Climate data requirements for agricultural modelling in CCAFS

Ann-Kristin Koehler and Andy Challinor
a.k.koehler@leeds.ac.uk

Outline

- Background:
  - CCAFS
  - Theme 1 within CCAFS
- General Large-Area Model for annual crops (GLAM)
- Assessing abiotic stresses using GLAM
- Conclusions

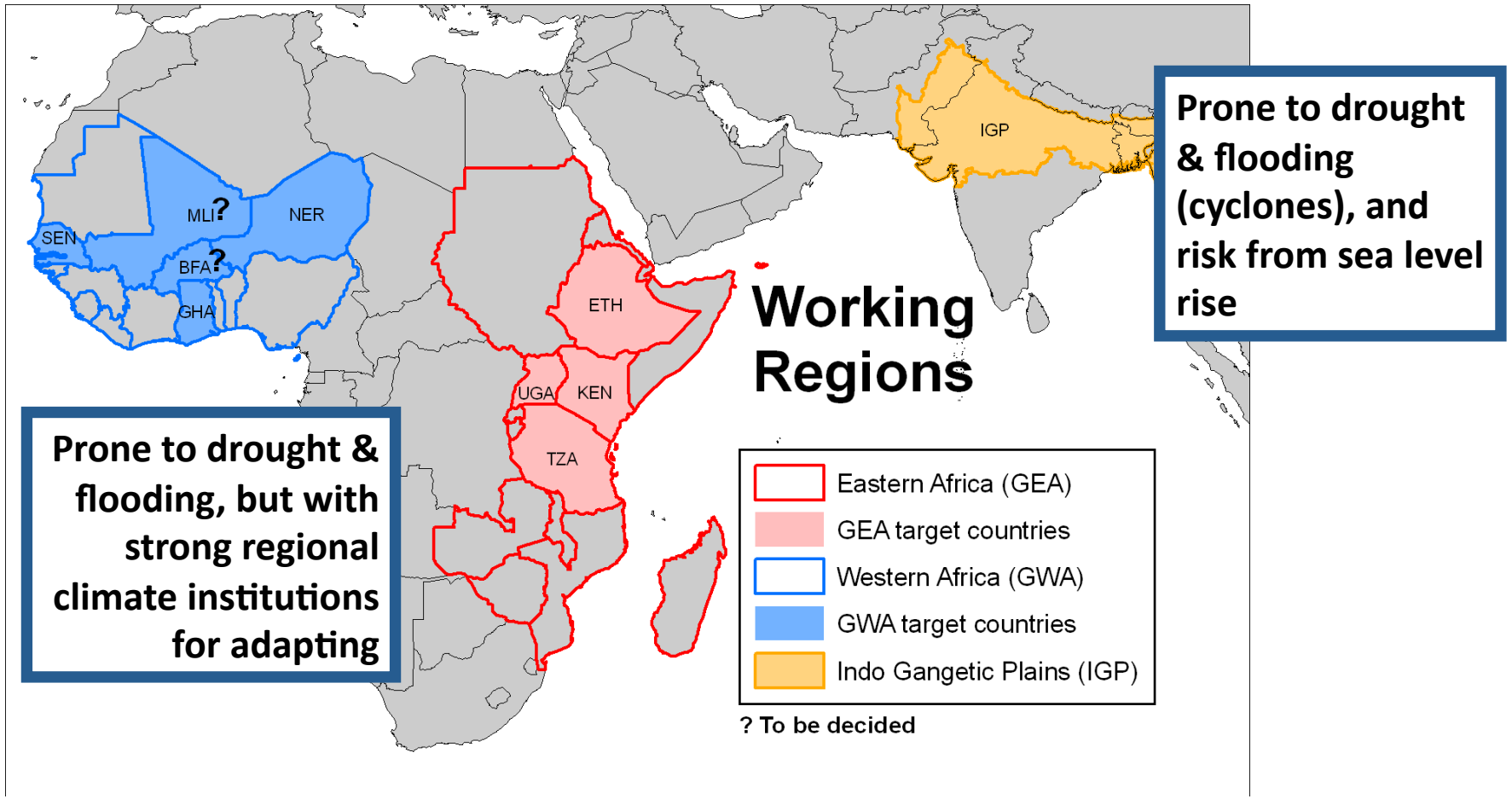
CCAFS

Consultative Group on International Agricultural Research

"Assessing impacts of climate change, facilitate adaptation and alleviate poverty under changing conditions"

CCAFS

Three initial focus regions.



