Irrigation shortfalls, food production and trade in India

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Introduction

- This talk continues the discussion of irrigation. However,

  - it focuses on the larger-scale impacts of irrigation shortfalls
  - the driver of irrigation water scarcity is economy growth

- Demonstrate "workflow"

  - synthesize data from diverse sources
  - pass data sequentially through modules

- Connect GEOSHARE and GTAP

Integrated economic-hydrological-agronomic analysis of irrigation water scarcity

- Geospatial details are potentially important
  - Irrigation availability differs by river basin
  - Water intensity of agriculture varies by crop and region

- The boundary issue
  - Source data are provided with different resolutions
  - They are often in conflict (e.g., irrigated crops where no cropland cover)
  - Economic activities and physical regimes are subject to different boundaries (basins, AEZs, and regions) – data exchange between modules.

Application: Impacts of future irrigation shortfalls

- Research Question
  - What are the likely impacts of future irrigation shortfalls on production, trade and consumption? (experimental design: future irrigation water shortage applied to today's economy)

- Data Fusion
  - Separate irrigated and rainfed sectors
  - Draw basins and AEZs within regions
  - Aggregate grid data to the desired scale

- Modeling Framework
  - Combine a water balance model (IMPACT-W) with an economic model (GTAP-BIO-W)

# Workflow
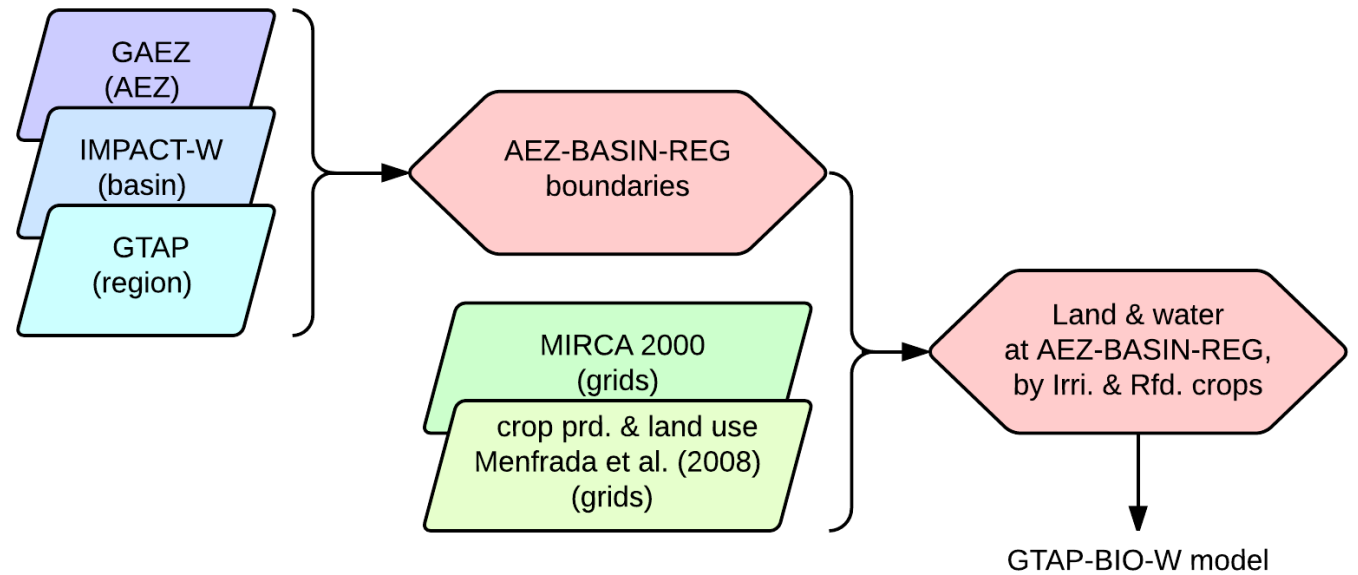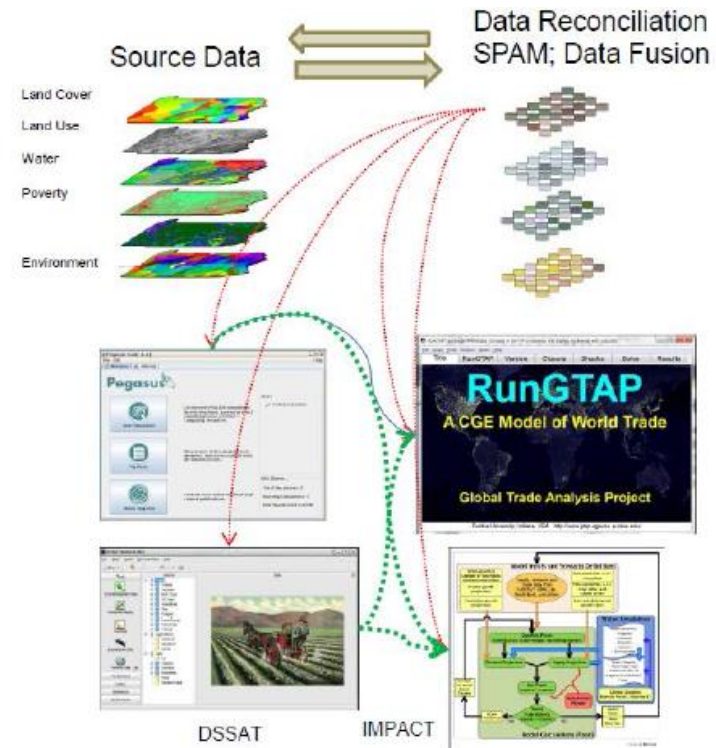
Draw basins and AEZs within India
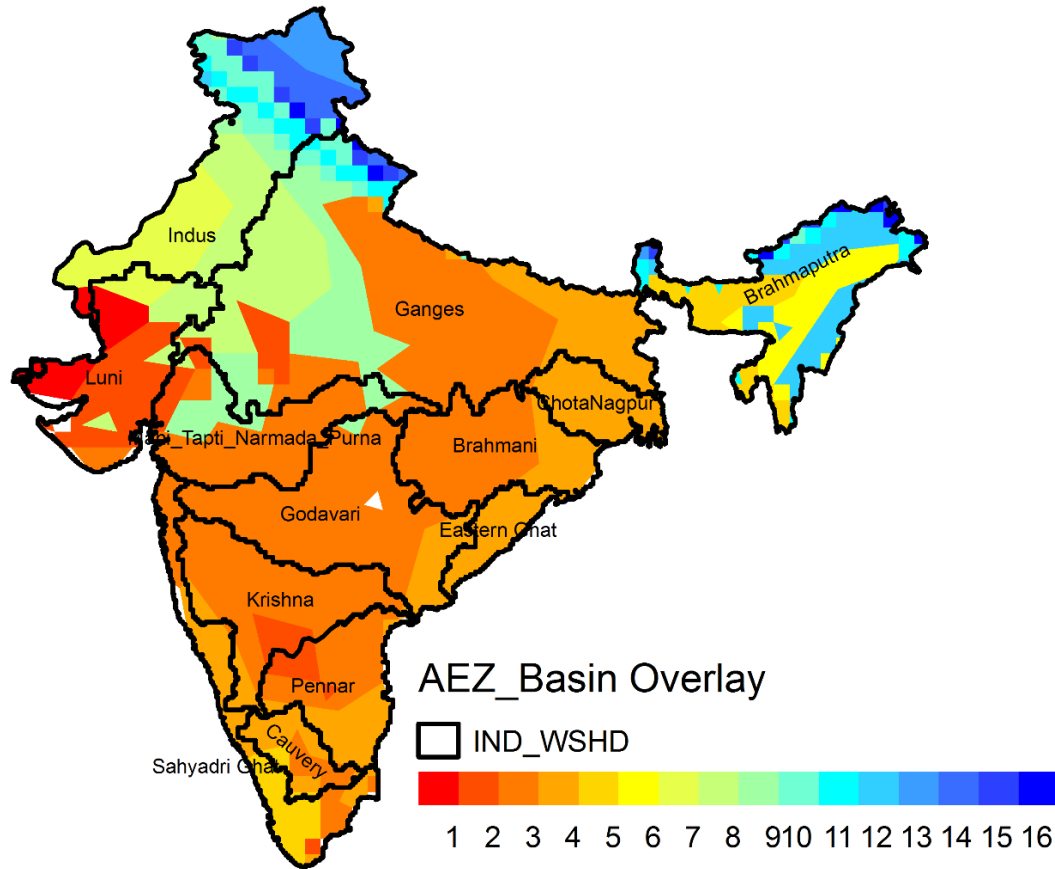
- 16 AEZs, 13 river basins

