

# Attributing historical changes and recent events in crop production and ensuing food insecurity to observed climate change

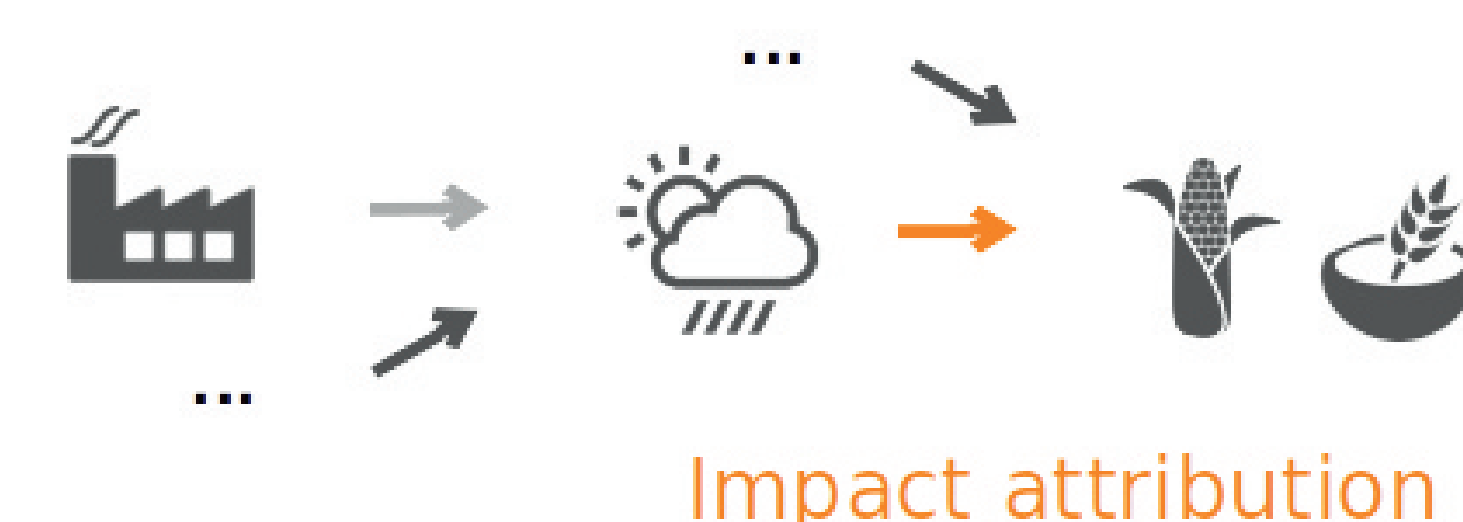
## Research question

(How much) has climate change contributed to this ... evolution of crop yields?  
... crop failure? food crisis?

## Concept

- Attribution: "evaluating the contribution of one or more causal factors to observed changes or events in climate-related natural and human systems" (IPCC AR6 WGII Ch. 16)
- here: by comparing observed crop yields with those modelled based on factual and counterfactual (no climate change) climate data

### Climate attribution



## Context

- evidence of effects of climate change to date on observed crop production, food systems, and food security still sporadic
- systematic evidence in an attribution framework could help in
  - understanding and assessing climate change loss and damage
  - facilitating adaptation to climate change in agriculture
  - highlighting non-climatic drivers and reducing disaster risk

