Multiple equilibria of the vegetation-atmosphere system in radiative-convective equilibrium storm-resolving simulations with interactive leaf phenology

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Leaf phenology

The temporal evolution of leaf amount due to

- Emergence
- Growth
- Death

Delpierre et al., 2017

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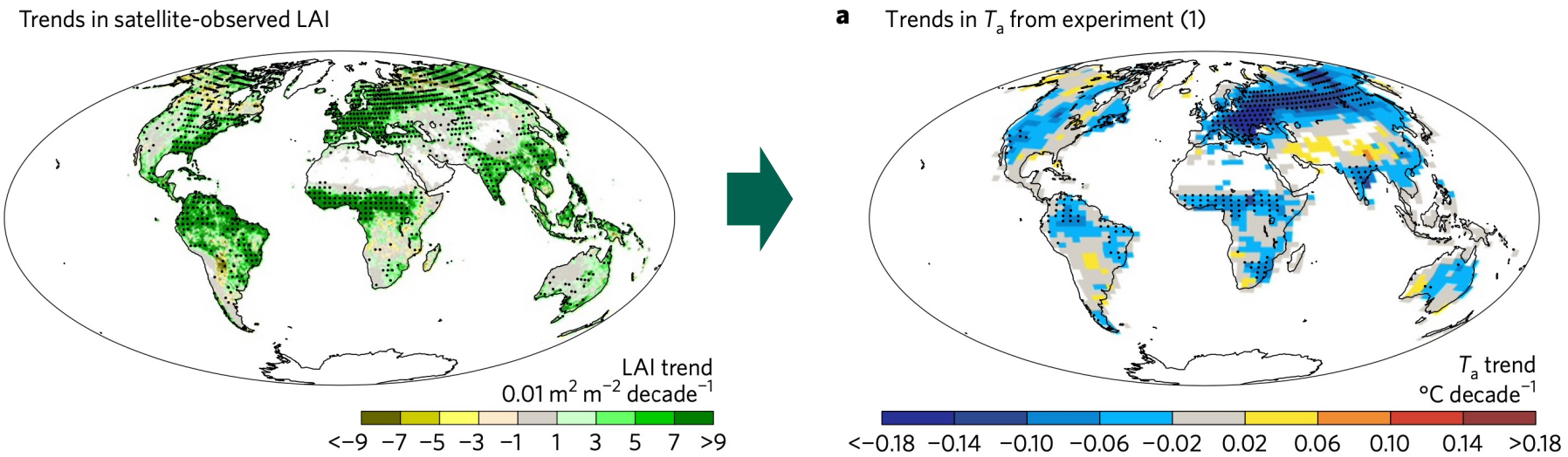
Influence on climate

Leaf phenology & LAI influence on climate through its control on
→ g_c, C_v, α …



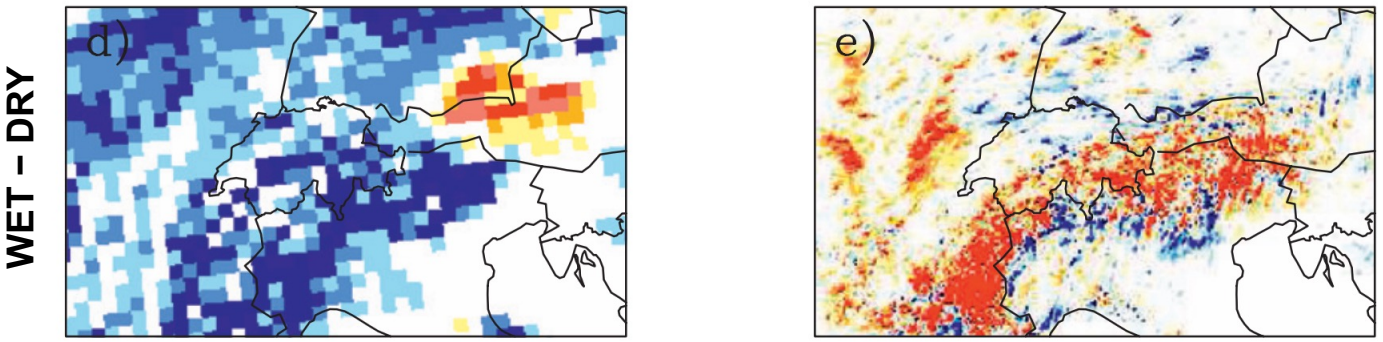
Zeng et al., 2017

Needs for high-resolution

Past studies used coarse-resolution
→ cannot resolve small-scale processes in land & atm.

Simulation with
convective parameterization
(dx = 25 km)

Simulation with
explicit convection
(dx = 2.2 km)



25 km: drier soil → lesser rain

2.2 km: drier soil → more rain

Hohenegger et al., 2009

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Goals

Investigate the effects of interactive leaves on the equilibrium climate of an idealized planet and vegetation states by

1. Characterizing potential equilibrium state

2. Comparing simulations with interactive leaves and fixed LAI

→ using idealized radiative-convective equilibrium (RCE) storm-resolving simulations

