Impacts of climate change on food security and nutrition: focus on adaptation

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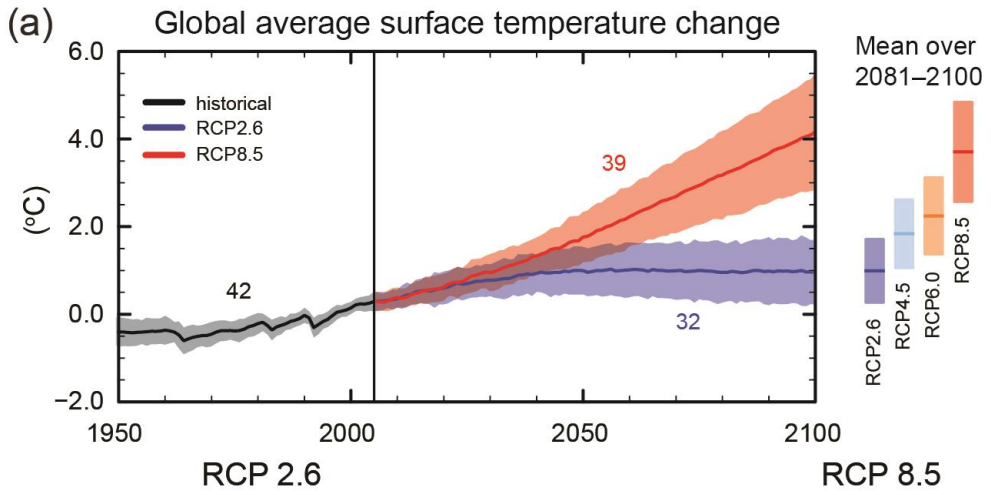
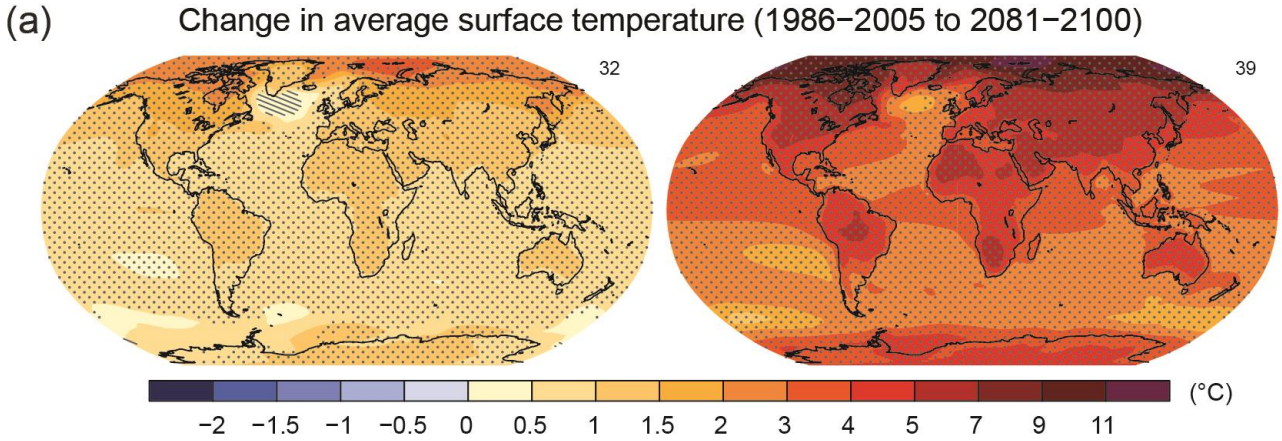
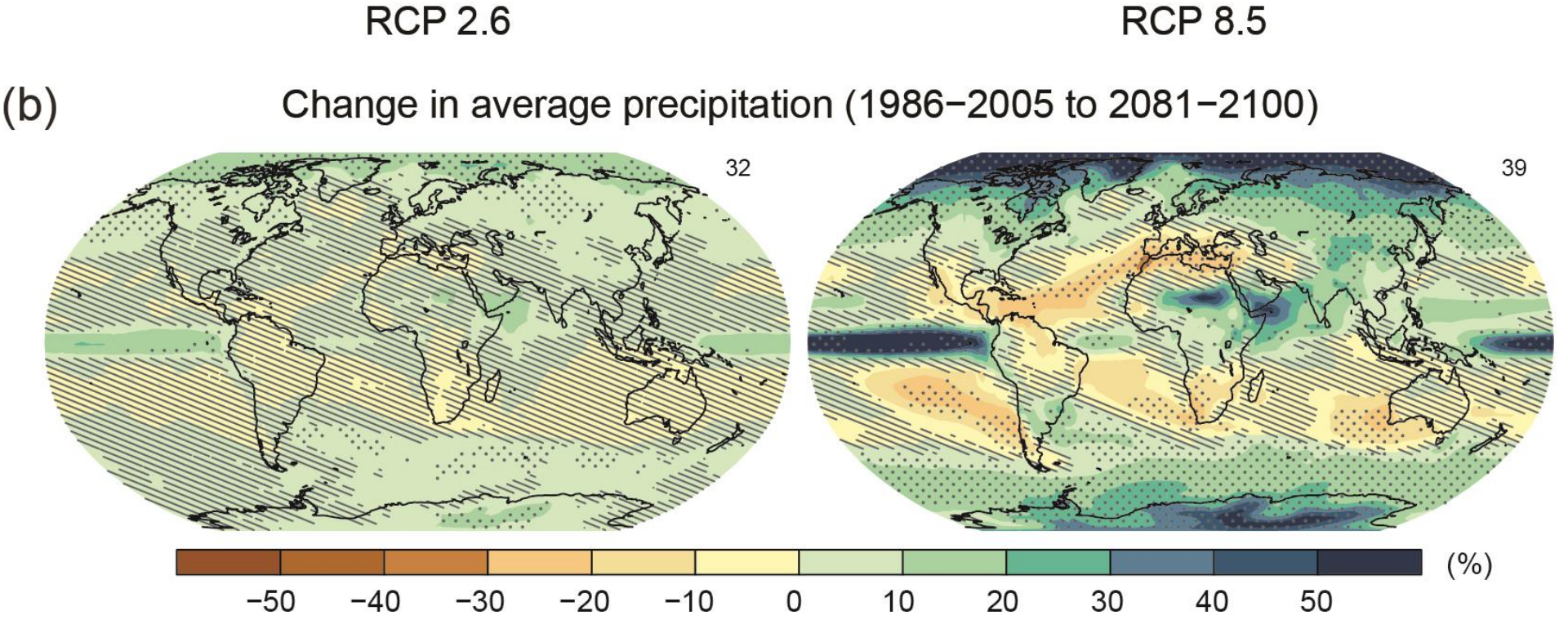
Projected change in surface temperature





