MODELING EFFECTS OF CLIMATE CHANGE AND VARIABILITY ON SORGHUM YIELD IN ETHIOPIA

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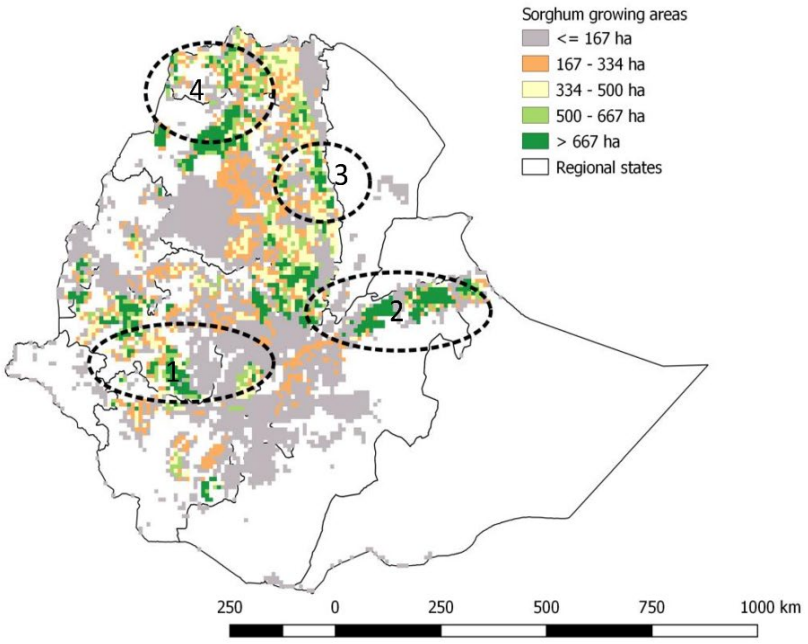
Outline

- Introduction
  - Background information
  - Objectives of the study
- Methodology
- Result and discussions
  - Climate variability
  - Climate change adaptation
- Conclusion

Introduction

- Agriculture constitutes the largest economy
- One of the most important cereals, third after Teff and Maize
- Drought resistance, an important food security crop



Growing areas

Sorghum consumptions

Objective of the study

1. To assess climate change and variability impacts on sorghum production

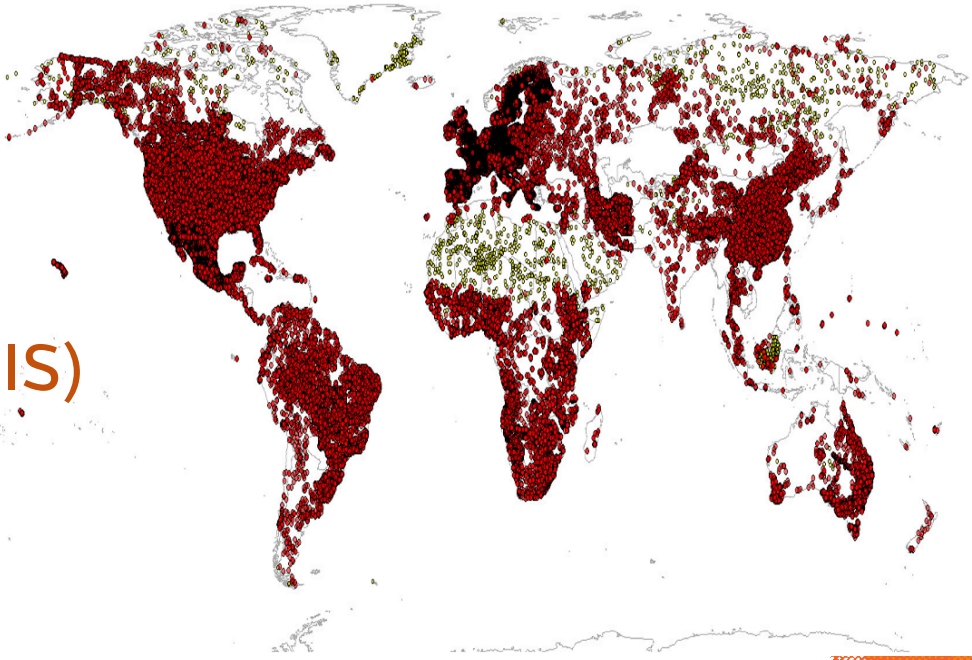
2. To evaluate selected climate change adaptation practices

Methods

- Monica- Model
  - One-dimensional, dynamic, process-based
  - Bio-chemical turn-over of carbon, nitrogen and water in agro-ecosystems
  - Using a daily time step
  - Processes in soil, plant, atmosphere

Methods

- Phenology, yield and management data
- Soil data- African soil information system(AFSIS)
- weather and climate data(ISIMIP [2017])
  - ipsl-cm5a-lr
  - 4 RCPs
  - 3 periods

