

*How may alpine ecosystems
respond to 'extended summer'?*



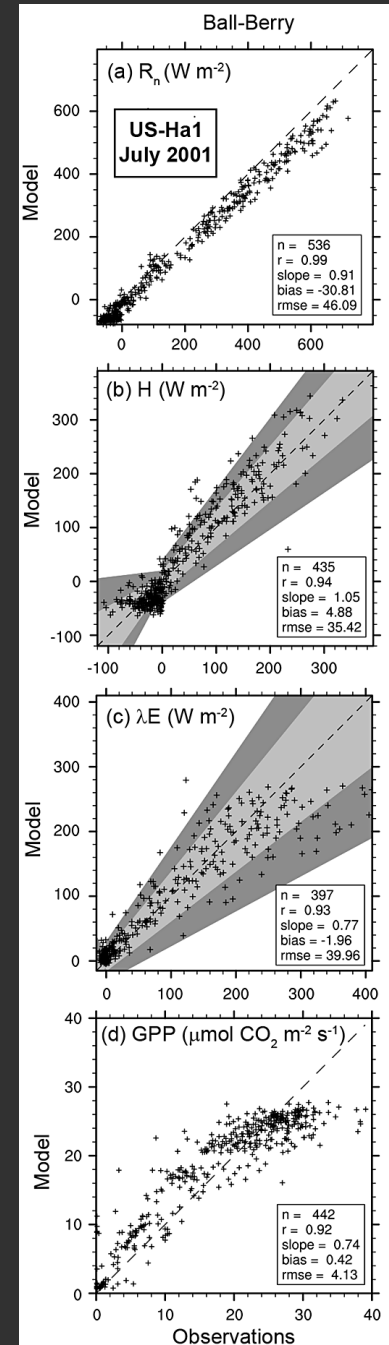
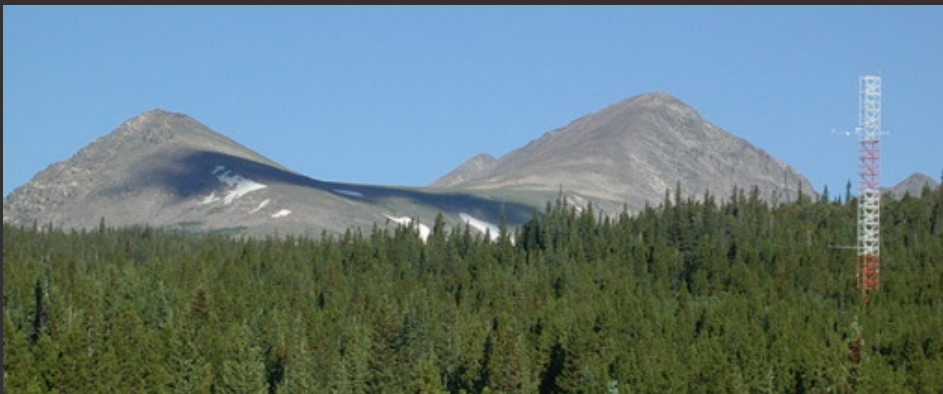
*PT-CLM in a a 'foreign'
ecosystem?*

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John Knowles, Katie Suding
CESM Tutorial August 2016

PT-CLM

‘Typically’

- SP mode
- Summer fluxes
- Evaluate biogeophysics



PT-CLM

‘Typically’

- SP mode
- Summer fluxes
- Evaluate biogeophysics

Today

- BGC mode
- Annual fluxes
- Evaluate biogeochemistry



Long-term records at Niwot



C1 (subalpine, 3048m)

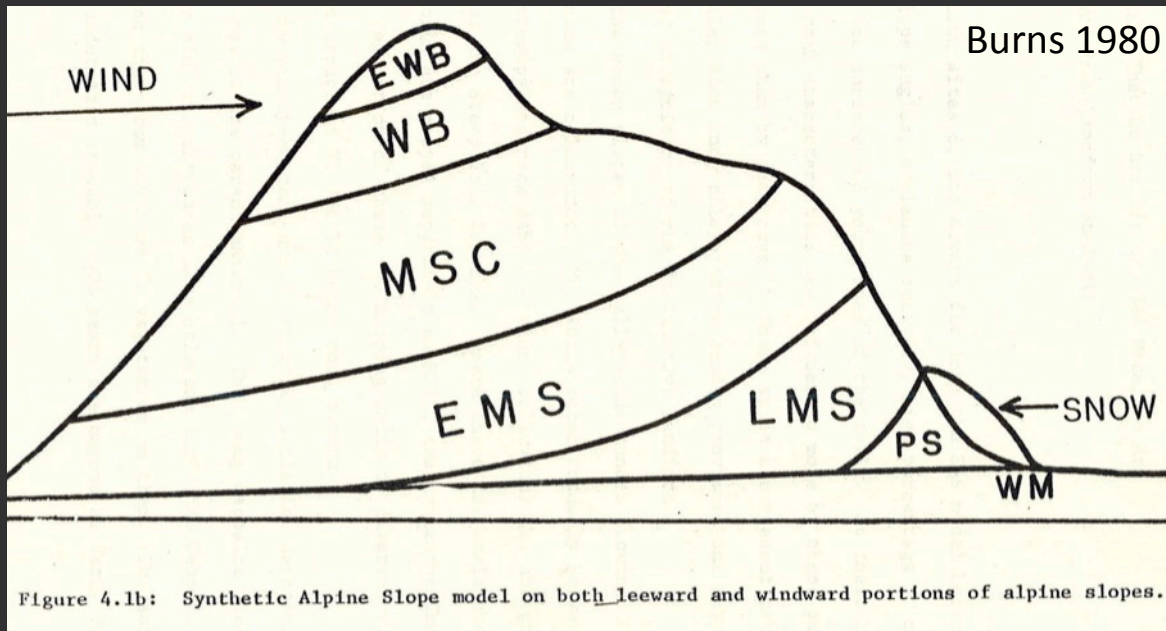


D1 (alpine, 3750m)



