



## Signature of climate extremes in crop yields

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Crop productions face increasing pressures from an increasing world population and a changing climate. Crop yield, i.e. production per unit area, can fluctuate considerably throughout time as a result of different economic (e.g., changes in trade policies, local incentives to agriculture, variations in demand and stock) and environmental (e.g., climate extremes, pests, wildfires) factors. We focus on climate and seek to quantify the influence of extremes on crop yield, with special emphasis on yield drops following dry and wet spells. A number of studies have examined the influence of extremes on crop production; however, only few have done so globally and none, to our knowledge, at a sub-national spatial scale and sub-annual temporal scale. Finer spatial and temporal scales are key for attributing yield drops consistently as extreme events can occur during very short periods (from several days to months), which cannot be detected using coarser scales.

We estimate historical yield drops due to extreme climate conditions in four crops (maize, soybean, wheat, barley) globally, considering the ten major crop producers from 1970 to 2014. We use gridded ( $0.5^\circ$ ) Standardized Precipitation and Evaporation Index (SPEI) of varying time windows (1 to 12 months) as the indicator of extreme events. High ( $>0.5$ ) and low ( $<0.5$ ) SPEI values are considered representative of wet and dry spells, respectively. The effect of climate varies across crop types and the period of the growing season at which the SPEI anomaly occurs. The different responses to extreme conditions exhibited by the different crop types provide valuable information to crop producers and water managers as they highlight timing of climate conditions for which each crop is most exposed to production losses.