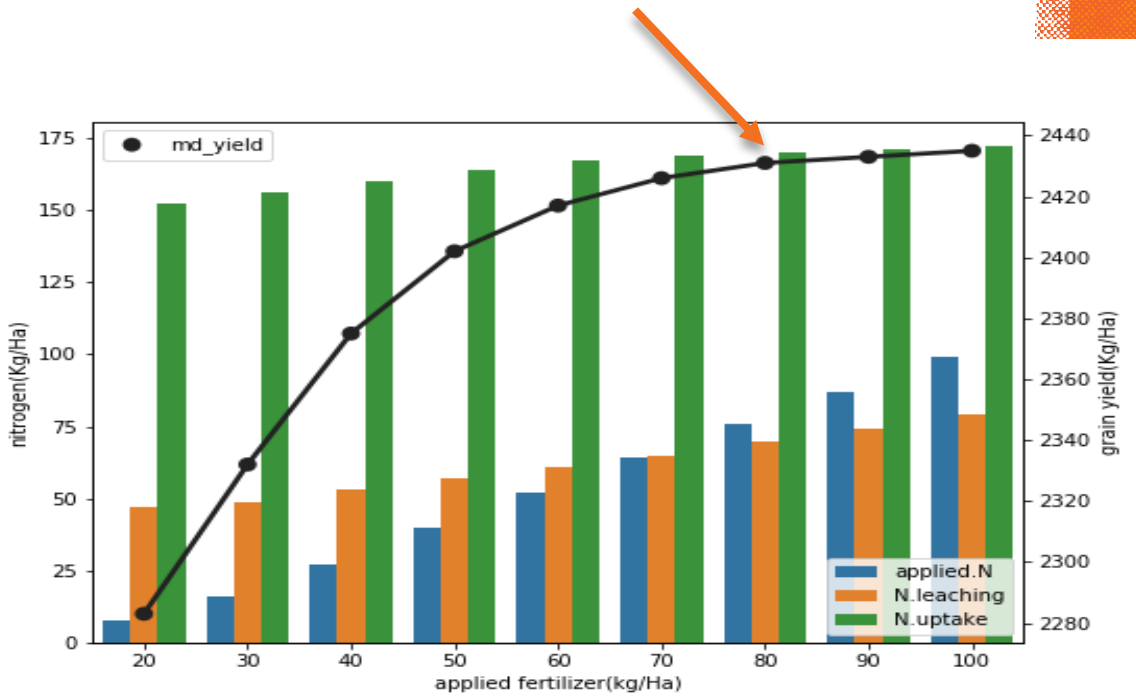


Model calbiration

- Calibrated following Houska et al. [2015]
  - Global optimization algorism , spotpy model calibration procedure
- Using data from field Experiments carried out at MARC during 2010–2011

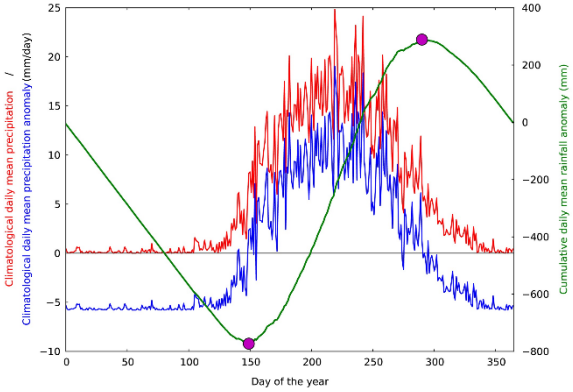
Methods…

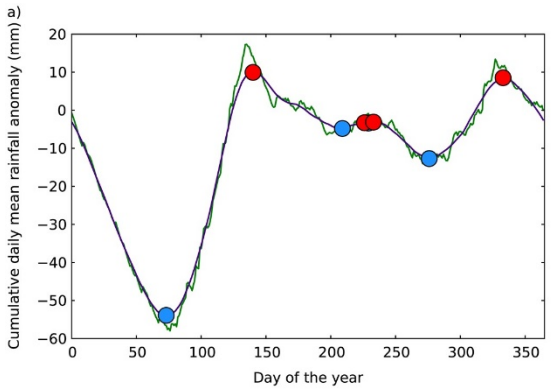
- Adaptation Fertilizer and sowing date
  - N demand fertilizer
  - Based on calculated onset

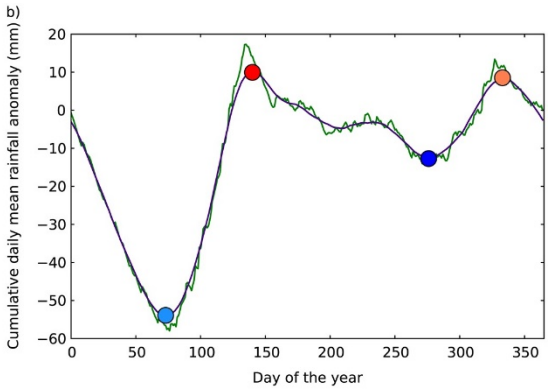


Methods…

- Variability Fractal dimension analysis derived from Hurst index as described by Xu et al. [2017]
- The onset date calculation was done based on Dunning et al. [2016] using R.

