Feedback between Water Availability and Crop Growth using a Coupled Hydrological- Crop Production model

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1. INTRODUCTION

- Increases in extremes, such as heatwaves and droughts, threaten crop production and food security.
- Irrigation is used to secure stable yields, increasing the competition with other sectors.
- Biophysical models - understand the dependencies of sectors
- Incorporating feedback allowing us to understand the impacts of hydroclimatic extreme changes.

2. OBJECTIVE

To quantify the mutual feedback between crop production and hydrology under climate extremes (i.e., droughts and heatwaves) in various regions globally.

3. METHODOLOGY

- Start day
- End day
- Evaporation, Transpiration, Vegetative characteristics (leaf area index, rooting depth, crop height)
- Modules
  - Forcing, Land Surface, Groundwater, Surface water routing, Irrigation and water use
  - PCR-GLOBWB
  - Soil Moisture
  - WOFOST

4. RESULTS

- Figure 2. Stand-alone (WOFOST) irrigated yields of maize crop for the 2000 year
- Figure 3. Relative percentage change error of stand-alone and one-way coupling irrigated maize yields for the 2000 year
- Figure 4. Temporal analysis of irrigated yields of maize crop compared with reported yields
- Figure 5. Spatial analysis of irrigated yields of maize crop compared with reported yields

5. NEXT STEPS

- Two-way coupling
- Downscale to 5 arc minutes
- Droughts and Heatwaves

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Spatial & Temporal: 30 arc minutes & 2000-2015
Crops: Maize, Soybean, Wheat, and Rice
Analysis: Irrigation and Rainfed analysis
Model runs: Stand-alone, One-way, and Two-way coupled PCR-GLOBWB2 and WOFOST models
Validation: Reported statistics, Soil Moisture (SM), Discharge and Irrigation withdrawals

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