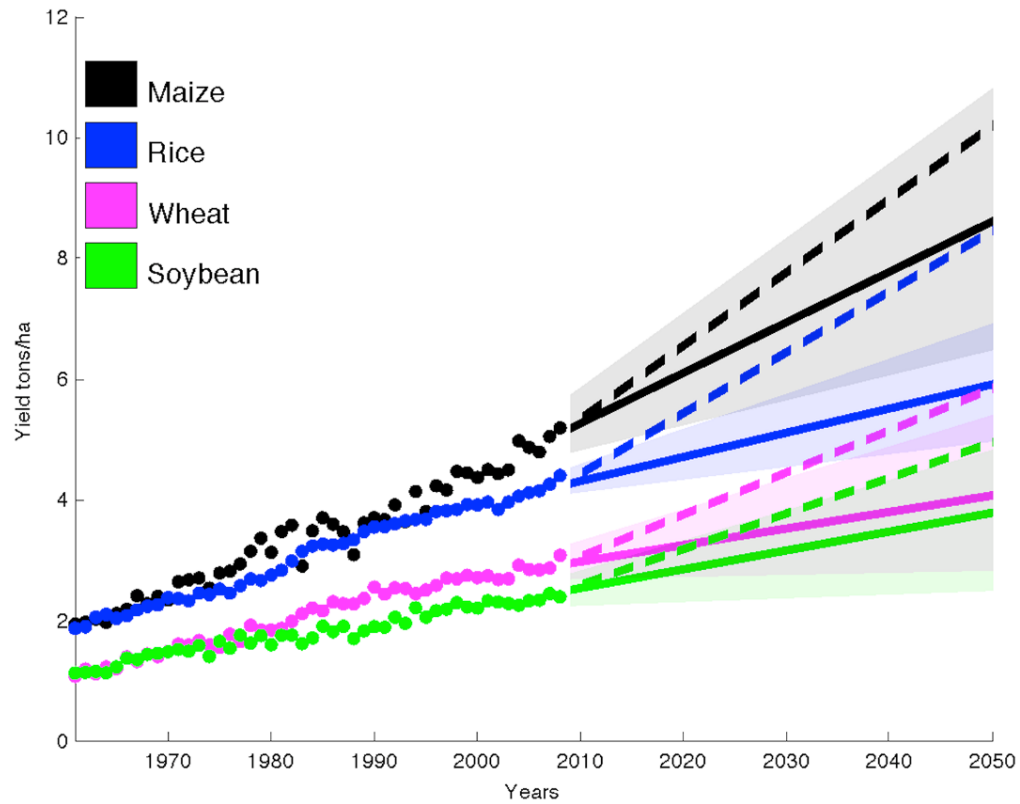


Understanding Soybean Responses to Global Changes: Impacts and Adaptations