Tvan (alpine, 3500m)

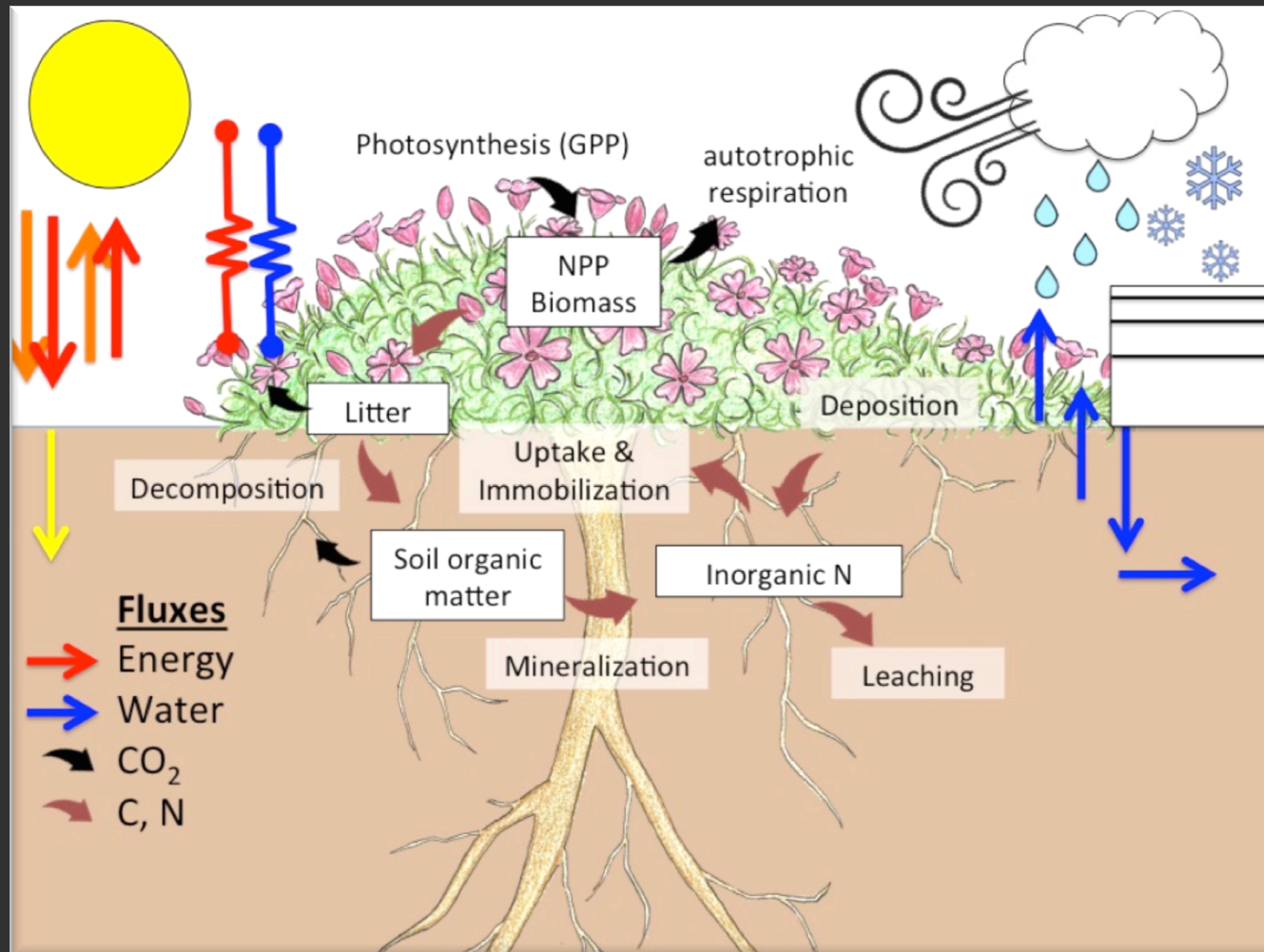
Snow & Alpine Ecosystems



Fell Field
Dry Meadow
Moist Meadow
Wet Meadow
Snow Bed

CLM response to extended summer

- Dull crayon in the box?
- Best synthesis of our scientific knowledge?



PT-CLM 4.5+

- Forced with local meteorology [2008-2013]
- Modified snow inputs and soil characteristics

