

From ecosystem stress to circulation response: Biophysical feedbacks during droughts and heatwaves

Diego G. Miralles

D. Hagan, O. Baez-Villanueva, K. Delbare, V. Deman, J. Geirinhas, C. Decancq, T. Mortier [...]

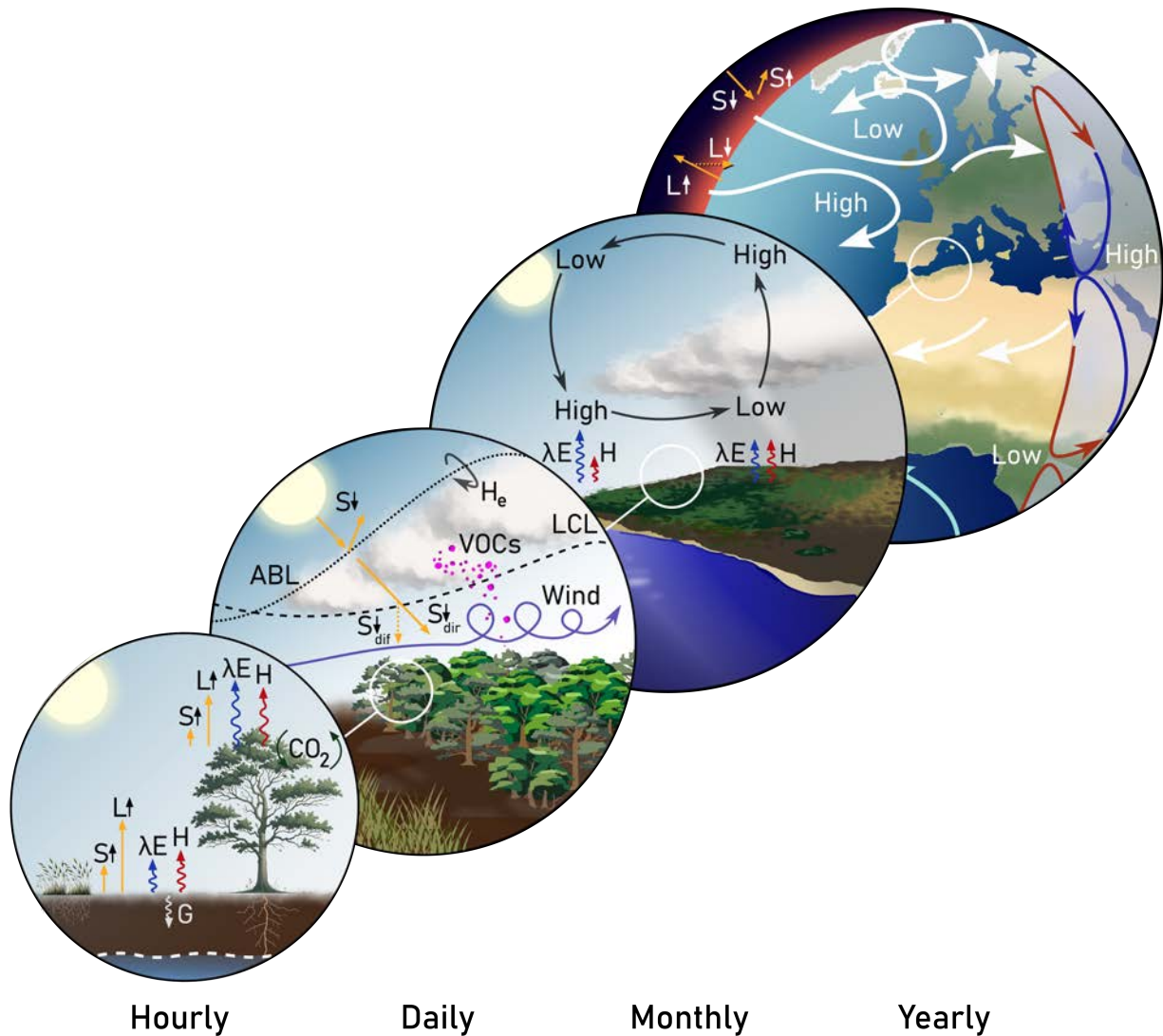


Global

Regional

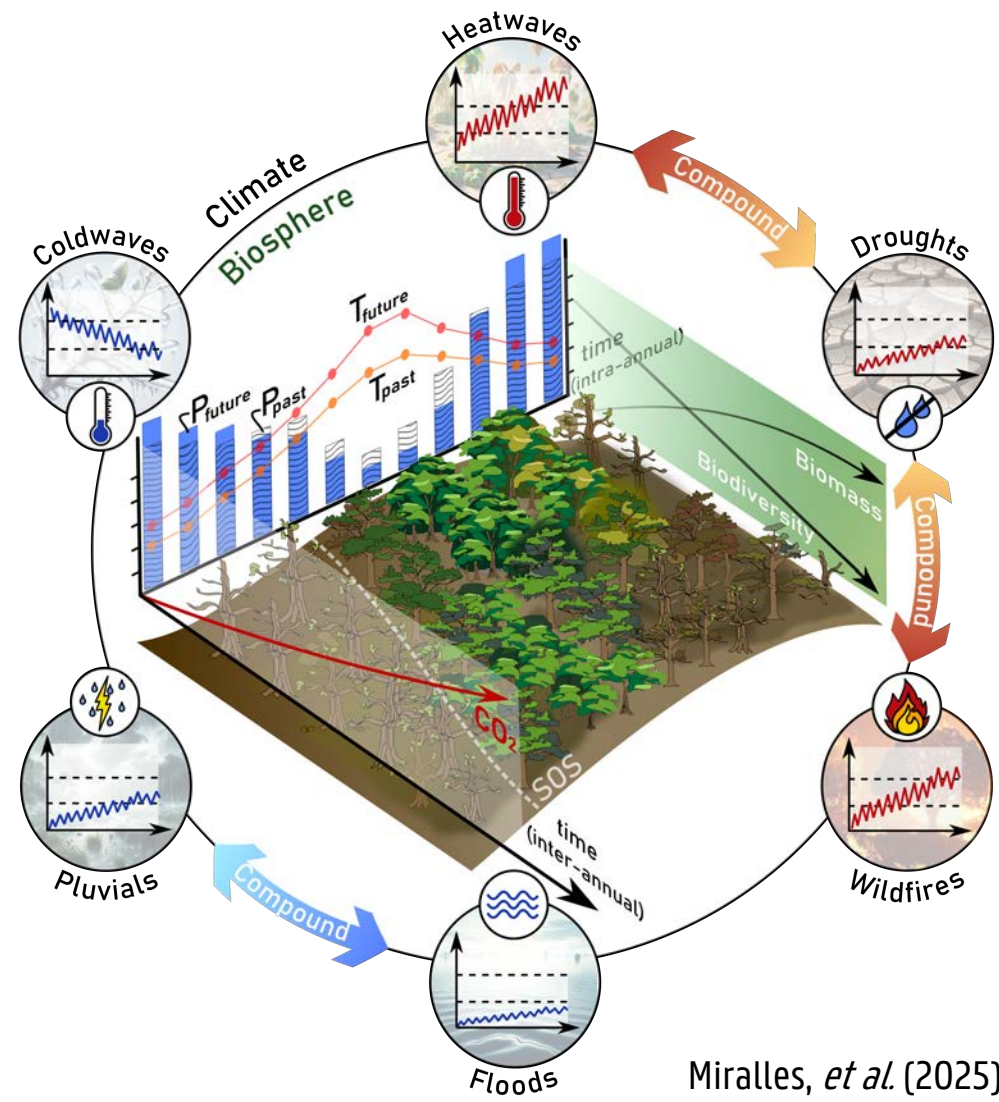
Ecosystem

Local



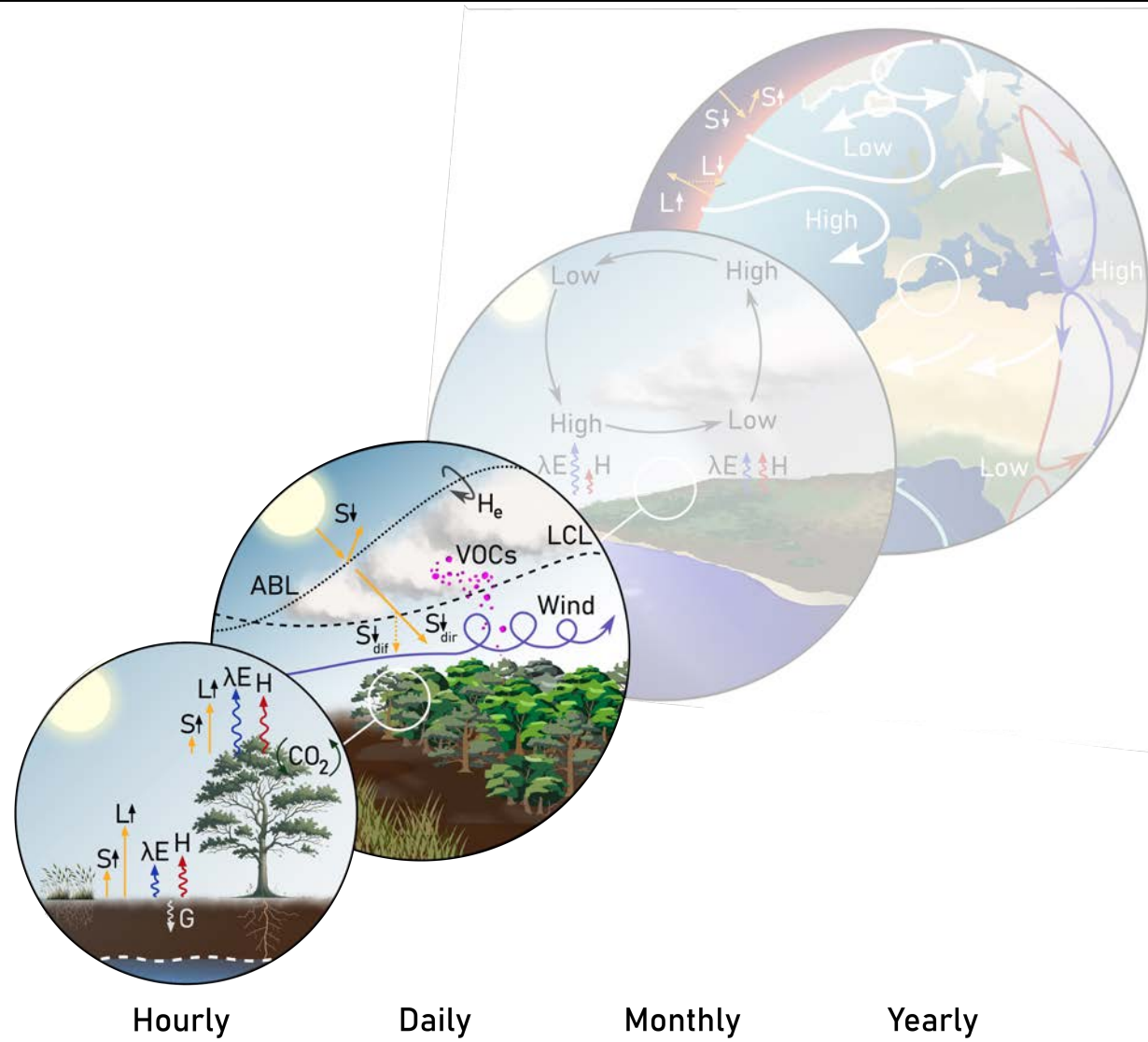
METEOROLOGICAL

CLIMATOLOGICAL



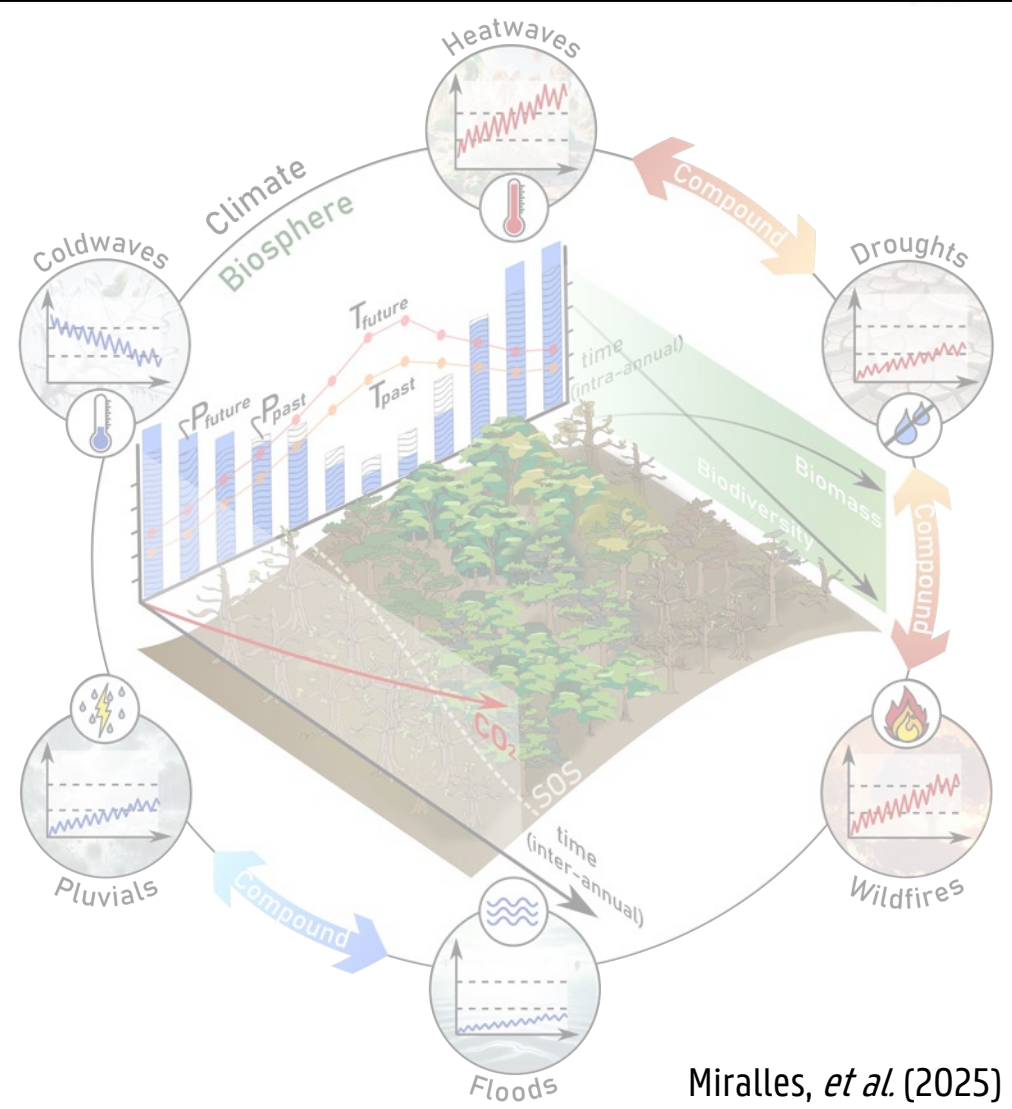


Global
Regional
Ecosystem