- The extent of irrigation scarcity differs across basins

- Several layers of competition:

  - Within a basin, AEZs compete for water

  - Within an AEZ, irrigated and rainfed activities compete for land

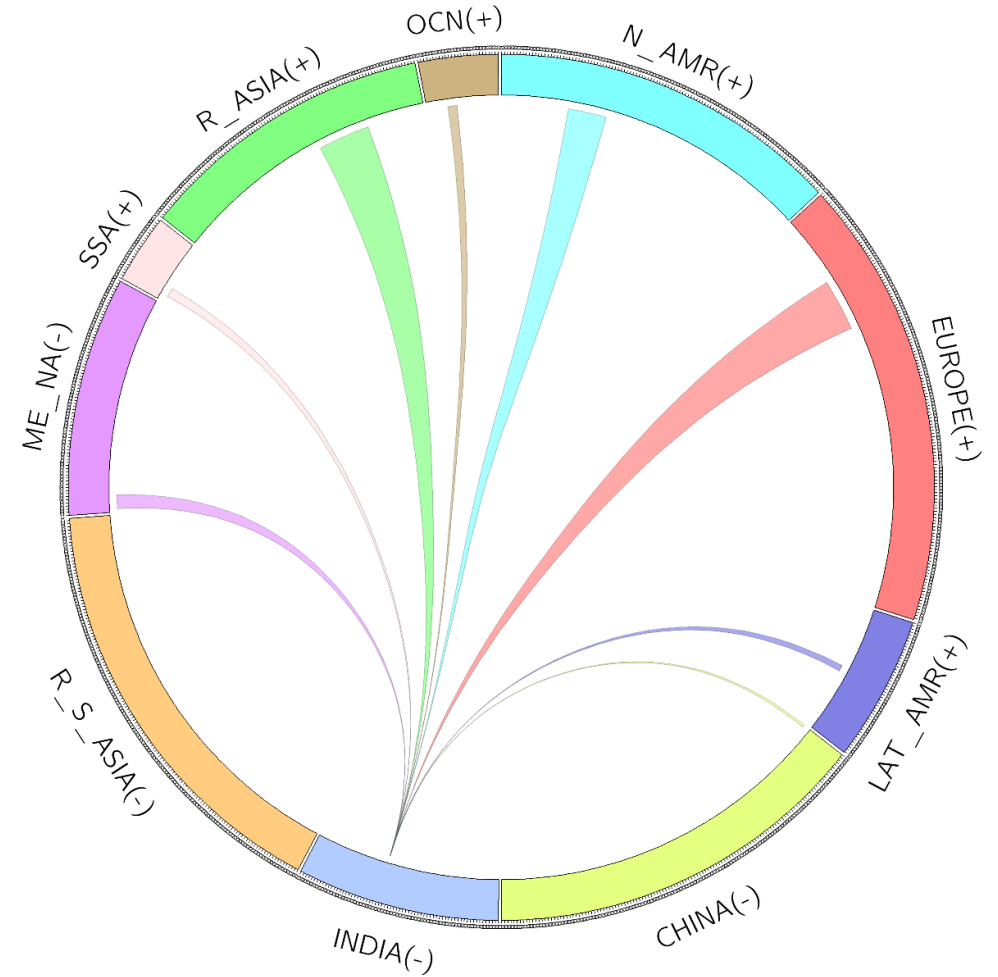 - Within irrigated area, crops compete

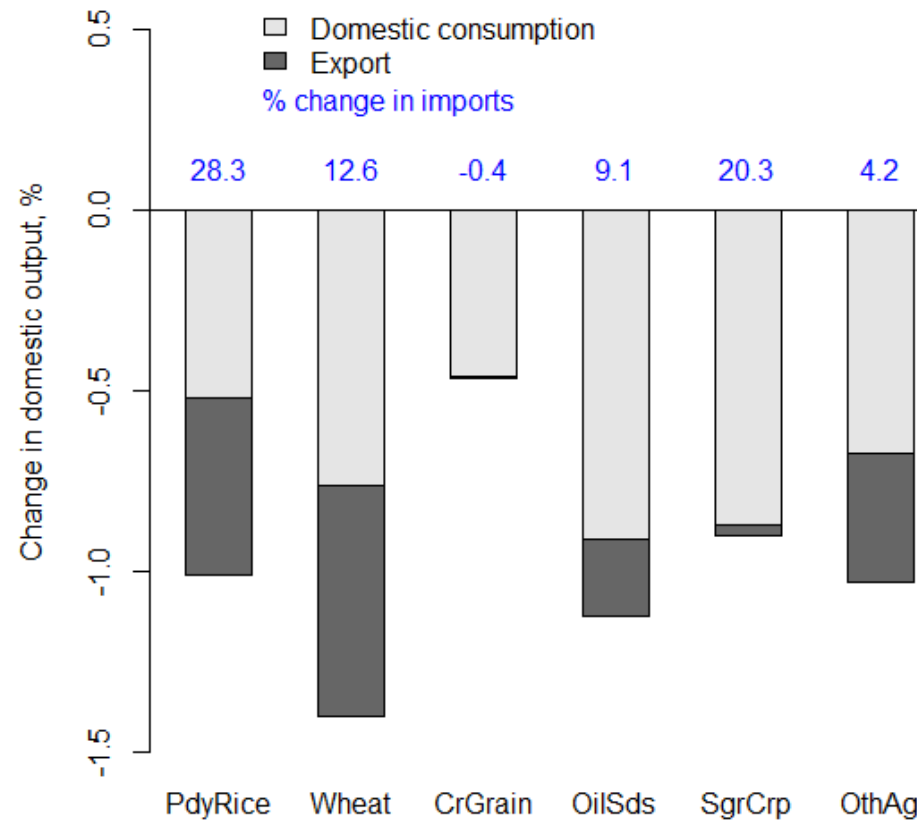# Increasing irrigation scarcity alters the geography of food trade