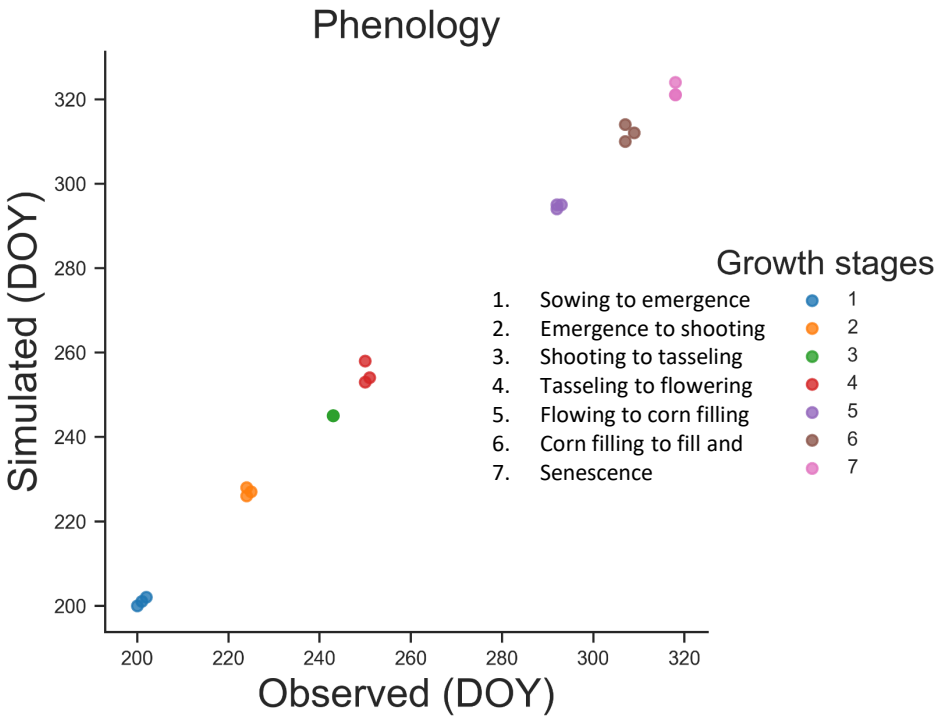


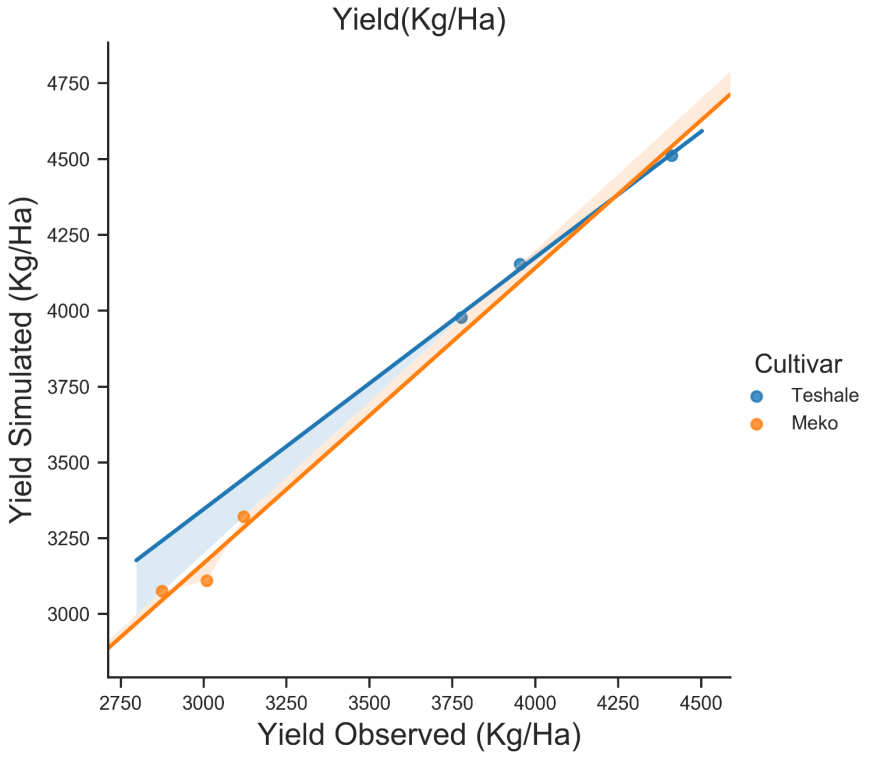




Results

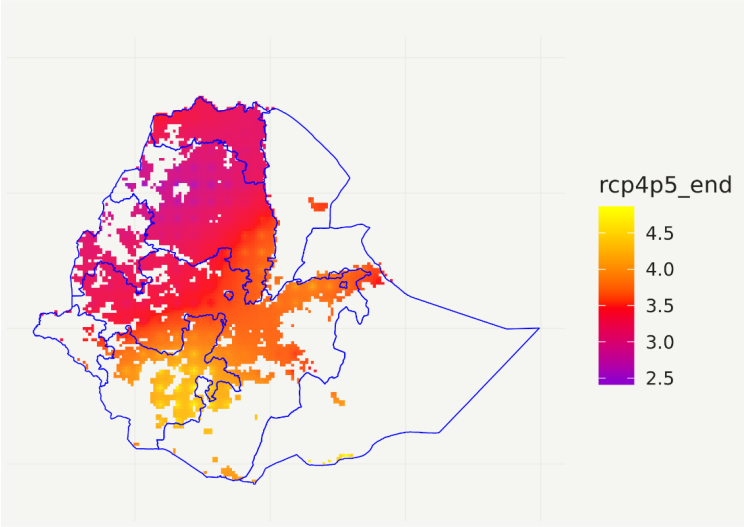
Calibration