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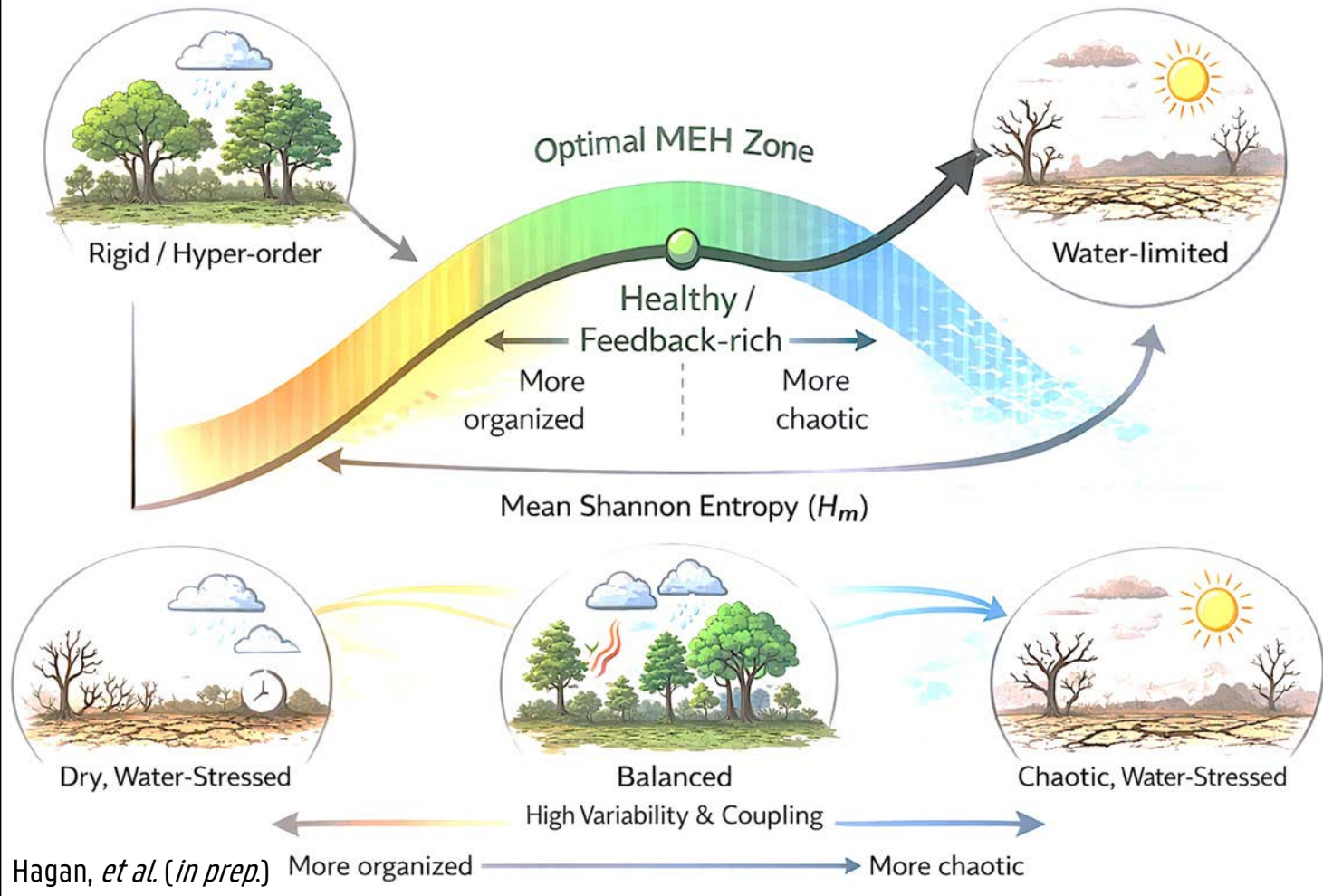
METEOROLOGICAL

CLIMATOLOGICAL





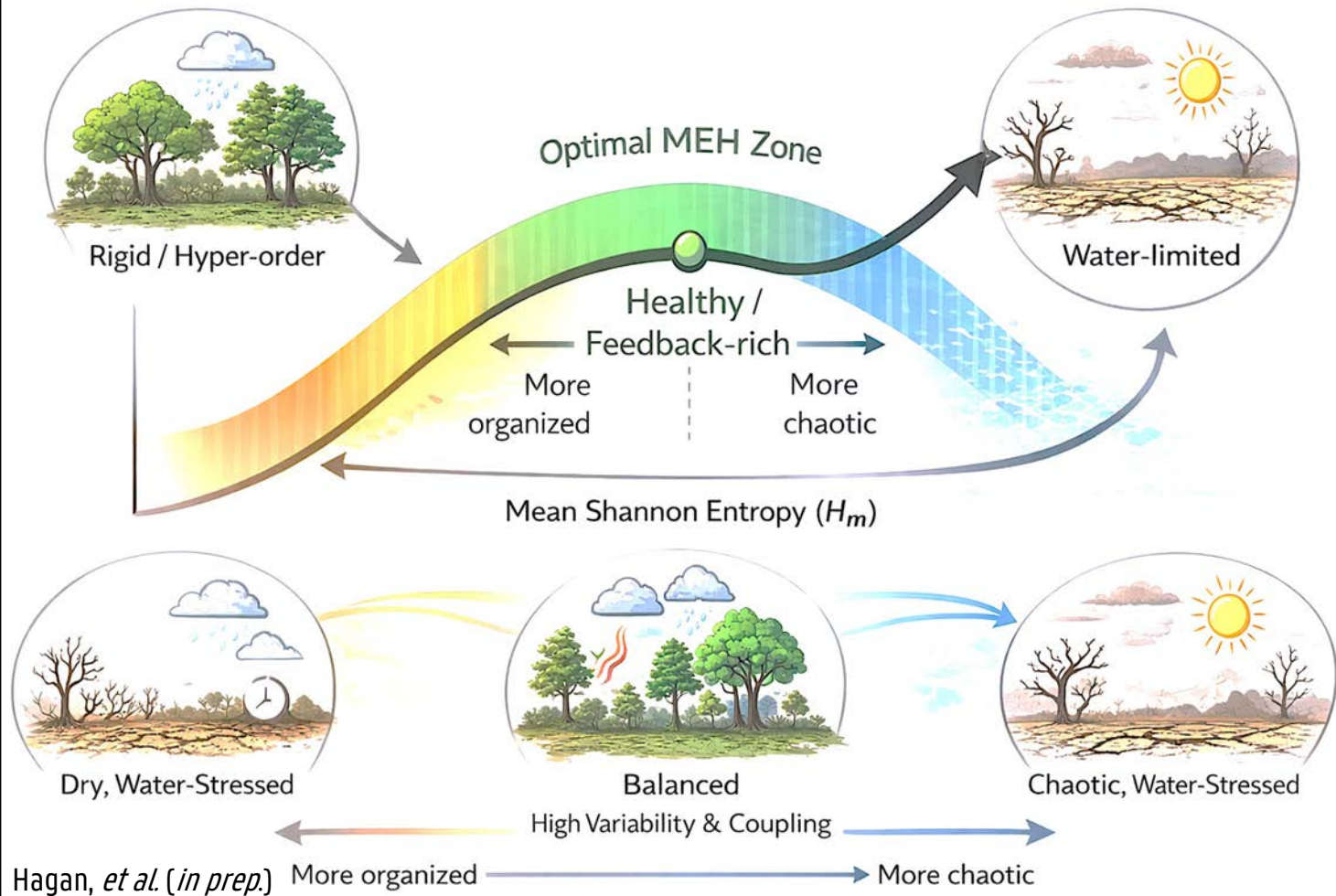
IPH / MEH – Information Production and Moderate Entropy Hypotheses



- ❖ **Information theory** to understand ecosystem stress and biophysical feedbacks on climate
- ❖ Each biome has a characteristic water–energy envelope where information transport peaks
- ❖ Drought tends to reduce information transport
- ❖ Opens the possibility to diagnose resilience and recovery from information theory