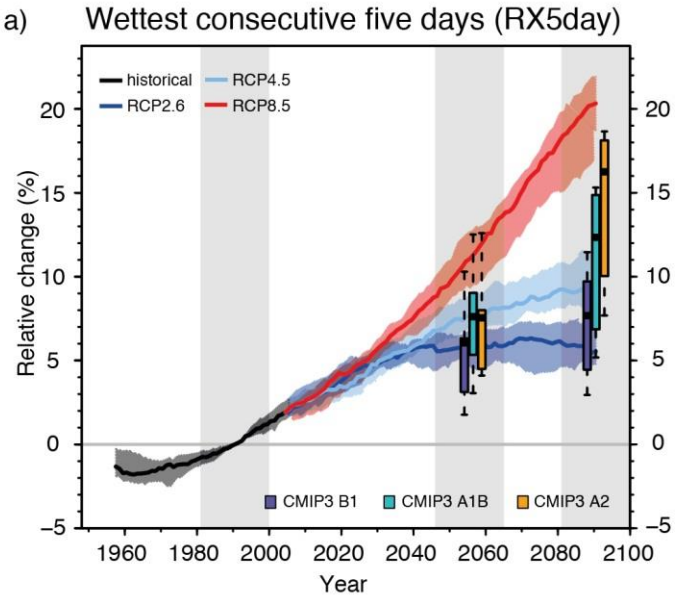
SPM.7 and 8 from IPCC AR5 WGI SPM

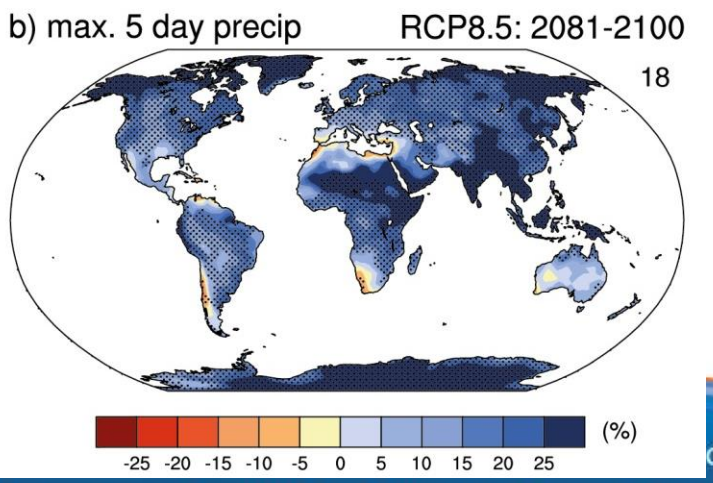
Projected change in precipitation

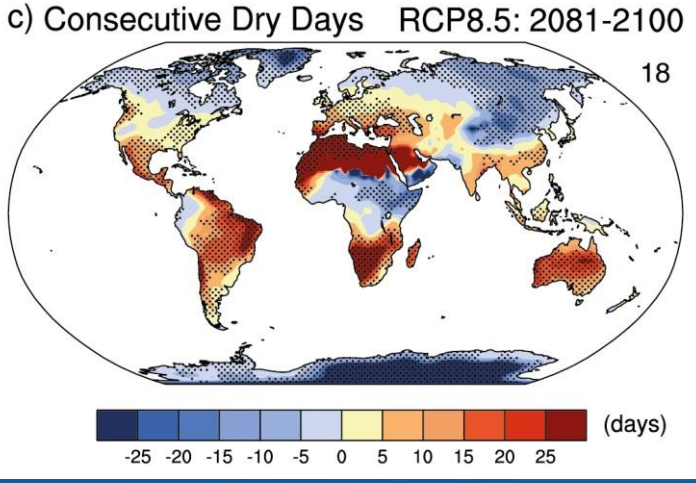


SPM.8 from IPCC AR5 WGI SPM

Projected change: extreme events







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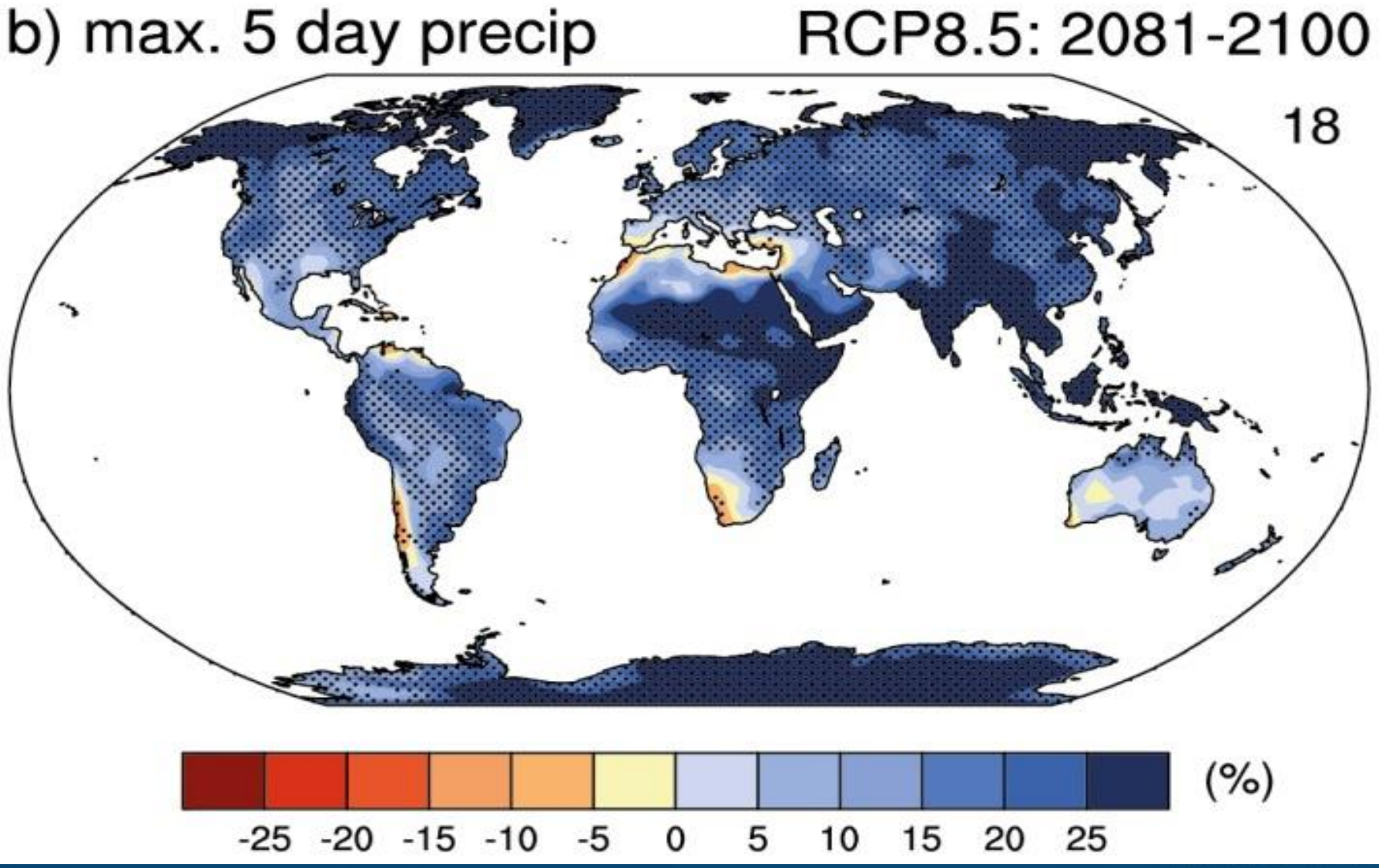