1. Flux *Validation*

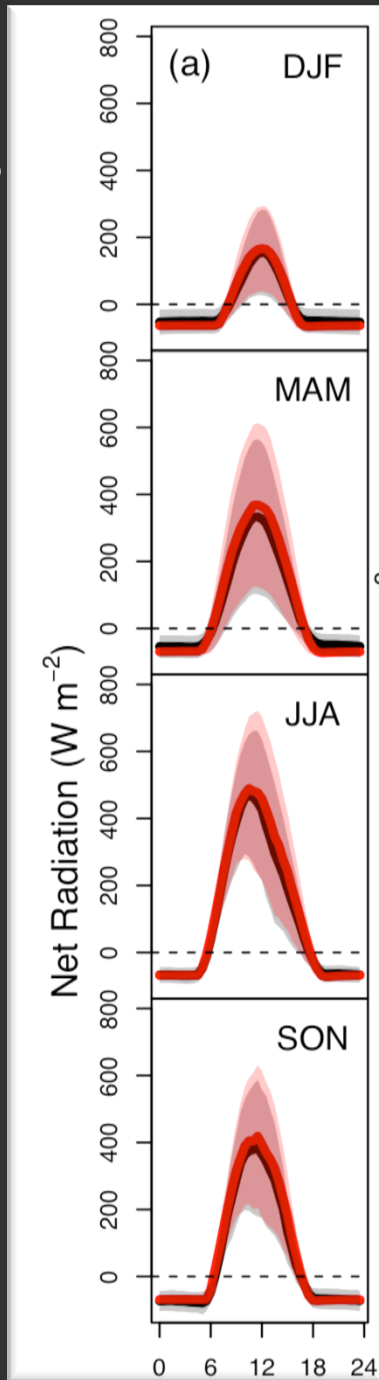
– Diurnal & Annual cycle

2. Landscape *Evaluation*

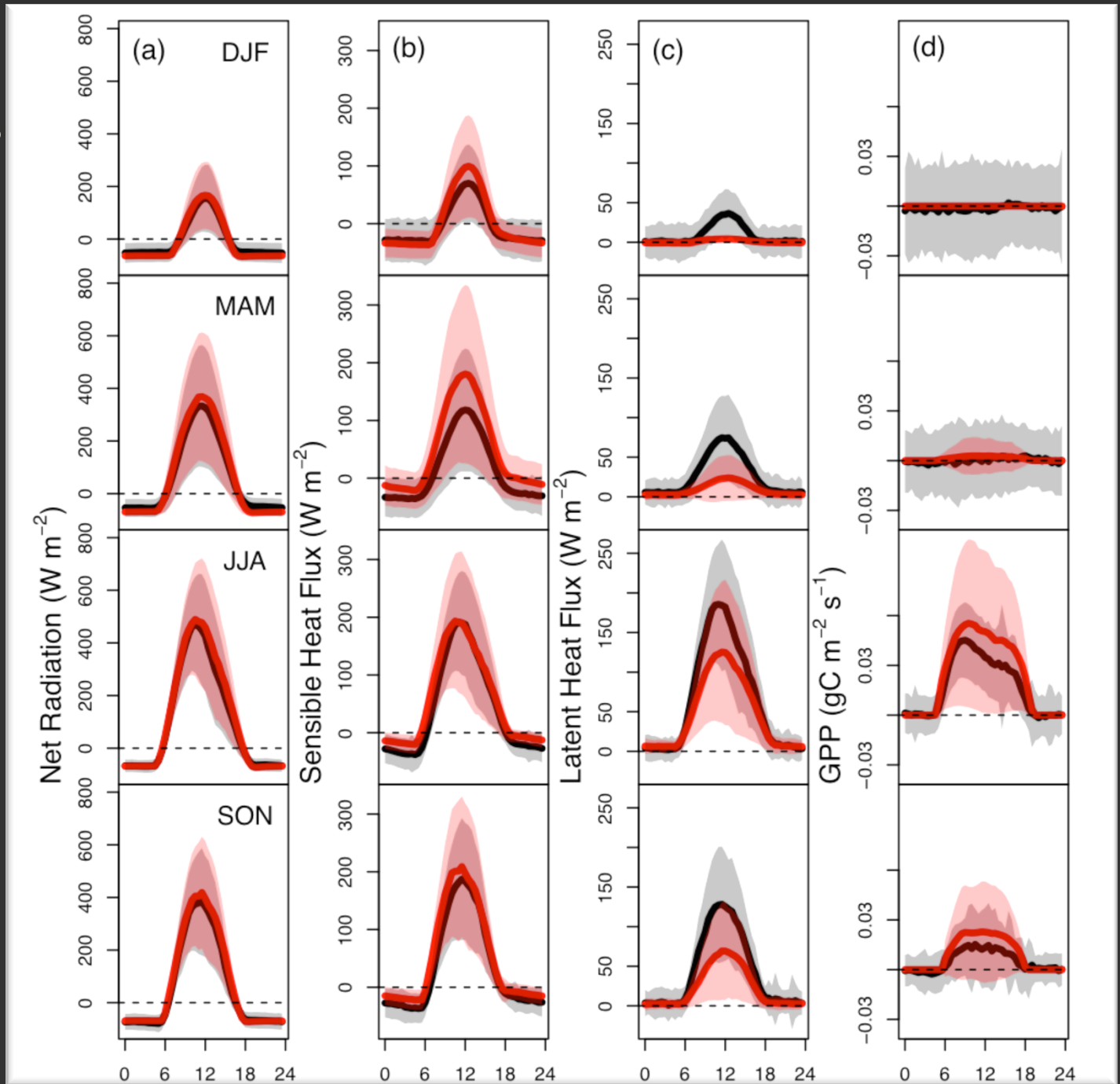
3. Extended summer Projection



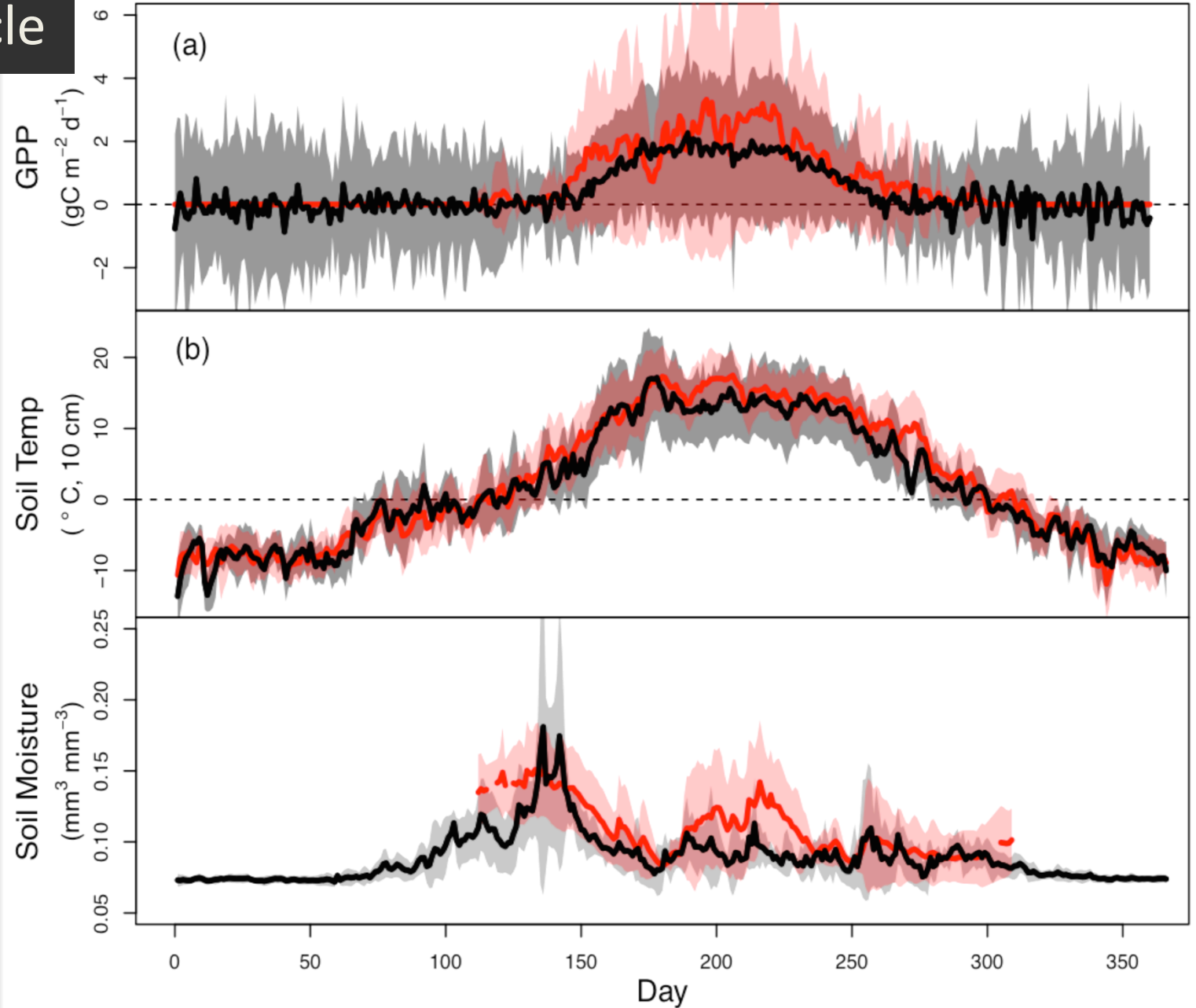
1a: Validate diurnal fluxes



