Using the CLM 5.0 to detect canopy stress patterns in a temperate mixed forest at Weierbach catchment, Luxembourg

_____
C.D. Jiménez-Rodríguez, M. Sulis, S. Schymanski, K. Mallick, G. Fabiani, R. Schoppach

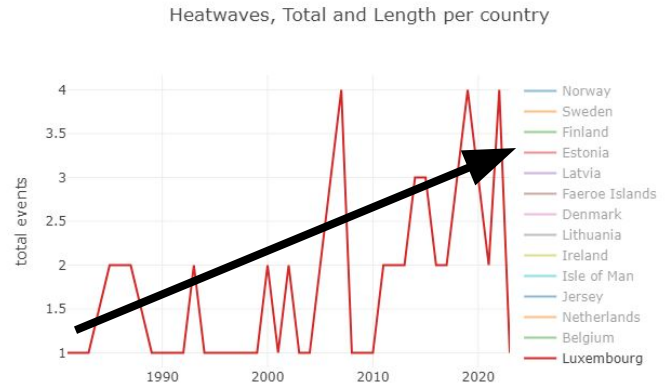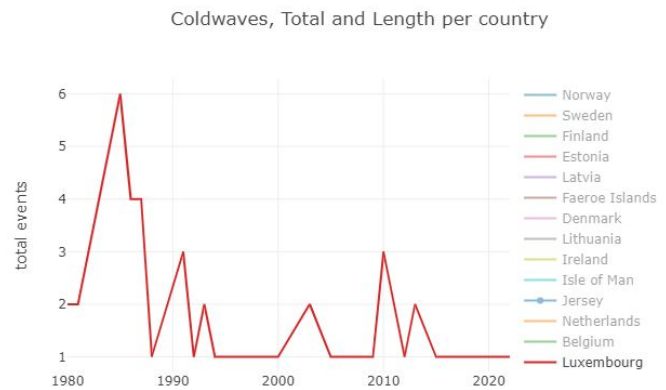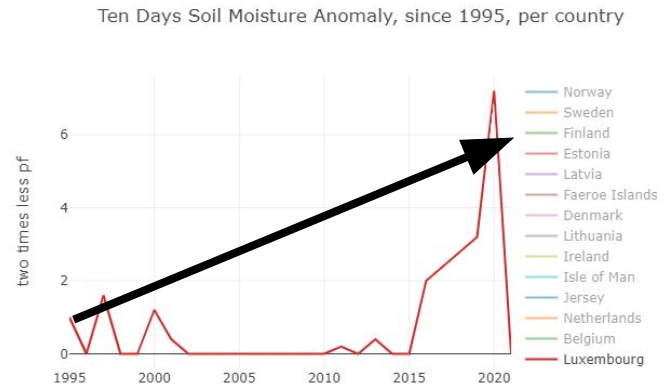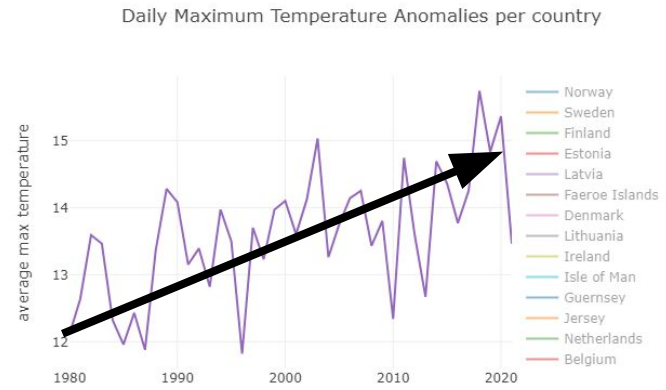**Considering that:**

- CLM provides a good tool to assess the hydraulic stress experienced by vegetation.

- CLM can be used to identify vegetated areas more susceptible to hydraulic stress.