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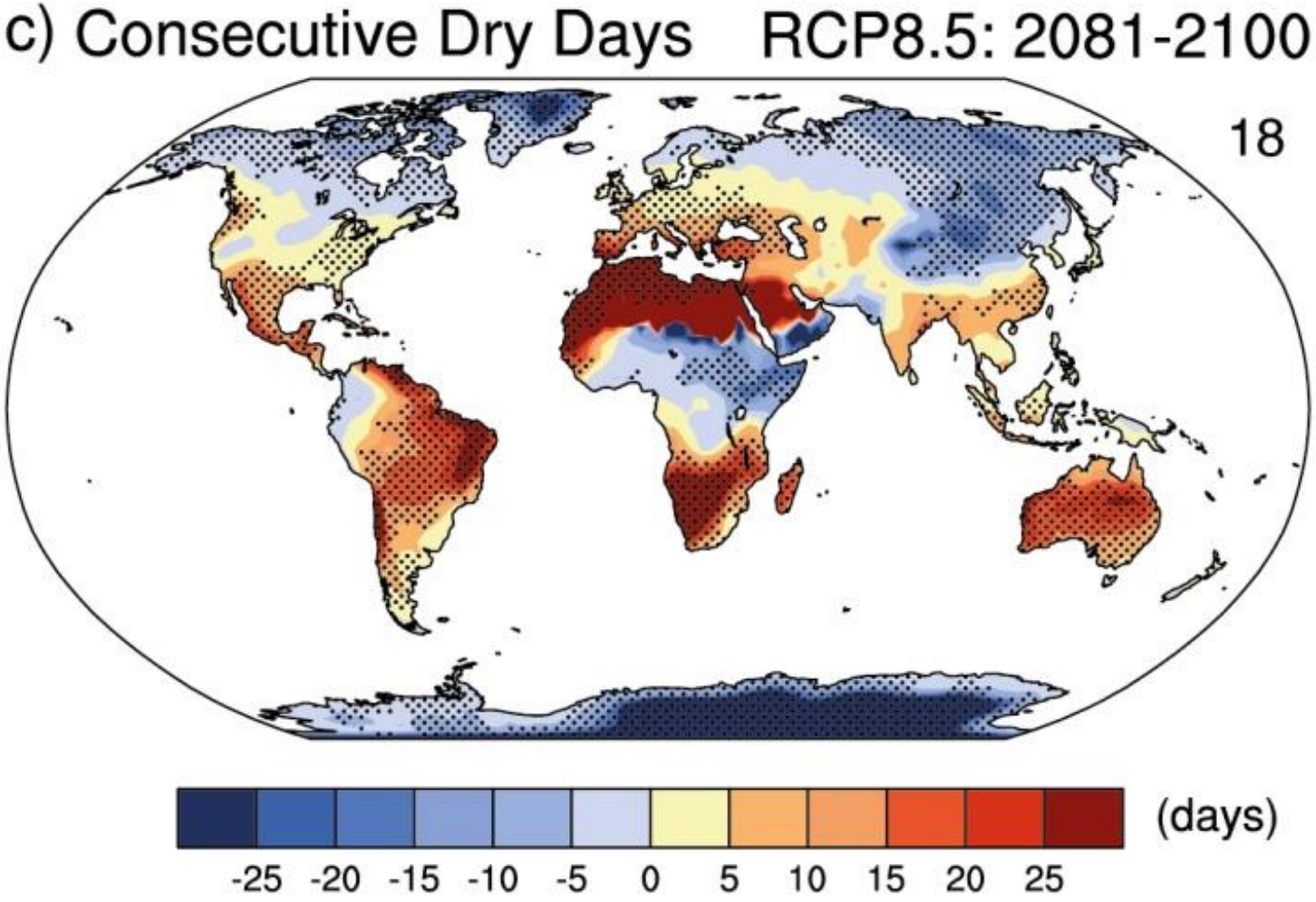
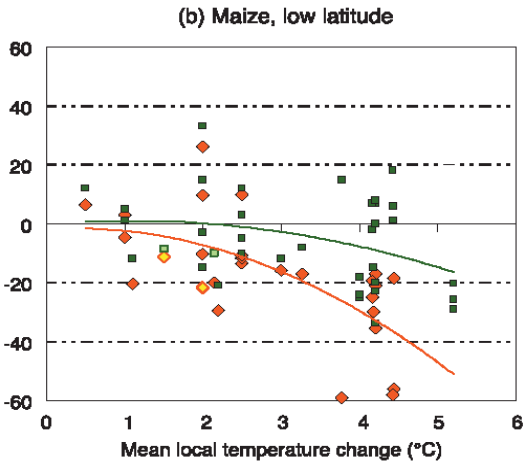


Impacts of changes in mean climate on crop agriculture

- Majority of climate change impact studies look at crop development shifts and yield variations. Under changes in mean climate conditions, *globally* speaking:
  - Increasing temperatures shorten growing period of crops (tropics, sub-tropics)
  - Cold limitation will be alleviated
  - More evapotranspiration due to warm temperature
  - ↑Irrigation water demand
  - Fire risks, pests and diseases
  - Impacts of changes in extreme events could be larger than those of mean changes in climate?