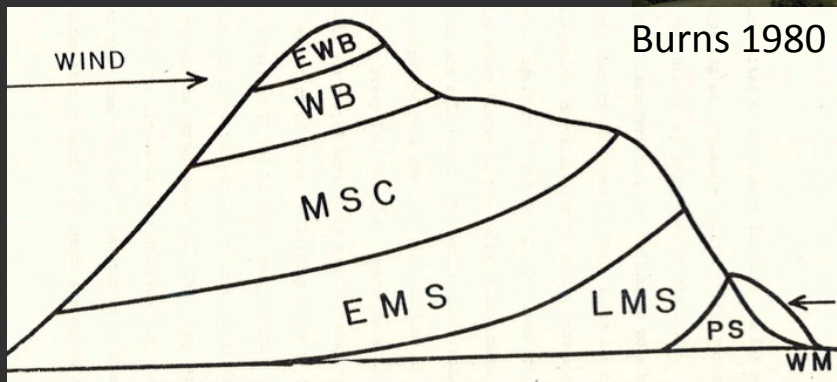
1a: Validate diurnal fluxes



1b: Validate annual cycle



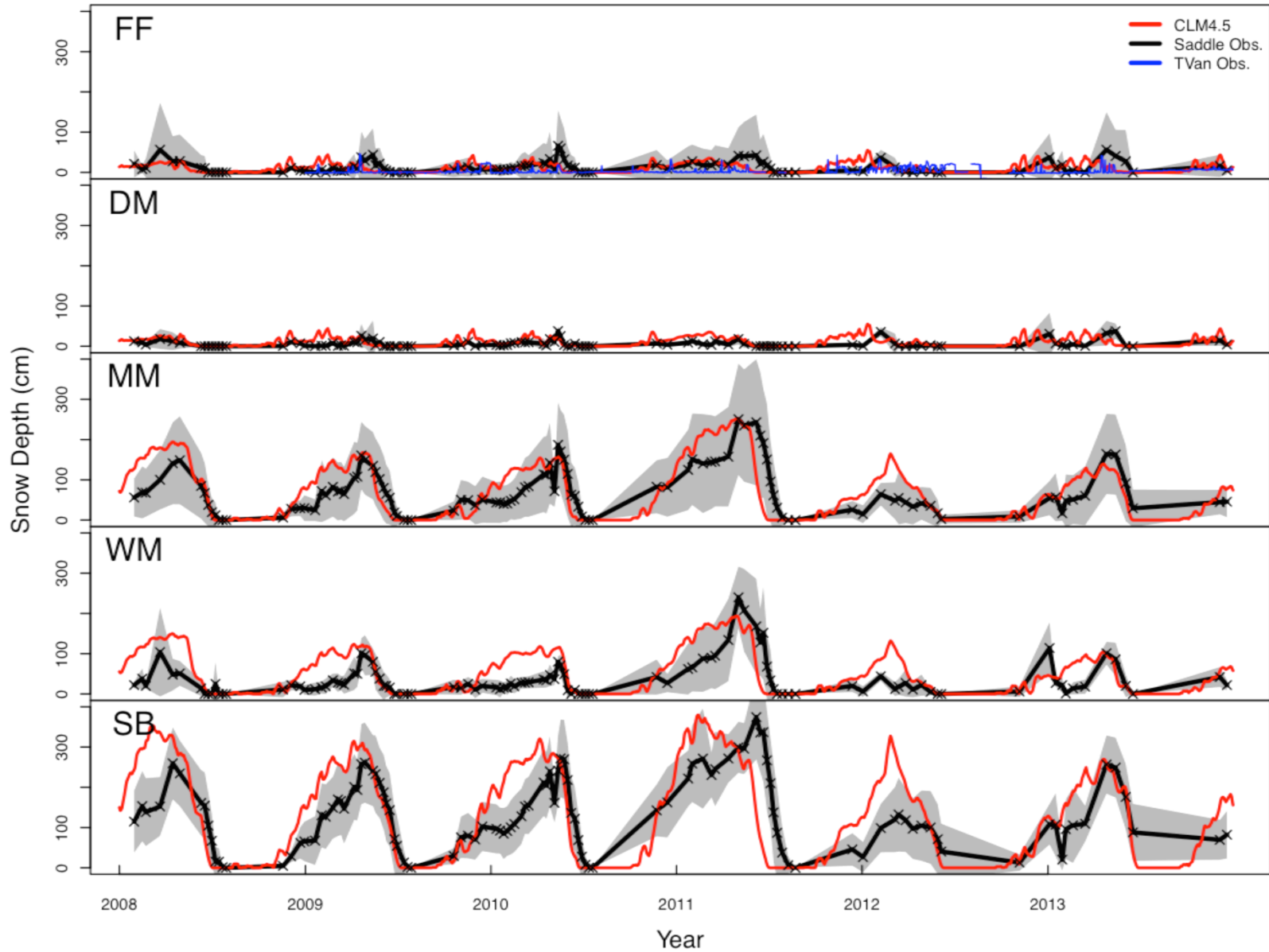
1. Flux Validation
2. Landscape Evaluation
 - Snow Depth & C cycle
 - Fell Field to Snow Bed