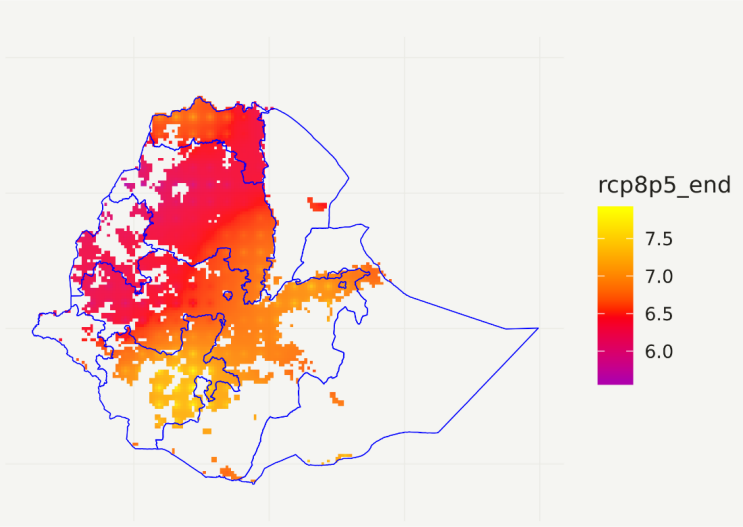




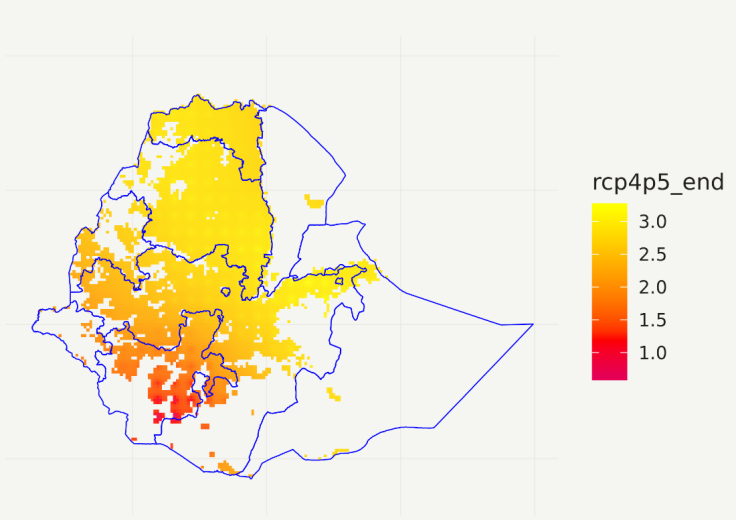
Projected climate change

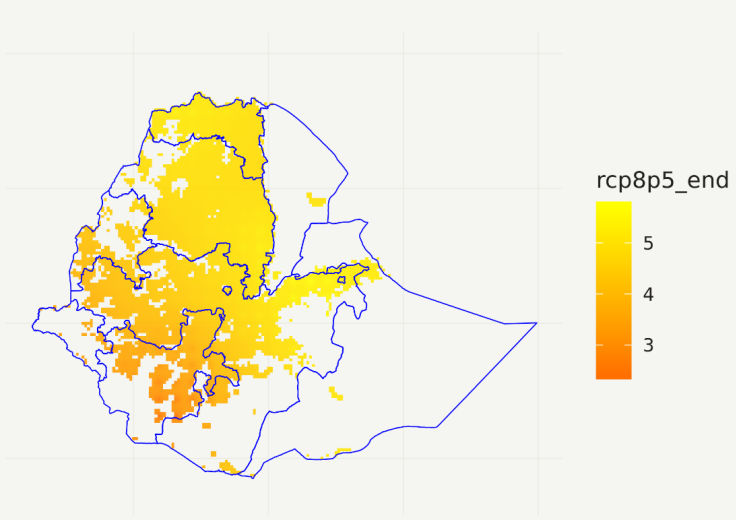
Tmin