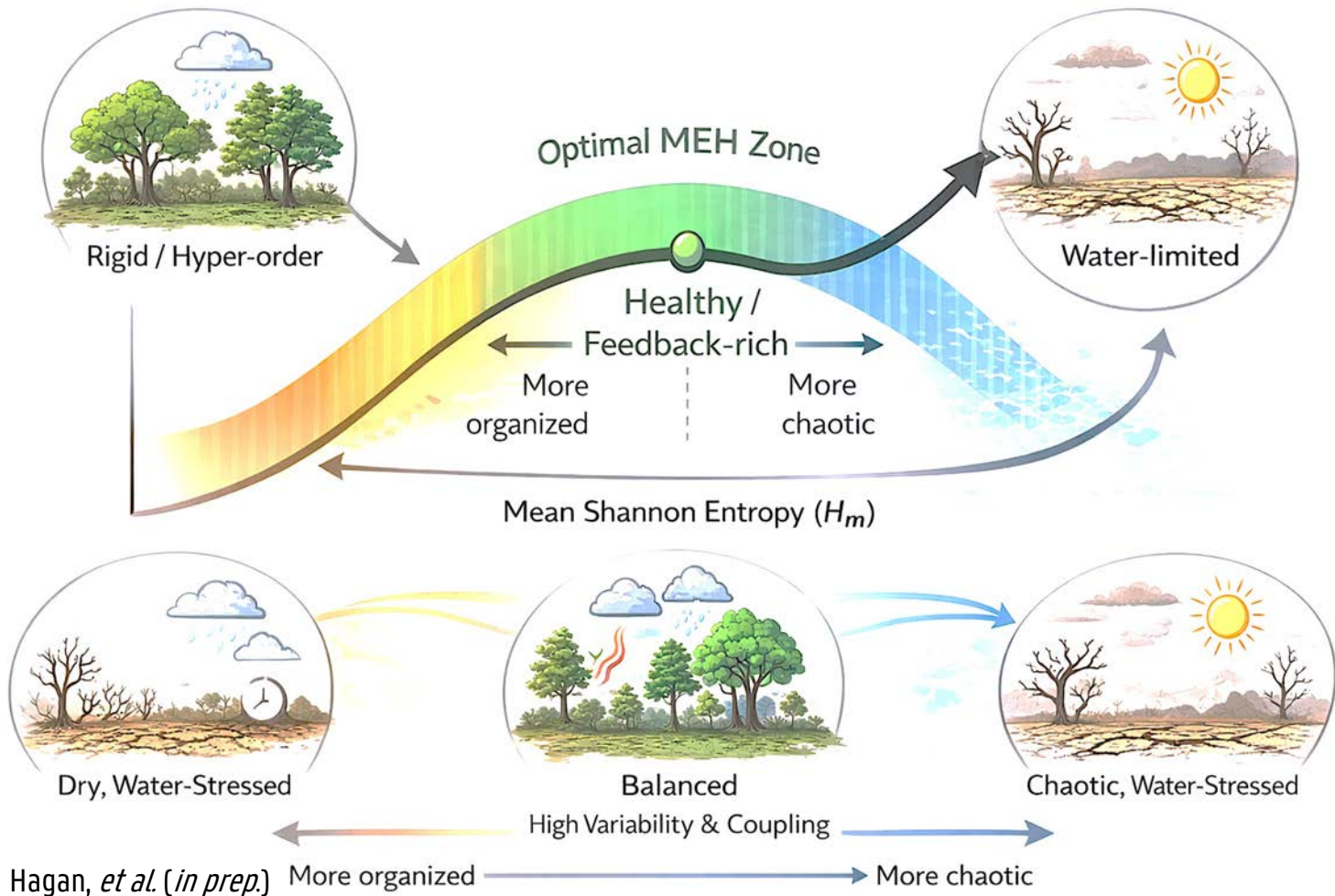
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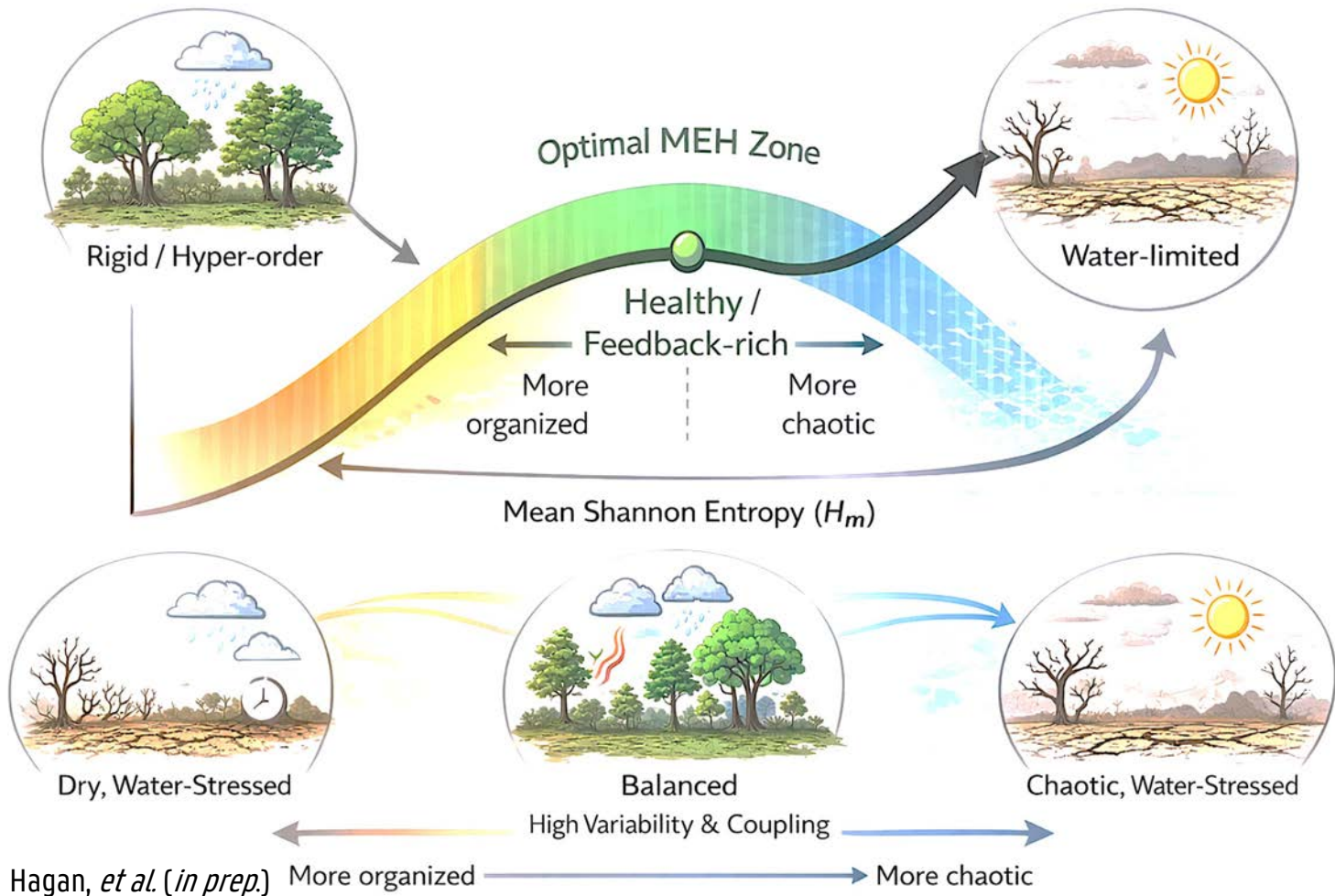
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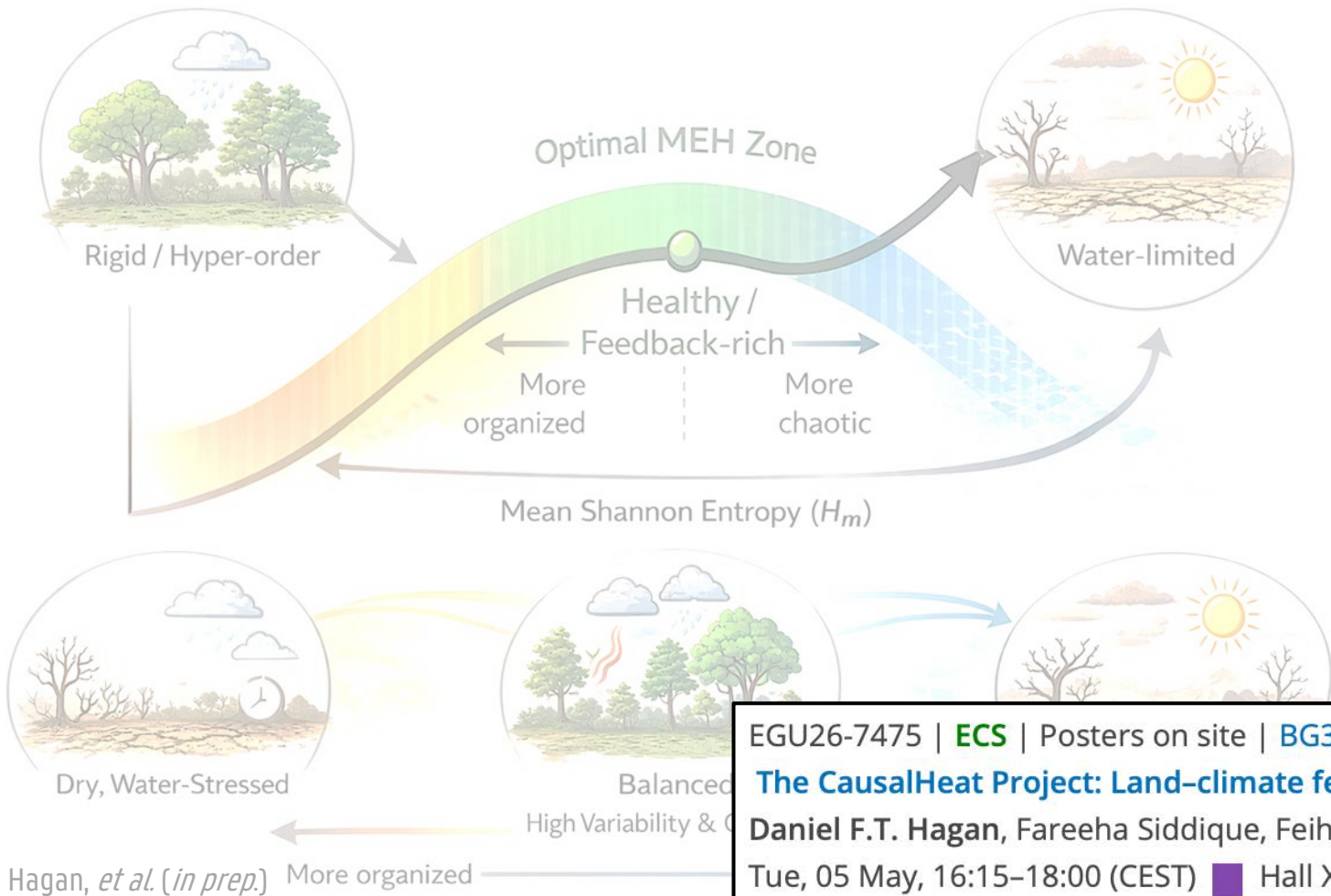
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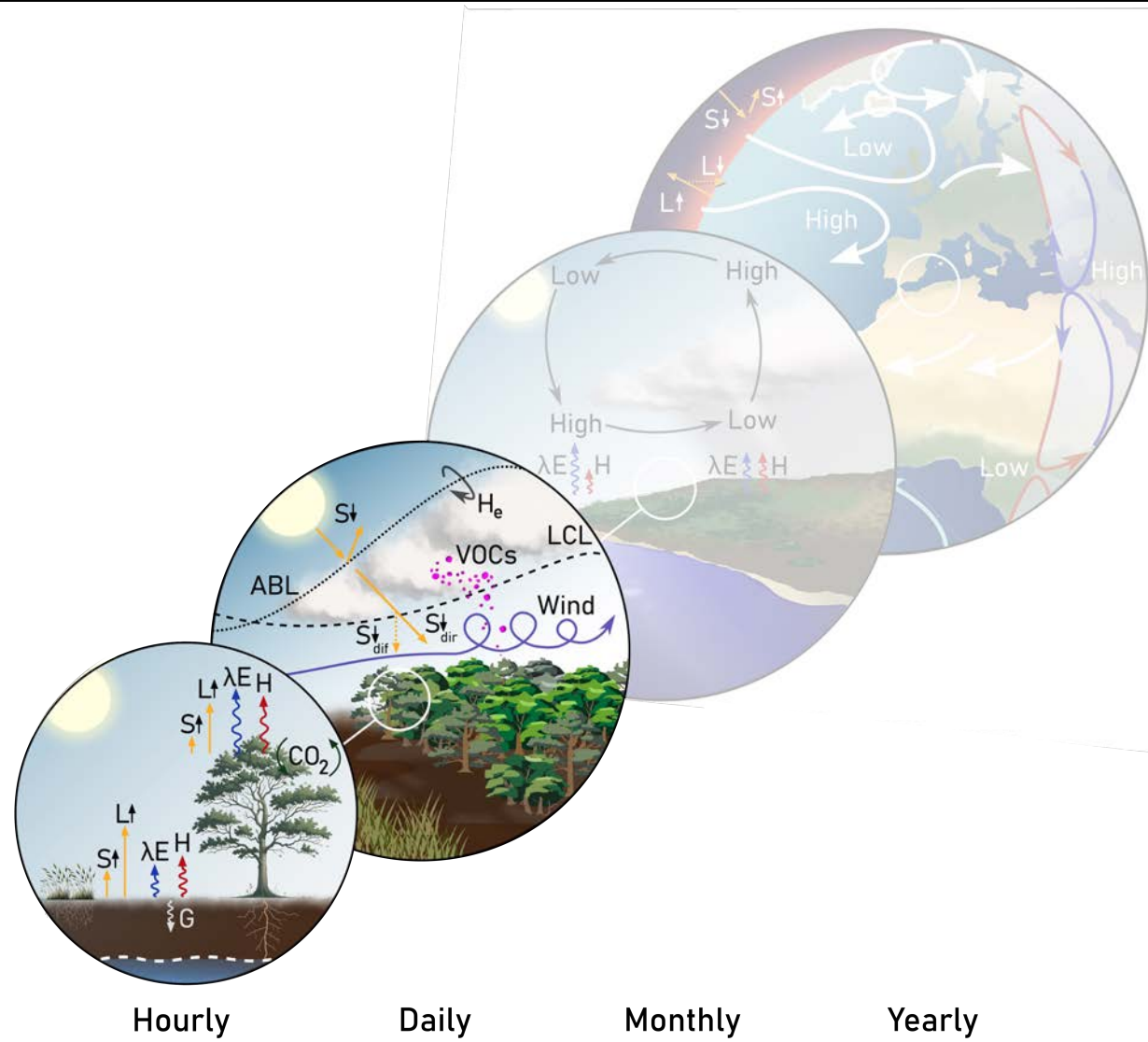
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EGU26-7475 | **ECS** | Posters on site | **BG3.37** ★
The CausalHeat Project: Land–climate feedbacks shaping ecosystem vulnerability to dry–hot extremes
 Daniel F.T. Hagan, Fareeha Siddique, Feihong Zhou, Min Liu, João M. Geirinhas, and Diego G. Miralles
 Tue, 05 May, 16:15–18:00 (CEST) ■ Hall X1 | X1.26