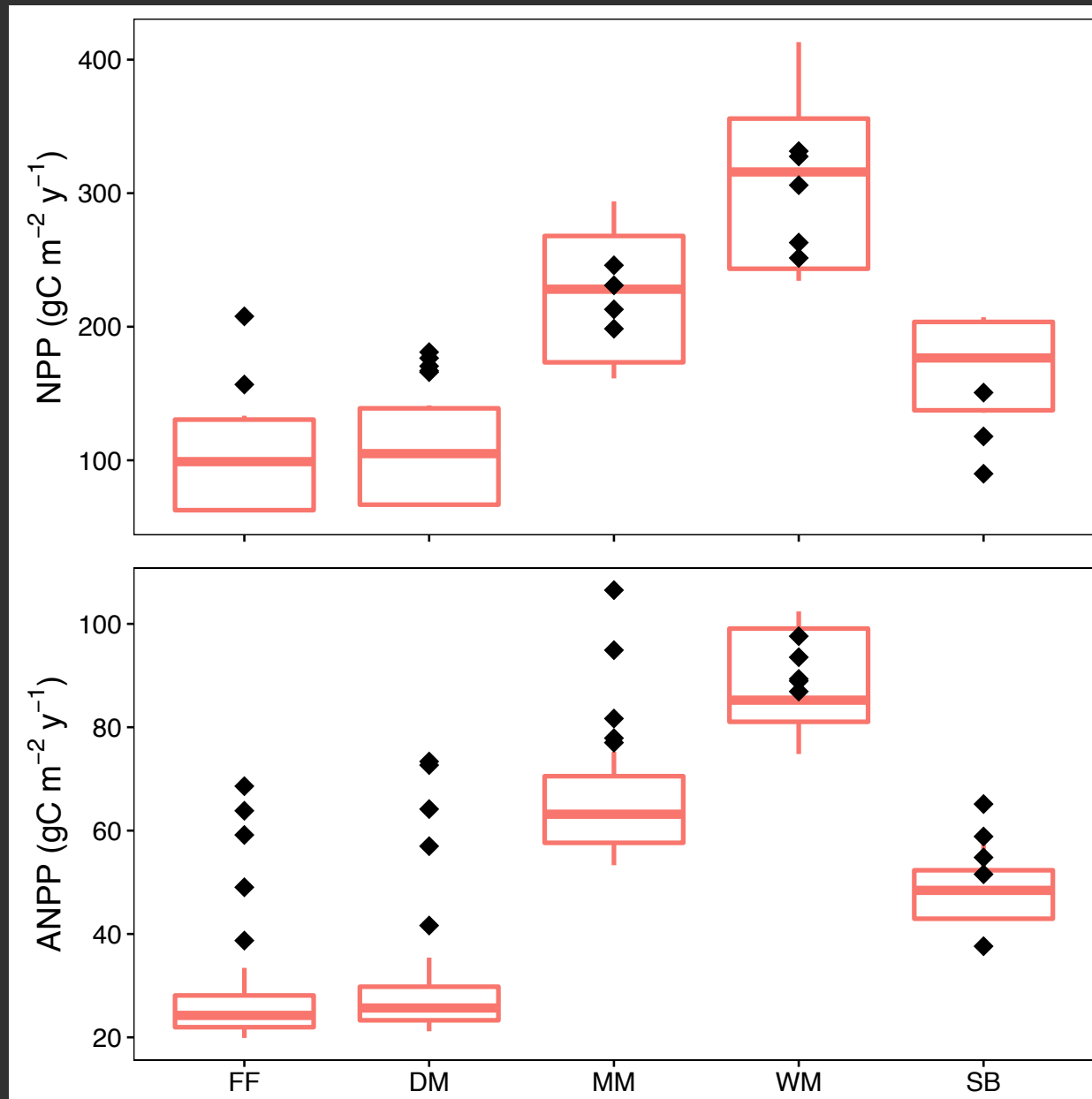
2a: Evaluate snow (depth & melt)



