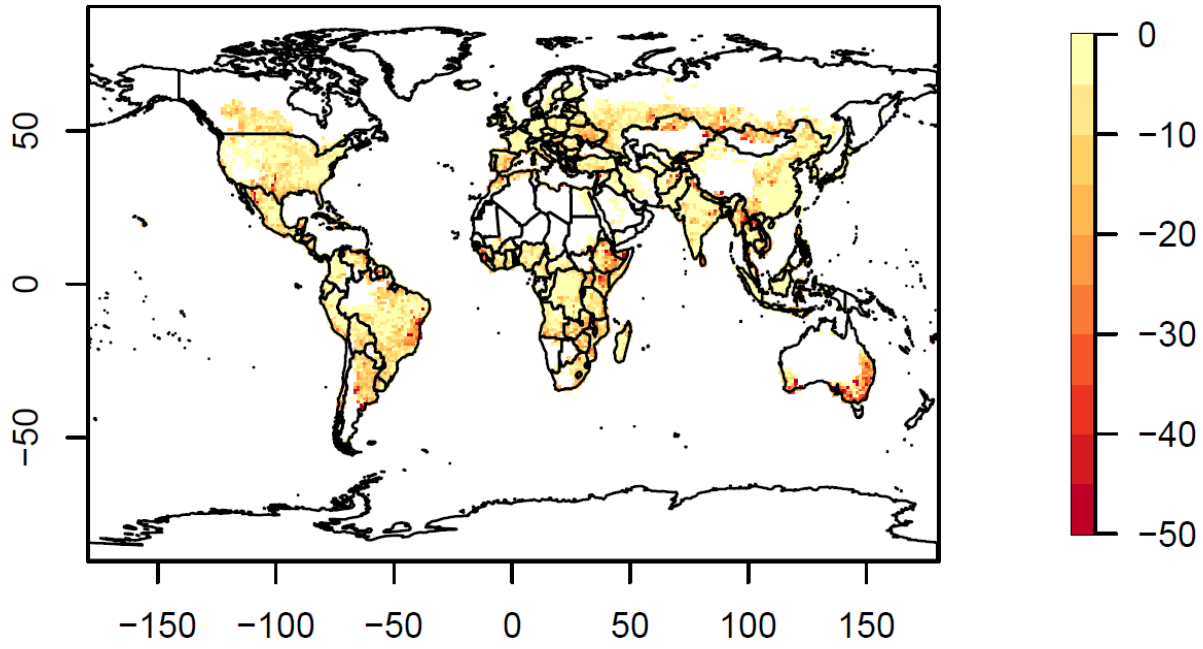
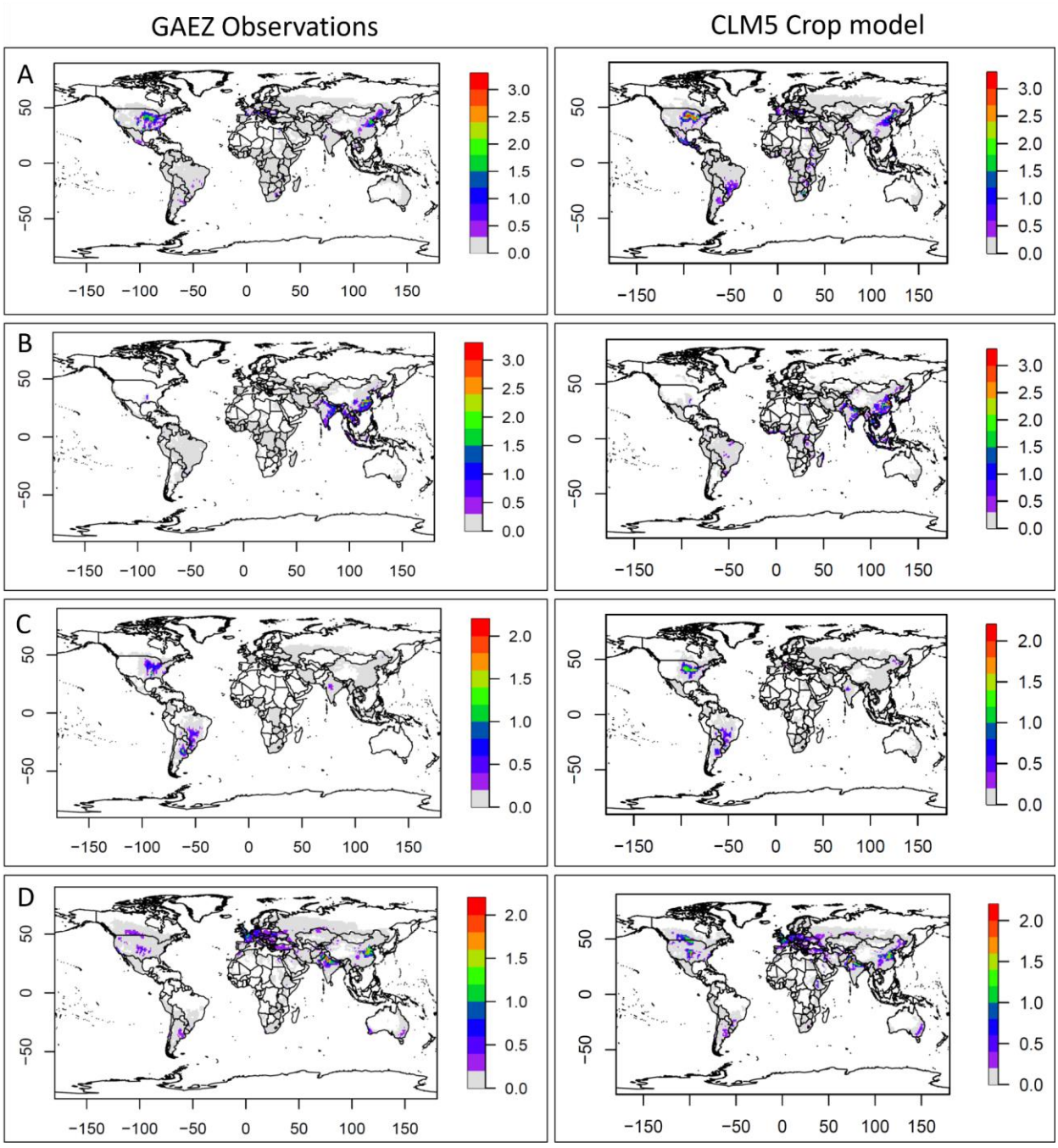
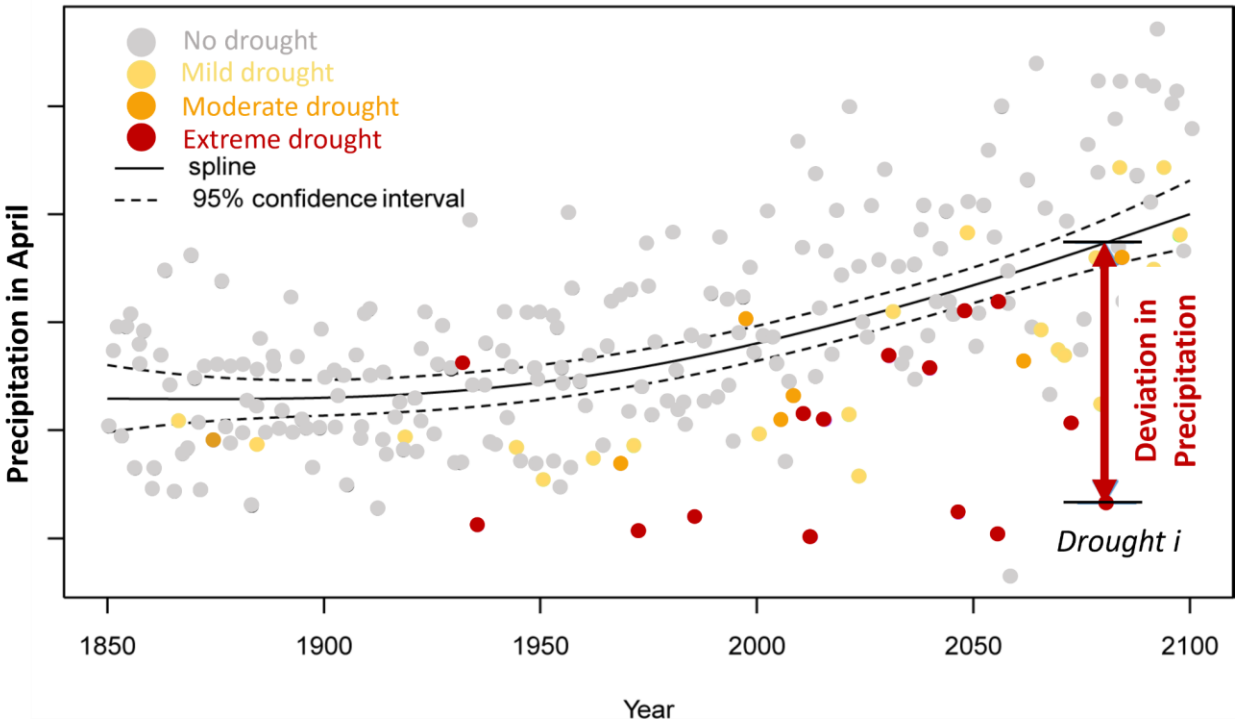