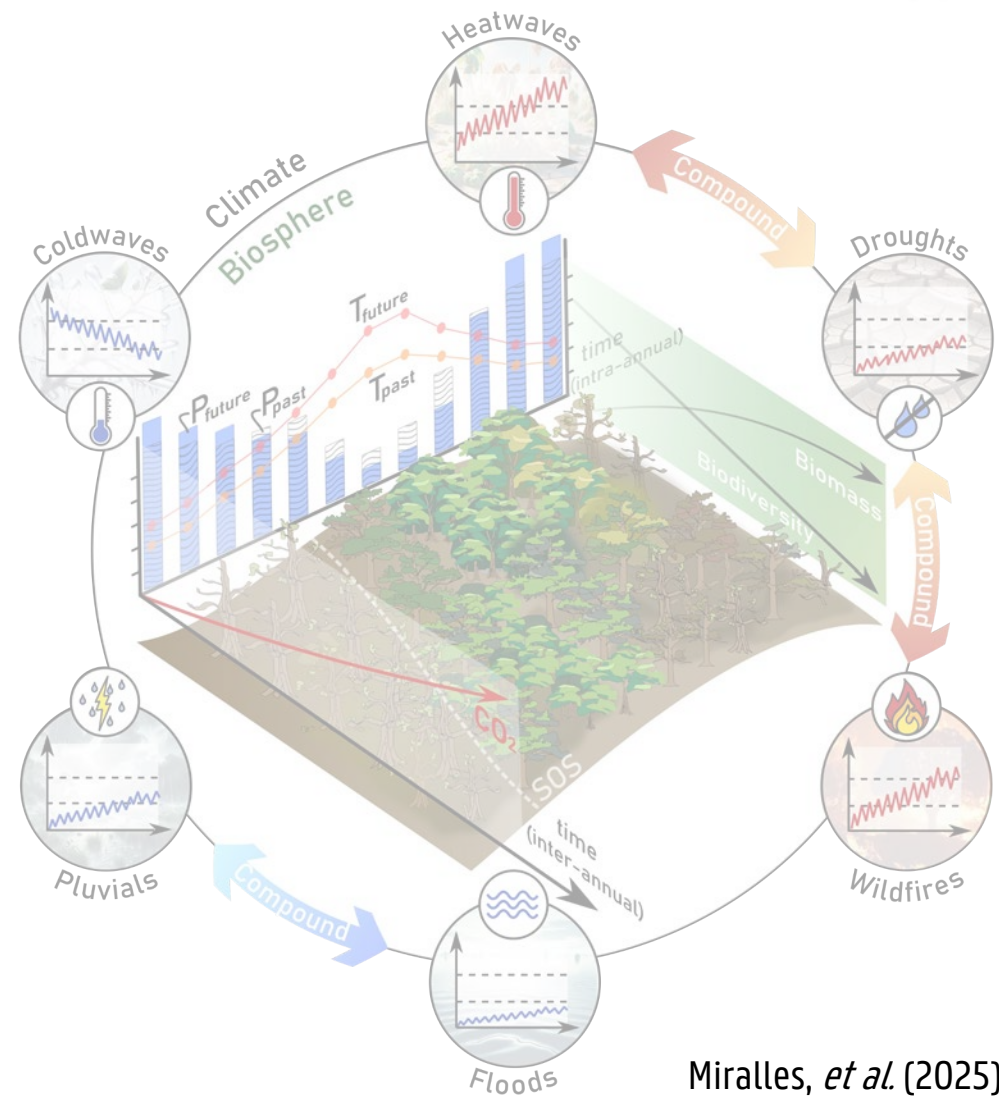


Global
Regional
Ecosystem
Local

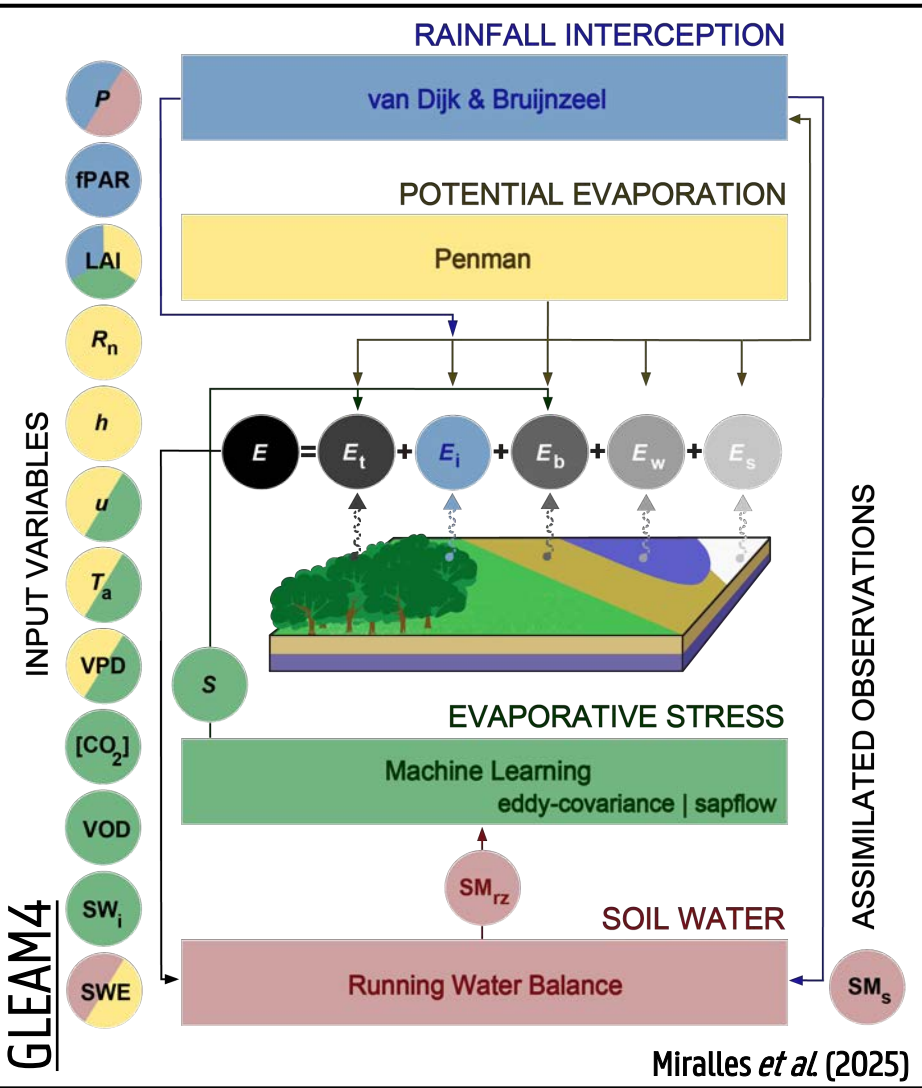


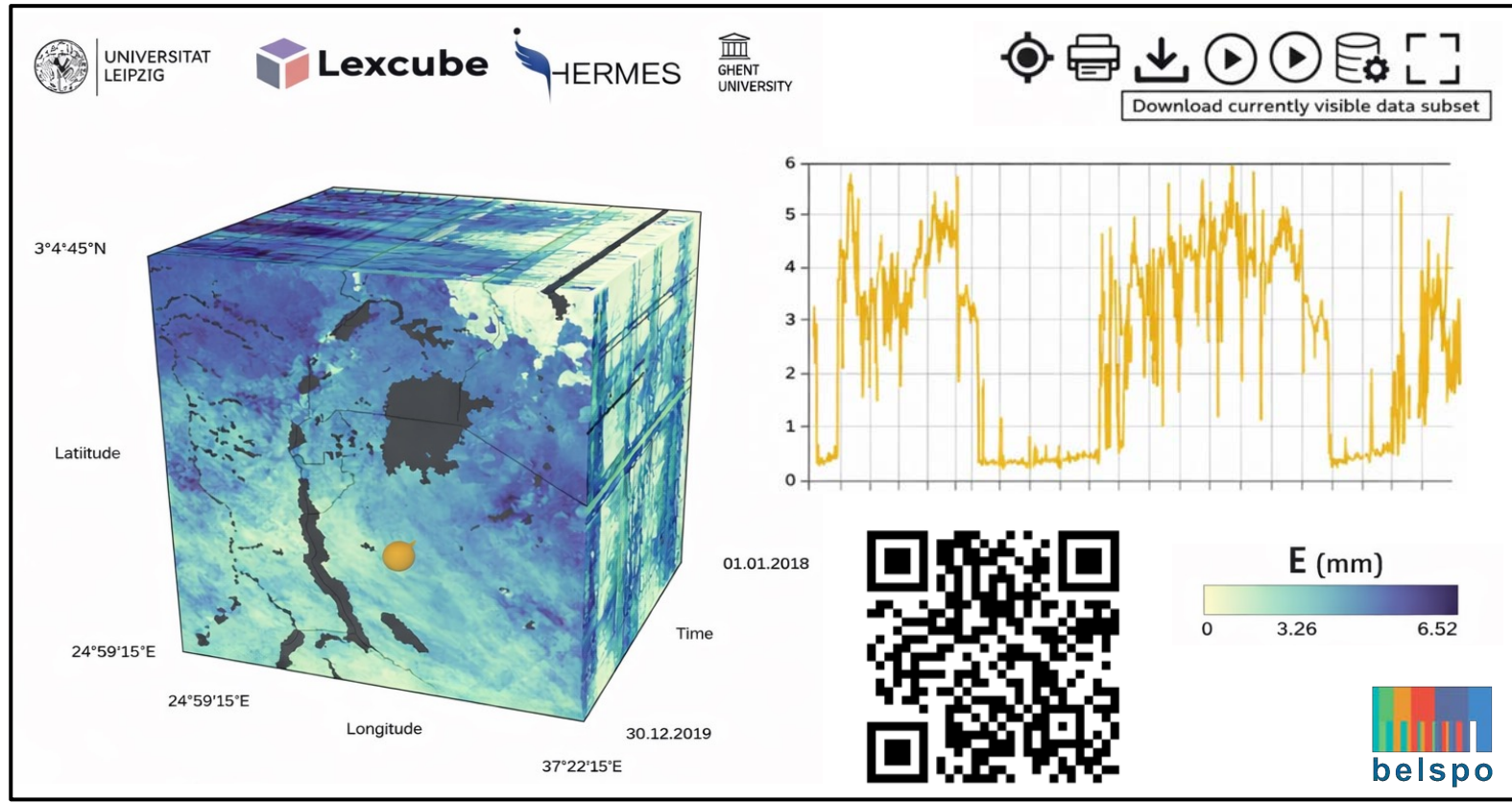
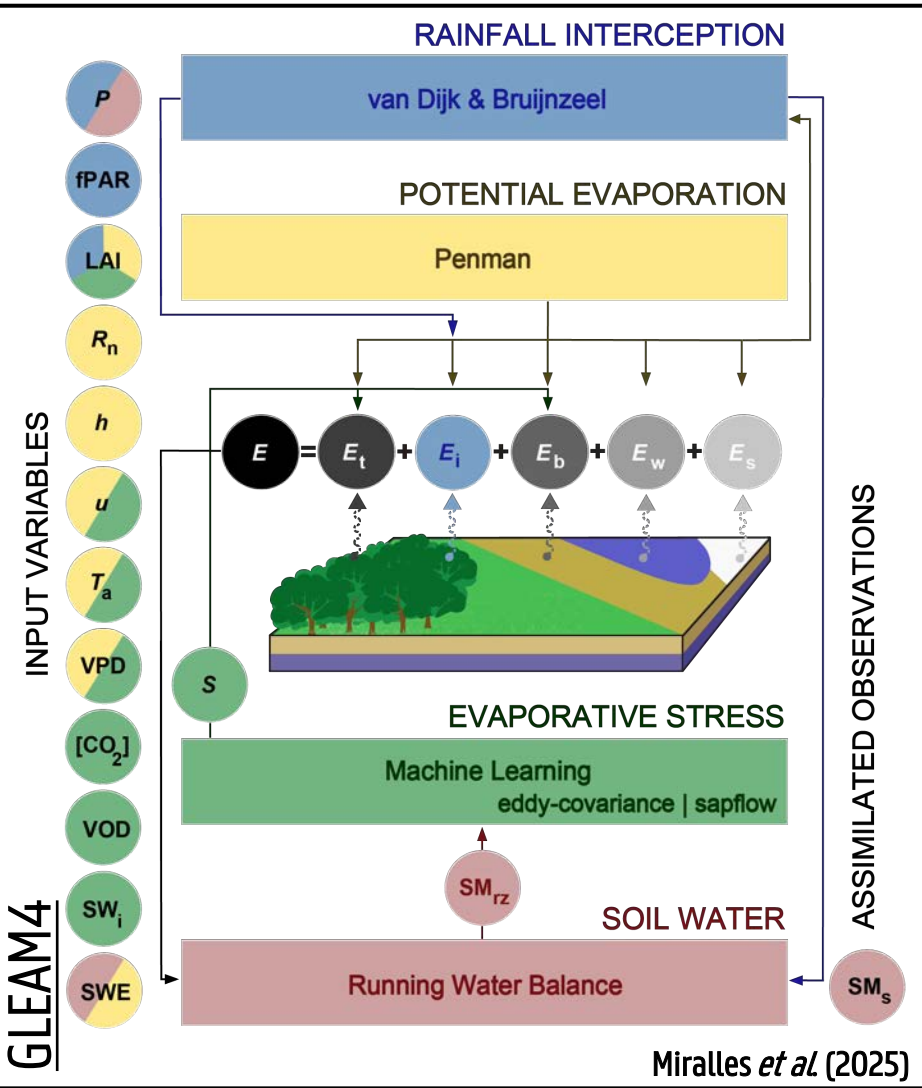
METEOROLOGICAL

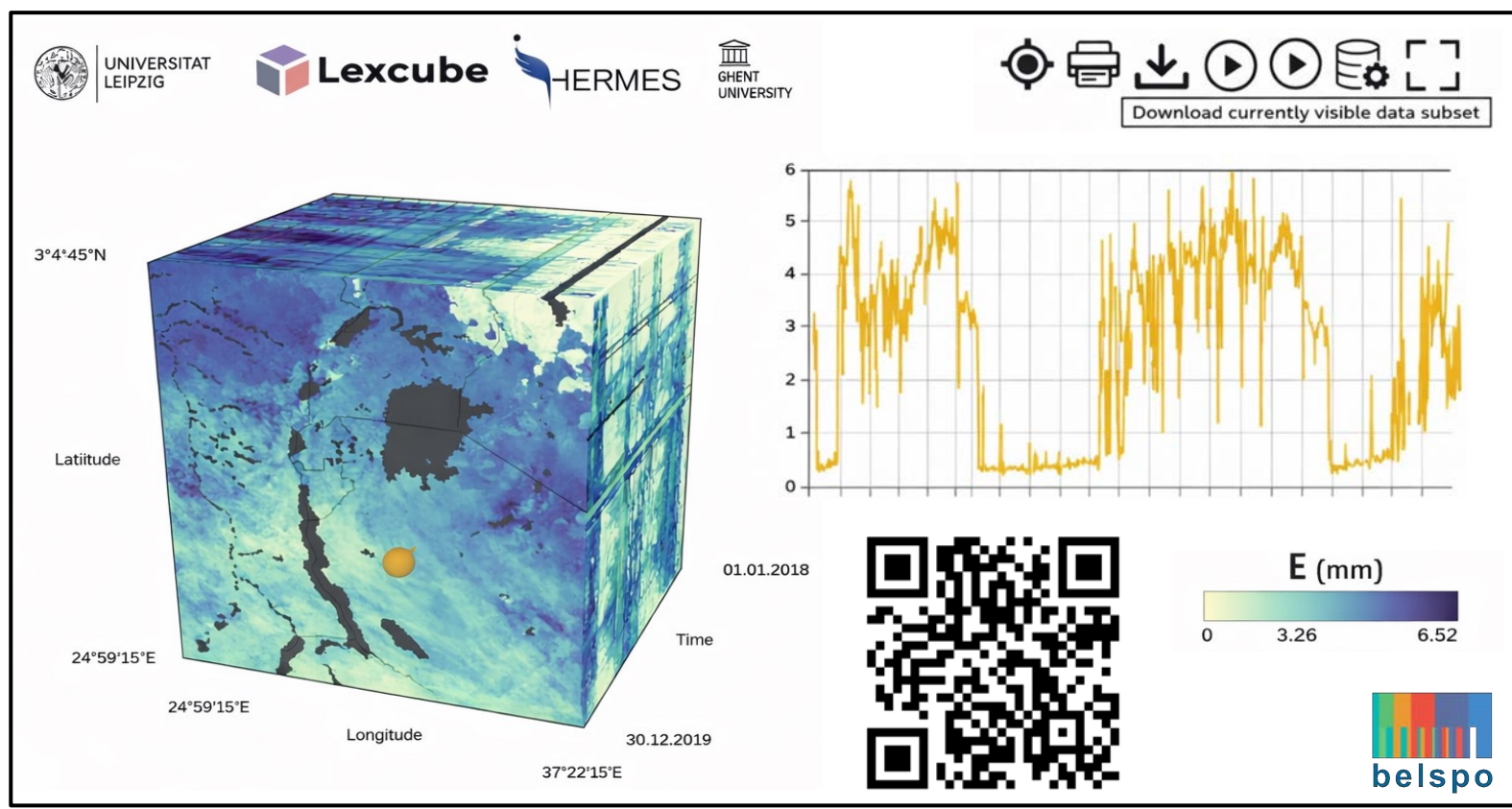
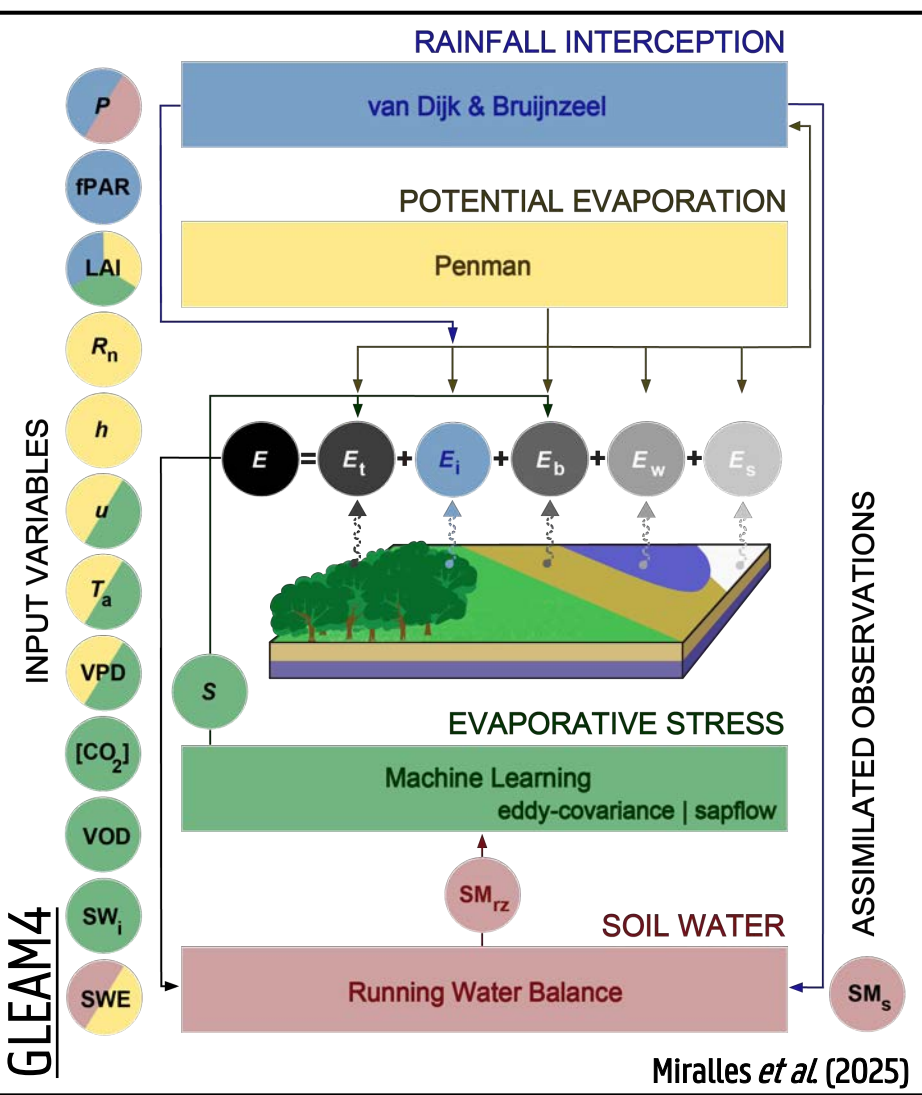
CLIMATOLOGICAL