- Current weather patterns in Luxembourg have increased the vegetation stress.
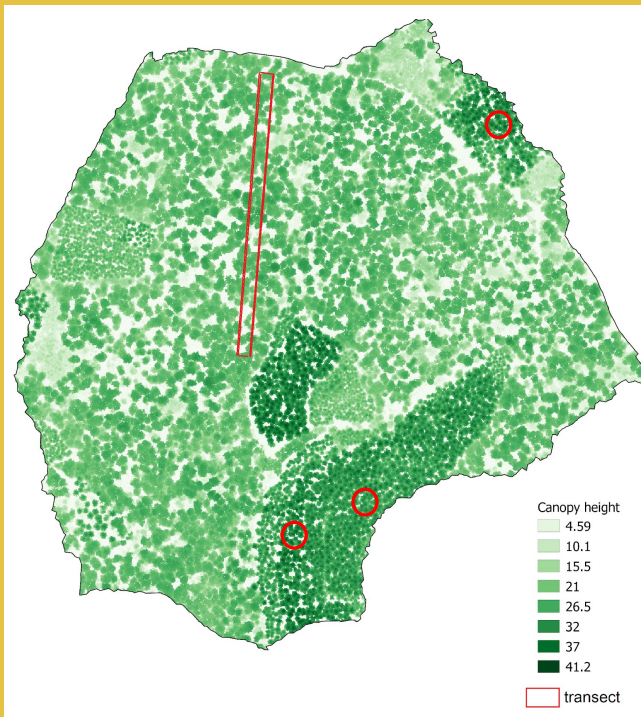

Current climate conditions in Luxembourg according to the European Drought Observatory

2015,2018,2019,2020

Source: https://edo.jrc.ec.europa.eu/edov2/php/index.php?id=1059

Canopy height
- 4.59
- 10.1
- 15.5
- 21
- 26.5
- 32
- 37
- 41.2
- transect
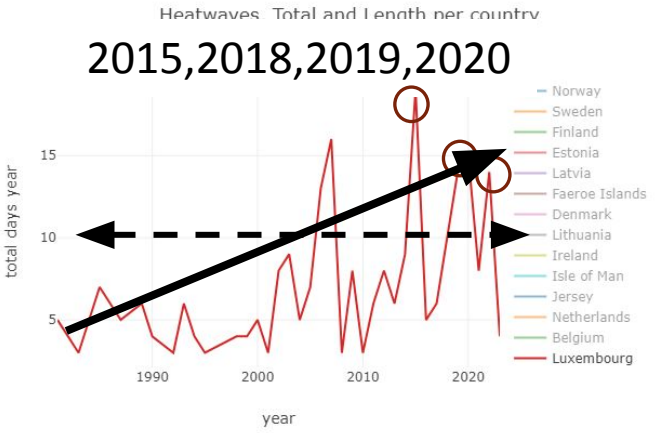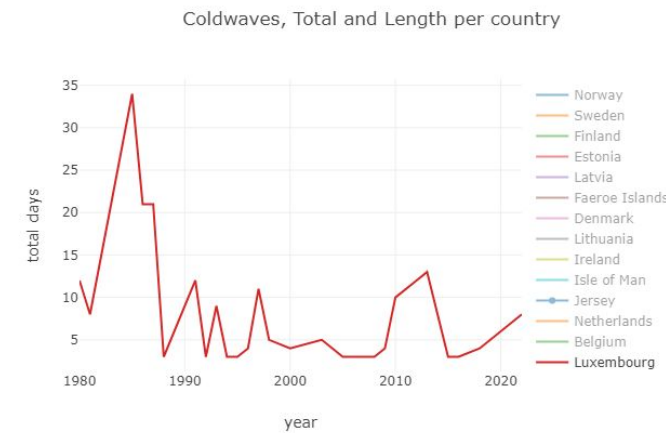
The Weierbach catchment provides a great field laboratory to test the impact of recent heat waves in Luxembourg.