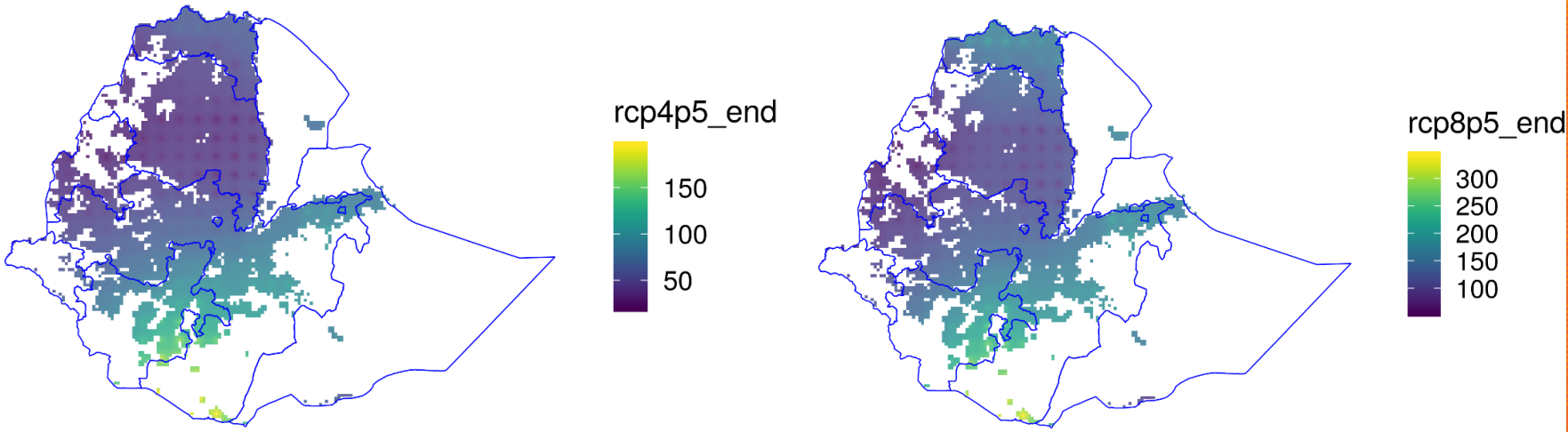
Tmax



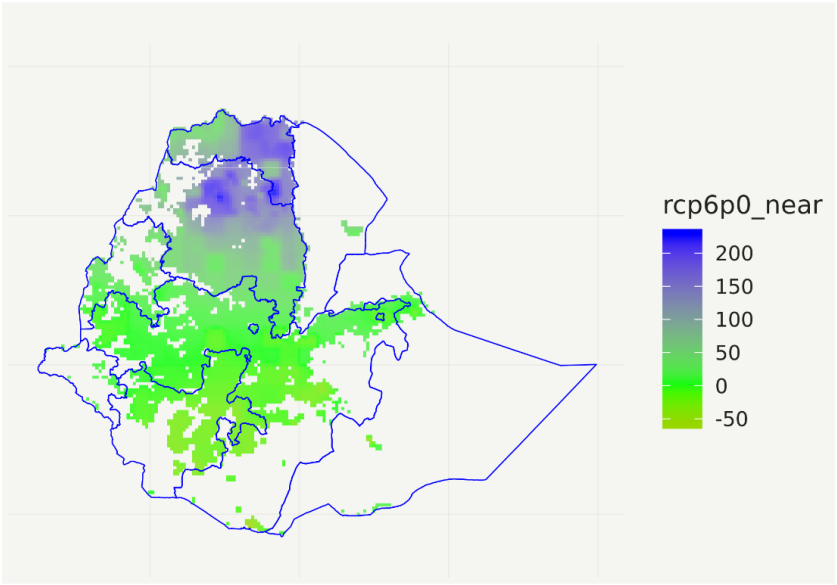


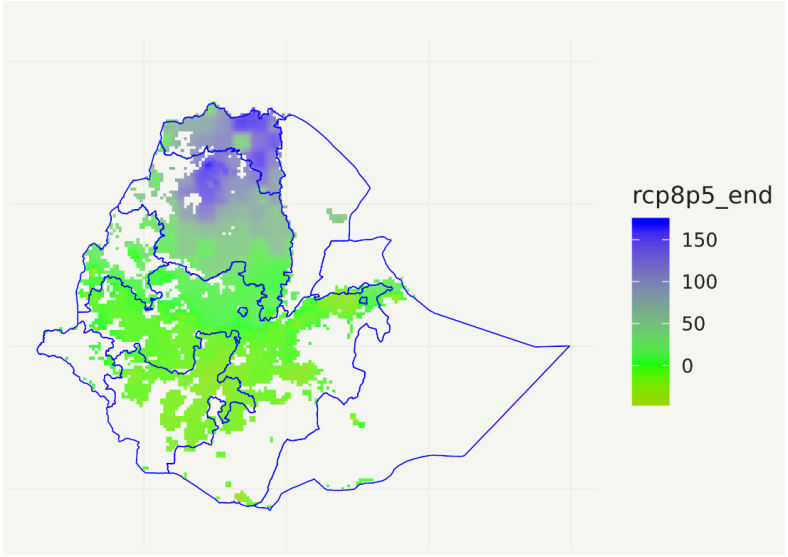
Projected…

Change precipitation(%)



