Incorporating crop growth modelling into JULES

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Outline

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- The basis for our crop modelling: GLAM
- Incorporating crop growth & development into MOSES2

  See: Osborne *et al,* (2007) Global Change Biology, 13; 169-183
- Coupled crop – climate variability in HadAM3
- Future challenges for crops in JULES

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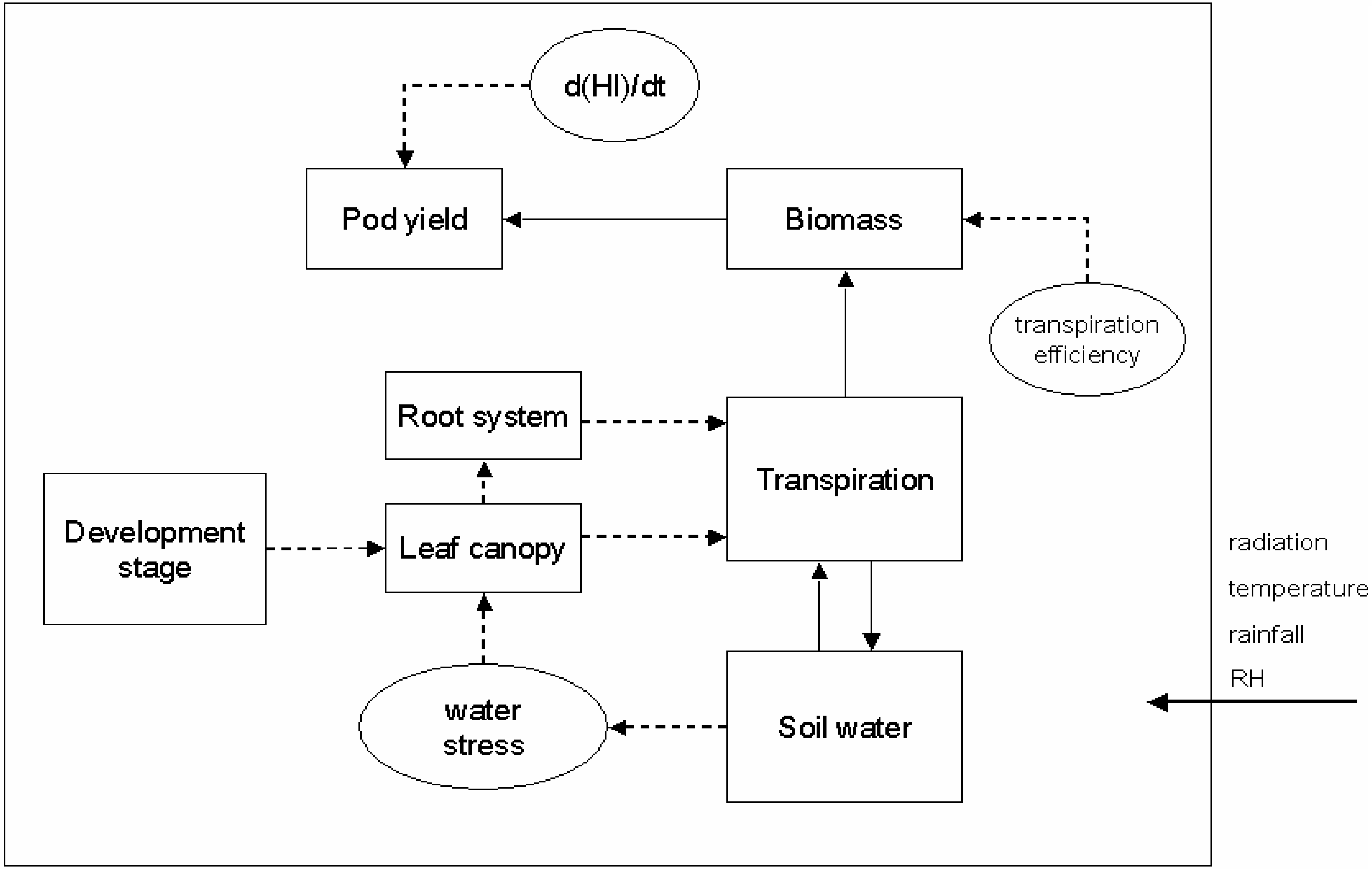
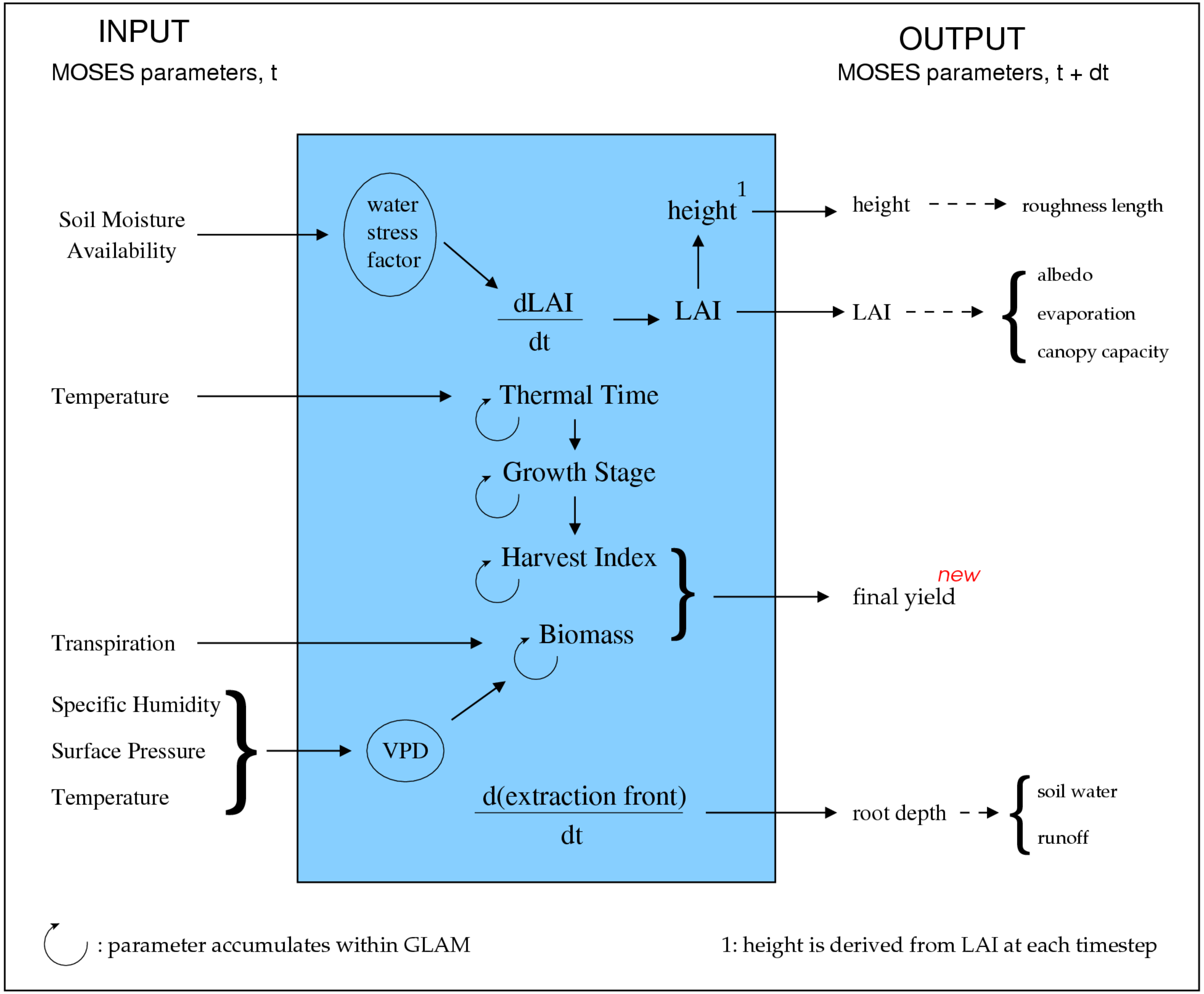
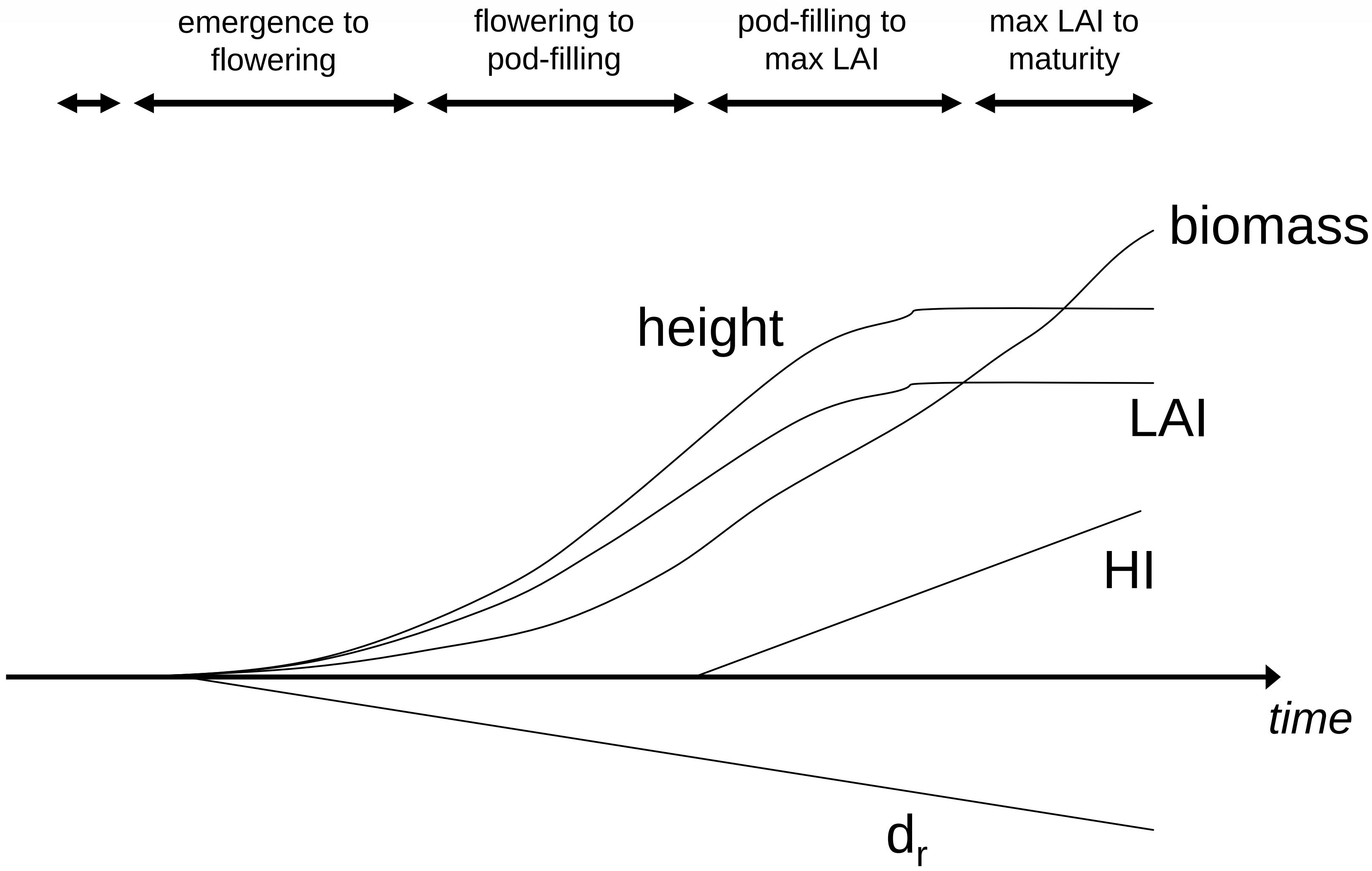
GLAM – off-line crop model