Plant Functional Type	Broadleaf Deciduous Forest		Needleleaf Evergreen Forest	
Species	Oak	Beech	Douglas Fir	Spruce
Area per PFT (%)	77.6		22.4	
Stand Basal Area (m² ha⁻¹)	13.1	19.0	32.7	14.4
Tree Density (trees ha⁻¹)	67	235	149	170
Sampling Area (%)	2.04		0.92	

$$E_{\mathrm{T}} = \sum_{\mathrm{sp}=1}^{n} \left(10^{-3} \frac{\bar{Q}_{\mathrm{sp}} \cdot N_{\mathrm{sp}}}{A} \right)$$
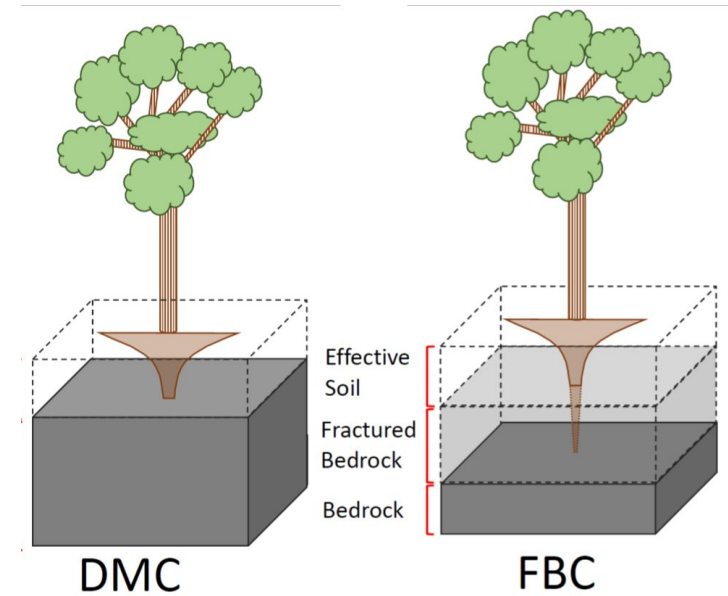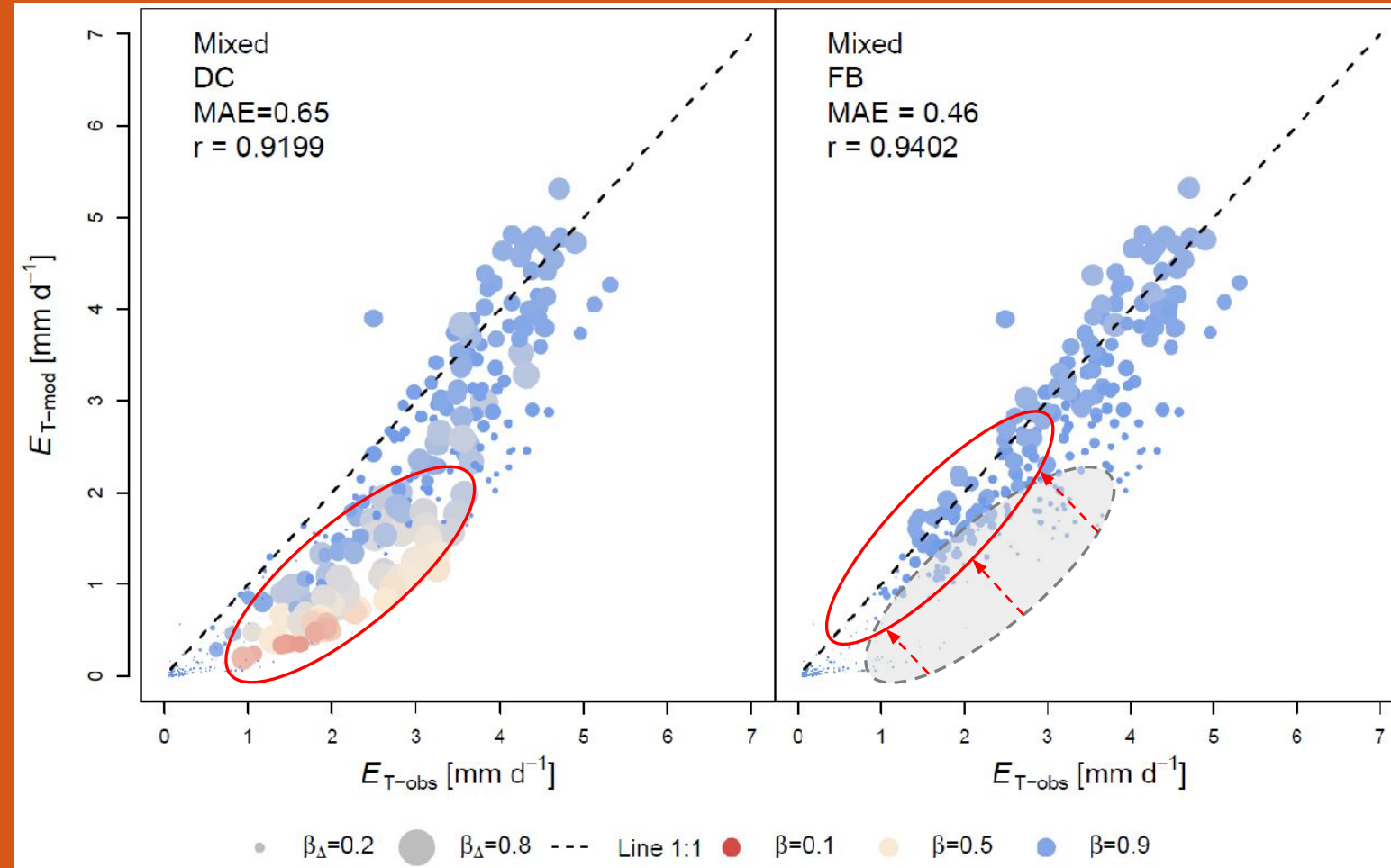
Atmospheric forcing based on Roodt station (~ 5km) and ERA 5