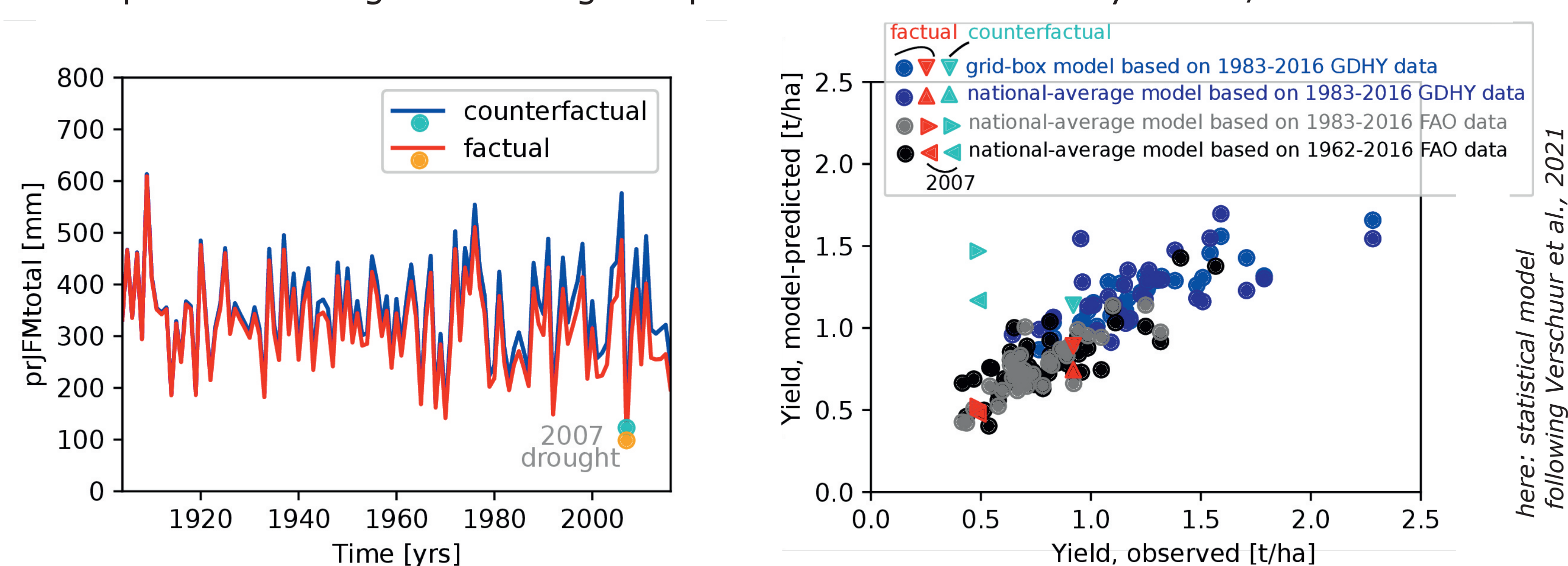
## Data

- crop yield data: national and sub-national FAO data, data from project partners, gridded data (GDHY) from Iizumi et al., 2020
- factual climate data: standard ISIMIP3a historical input data (homogenised product based on downscaled/spatially aggregated and bias-adjusted versions of 20CR/ERA5, daily)
- counterfactual climate data (ATTRICI): removes shifts correlated to low-frequency (>10-year) global-mean temperature change as a function of grid cell and time of the year (Mengel et al., 2021)

## Approach 1: Use of statistical crop models

- set of regional case studies using statistical crop models with a semi-empirical approach for variable selection (➡ Rahel Laudien et al)
- Advantages
  - statistical crop models are computationally simple, fast, and flexible
  - may include effects of climate/weather that are not resolved in process-based models
  - can be targeted to region-specific data availability and knowledge

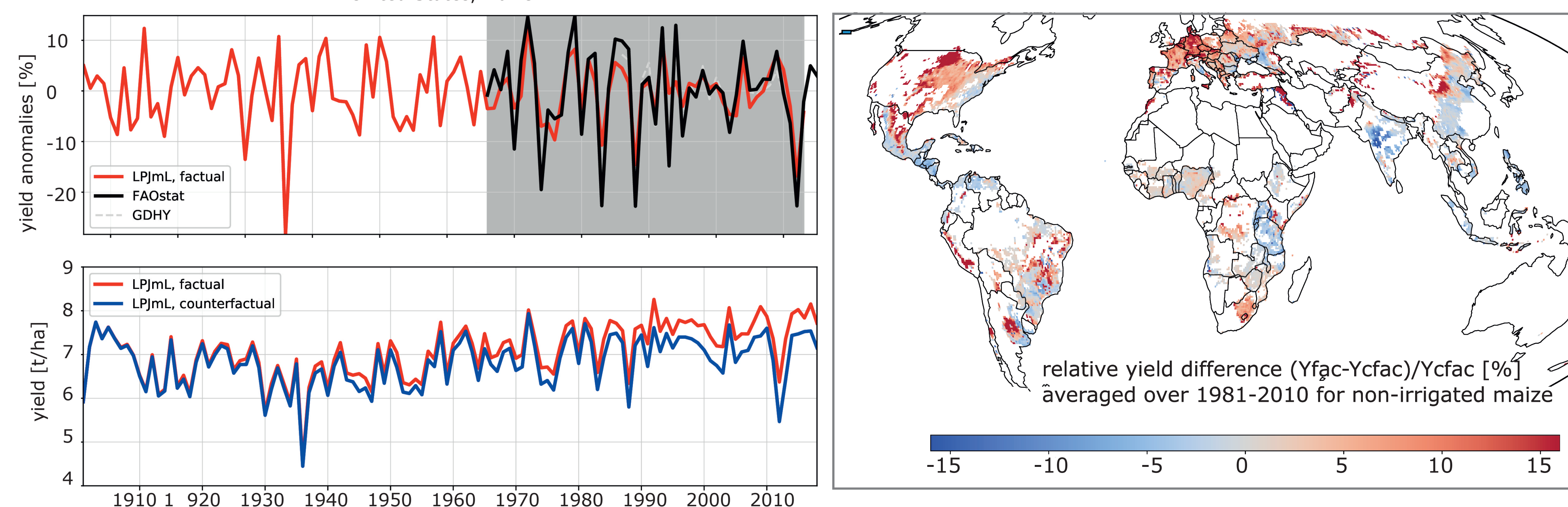
### Example: Attributing 2007 drought impacts on Lesotho maize yields w/ a statistical model



## Approach 2: Use of global gridded crop models

- global study with a multi-model ensemble of process-based crop models (AgMIP)
- Advantages
  - provides more independent evidence of the links between weather/climate & yields
  - gives a characterisation of model-contributed uncertainty
  - allows to explore different attribution subquestions (historical adaptation? CO2?)

### Preliminary results from LPJmL (example): model evaluation & comparison of factual vs counterfactual yields



## Conclusions

Methodology suggested for attributing climate impacts on crop yields using crop models and ISIMIP3a data, aimed at providing loss & damage estimates, facilitating climate change adaptation, and supporting disaster risk reduction. Find us for discussion & look out for publications in 2023!