ΔYield Maize



Low-latitudes
ΔYield ~ f(ΔT rainfall, CO_2)
Without, With adaptation

Key impacts on livestock

Major factors are:

- Quantity and quality of feeds
- Heat stress
- Water
- Livestock diseases and disease vectors

Key impacts on fisheries and aquaculture

Major factors are:

- Increased water temperatures
- Sea-level rise
- Decreased pH
- Changes in current sea productivity patterns
- Flooding, droughts
- Increases in frequency and intensity of storms and other extreme weather events

Key impacts on forestry

Major factors are:

- Daytime, nighttime and seasonal temperatures
- Storm patterns
- Duration and intensity of heat waves
- Droughts and floods
- Incidence of pests and diseases
- Frost, snow and ice cover

Key impacts on food security and nutrition

- All-dimensions of food security will be affected, but the majority of assessments are on **food production / availability**
- Nutrition can be affected through changes in **food intake, diseases**.
- ↑Global food production for ↑T of moderate size, ↓production for further warming
- Subsistence sectors at low latitudes threatened (**notably Africa, parts of Asia**)
- **Complex, local negative impacts** are possible on small holders

IPCC, 2007

Assessments of impacts and vulnerability

- In order to adapt to climate change, everyone needs to understand what happened in the **past**, what is happening **now**, and what will happen in the **future**.
- We need a solid evidence-base about **projected impacts** of climate change and associated **vulnerability** to inform climate change adaptation planning

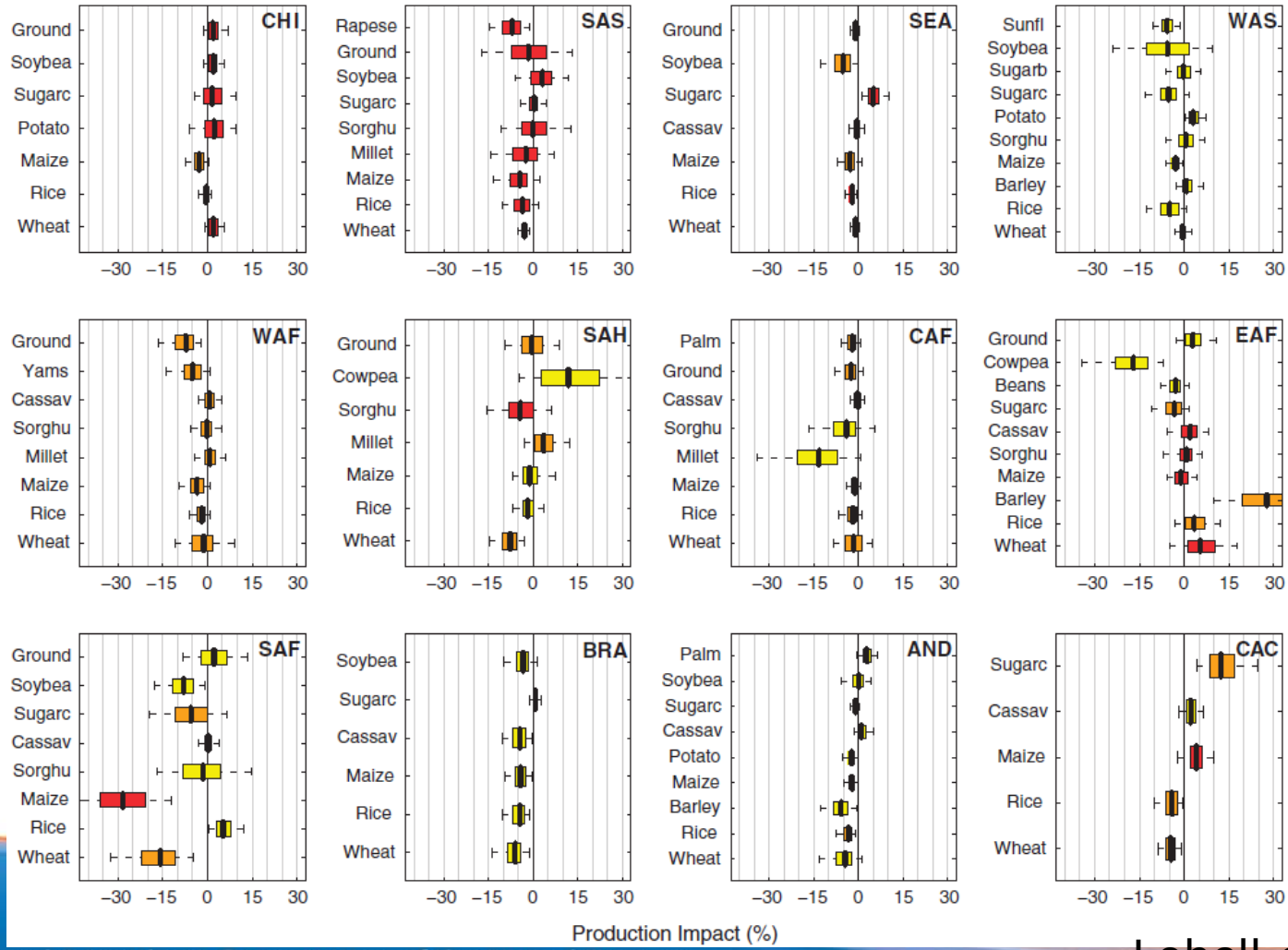
What: types of impact assessments

- **Sectors**
  - Water
  - Crop
  - Pasture
  - Livestock
  - Fisheries
  - Ecosystem
  - Forest
  - Economy
  - Coast
  - Industry
  - Health, etc.
- **Spatial scale**
  - Global
  - Regional
  - National
  - Sub-national
  - Local
- **Temporal scale**
  - Intraseasonal
  - Seasonal
  - 10 years
  - 30 years
  - 50 years
  - 100 years
  - Centuries and beyond