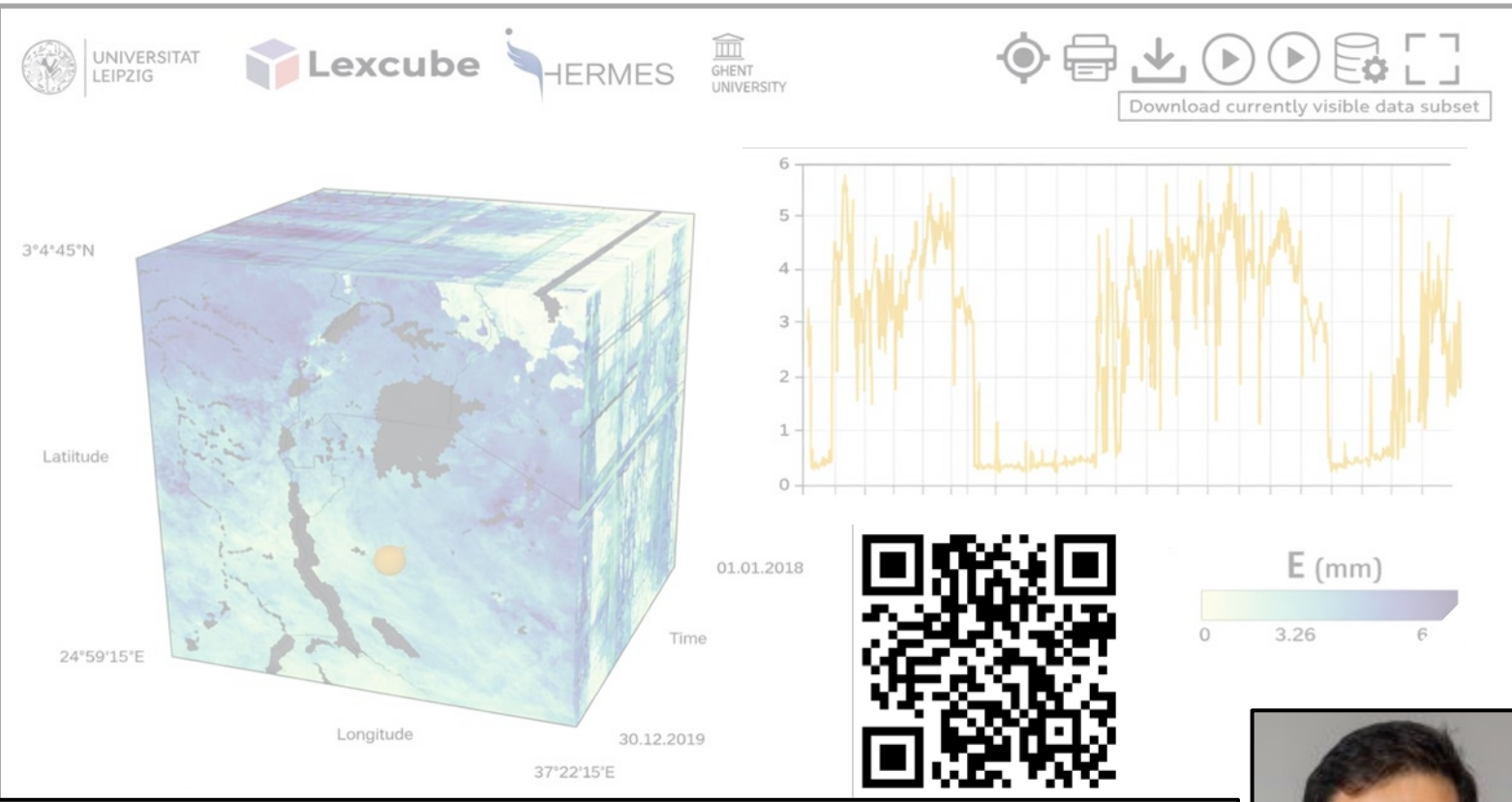
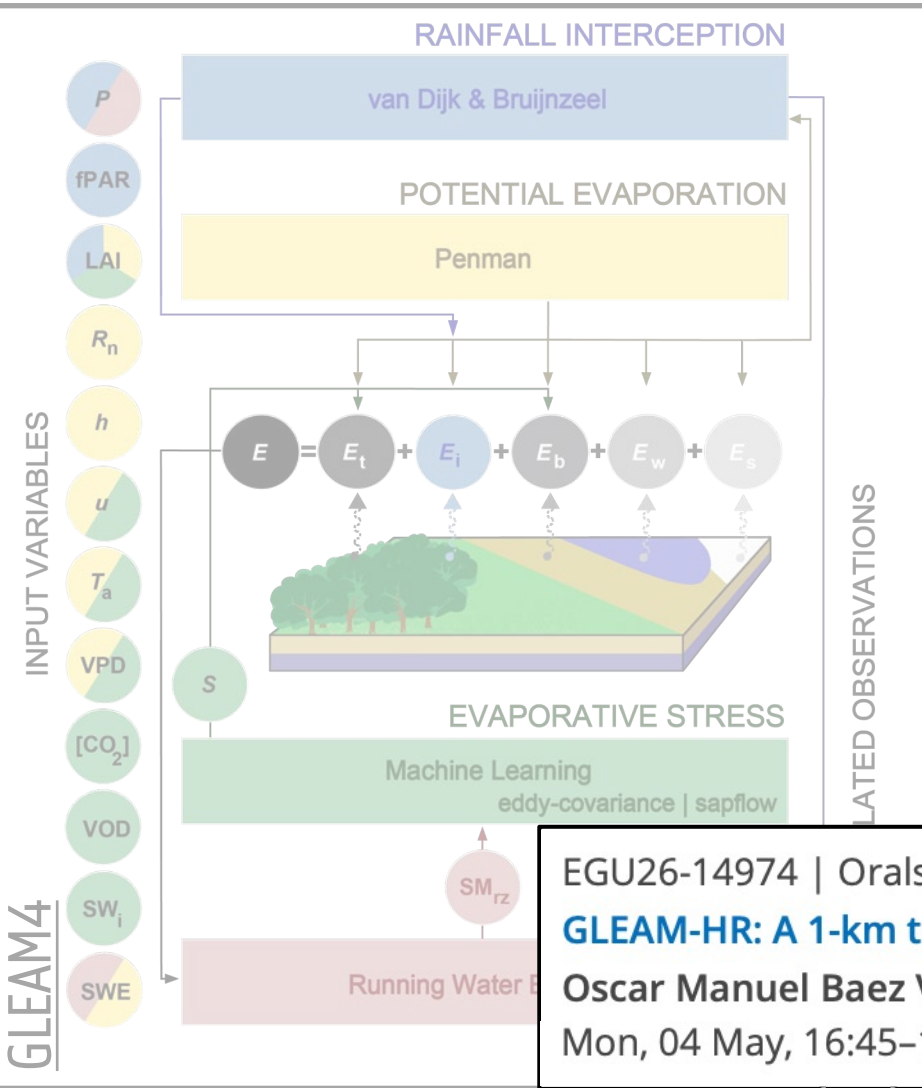
Miralles, *et al.* (2025)







- ❖ New GLEAM4.3 to be released, including **irrigation** influences
 - ❖ Towards: **1-km global**; hybrid model with **online training**
- esa



EGU26-14974 | Orals | **HS6.3** ★

GLEAM-HR: A 1-km terrestrial evaporation dataset with explicit representation of irrigation

Oscar Manuel Baez Villanueva, et al.

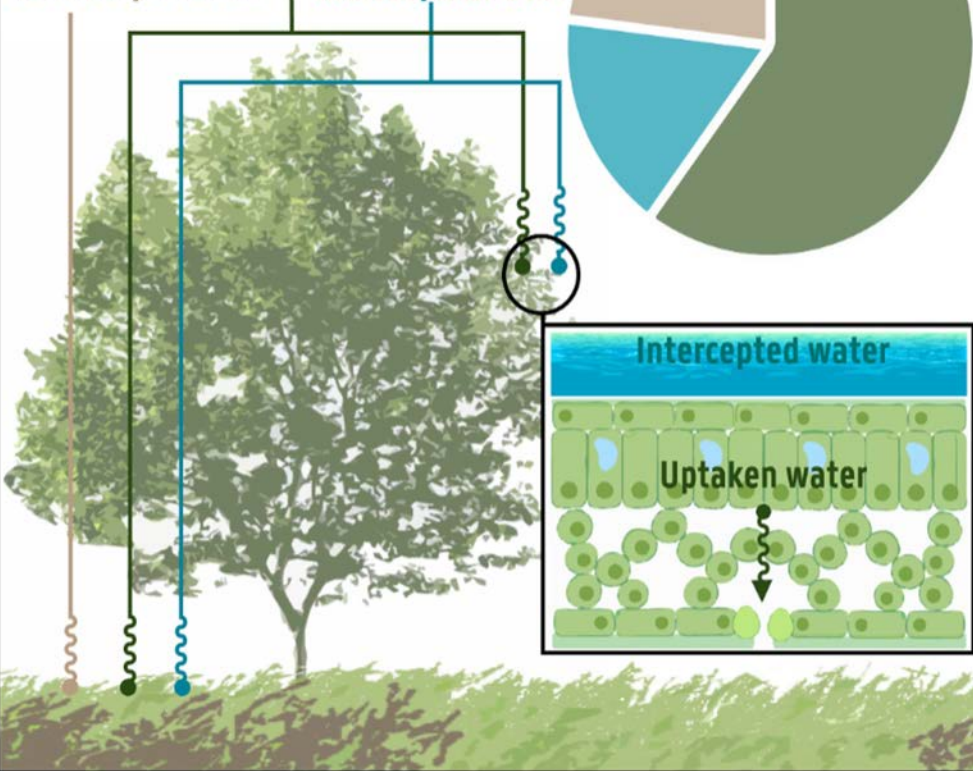
Mon, 04 May, 16:45–16:55 (CEST) ■ Room 2.15





Evaporation | Latent heat flux

Soil evaporation | Transpiration | Interception loss



Miralles *et al.* (2020)



Land Evaporation CCI

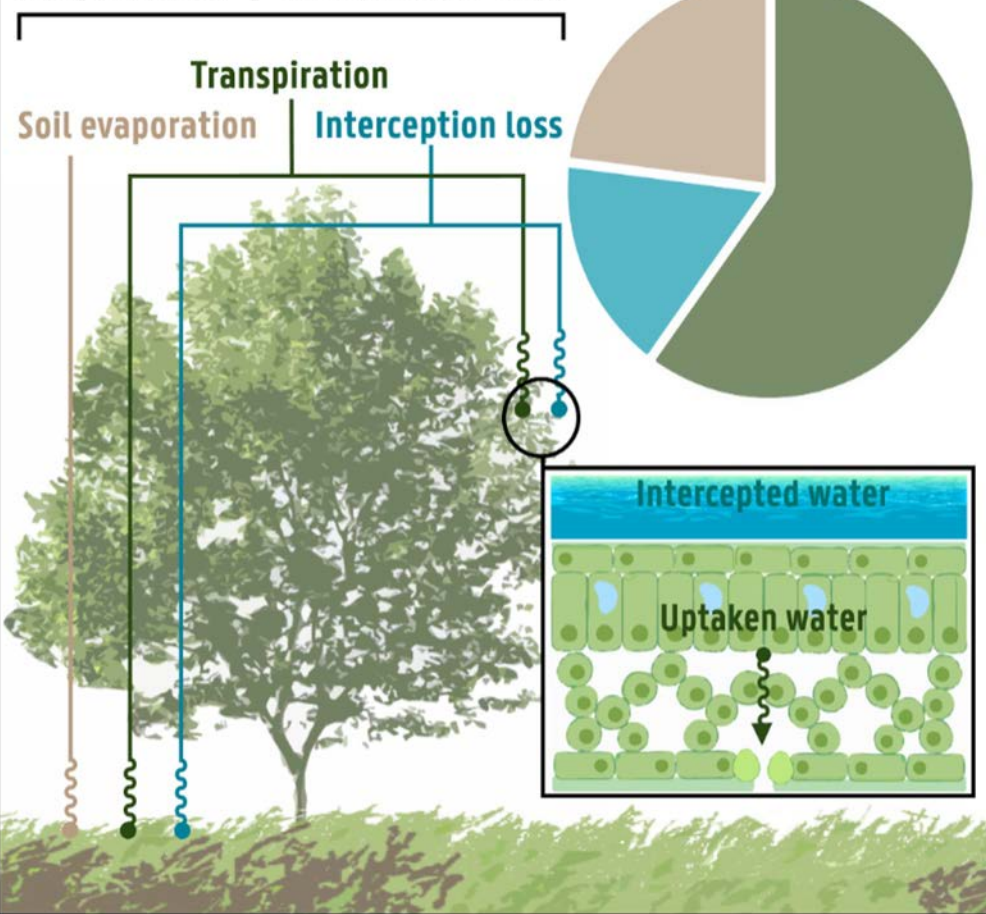
Generating long-term global land evaporation records using Earth observation data



- ❖ **Objective:** to deliver a **new global, long-term, high-accuracy E dataset** fully based on satellite data
- ❖ Including E components and latent/sensible heat flux
- ❖ Modular multi-physics approach to enable algorithm selection and epistemic uncertainty characterisation