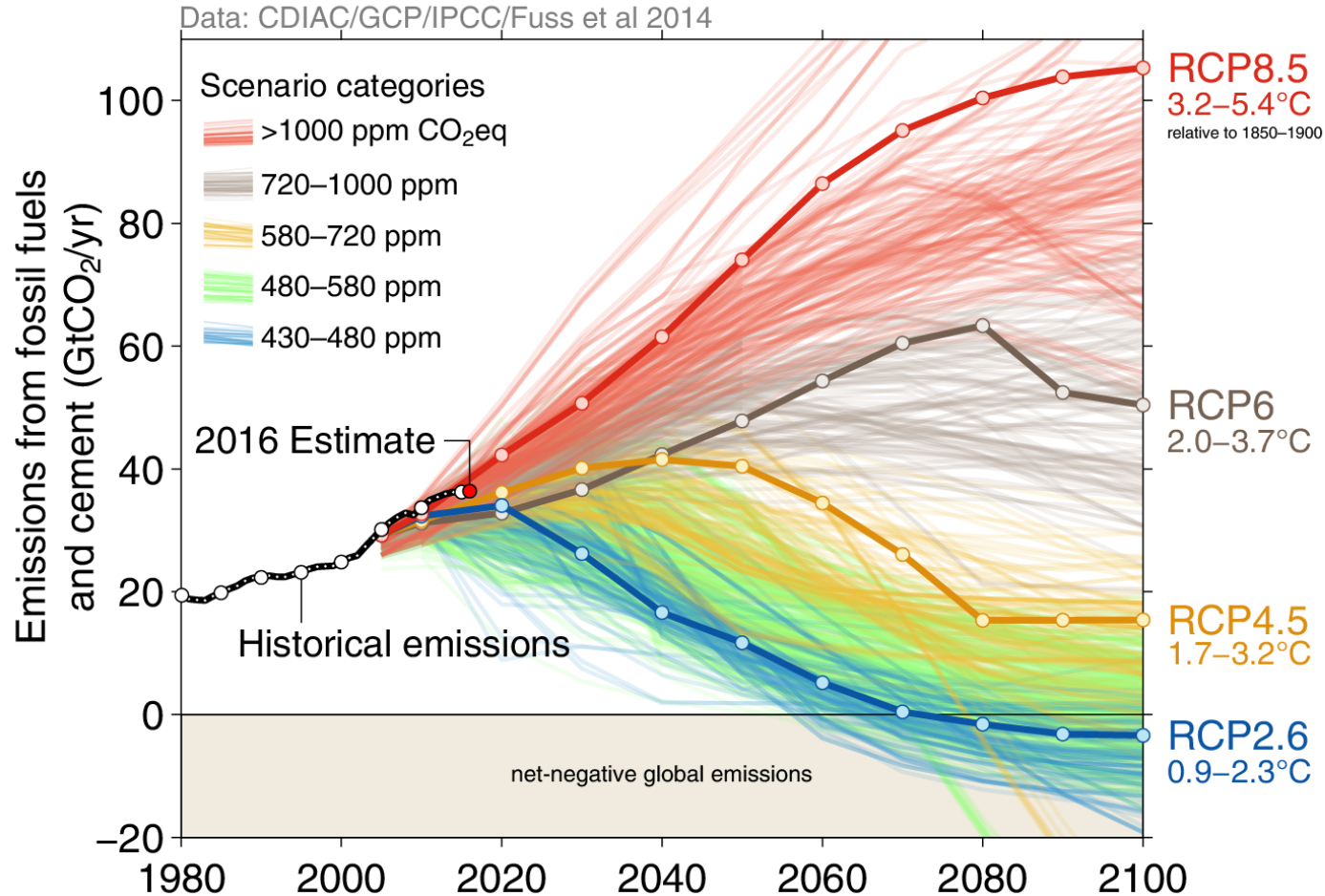
Carl Bernacchi
USDA-ARS
University of Illinois