Extended Data Figure 1. Global map showing simulated regional scale future maximum percent production reduction of the four major crops (maize, rice, soybean, wheat, summed together) as a result of drought over 2040-2050. Only Grid cells with more than 10,000 Tonnes/year of big four crop production are shown.



Extended Data Figure 2. CLM5 model validation. To validate CLM5 crop model outputs (right column), we compare modeled spatial and temporal production during the historical period (2000-2010) against a number of standard global datasets used for evaluating crop models. These include data from the Global Agro-Ecological Zone (GAEZ) project[34] (left column). A: Global maize production (Million Tons/year), B: Global rice production (Million Tons/year), C: Global soybean production (Million Tons/year), and D: Global wheat production (Million Tons/year).



Extended Data Figure 3. Conceptual figure demonstrating how drought effects are isolated from a time series of climate forcings. When a future "drought" month is identified, we re-calculated the relevant climate variables (temperature, precipitation, radiation, and specific humidity) under the assumption of no-drought conditions. Following Xu et al[1]., we first fit a smooth spline to the simulation output data for a specific climate variable (e.g., precipitation), per grid cell and month (e.g., May) from the 1900–2050 timeseries of model outputs. This spline is then taken to represent the mean climate conditions for the month of interest during the period 2015-2050. To generate a "without drought" forcing time series for the same climate variable, that variable's true (drought) value is removed and replaced in the climate forcing time series by its mean value, as given by the value of the spline fit.

Extended DataTable 1: Equilibrium climate sensitivity (ECS) for the different climate model outputs used in this study.

model	GFDL	MPI	IPSL	UKESM
ECS (°C)	2.7	3.0	4.6	5.4