Evaporation | Latent heat flux



Miralles *et al.* (2020)



Land Evaporation CCI

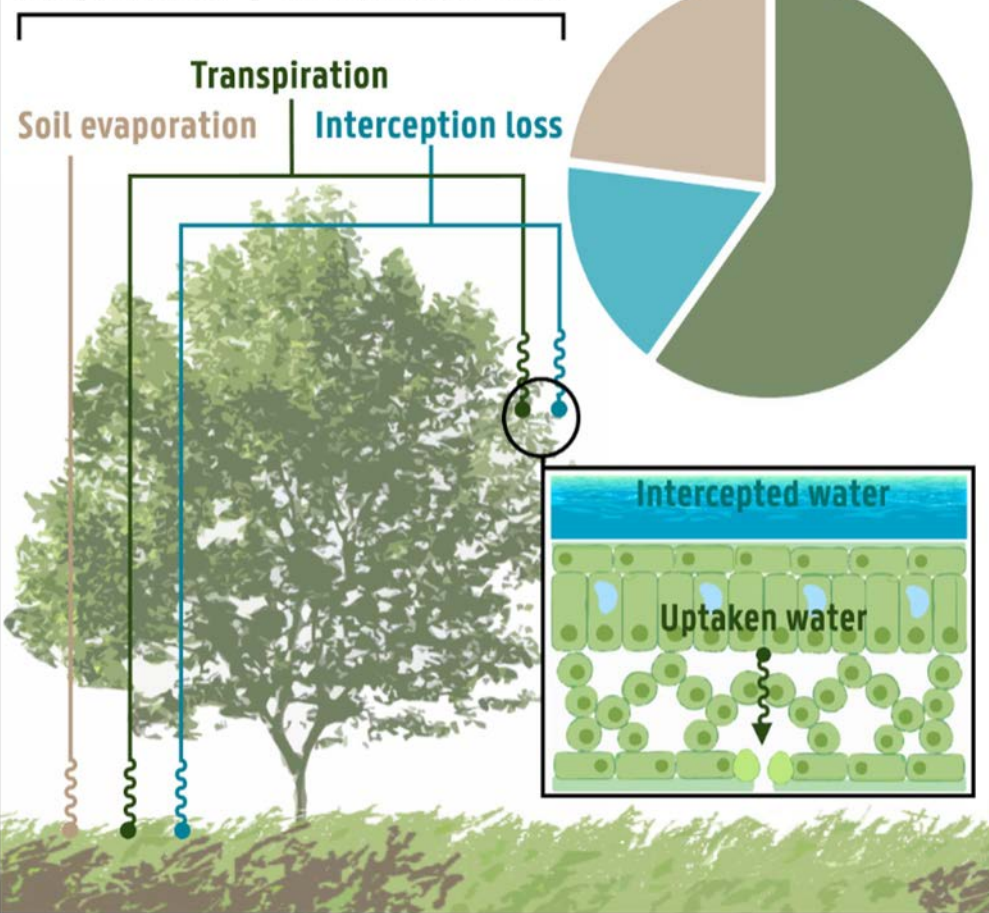
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Miralles *et al.* (2020)



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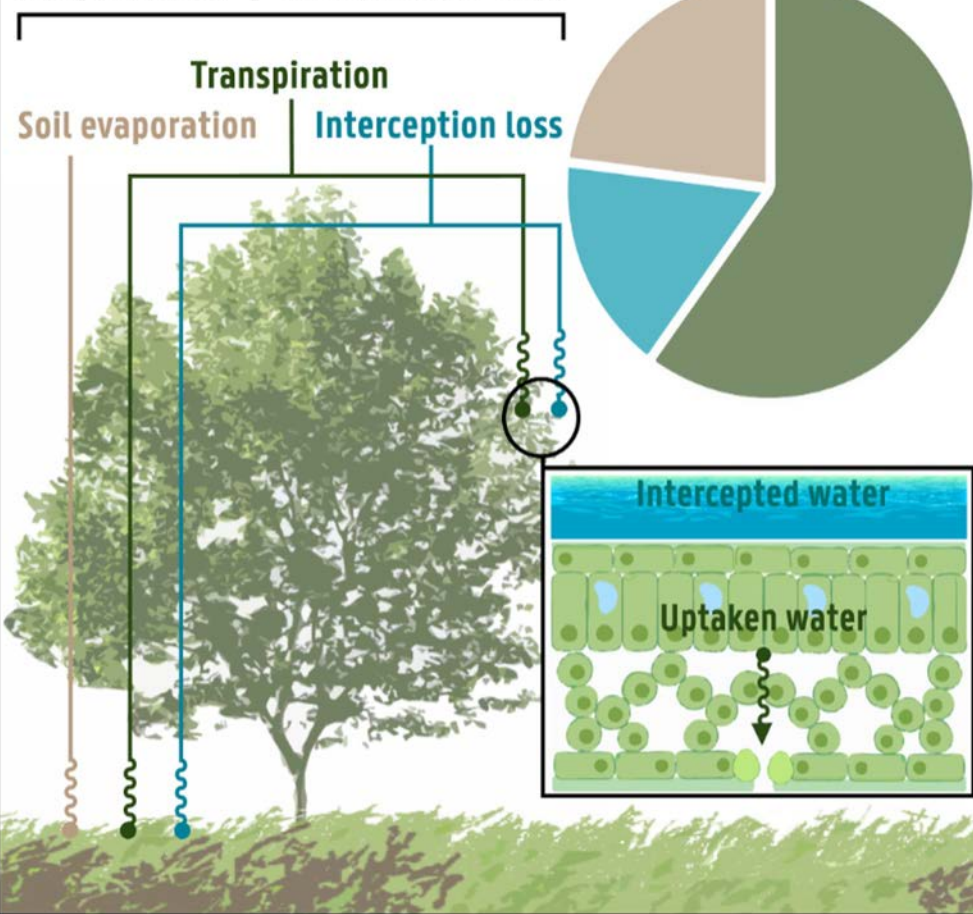
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Evaporation | Latent heat flux



Miralles *et al.* (2020)



Land Evaporation CCI

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EGU26-11978 | [ECS](#) | PICO | [HS2.5.2](#) ★

[ESA CCI Land Evaporation: Towards a long-term consistent satellite-based global evaporation dataset](#)

Kwint Delbare, Oscar M. Baez-Villanueva, and Diego G. Miralles and the ESA-CCI Consortium