Agricultural Demand



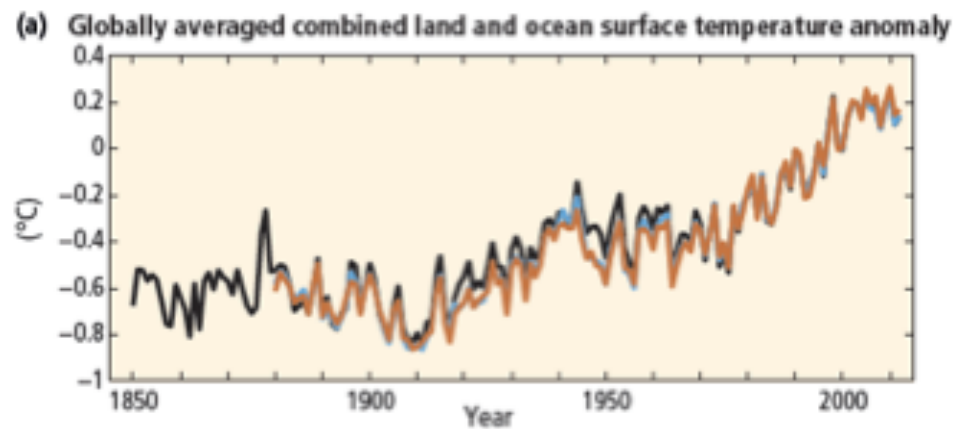
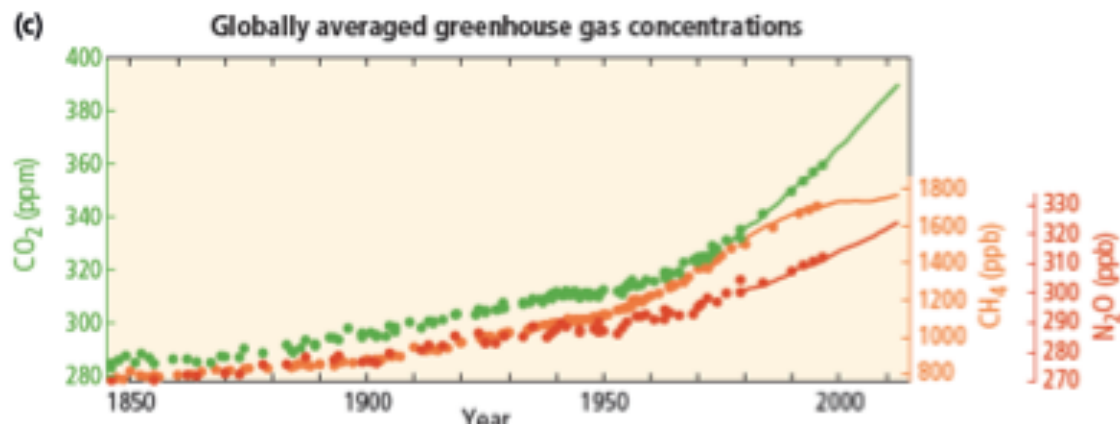
The emission pledges to the Paris Agreement avoid the worst effects of climate change (4-5°C)
 Most studies suggest the pledges give a likely temperature increase of about 3°C in 2100



The IPCC Fifth Assessment Report assessed about 1200 scenarios with detailed climate modelling on four Representative Concentration Pathways (RCPs)

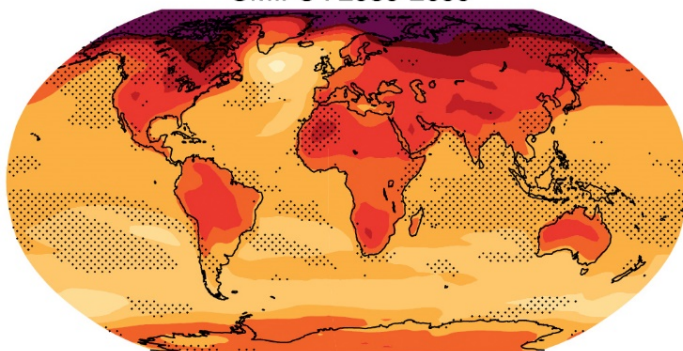
Source: [Fuss et al 2014](#); [CDIAC](#); [IIASA AR5 Scenario Database](#); [Global Carbon Budget 2016](#)

