielded by GHMs rely on several questionable assumptions.

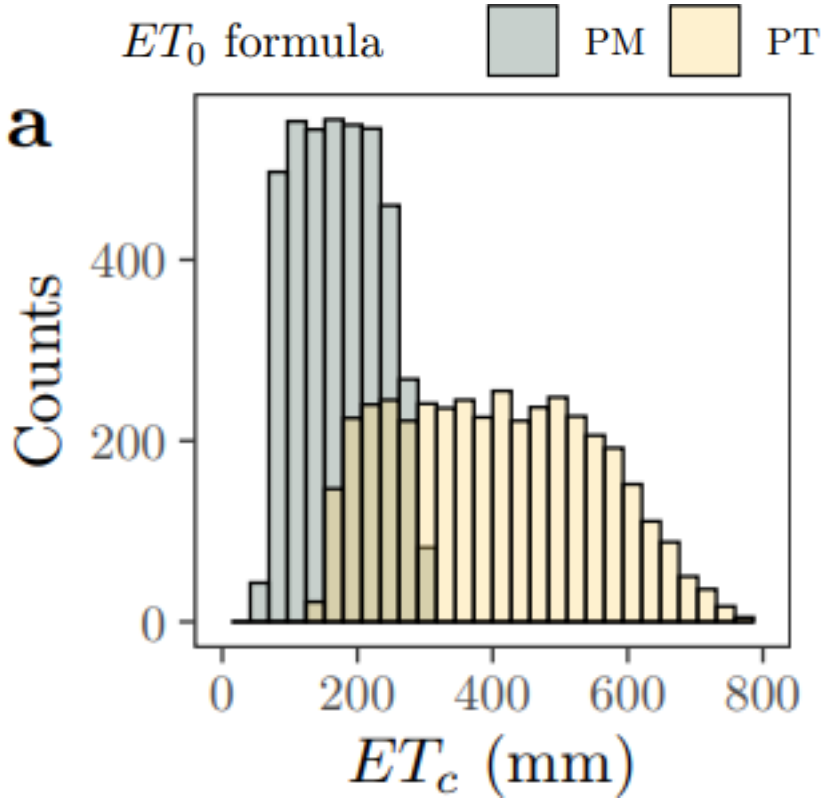
METHODOLOGY



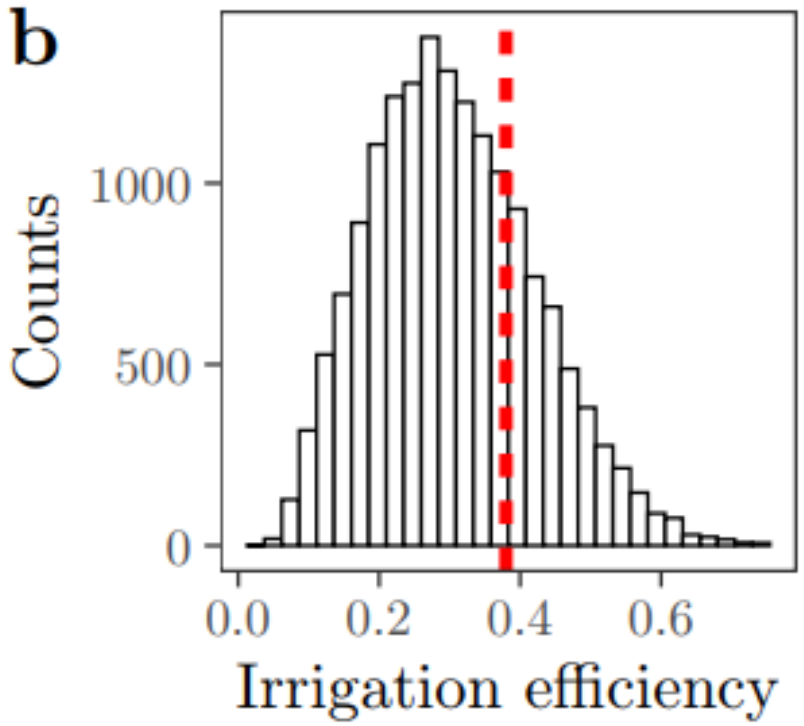
The main uncertainties and ambiguities embedded in each of the basic terms used to calculate global irrigation water withdrawals

KEY FINDINGS

- Examples of the ambiguities embedded in the calculation of global irrigation water withdrawals