Sowing dates

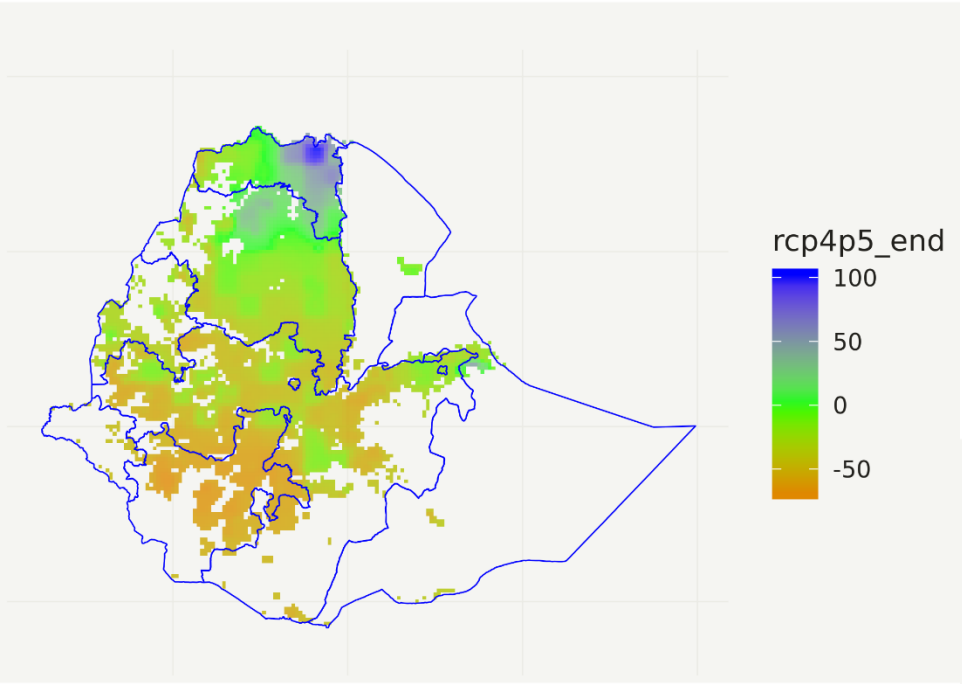


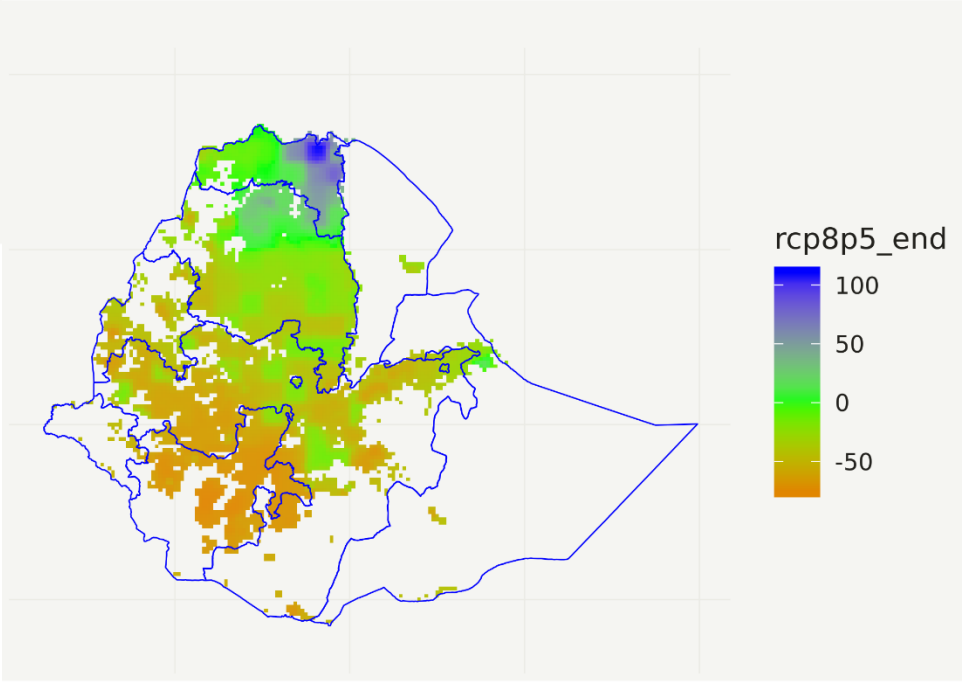


- Early onset ….south and sw