Lower Boundary Conditions based on Glaser *et al.* (2016)
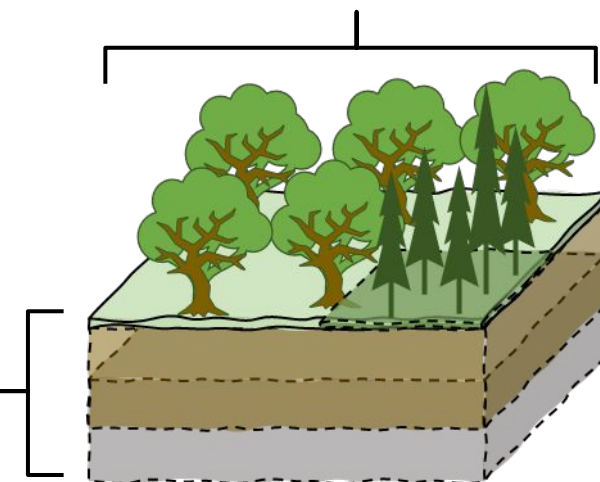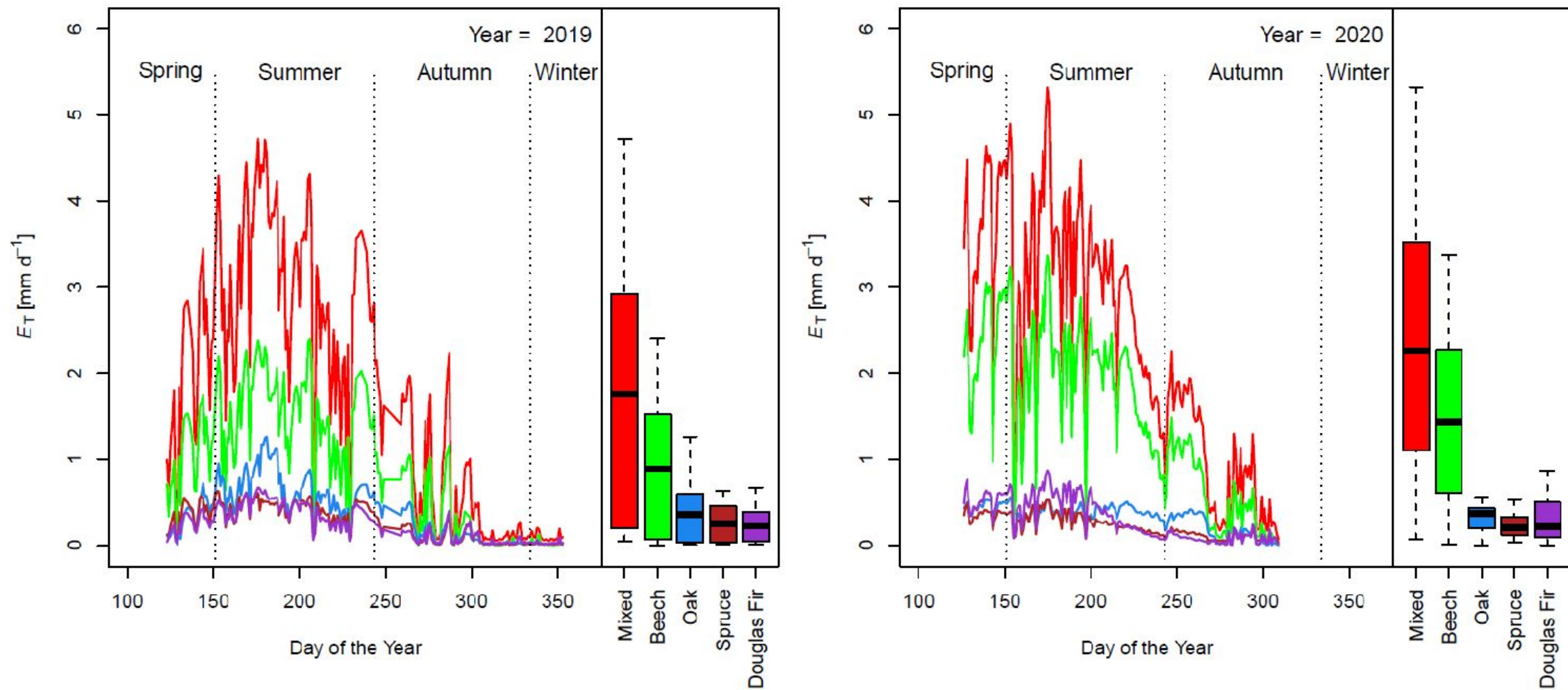
- Larger contribution of E_T by BDT
- Beech is the main species contributing to E_T.

