

This is a very interesting study with relevant findings.

Dear Olivia,

Thank you for finding our study interesting and relevant. In what follows, we elaborate on your constructive comments.

I have two questions regarding the relation between the yield and the soil moisture. How does your methodological approach deal with threshold behaviours of the link between soil moisture and yield and pot. changes in the sign of the link depending on the magnitude of the anomaly? How does your approach deal with an asymmetrical link between soil moisture and yield anomalies for + and - soil moisture anomalies?

The method we apply (i.e. Structural equation modeling) assumes linear functional relationships between any two variables but this can be in principle extended to model non-parametric relationships (Bongers et al., 2021). To explore potential threshold behaviors and asymmetrical links between summer soil moisture and yield anomalies, we visualize scatter plots of the two spatially averaged variables for each region separately. Additionally, we add scatter plots of the two variables based on the full grid-cell based dataset. Using the full dataset allows to leverage a larger sample size that can potentially reveal details that might be masked in the spatially averaged time-series.

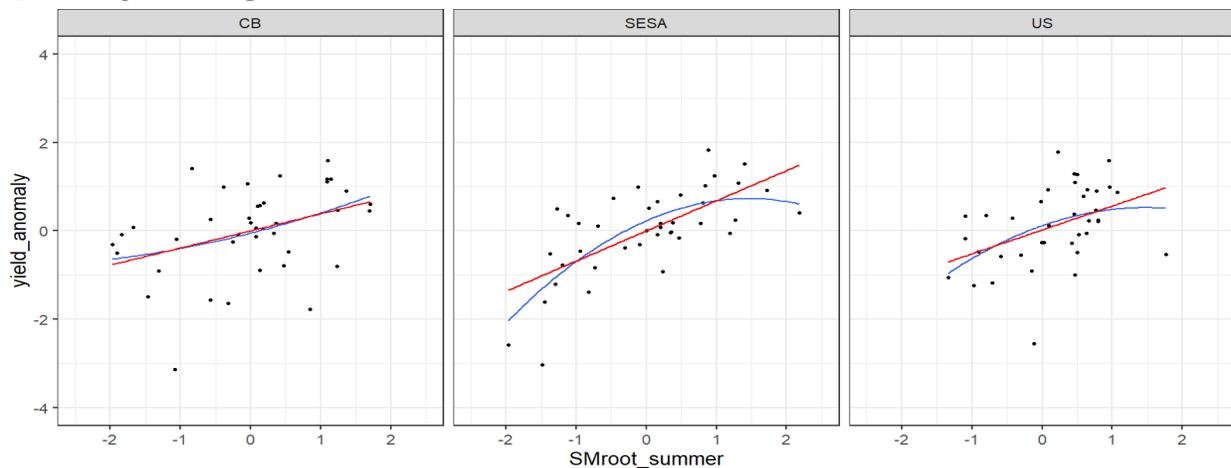


Figure R7: Scatter plots between yield anomalies and summer soil moisture for spatially averaged data over the different study regions separately. Linear (in red) and quadratic (in blue) fits over the data to reveal relationship tendencies in the data.

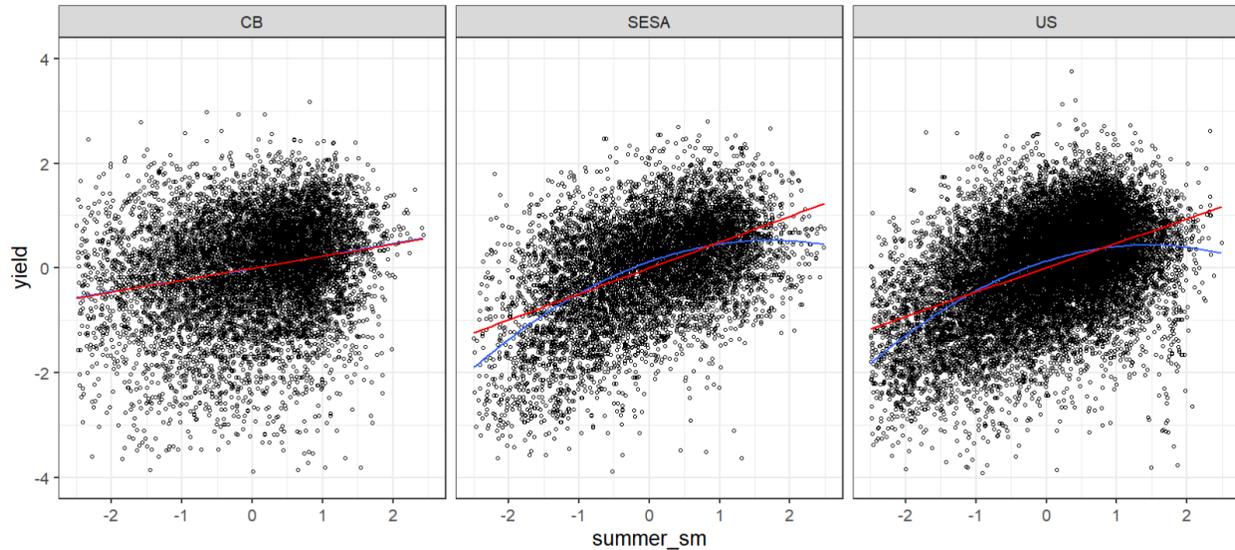


Figure R8: Scatter plots between yield anomalies and summer soil moisture for pooled data over the different study regions separately. Linear (in red) and quadratic (in blue) fits over the data to reveal relationship tendencies in the data.

Results show an overall increase in yield anomalies for higher levels of soil moisture for all regions consistent with the assumption we make in this study. This dominant linear relationship can be potentially explained by our focus on summer season soil moisture which often reports lower absolute values compared to, for e.g. spring seasons. Still, for large values of summer soil moisture, we see the possibility of negative yield anomaly occurrence which is consistent with reported negative effects of excess moisture on crops. Given the low occurrence of such events in addition to our focus here on the effects of hot and dry conditions, we believe that assuming a linear functional form is sufficient and doesn't compromise much the estimation of the relationship between summer soil moisture and yield. We do note however in the text that soybean yields can also be impacted by excessive rainfall and soil moisture (L337), an aspect that can be further explored in future studies.

I recommend one additional round of proofreading, there are some small grammatical errors and typos and formulations that could still be improved, e.g., line 3 soybean yield, or l29 increasingly growing --> growing

Thank you, we will do this when submitting the revised version of our manuscript.

Kind regards

Olivia

References:

Bongers, S., Forré, P., Peters, J. and Mooij, J. M.: Foundations of structural causal models with cycles and latent variables, *Ann. Stat.*, 49(5), 2885–2915, doi:10.1214/21-AOS2064, 2021.