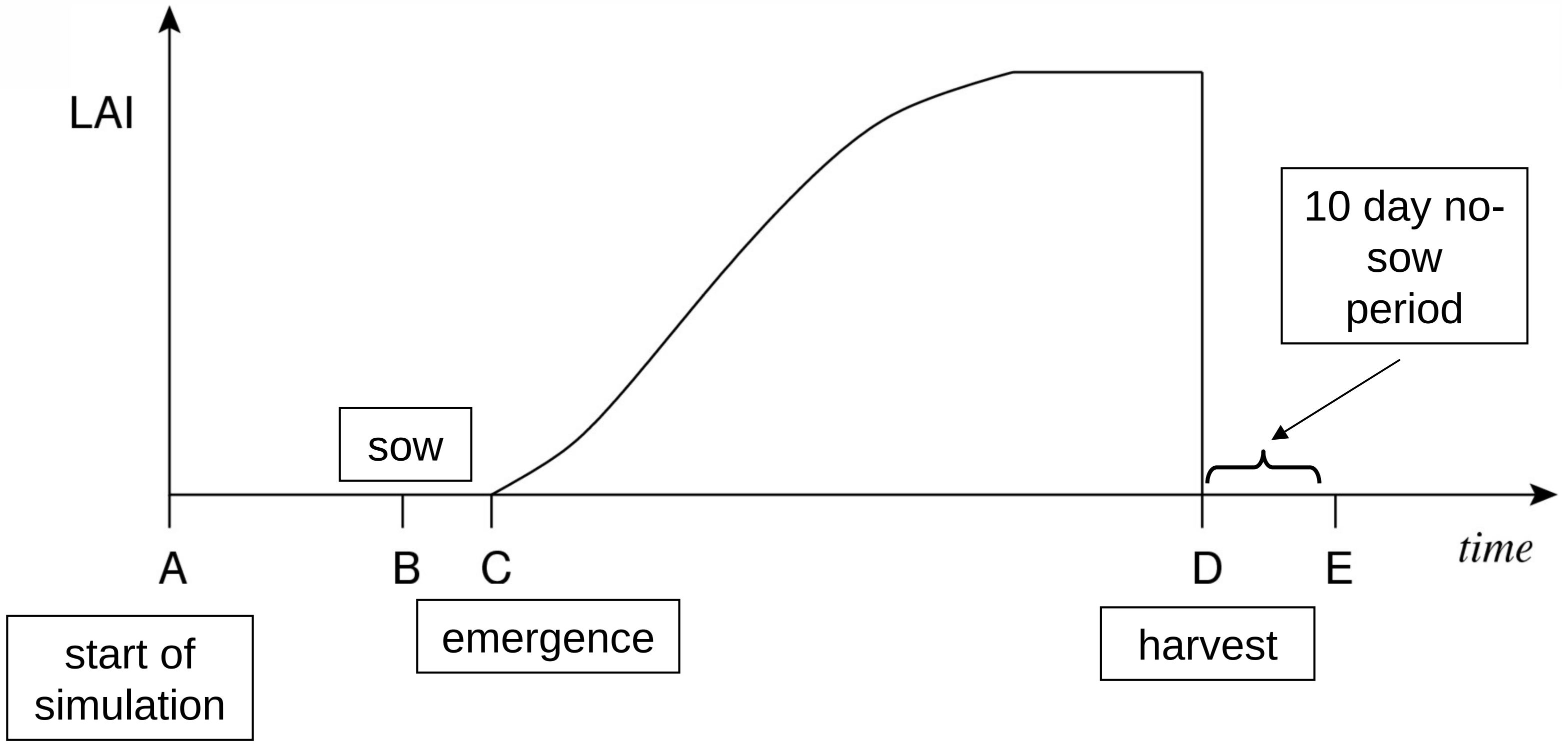
Crop growth modelling in MOSES



Schematic of crop growth in JULES



‘Management’



Sowing date based on soil moisture.