- Contribution of Oak, Spruce, and Douglas Fir is relatively small at catchment level.

Jiménez-Rodríguez *et al* (2023). Paper in preparation.

Jiménez-Rodríguez *et al* (2022). Biogeosciences.

Jiménez-Rodríguez *et al* (2023). Paper in preparation.

DC has the larger MAE and lower r for ET

FB showed almost no vegetation stress

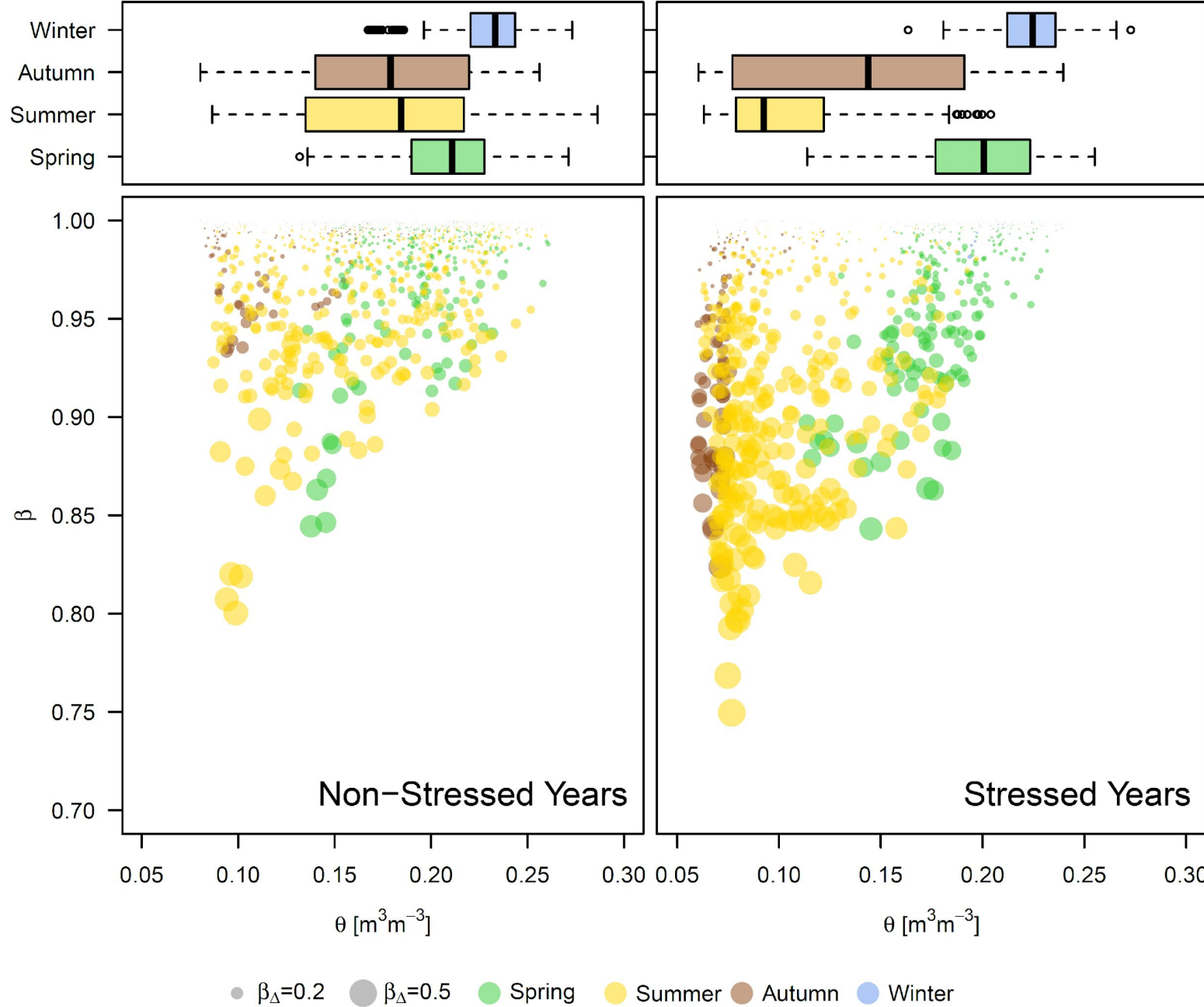How to test the "accuracy" of the vegetation stress modelled by CLM5?
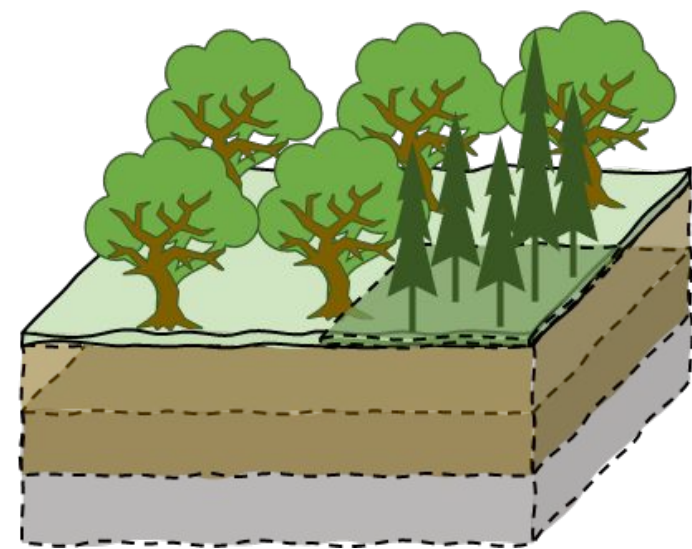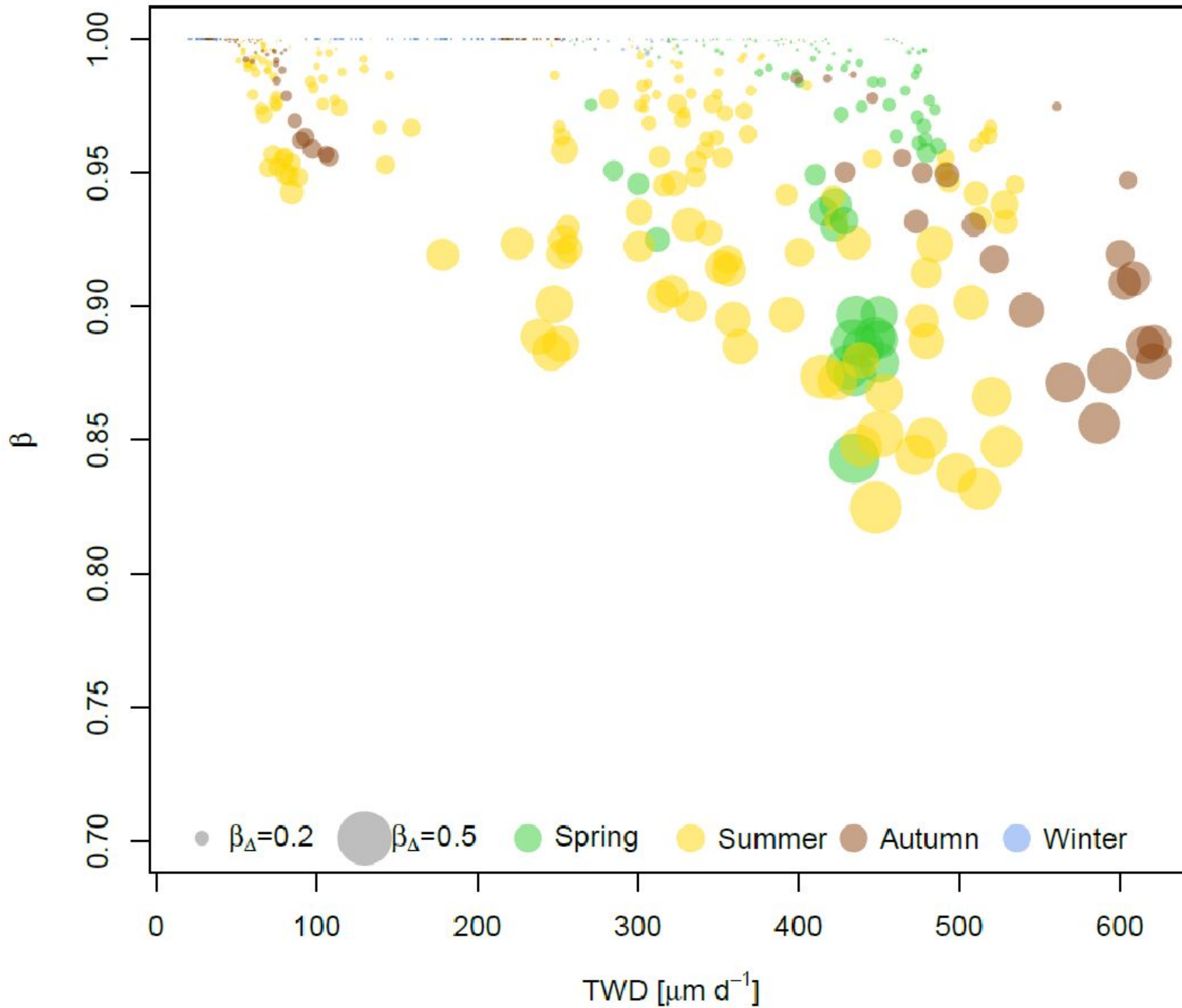
Proposed Approaches