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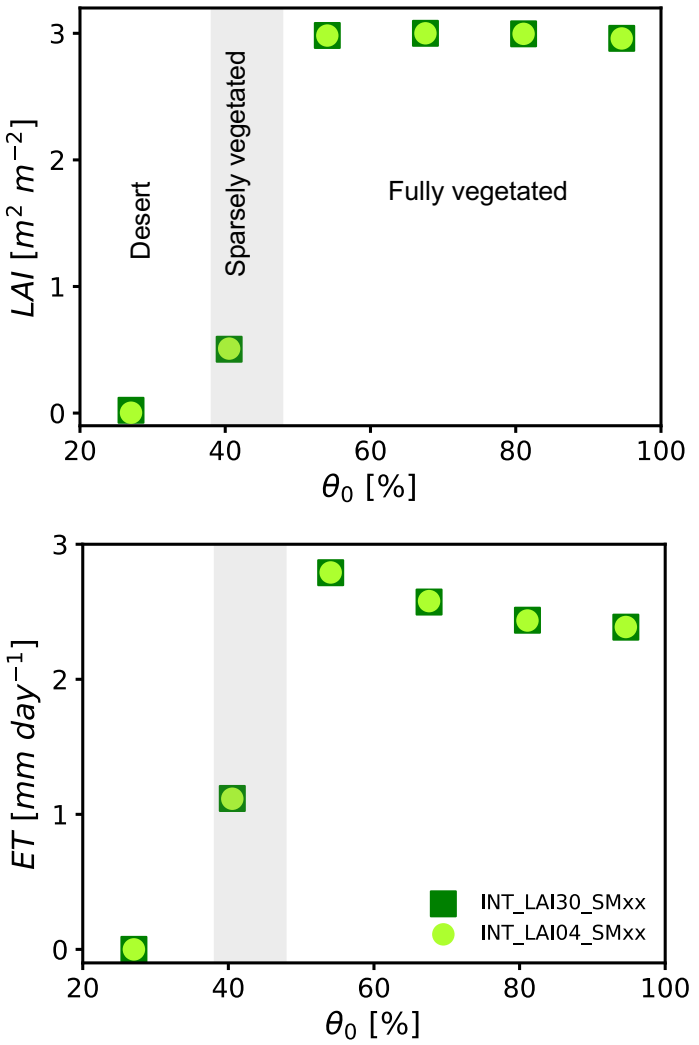
Equilibria in the vegetation-atmosphere system with interactive leaves

1. Three categories of equilibrium states exist

2. Equilibrium states are only dependent upon the initial soil moisture

3. It is difficult to kill the plant in our set-up



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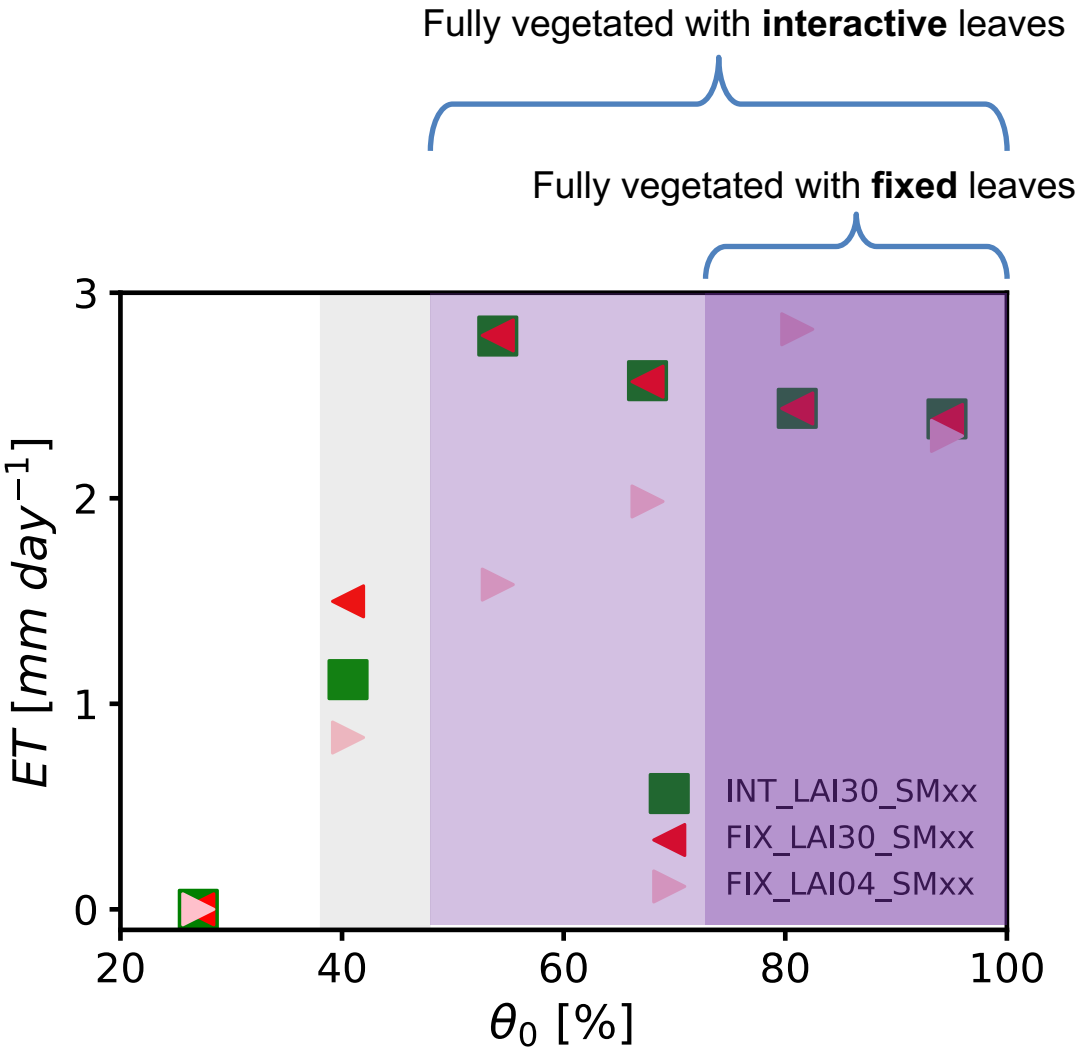
The role of interactive leaves

- Earlier transition to fully vegetated planet with interactive leaves



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Thank you !

Questions?

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