Irri. reliability index = actual consumption / potential irri. demand
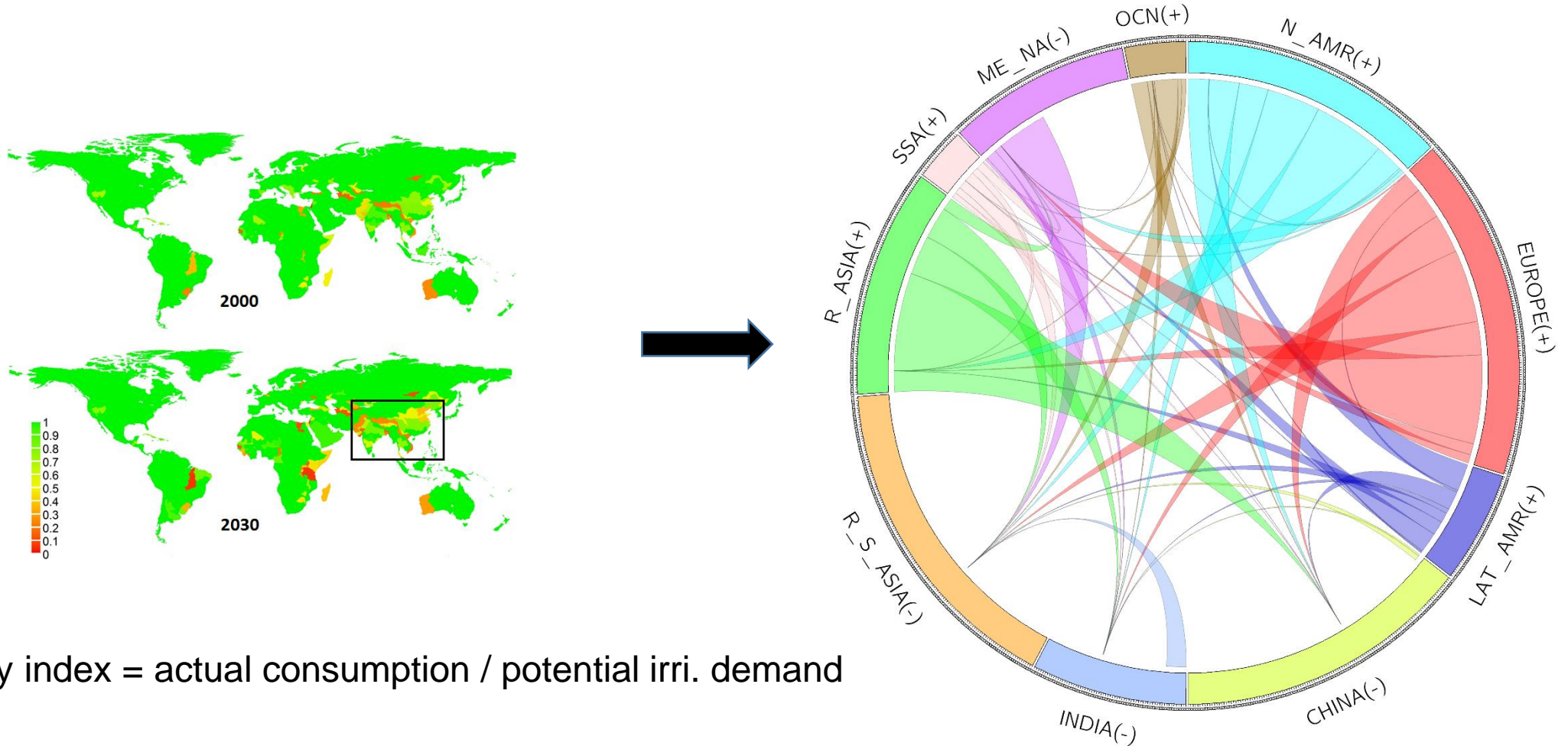
Zoom in to India
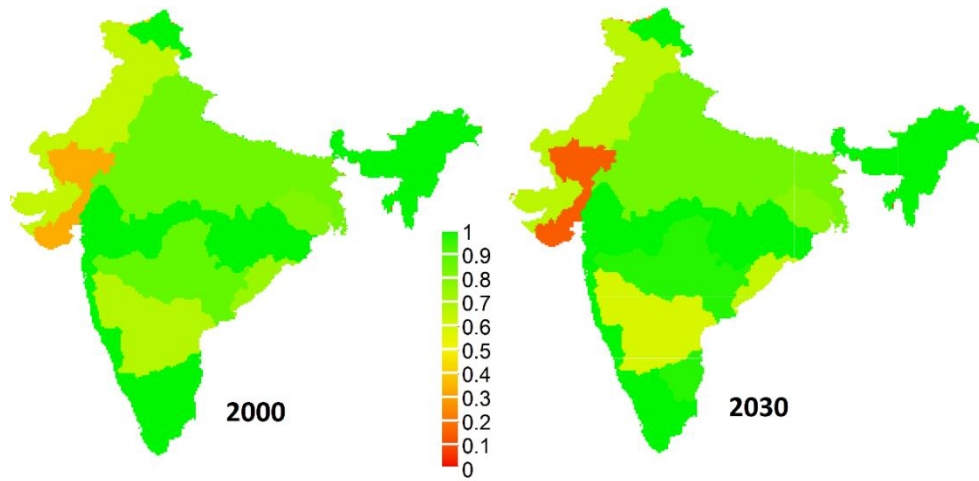
Red color means potential irrigation demand is less satisfied by actual irrigation consumption

As output falls, consumers substitute domestic crops with low cost imports

Lessons for GEOSHARE

- GEOSHARE can be linked to the GTAP user community through a workflow

- Valuable where subnational, geospatial detail is needed

- Current state of the art is ad hoc and requires user to reconcile Ramankutty and Siebert data bases on their own

- By making land cover, land use and irrigation data sets consistent, we can improve the ease and quality of analysis of the impacts of future water scarcity on economic growth, production, consumption and trade