Forecast

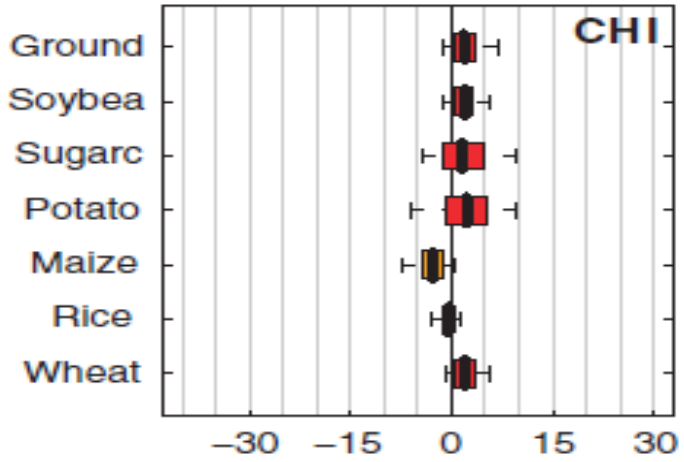
Projection

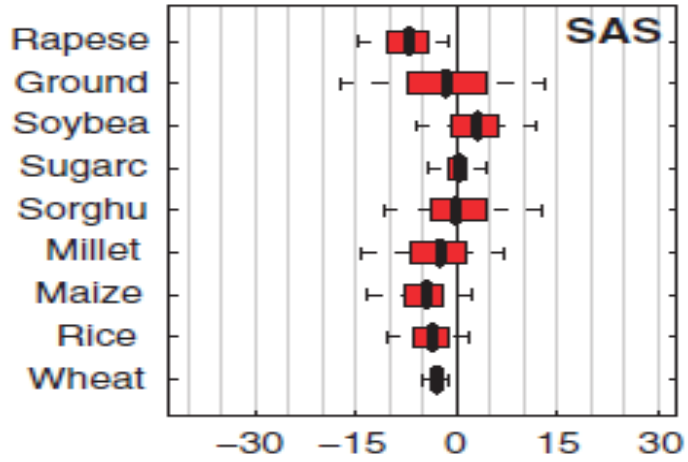
A global assessment example: Production impacts (%) in 2030

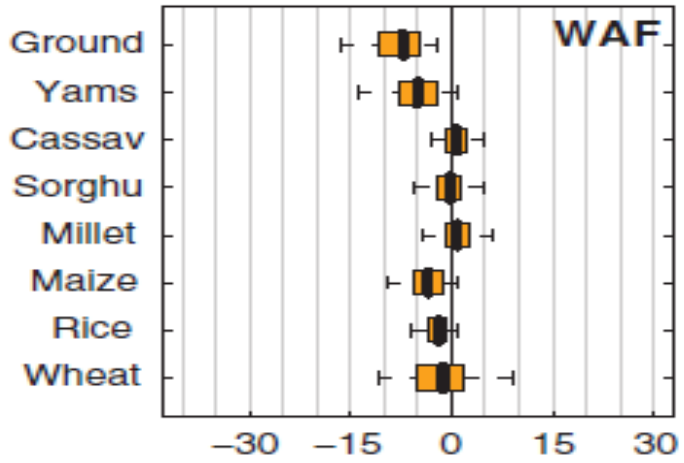


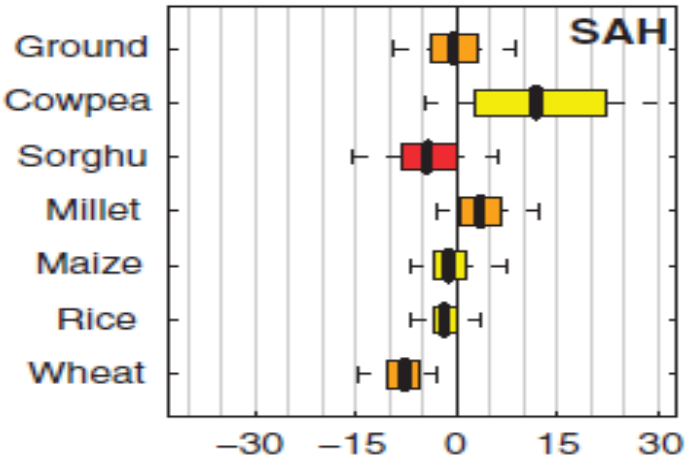
Lobell et al., 2008

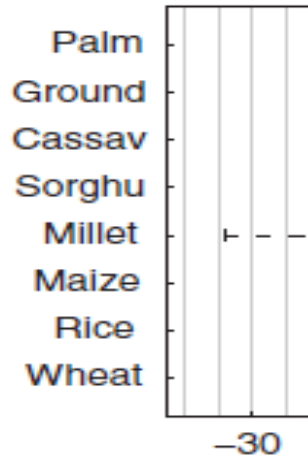
A global assessment example: Production impacts (%) in 2030