Emergence determined by thermal time accumulation.

In optimum environments, 10 day break post-harvest.

In sub-optimum environments longer restrictions on sowing date.

Crop and climate variability

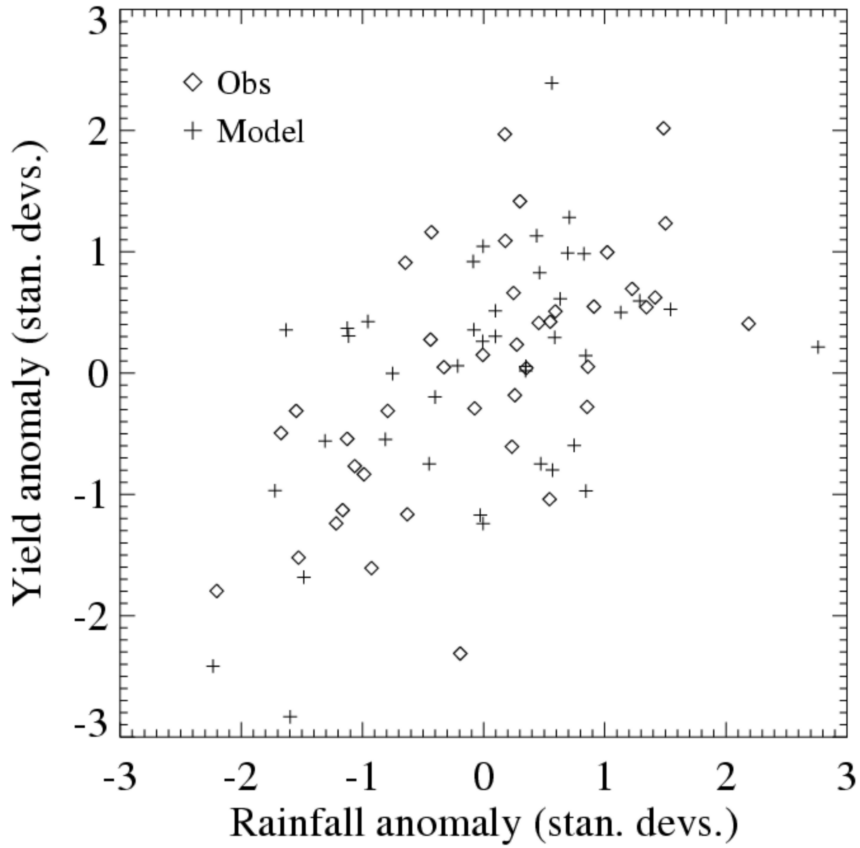