- Remote Sensing Data
- Field data
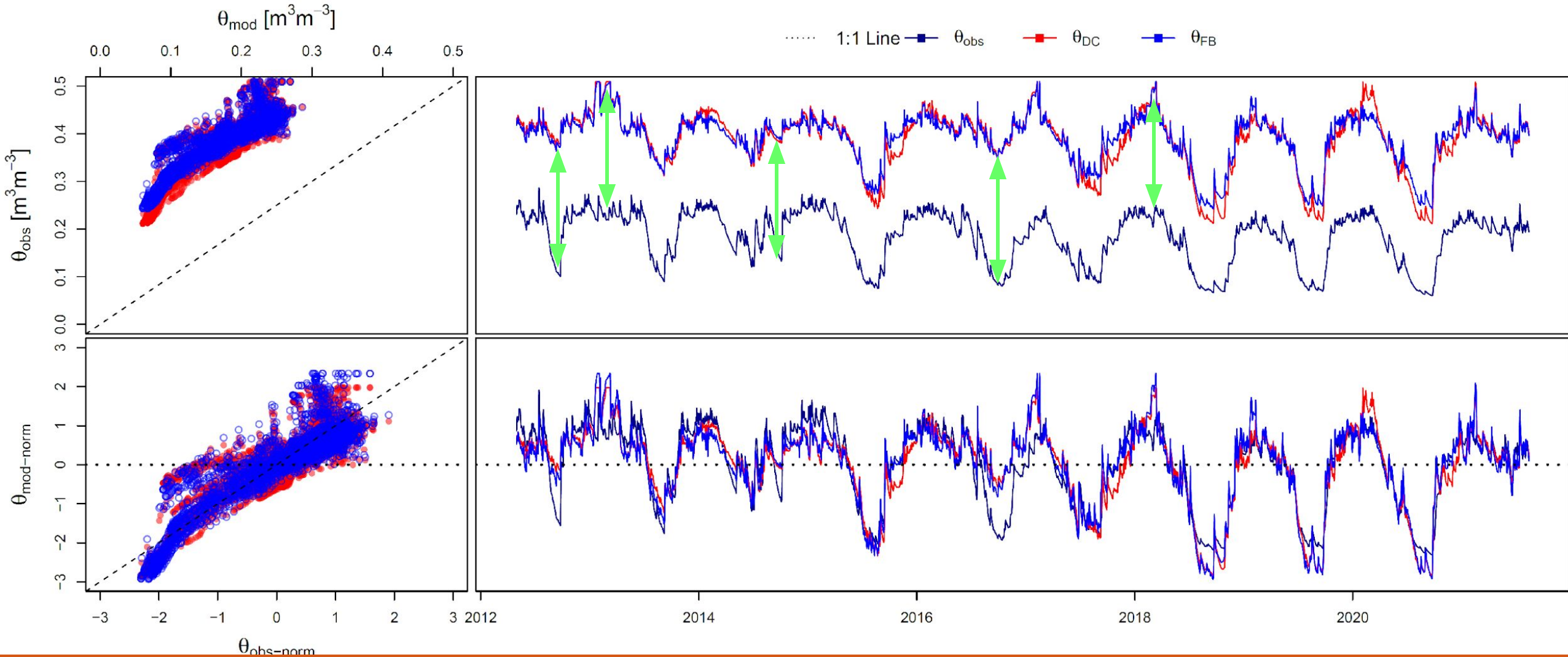
- Both model configurations overestimate the soil moisture measured on site.