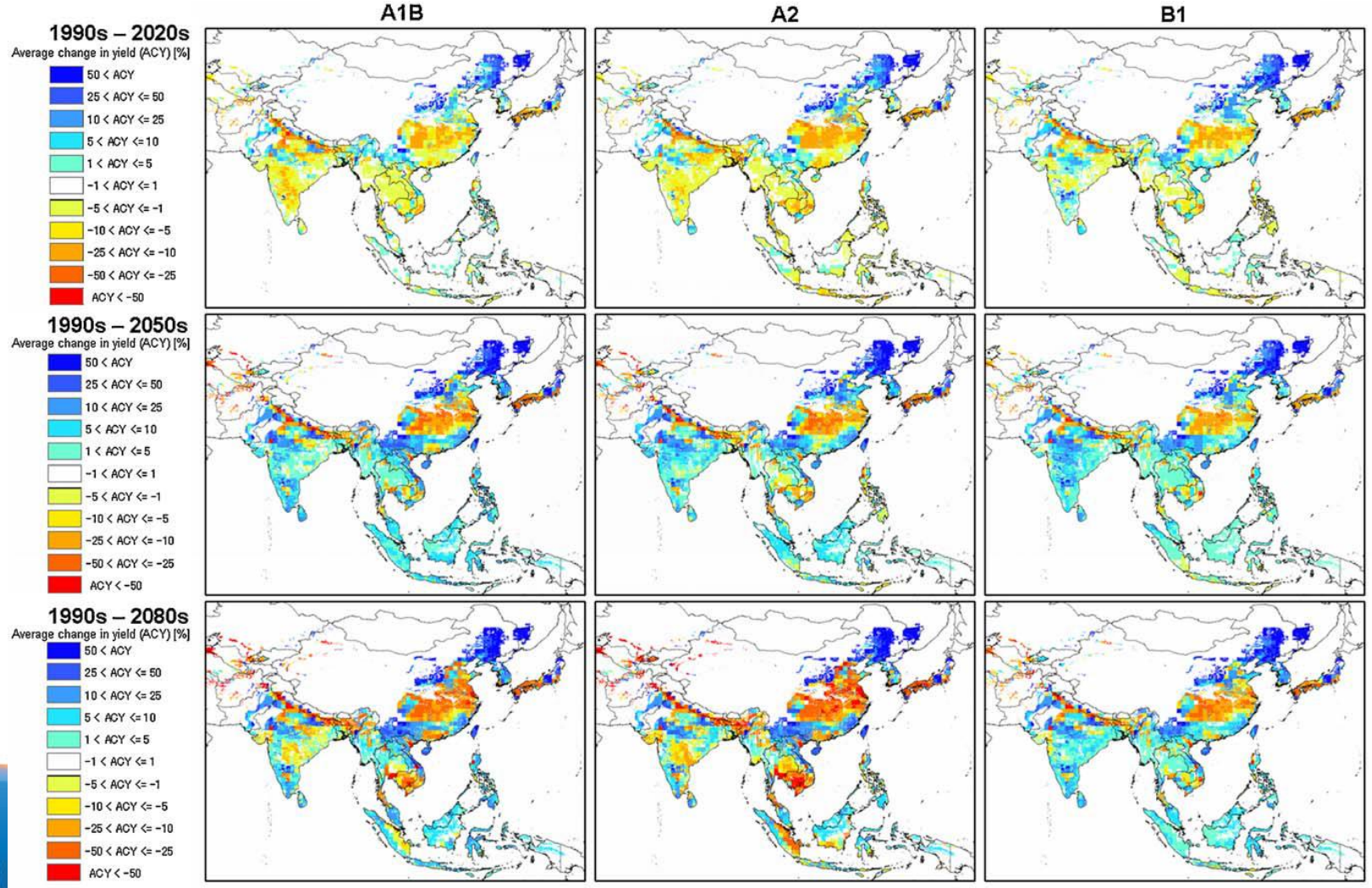






Lobell et al., 2008

A regional assessment example: Average change in rice yield in Asia



Masutomi et al., 2009

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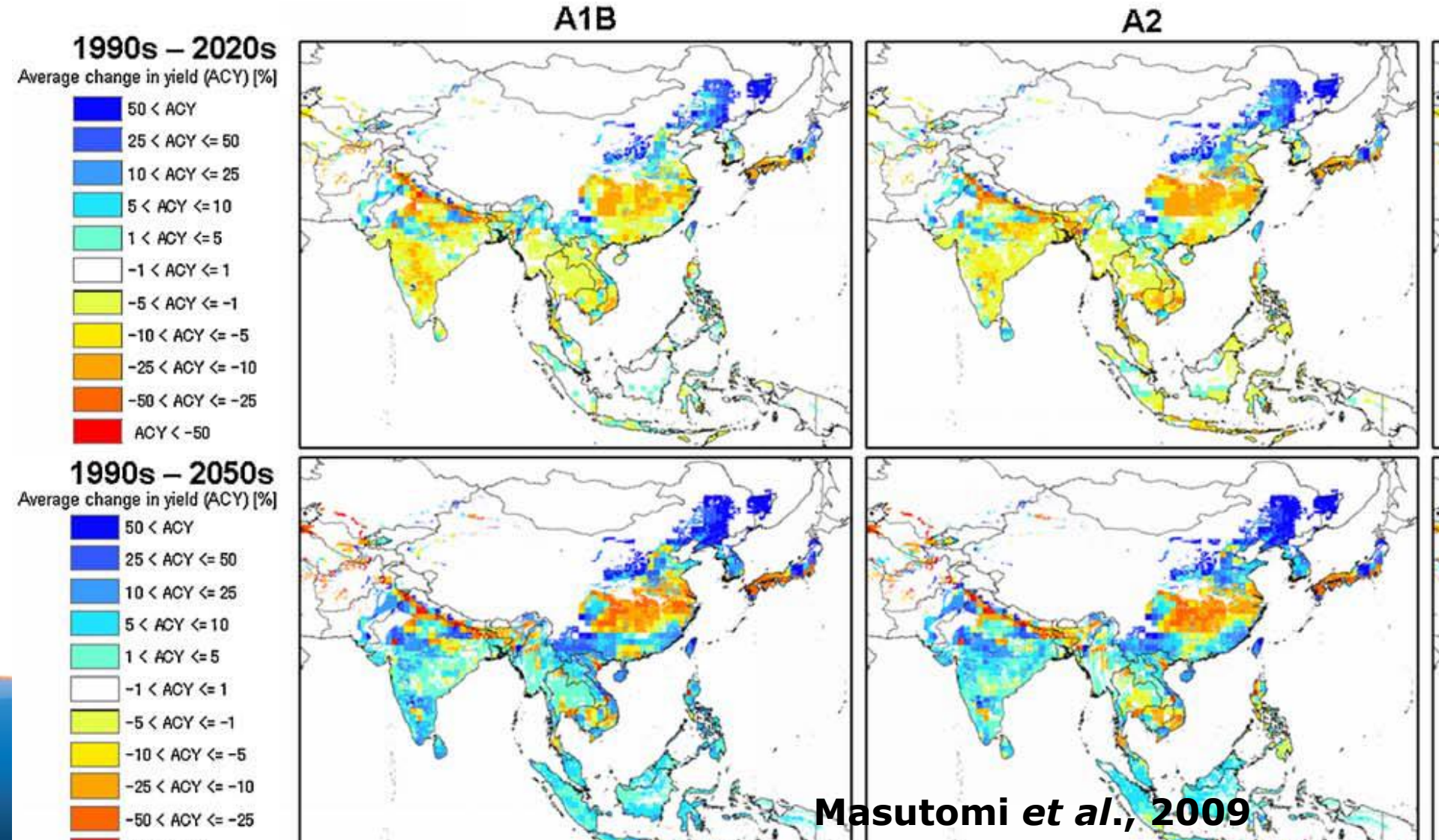