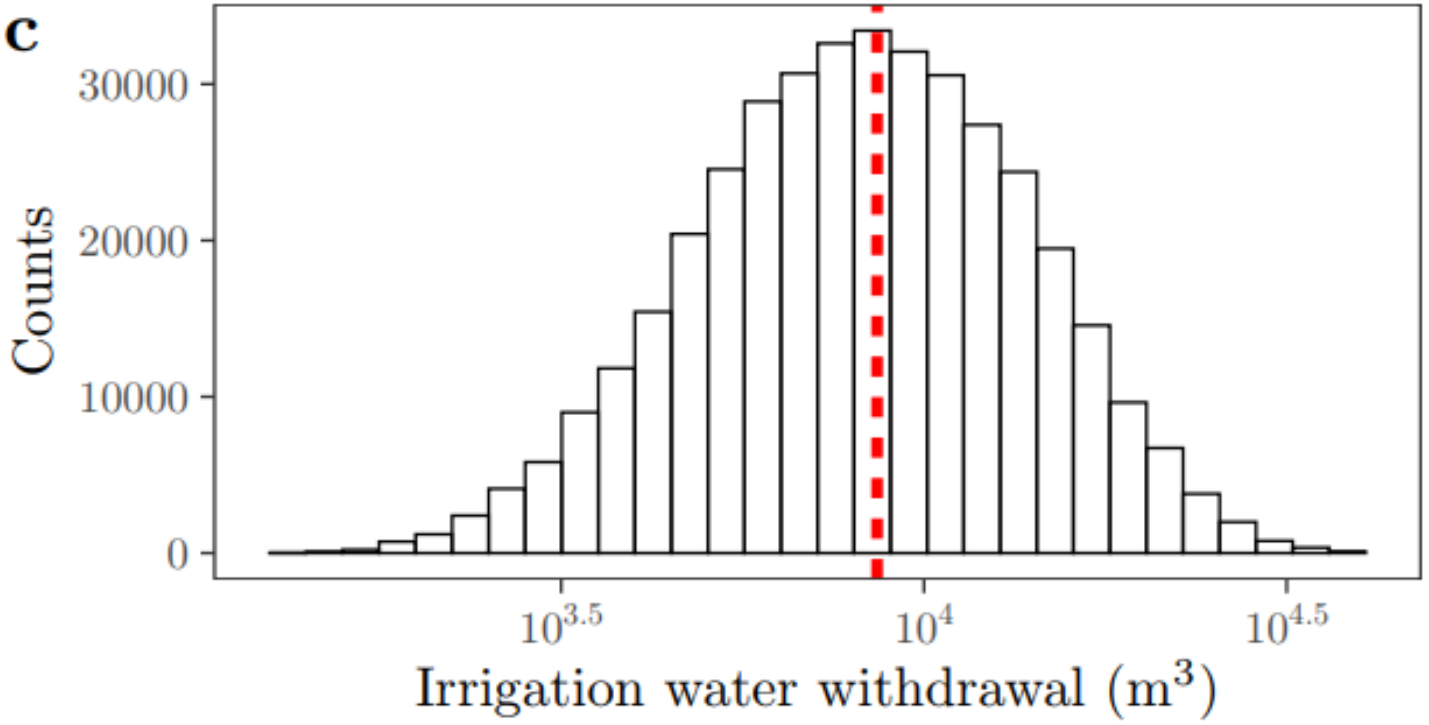
Uncertainties in the estimation of the crop evapotranspiration



Distribution of the irrigation efficiency of China after propagating uncertainties

KEY FINDINGS

Distribution of the water withdrawn to irrigate wheat in a specific grid cell of the Uvalde County, Texas, USA for January 6-7 200. All uncertainties in the calculation of IWW are considered. The red, vertical line is the estimate produced when the uncertain parameters used in the calculation of IWW are characterized with point estimates (e.g., mean values)



CONCLUDING REMARKS..

We show that current models misguide us under an accuracy mirage, and it is impossible to know whether we are underestimating or overestimating the impact of irrigation agriculture in the water cycle.

We integrate the main uncertainties in calculating irrigation water withdrawals and show that the resulting estimates may vary by more than two orders of magnitude.

We discuss the dangers of relying on spuriously accurate models for policymaking at large spatial scales and offer corrective measures to ensure that uncertainties are properly accounted for and quantified.

Omitting uncertainties can also make water managers issue fixed water licenses that do not reflect varying water availability and water requirements' evolution over time. By the time the error is amended, the social-ecological damage may have become irreversible

THANK YOU

Email: *razi.sheikholeslami@ouce.ox.ac.uk*

Twitter: @RaziOptimus

REFERENCES

Puy, A., Sheikholeslami, R., Gupta, H., Hall, J., Lankford, B., Lo Piano, S., Meier, J., Pappenberger, F., Porporato, A., Vico, G., and Saltelli, A. (2022). The delusive accuracy of global irrigation water withdrawal estimates. Nature Communications. (*accepted*)

Puy, A., Sheikholeslami, R., Gupta, H., Hall, J., Lankford, B., Lo Piano, S., Meier, J., Pappenberger, F., Porporato, A., Vico, G., and Saltelli, A.: How certain are we about the model-based estimations of global irrigation water withdrawal? , EGU General Assembly 2022, Vienna, Austria, 23–27 May 2022, EGU22-8603, https://doi.org/10.5194/egusphere-egu22-8603, 2022.

Puy, A., Lankford, B., Meier, J., Van Der Kooij, S., & Saltelli, A. (2022). Large variations in global irrigation withdrawals caused by uncertain irrigation efficiencies. Environmental Research Letters, 17(4), 044014. https://doi.org/10.1088/1748-9326/ac5768