2a: Evaluate snow (depth & melt)



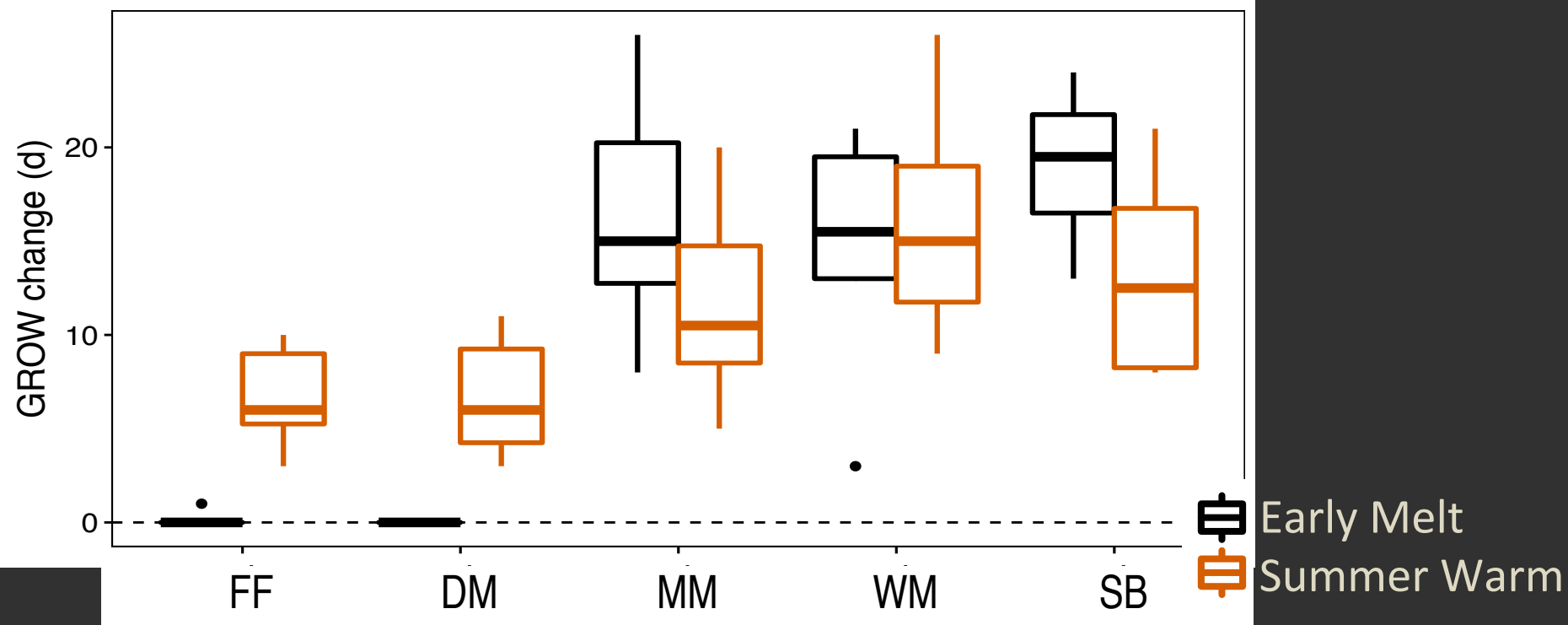
2b: Evaluate productivity

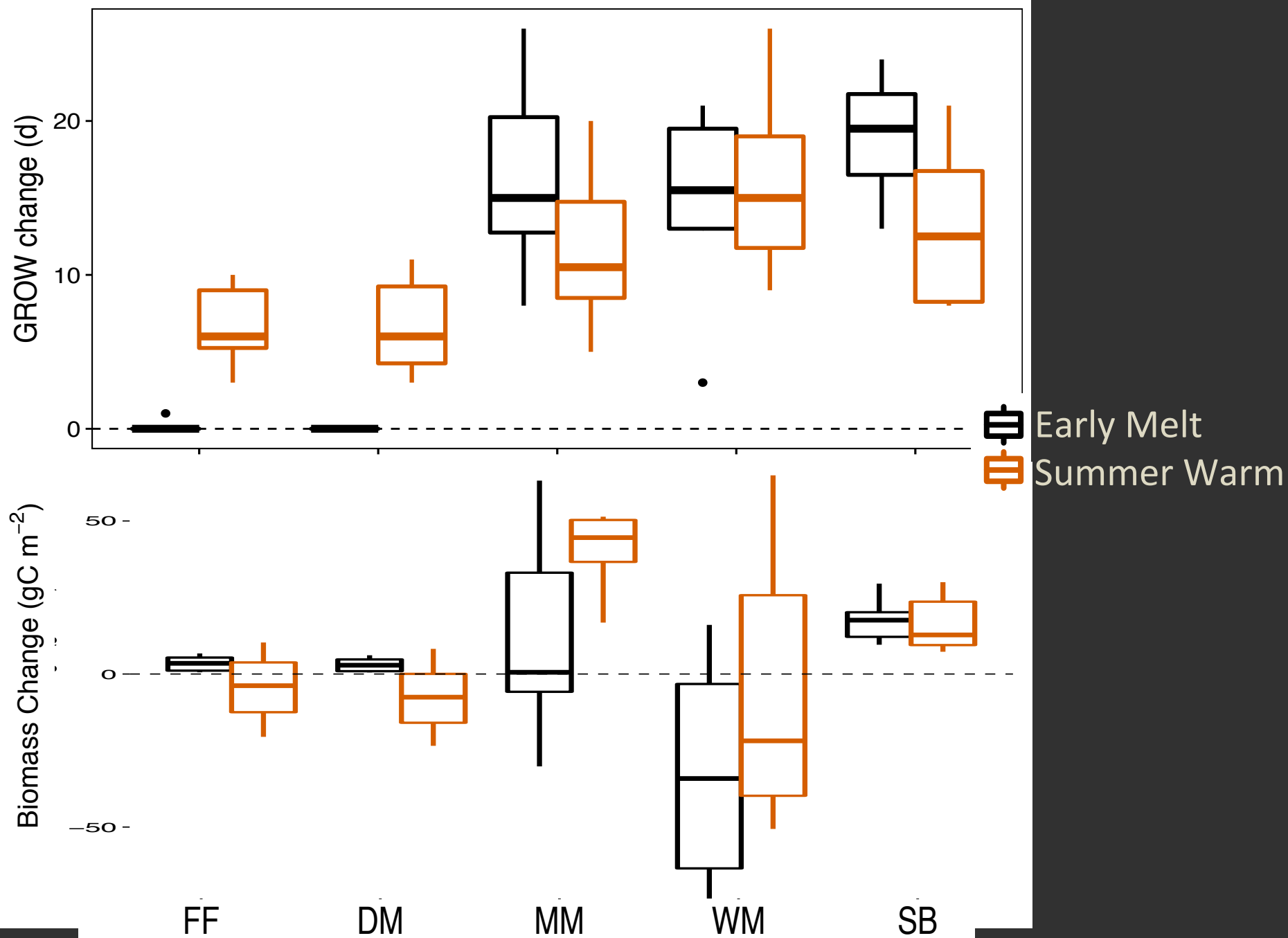




1. Flux Validation
2. Landscape Evaluation
3. Extended Summer Projection