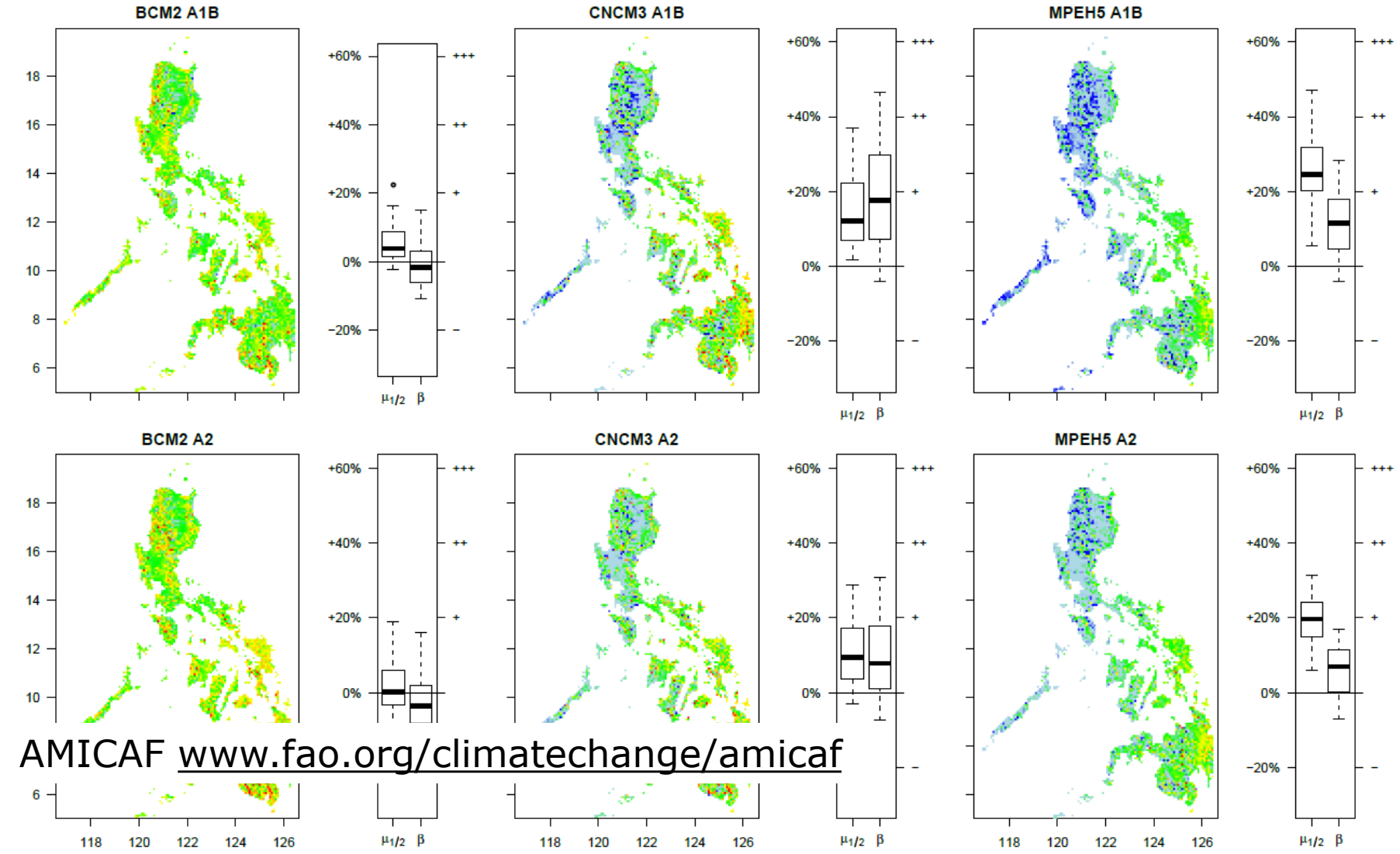


Masutomi *et al.*, 2009

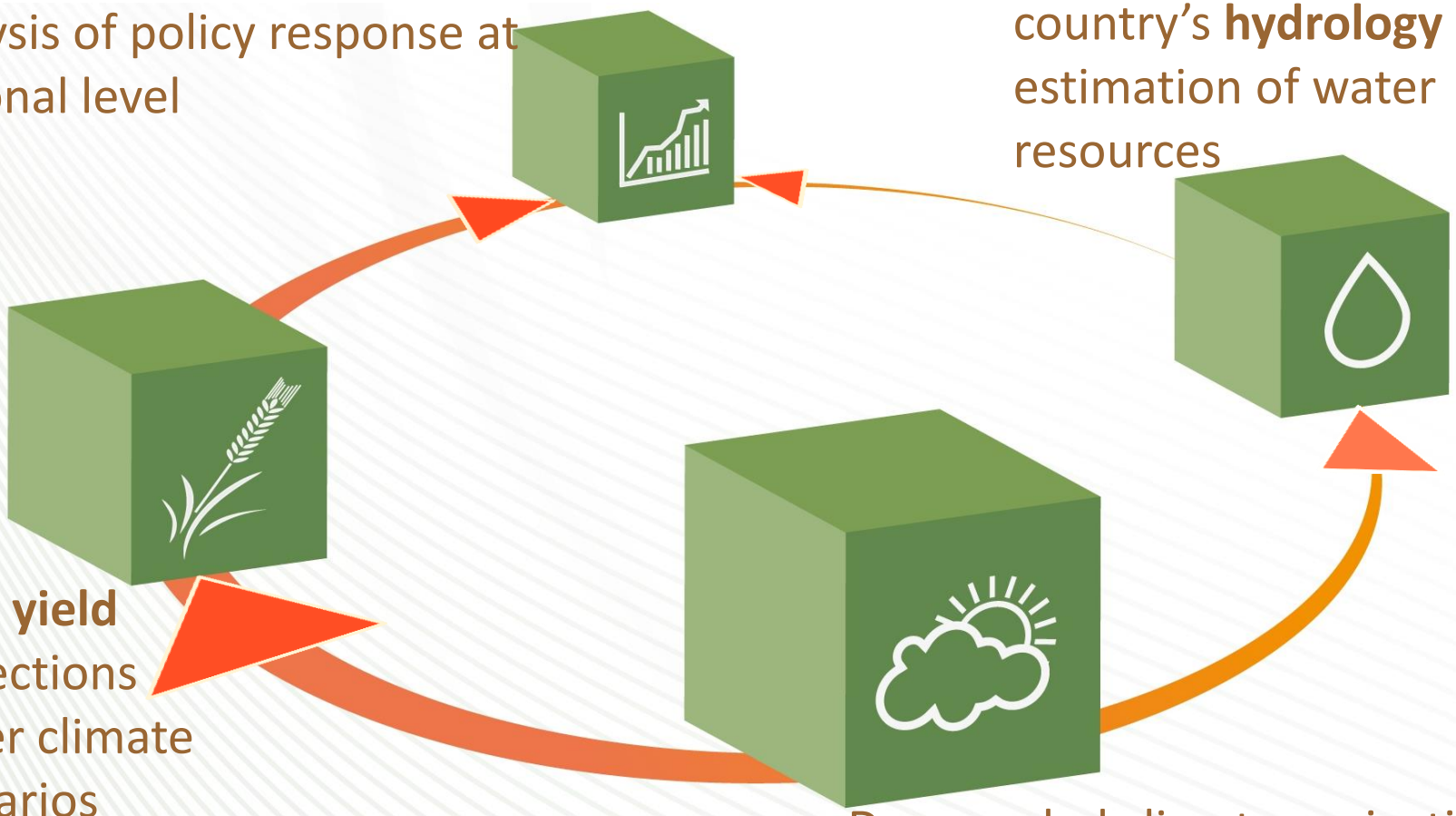
A country assessment example:
Surface water availability and river discharge change in the Philippines, 2011-2040 vs 1971-2000