Theme 1: Adaptation pathways under progressive climate change (2030s)

- **What climate information is important for agriculture?**

  - Changes in mean temperature and sub-seasonal variability

  - Changes in rainfall quantity and distribution

  - CO_2 fertilisation effect

  - Ozone damage

>Timing of events: high temperature, rain

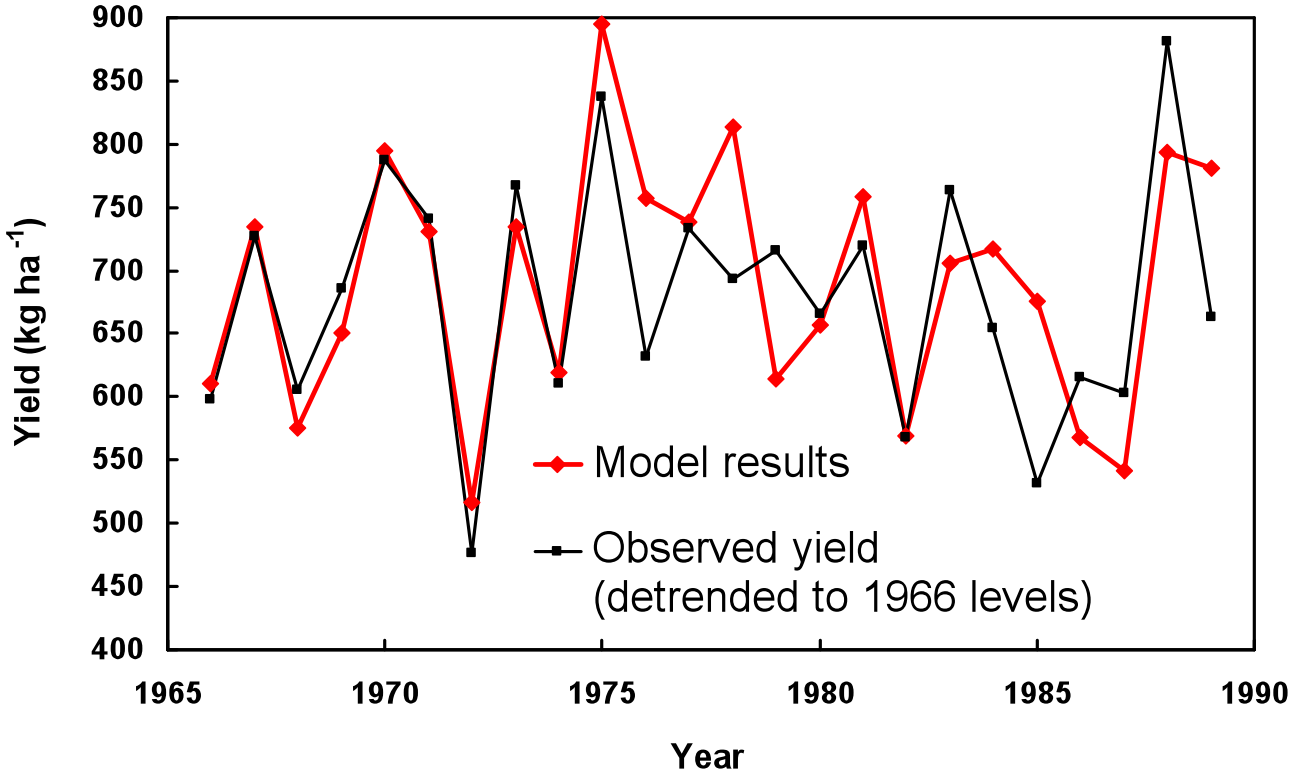
Theme 1: Adaptation pathways under progressive climate change (2030s)

- **Developing adaptation strategies**
  - Explore adaptation options, e.g. genetic improvement, on-farm management practices
  - Test options via modeling
  - Prioritising adaptation strategies
- **How to communicate the results to the farmers?**
  - Regional Program Directors to facilitate the research in each region