Global Greenhouse Gas Emissions

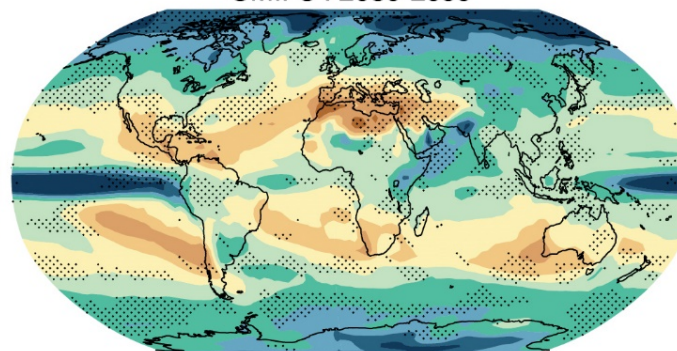


Land Surface vs. Ocean Temperatures

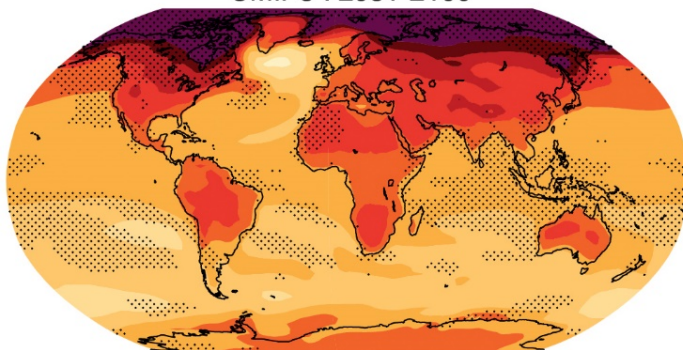
Temperature scaled by global T ($^{\circ}\text{C}$ per $^{\circ}\text{C}$)
CMIP3 : 2080-2099



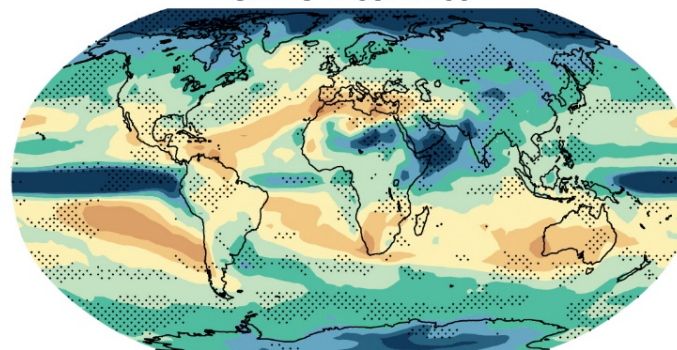
Precipitation scaled by global T (% per $^{\circ}\text{C}$)
CMIP3 : 2080-2099



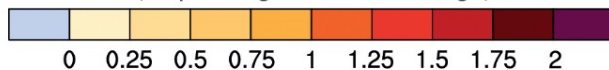
CMIP5 : 2081-2100



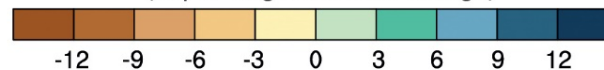
CMIP5 : 2081-2100



($^{\circ}\text{C}$ per $^{\circ}\text{C}$ global mean change)



(% per $^{\circ}\text{C}$ global mean change)



SoyFACE Global Change Research Facility

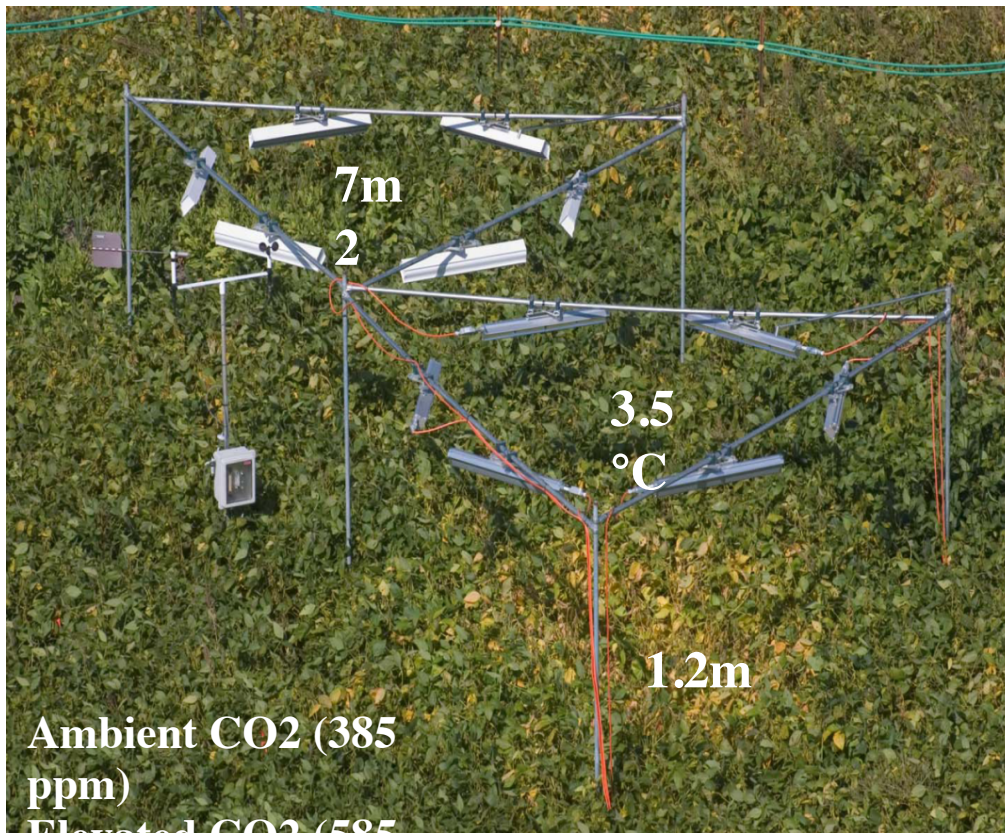
Investigating crop responses to elevated CO₂