 - Early melt
 - Summer warm







PT-CLM can simulate a 'foreign' ecosystem

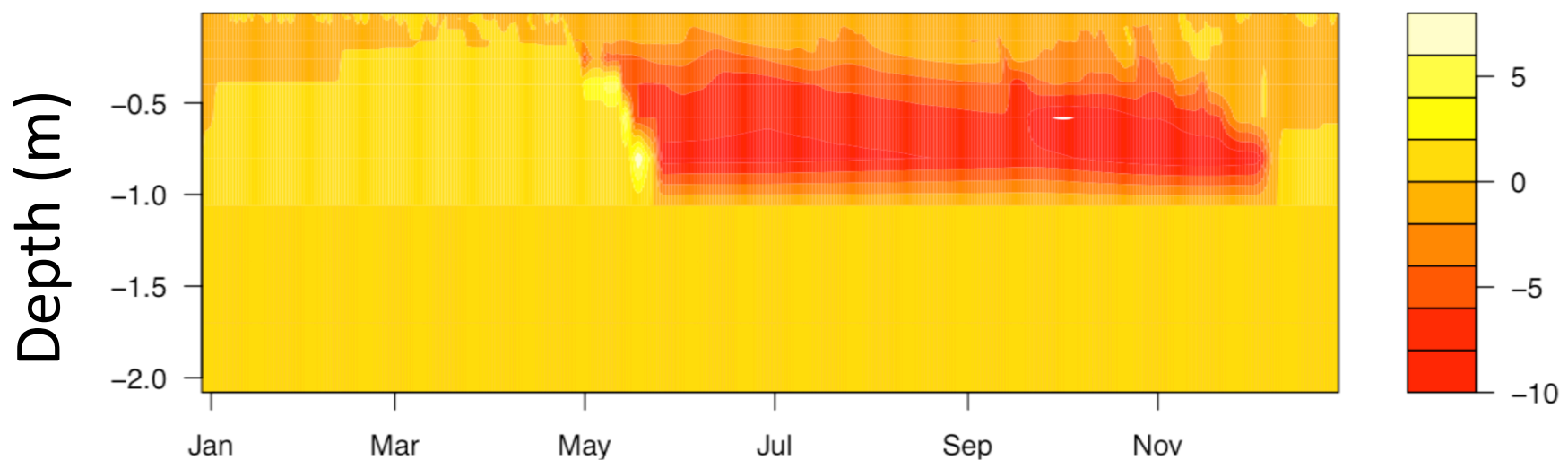


Suggests connectivity will shape how alpine ecosystems respond to climate change?