- Normal to late

Impacts of climate change

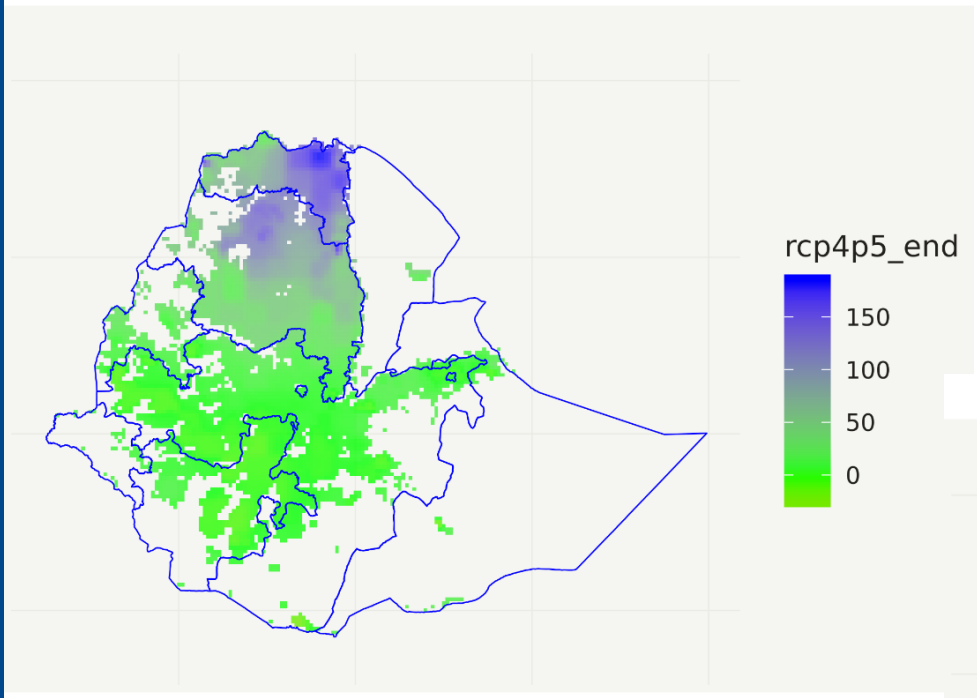
Change in yield(%)