GLAM (**G**eneral **L**arge-**A**rea **M**odel for annual crops)

•**Input data:** weather (daily tmin, tmax, srad, rain), soil hydrological properties, planting window, yield gap parameter (YGP)

- **YGP:** time-independent site-specific parameter to account for non-climatic determinants of yield



GLAM:
Developed for groundnut in India, since then adapted to other annual crops

Challinor et al. 2004

Assessing abiotic stresses

Example: High temperature stress for groundnut in India and genotypic adaptation (Challinor et al. 2007)

Climate model: Hadley Centre PRECIS regional climate model, A2 scenario 2071-2100 (high emission)

Results: Number of years (from 2071-2100) when the total number of pods setting is below 50%

Sensitive variety

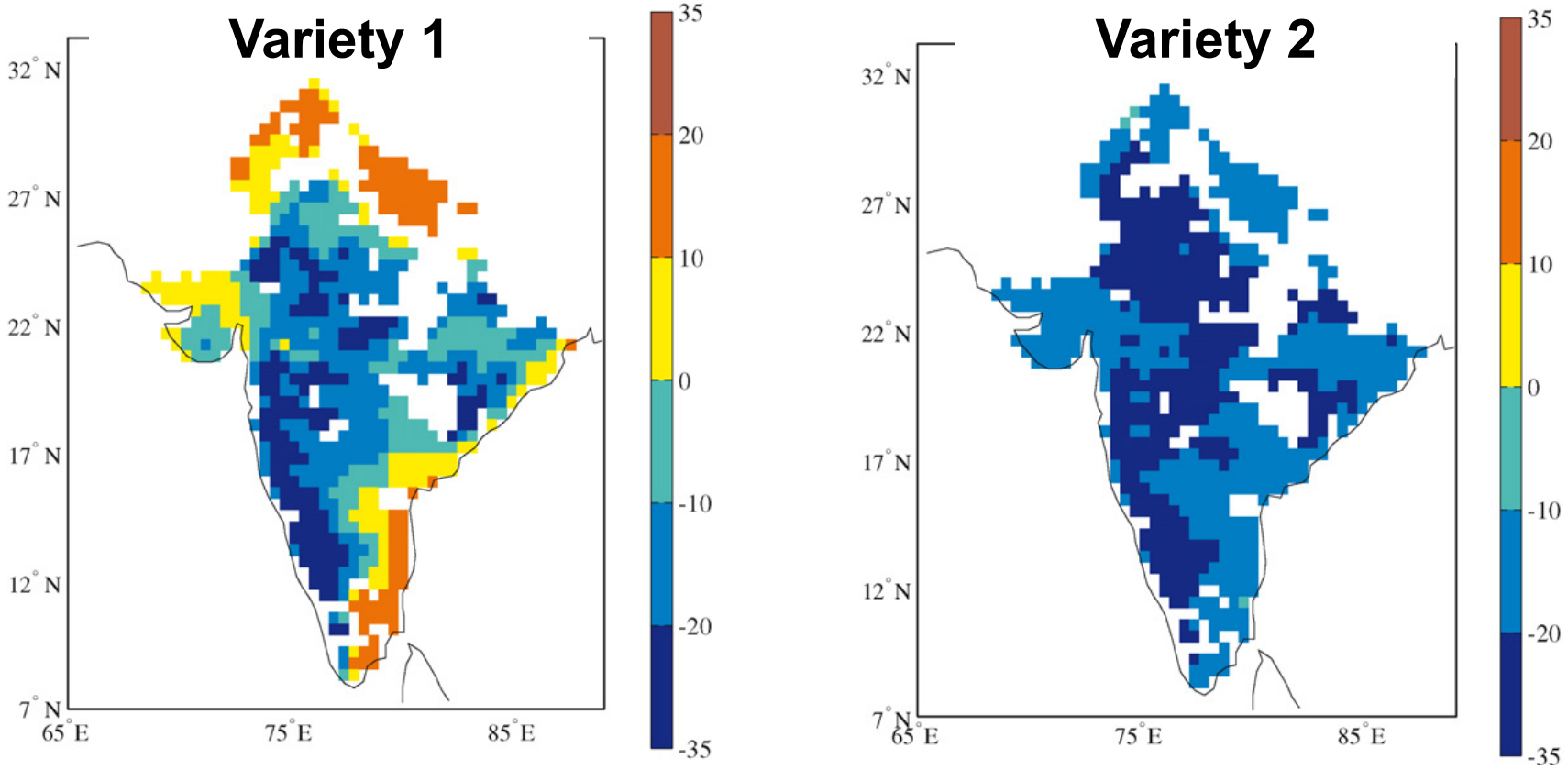
Tolerant variety

Assessing abiotic stresses

Example: Temperature effect on duration for groundnut in India (Challinor et al. 2007)