2 climate simulations

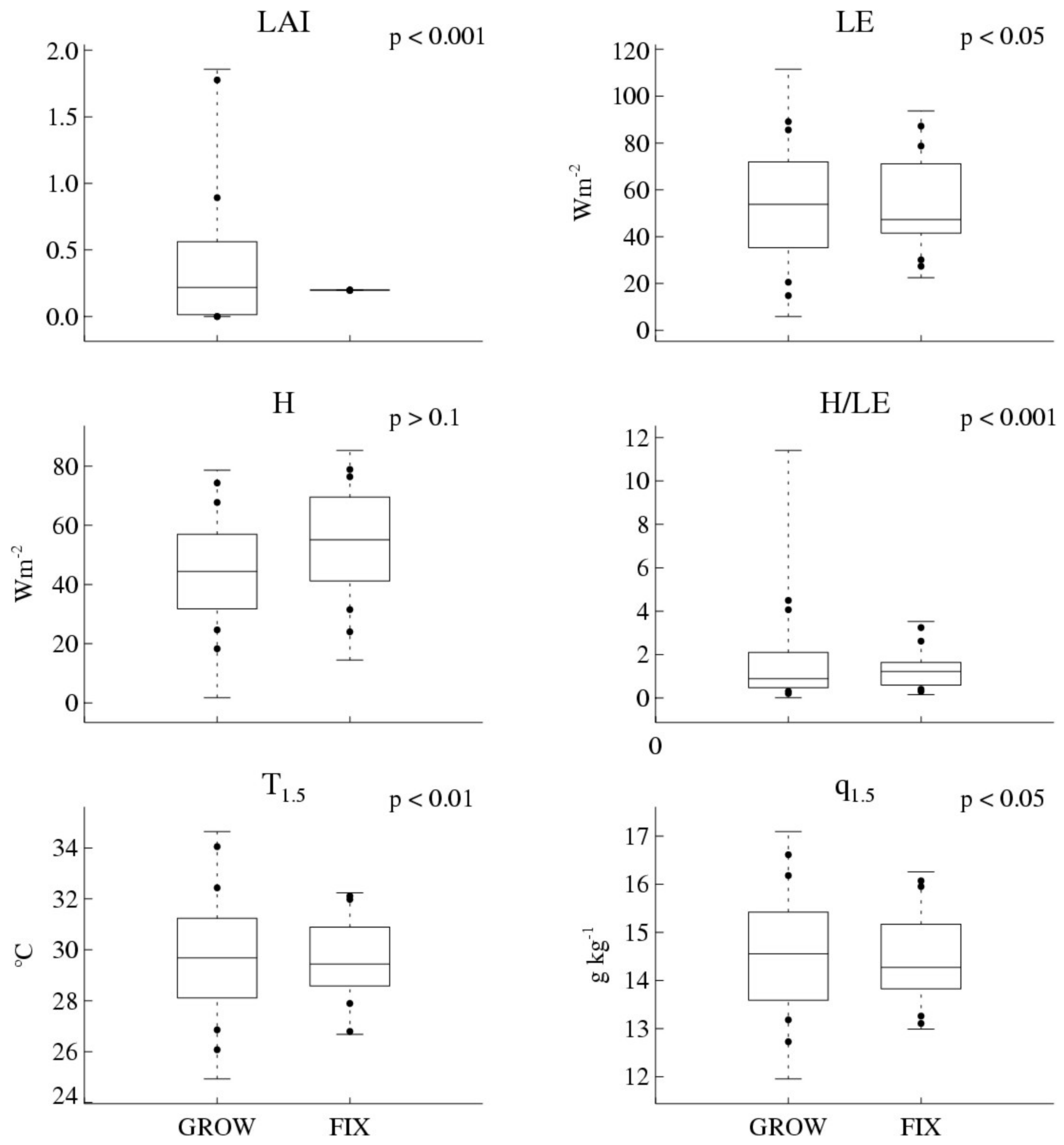
GROW: with growing crop

FIX: without growing crop (same annual cycle of LAI each year)

GROW simulation reproduces observed relationship between rainfall and yield for India