T-FACE: Understanding crop responses to temperature

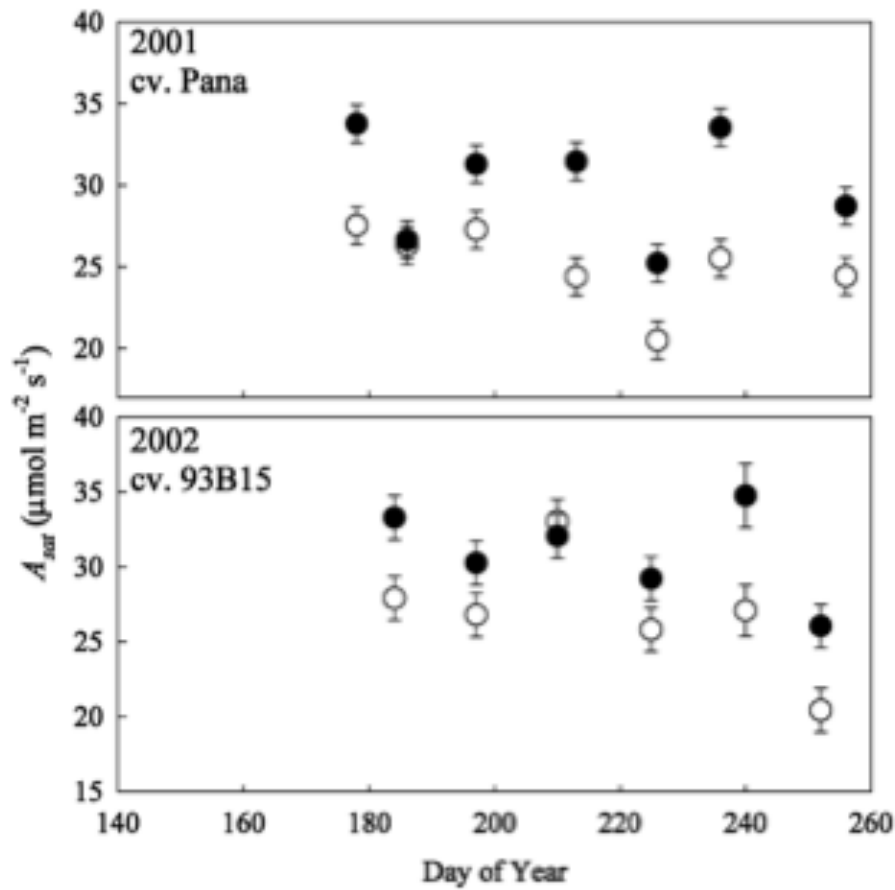


T-FACE Experiment



- Four Treatments:
- Ambient CO₂ and temperature
- Elevated CO₂ (+200 ppm) & ambient temperature (eC)
- Elevated temperature (+3.5 °C) & ambient CO₂ (eT)
- Elevated temperature & CO₂ (eT+eC)

Photosynthetic Responses to CO₂



- Mean increase in A_{sar} of $\sim 20\%$ for both 2001 and 2002
- Similar responses averaged over all years of SoyFACE (2001 to 2015)
 - Interannual variation is apparent, however, with a range of 0% to $\sim 22\%$

Soybean: Optimal photosynthetic increases are not observed