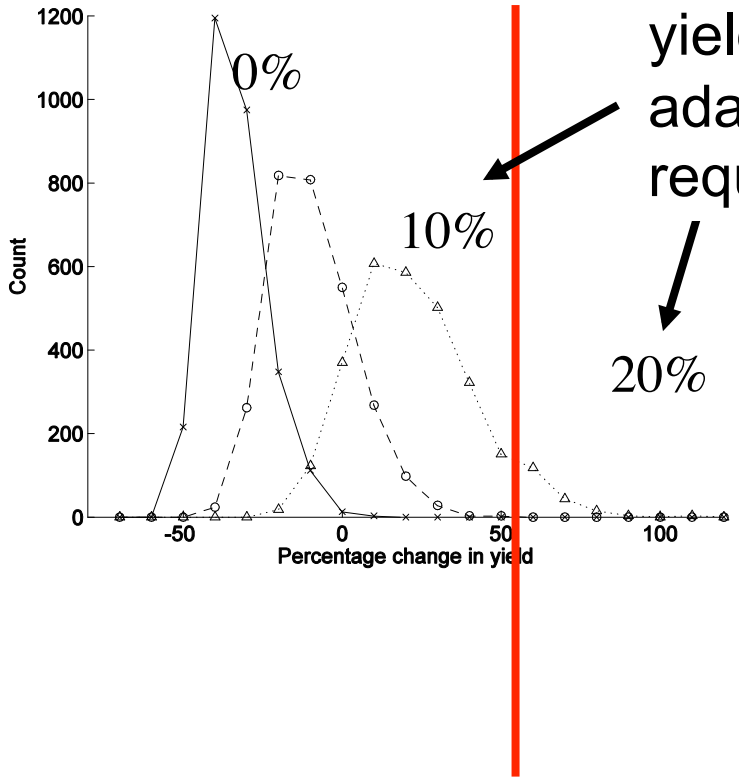
Climate model: Hadley Centre PRECIS regional climate model, A2 scenario 2071-2100 (high emission)

Results: Changes in mean crop duration relative to baseline



Quantifying uncertainty in yield changes for groundnut for one region in India

180,000 crop simulations, varying both climate (QUMP) and crop response to doubled-CO_2 climate



Results: Change in mean simulated yield from baseline to double-CO_2 and adaptation by increasing thermal time requirement by 10 and 20%

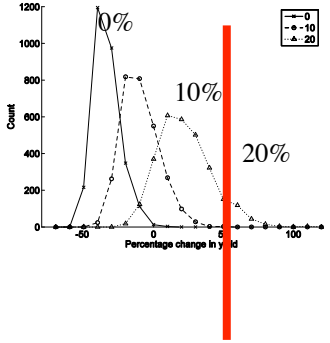
Challinor et al. (2009a)

Conclusions

•Regional variability in crop yield response to climate change

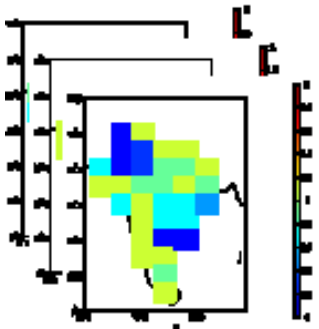
> Site-specific crop adaptation strategies

•Robustness of results: need to account for uncertainty in climate and crop model



Conclusions

- CORDEX: climate model evaluation on the spatial resolution as required for impact studies



- Increased climate skill
- Higher resolution for impacts
- Less quantification of uncertainty

Challinor et al. (2009)

References

Challinor et al. 2004. Design and optimisation of a large-area process-based model for annual crops. *Agricultural and Forest Meteorology.* 124: 99-120.

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Thank you!