- Data standardization shows that CLM5 retrieved the Θ seasonality.

- The lower soil moisture measured during the dry years is reflected in lower β values.

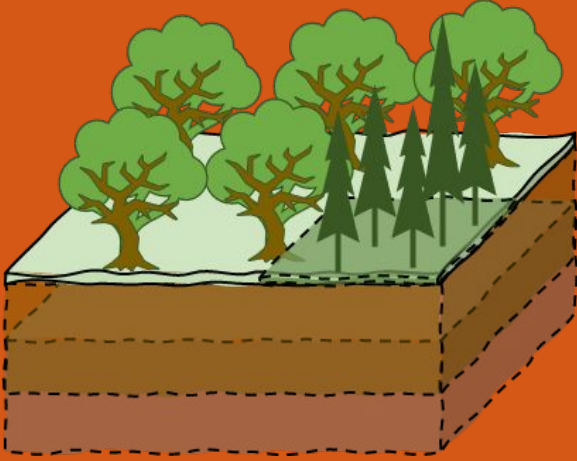- No drastic β values (> 0.5) were showed by the model

- Dendrometers measured the changes in tree circumference.

- Affected by water stress, tree growth, freezing temperatures.

- There is an increment on the average β and β_{Δ} measured on site.

Jiménez-Rodríguez *et al* (2023). Paper in preparation.

Thanks!   ¡Pura Vida!

_____
C.D. Jiménez-Rodríguez, M. Sulis, S. Schymanski, K. Mallick, G. Fabiani, R. Schoppach

LUXEMBOURG INSTITUTE OF SCIENCE AND TECHNOLOGY | LIST

Luxembourg National Research Fund

CAPACITY