r_{obs}=0.62, r_{model}=0.49





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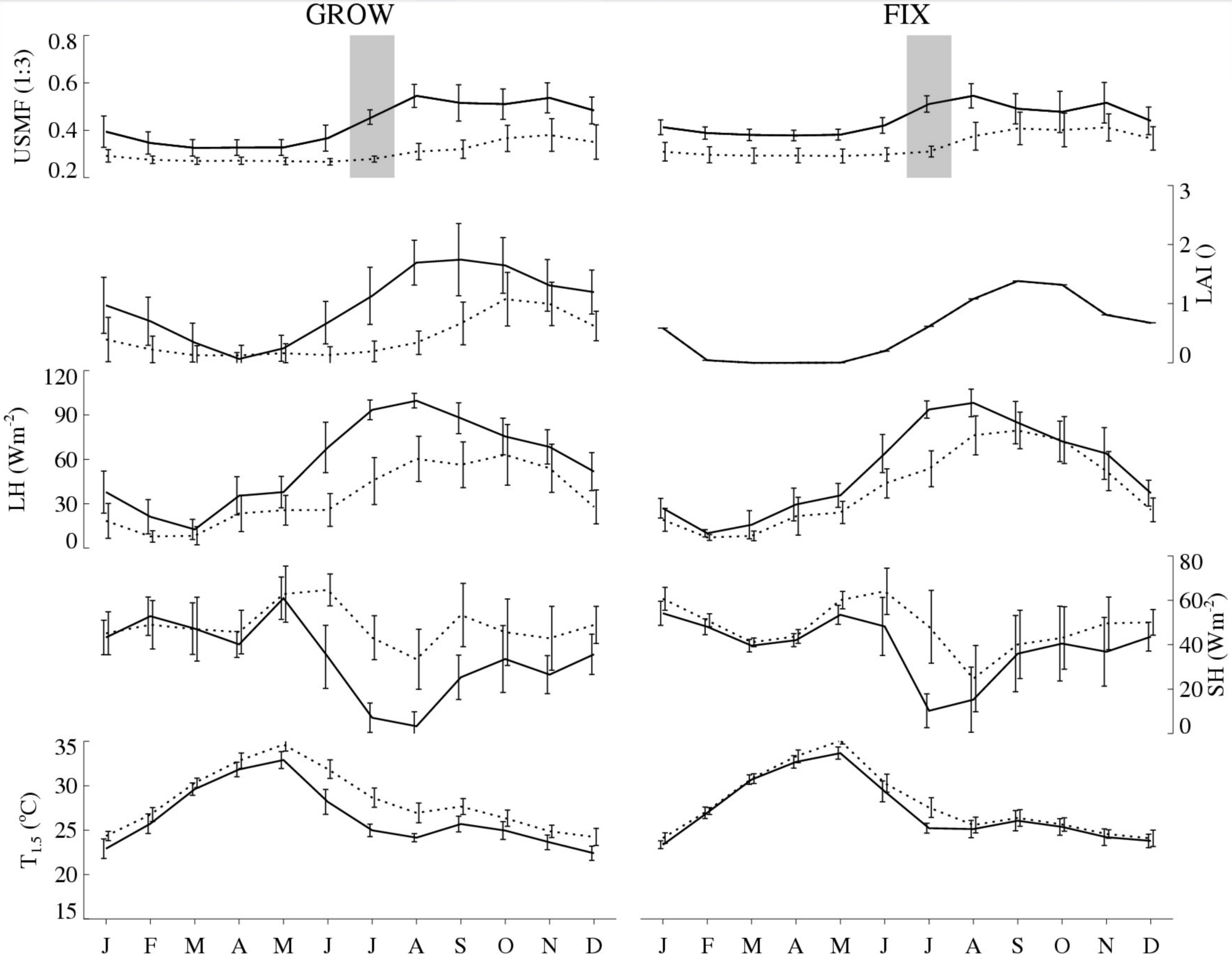
SE India June

Growing crops increase climate variability during the early part of the growing season