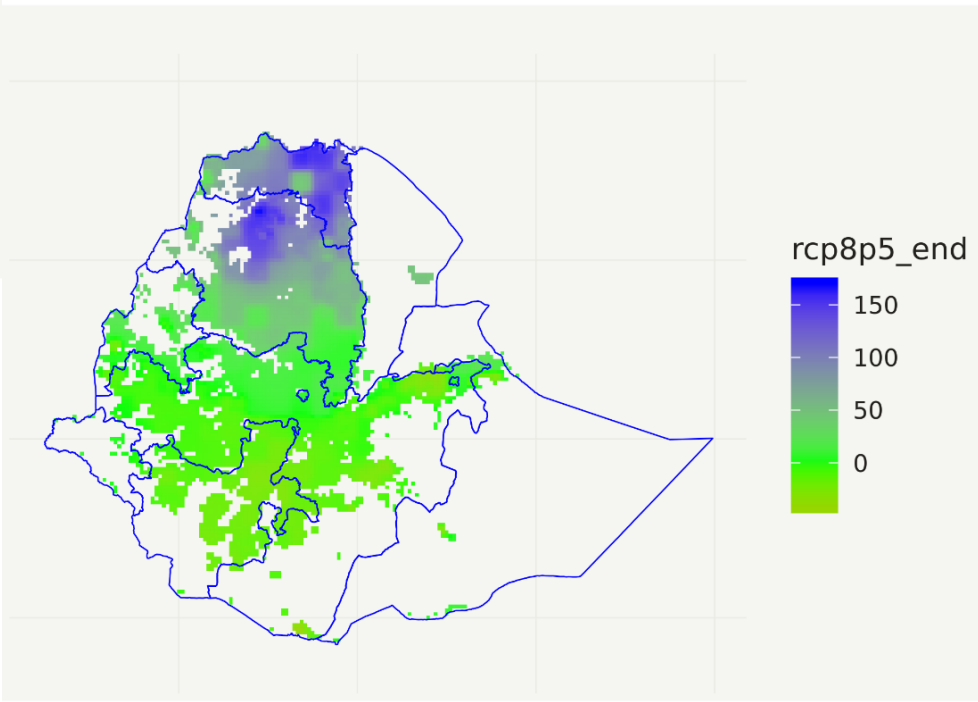




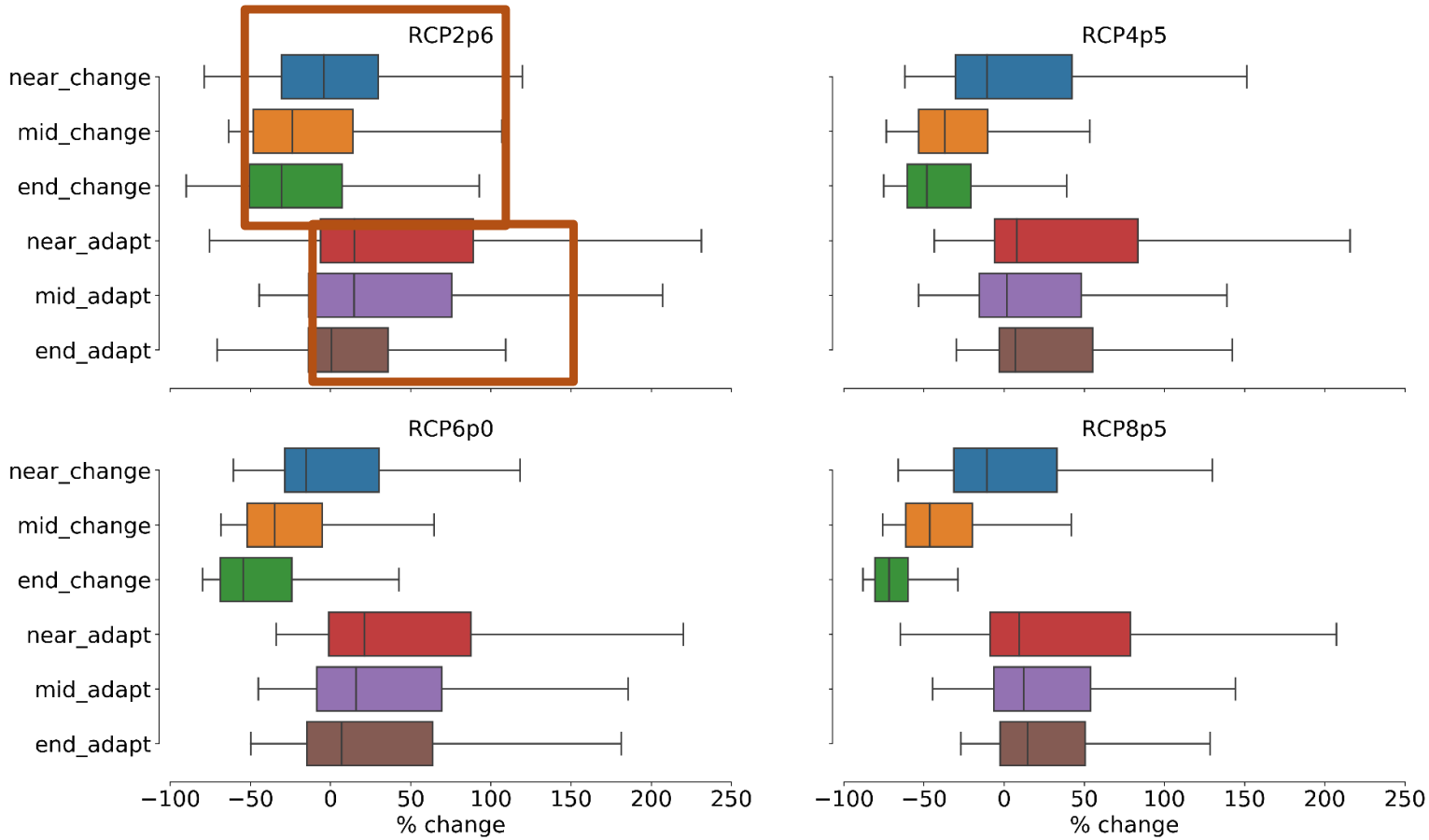
Sorghum yield with Adaptation

Change in yield(%)





Sorghum yield with Adaptation



Conclusion

- Climate change and variability expected to be very high
- Without adaptation strategies up to 50% yield reduction is expected
- Calculated onset date and targeted fertilizer application would increase production up to 150%


Thank you

https://conference.ifas.ufl.edu/waterinstitute/tentative-detailed-agenda.html