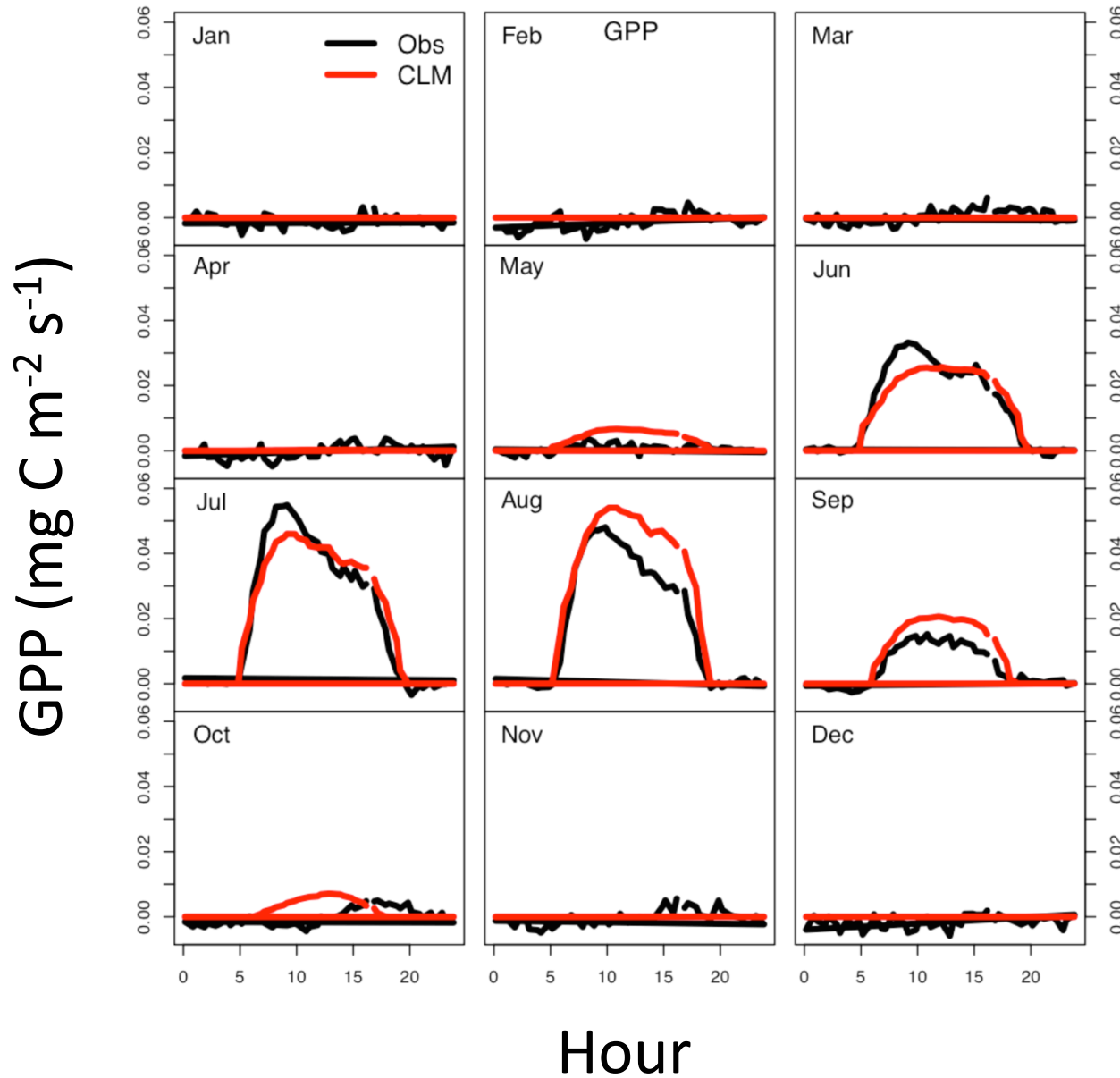
Adjusting assumptions about Rh & photosynthesis

$$\frac{1}{r_s} = g_s = m \frac{A_n}{c_s / P_{atm}} h_s + b \beta_t$$

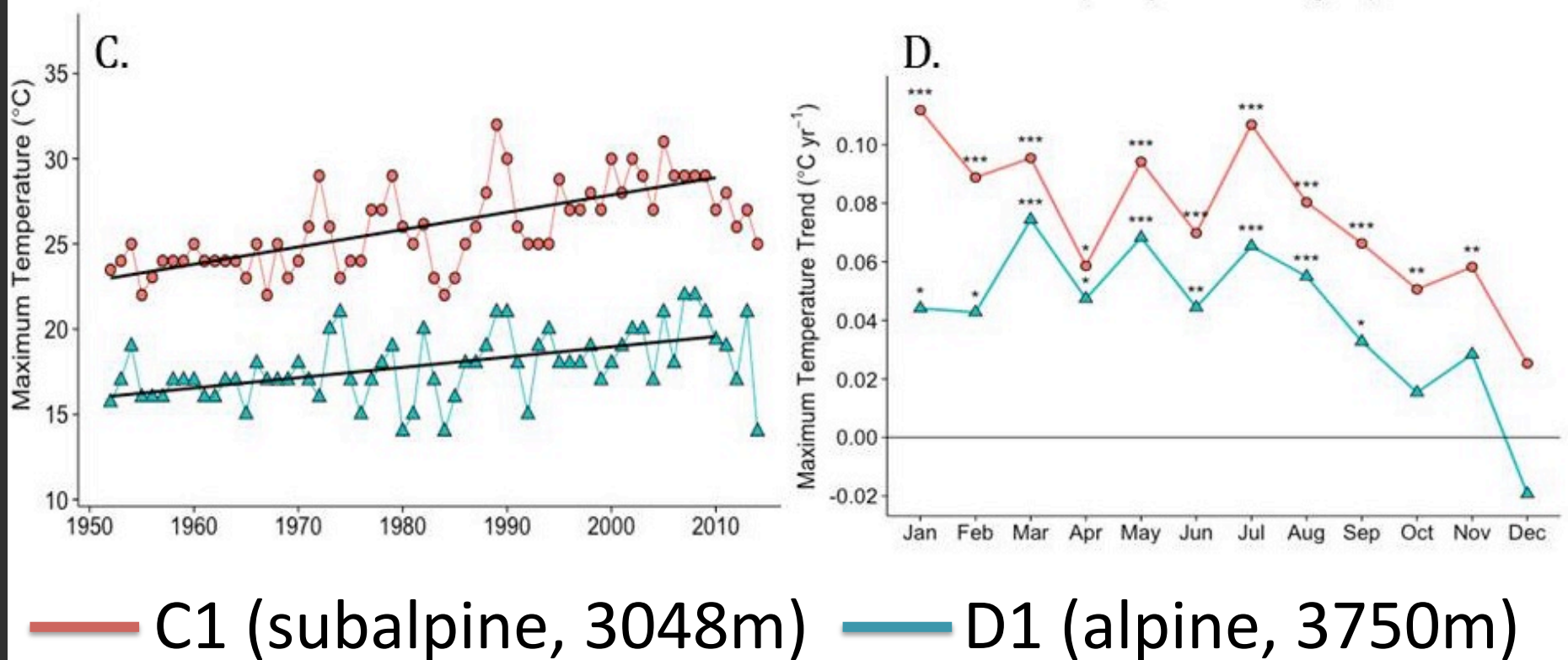
Soil H₂O (kg m²)



Diurnal cycle of GPP



Warming trends at Niwot



Ecosystem response to extended **summer**