Soil moisture composite

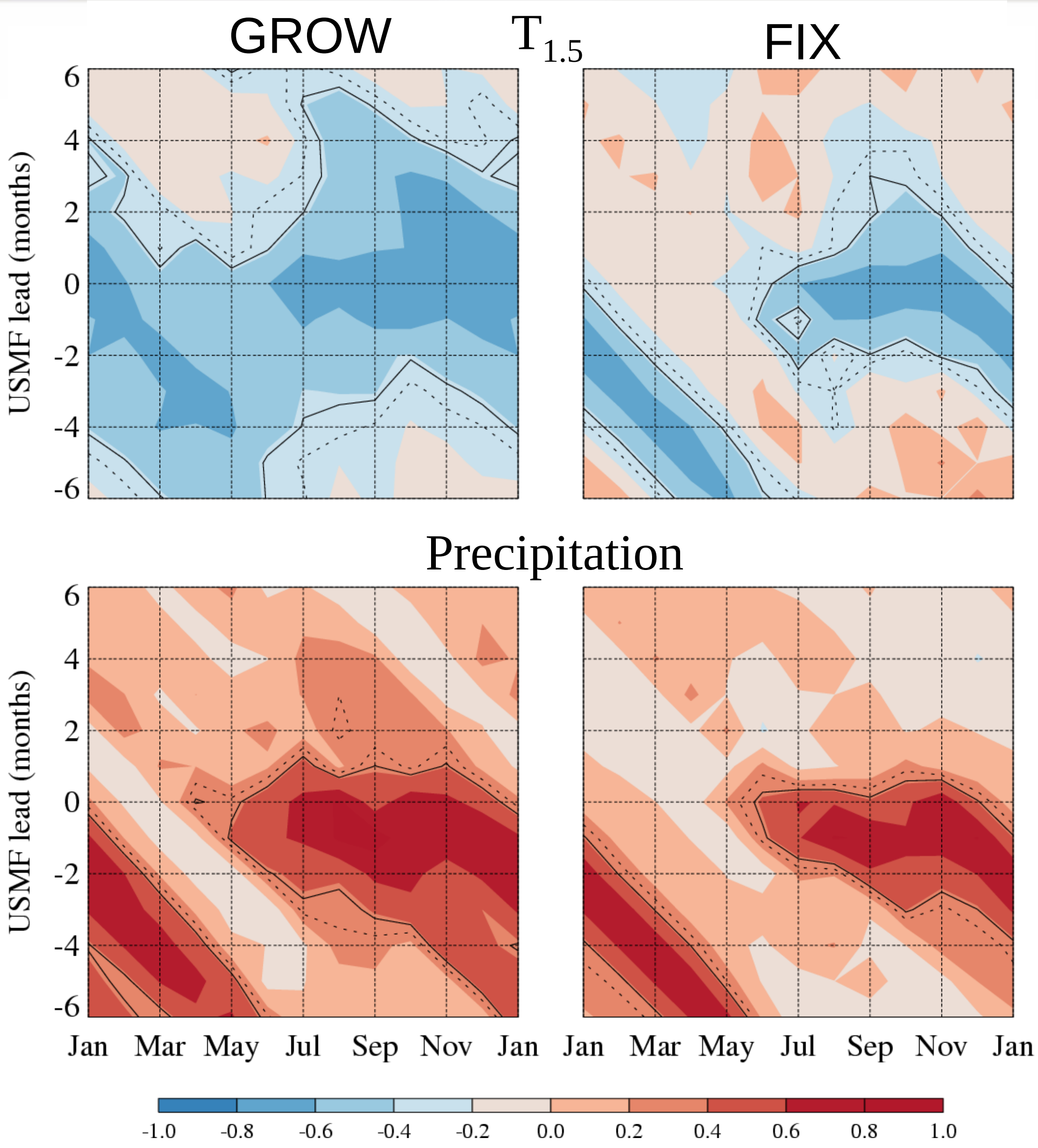
Response of LAI to SM anomaly amplifies response of surface climate

which is maintained for longer



Soil moisture – climate correlations

Interactive crops enable a feedback of soil moisture on climate



Future challenges for GLAM-JULES

Other crops: wheat (spring and winter), maize, soyabean, grasslands

Integration into carbon (and nitrogen) cycling within JULES.

Multiple crop tiles in JULES/MOSES

Humans:

- Management: sowing, season length (variety choice), rotations.
- Technology: yield gap parameter
- Irrigation
- Adaptation