AMICAF www.fao.org/climatechange/amicaf

Economic impact and analysis of policy response at national level

Simulation of the country's **hydrology** and estimation of water resources



Crop yield projections under climate scenarios

Downscaled climate projections under various **climate scenarios**

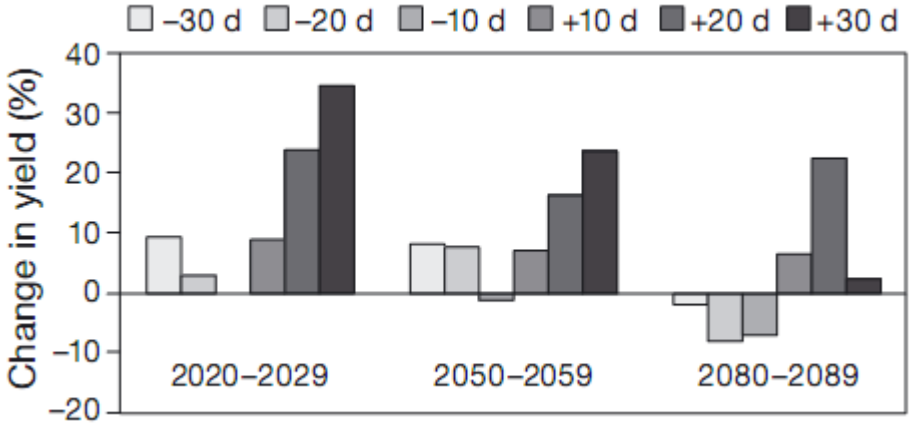
MOSAICC
Modelling System for Agricultural Impacts of Climate Change

www.fao.org/climatechange/mosaicc

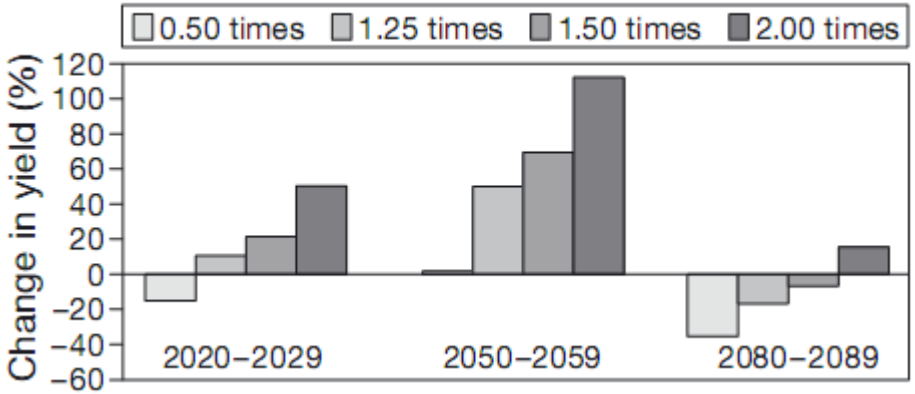
MOSAICC: Modelling System for Agricultural Impacts of Climate Change -> best suited for national assessment with sub-national disaggregation

A field assessment example:
Rice in Northeast Thailand – adaptation options

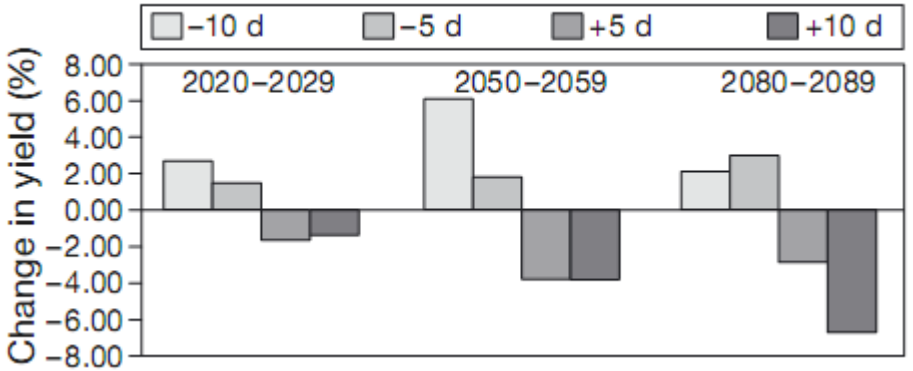
Different sowing dates



Application rate of nitrogen fertilizers



Application time of nitrogen fertiliz



Babel et al., 2011

With more sophisticated process-based modelling one could explore effectiveness of adaptation options, but at site scale

Conclusions

- Climate projections carry deep uncertainties, and impact and vulnerability assessments, and subsequent adaptation planning, need to deal with deep uncertainties
- Impacts vary by scale (spatial, temporal)
- No one assessment can be considered as definitive
- Assessments of impacts and vulnerability need to be designed to meet the information needs of stakeholders