Fri, 08 May, 16:25–16:27 (CEST) ■ PICO spot A | PICOA.6

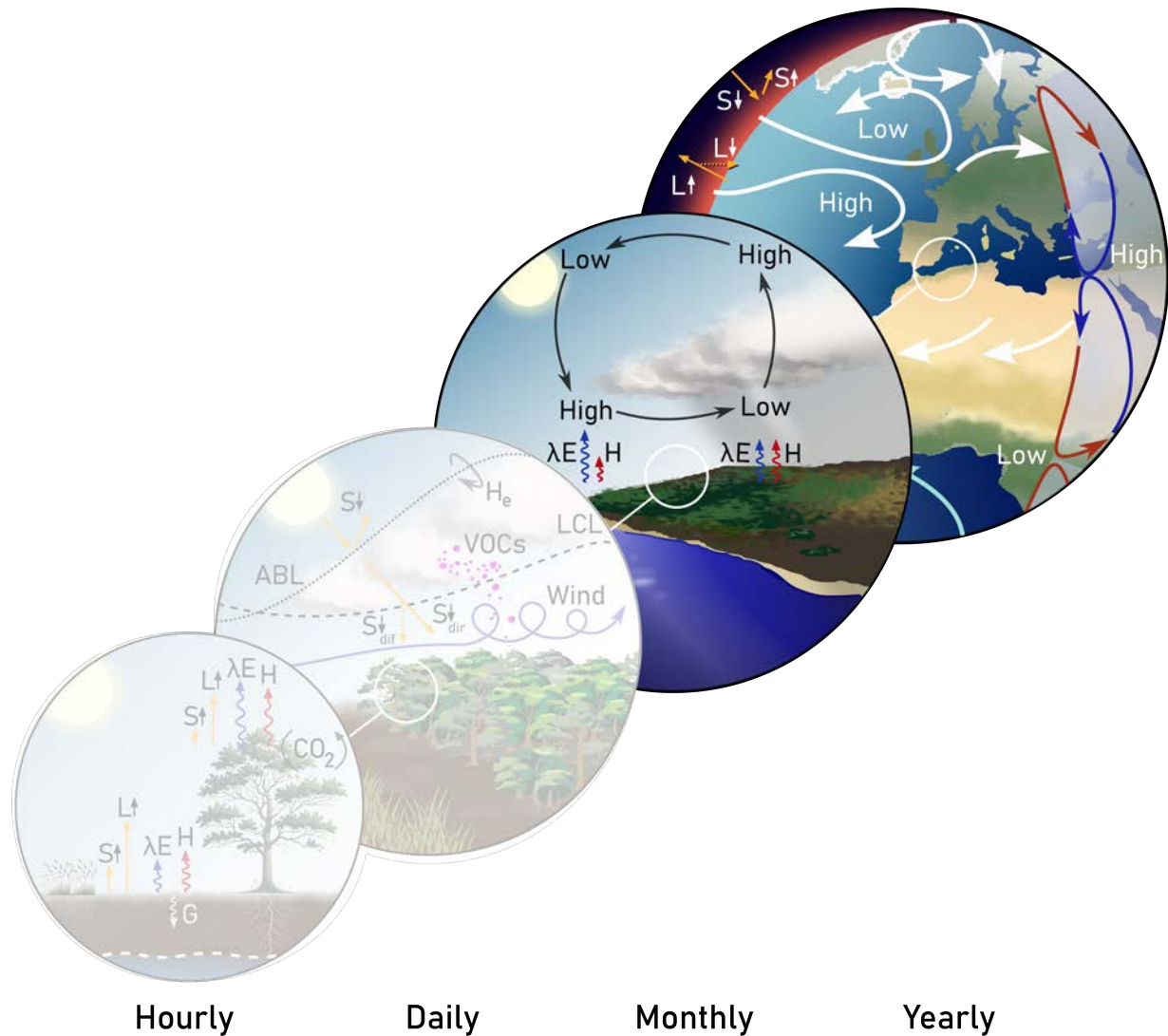


Global

Regional

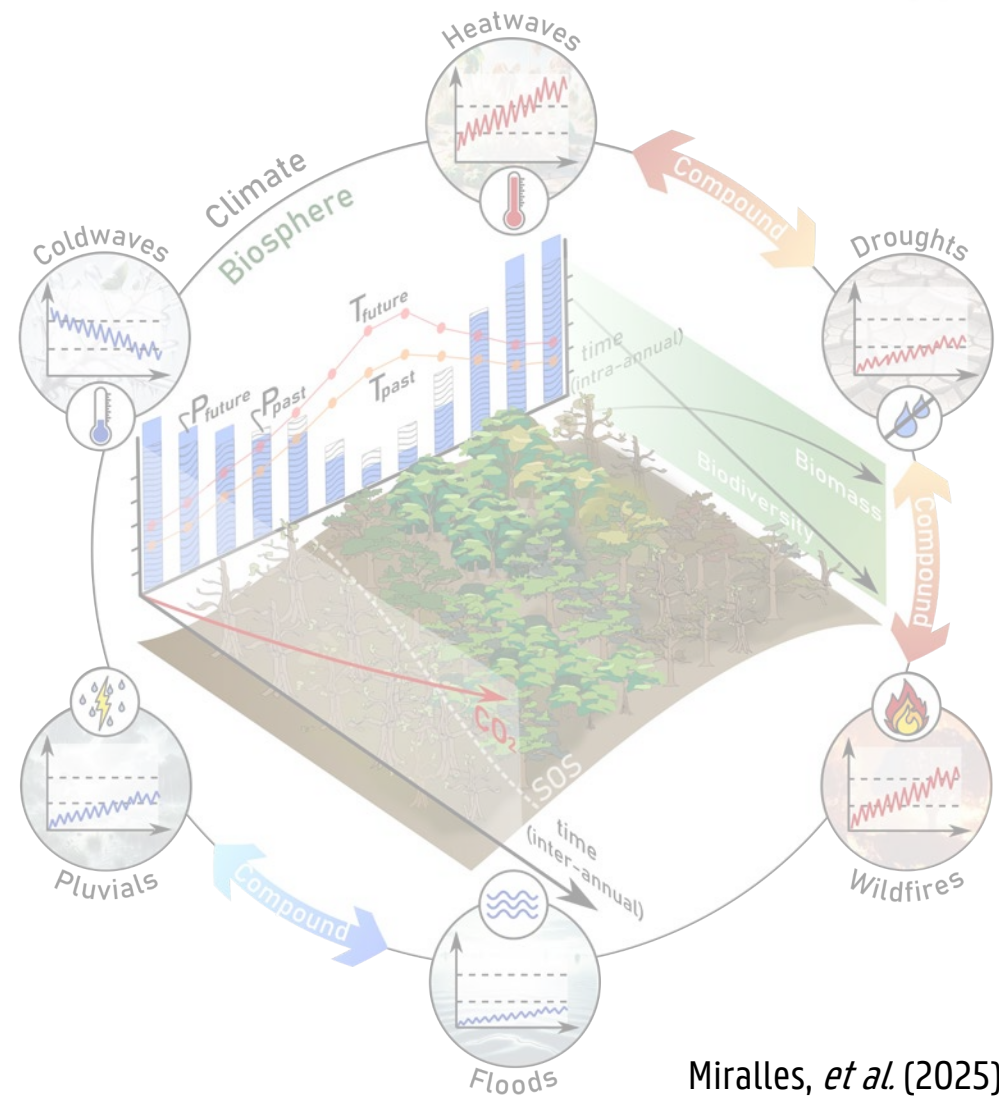
Ecosystem

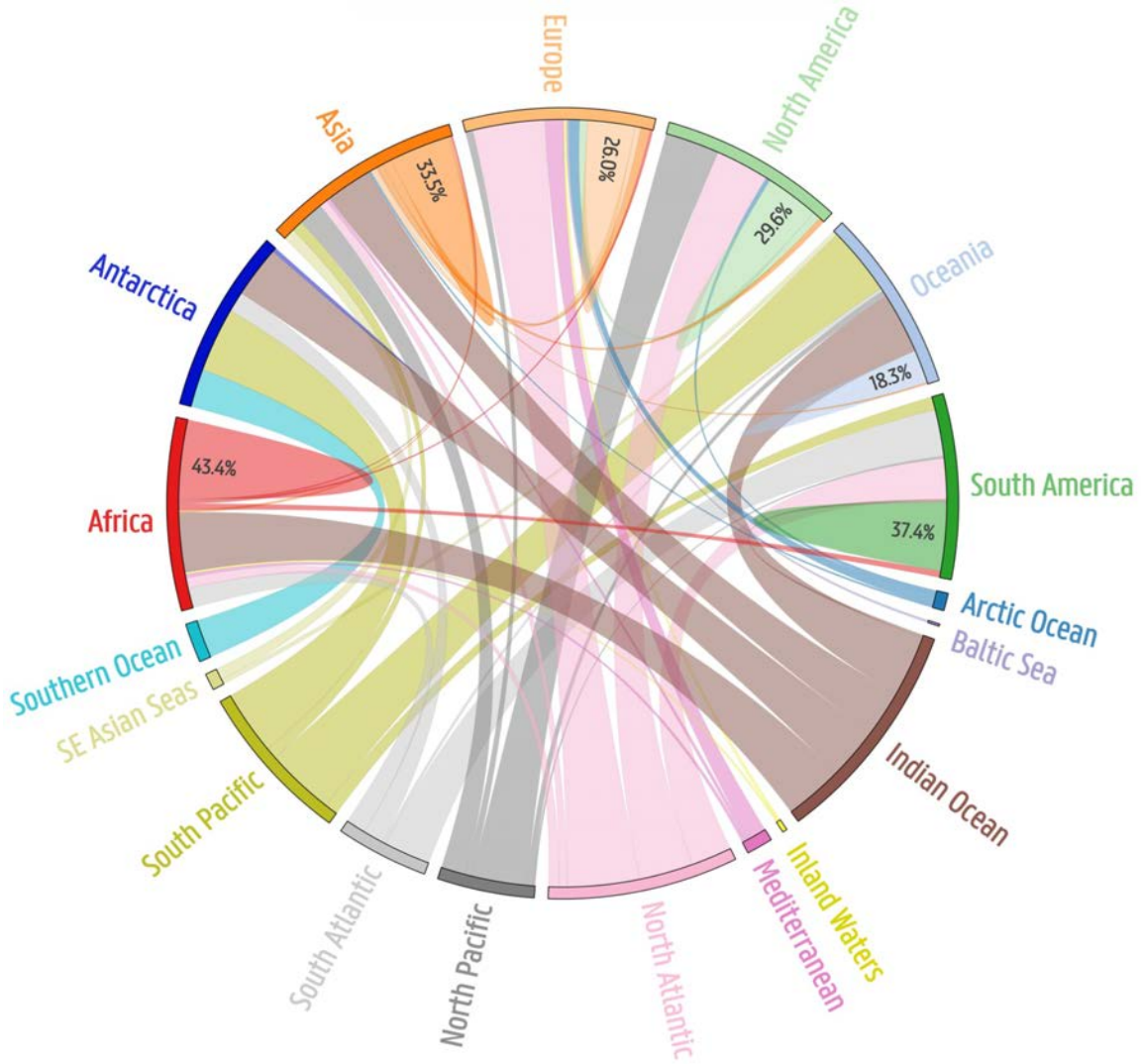
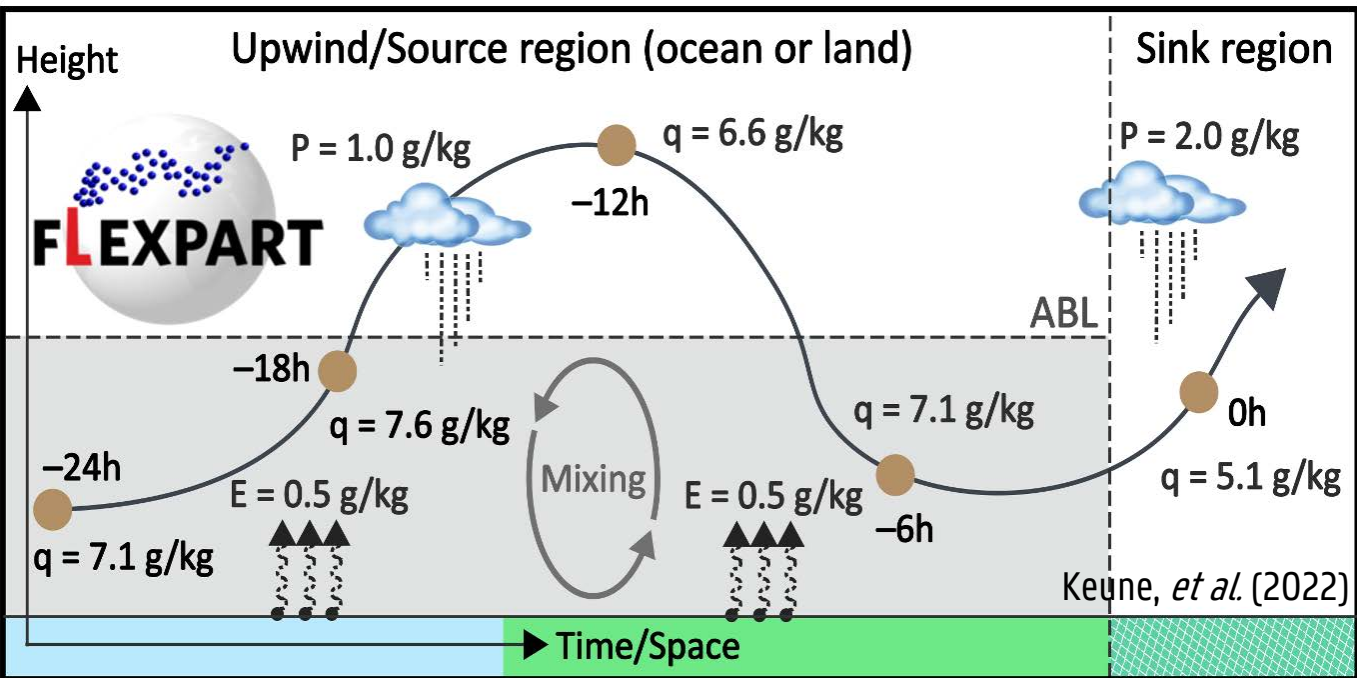
Local



METEOROLOGICAL

CLIMATOLOGICAL





<https://doi.org/10.5194/essd-2026-115>
 Preprint. Discussion started: 16 March 2026
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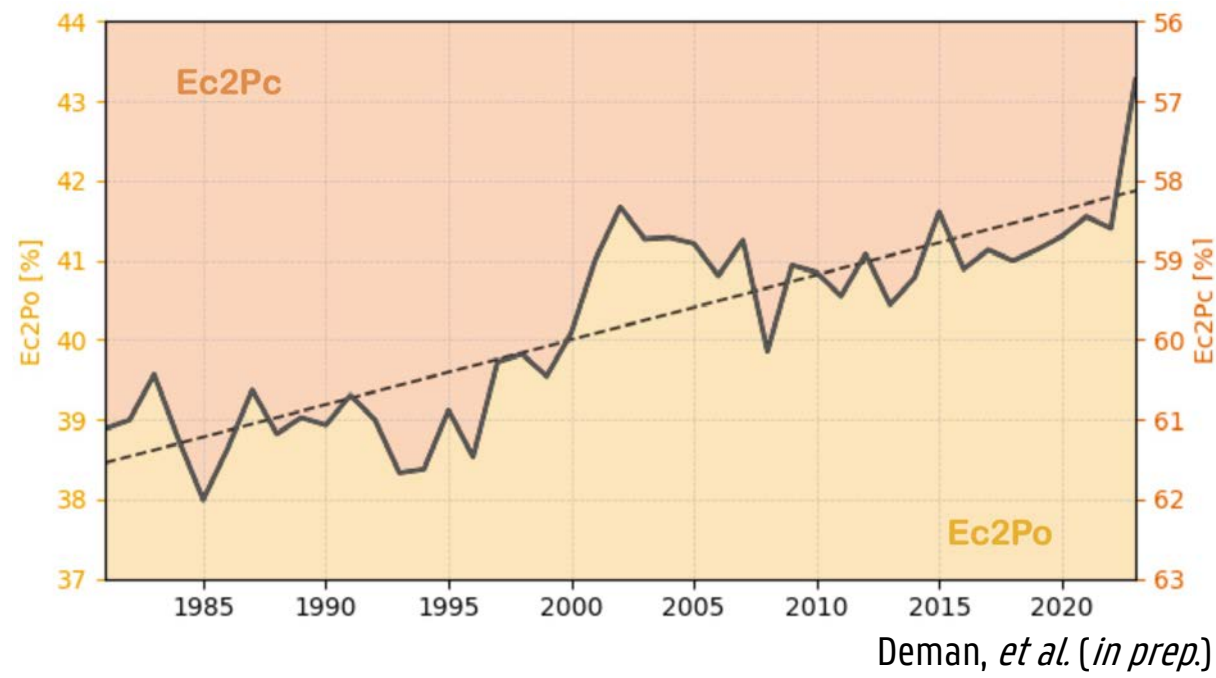
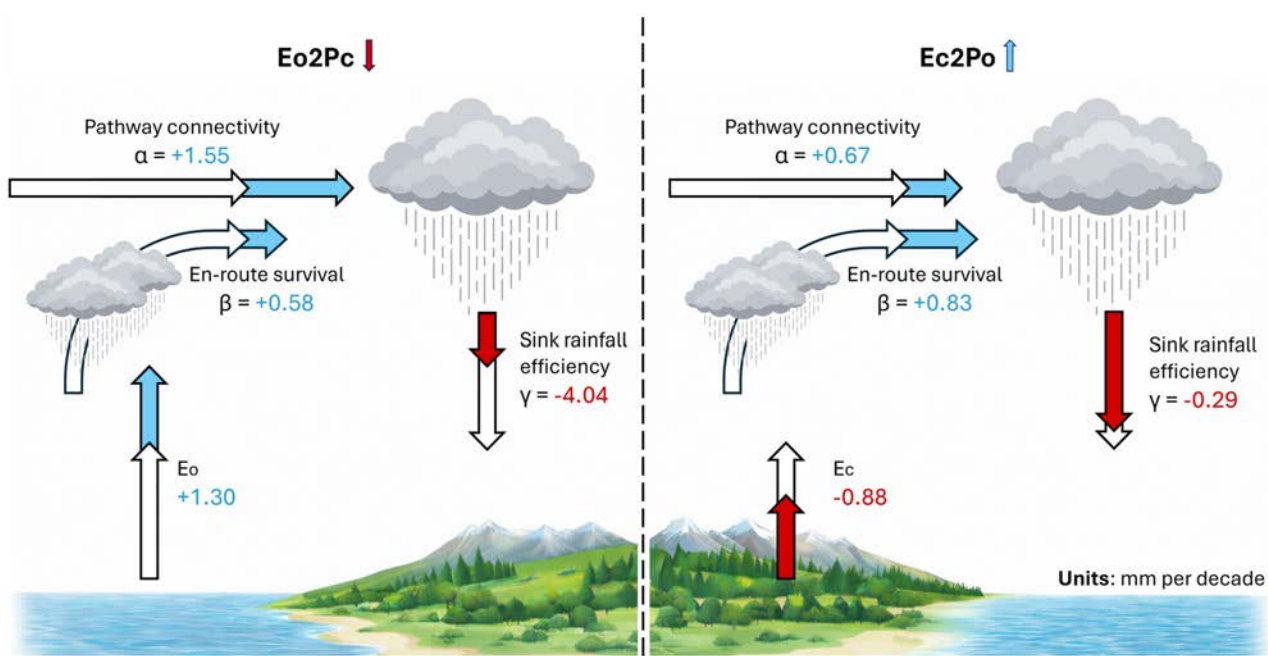
A four-decade global Lagrangian air-parcel trajectory dataset for atmospheric moisture and heat analysis

Victoria M. H. Deman¹, Damián Insua-Costa¹, Jessica Keune², Akash Koppa³, and Diego G. Miralles¹



- ❖ **Continental drying** in terms of P-E, driven by:
 - ❖ Reduced land rainfall efficiency
 - ❖ Longer transport distances

➡ **More land-to-ocean P exports**





❖ **Continental drying** in terms of P-E, driven by:

- ❖ Reduced land rainfall efficiency
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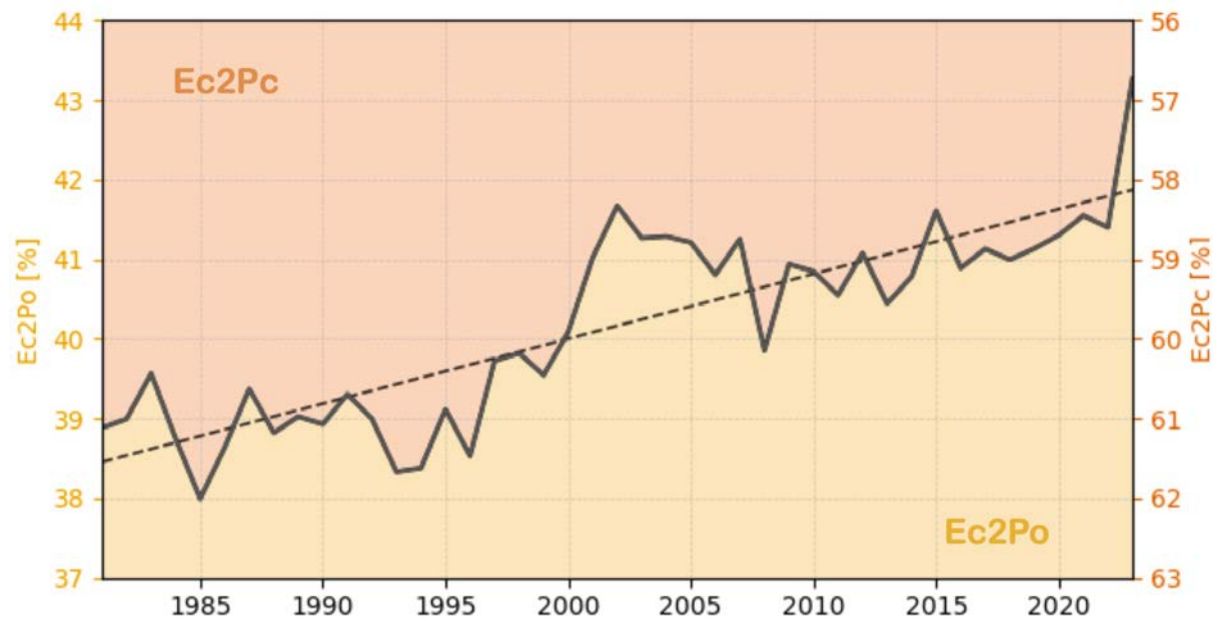
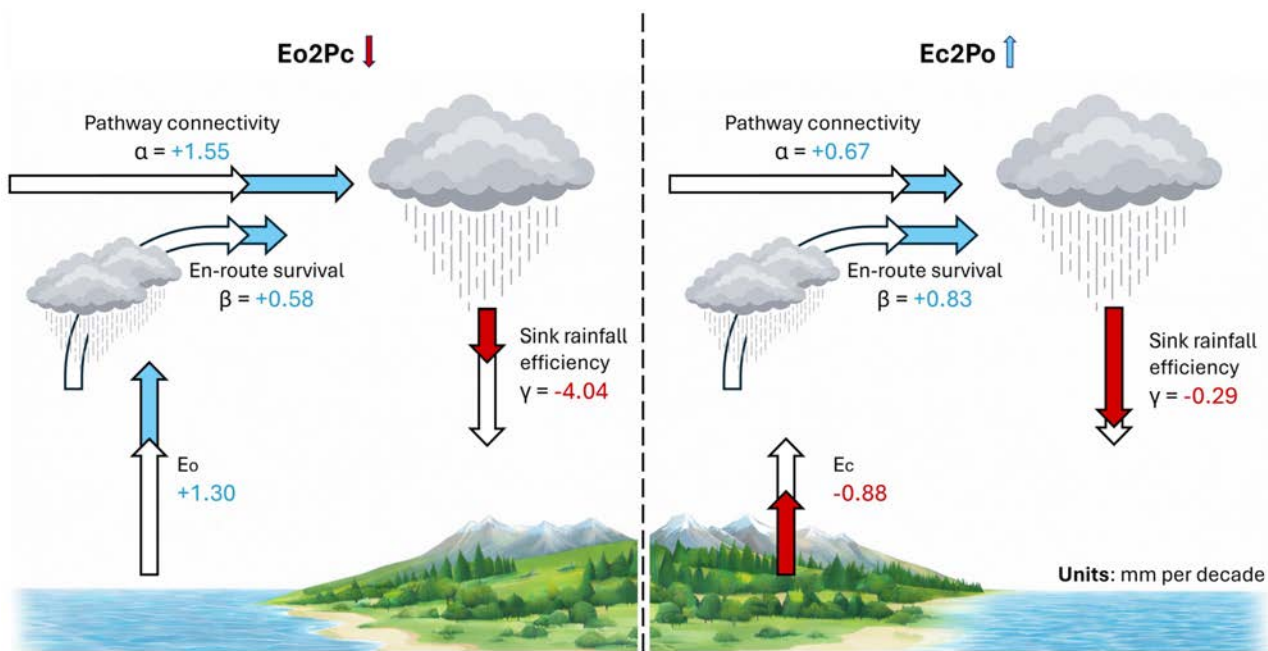
➡ **More land-to-ocean P exports**

EGU26-8321 | **ECS** | Orals | **HS2.5.3** ★

Changing moisture transport as a driver of continental drying ▶

Victoria M. H. Deman, Damián Insua-Costa, and Diego G. Miralles

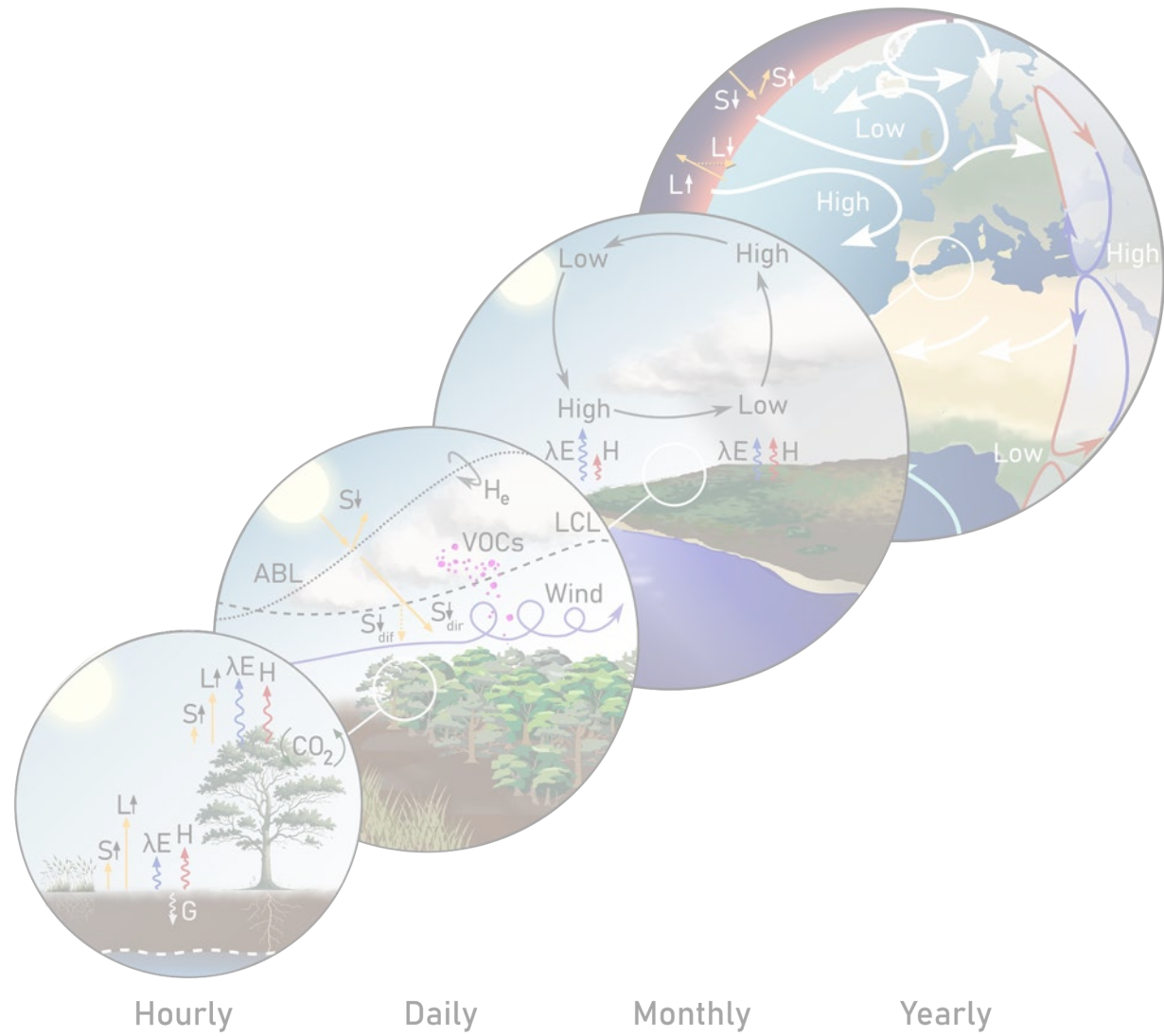
Wed, 06 May, 17:50–18:00 (CEST) ■ Room B



Deman, *et al.* (*in prep.*)

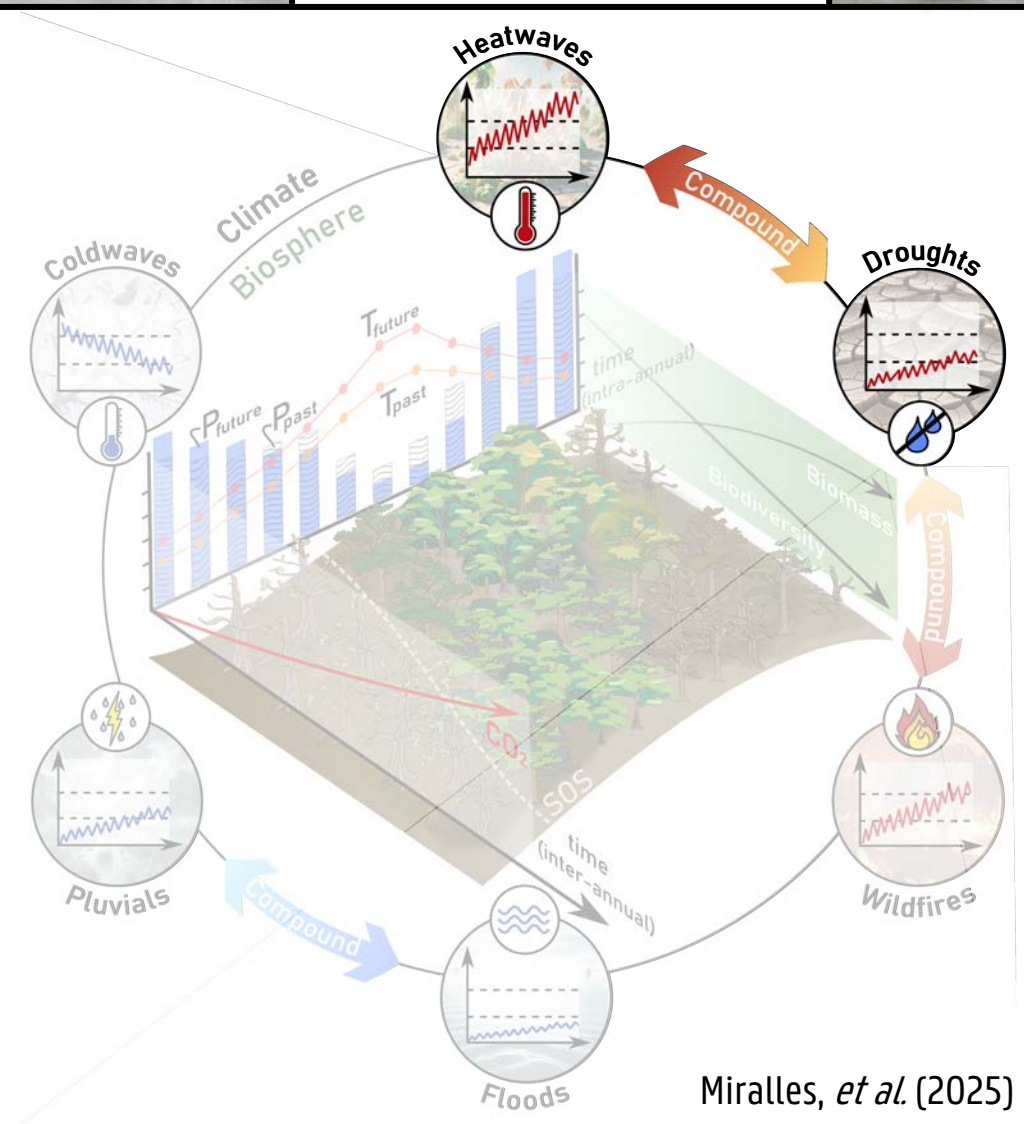


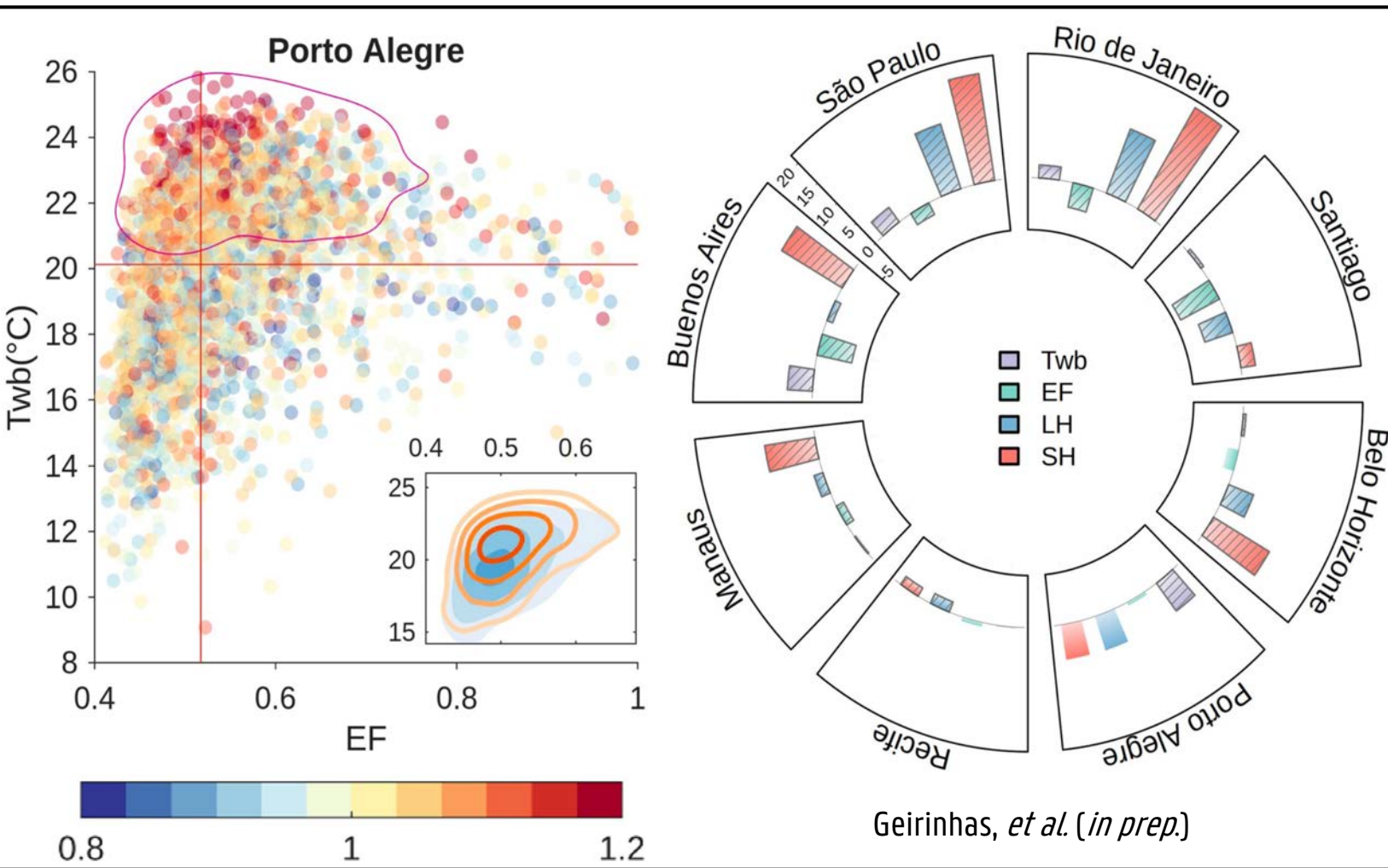
Global
Regional
Ecosystem
Local



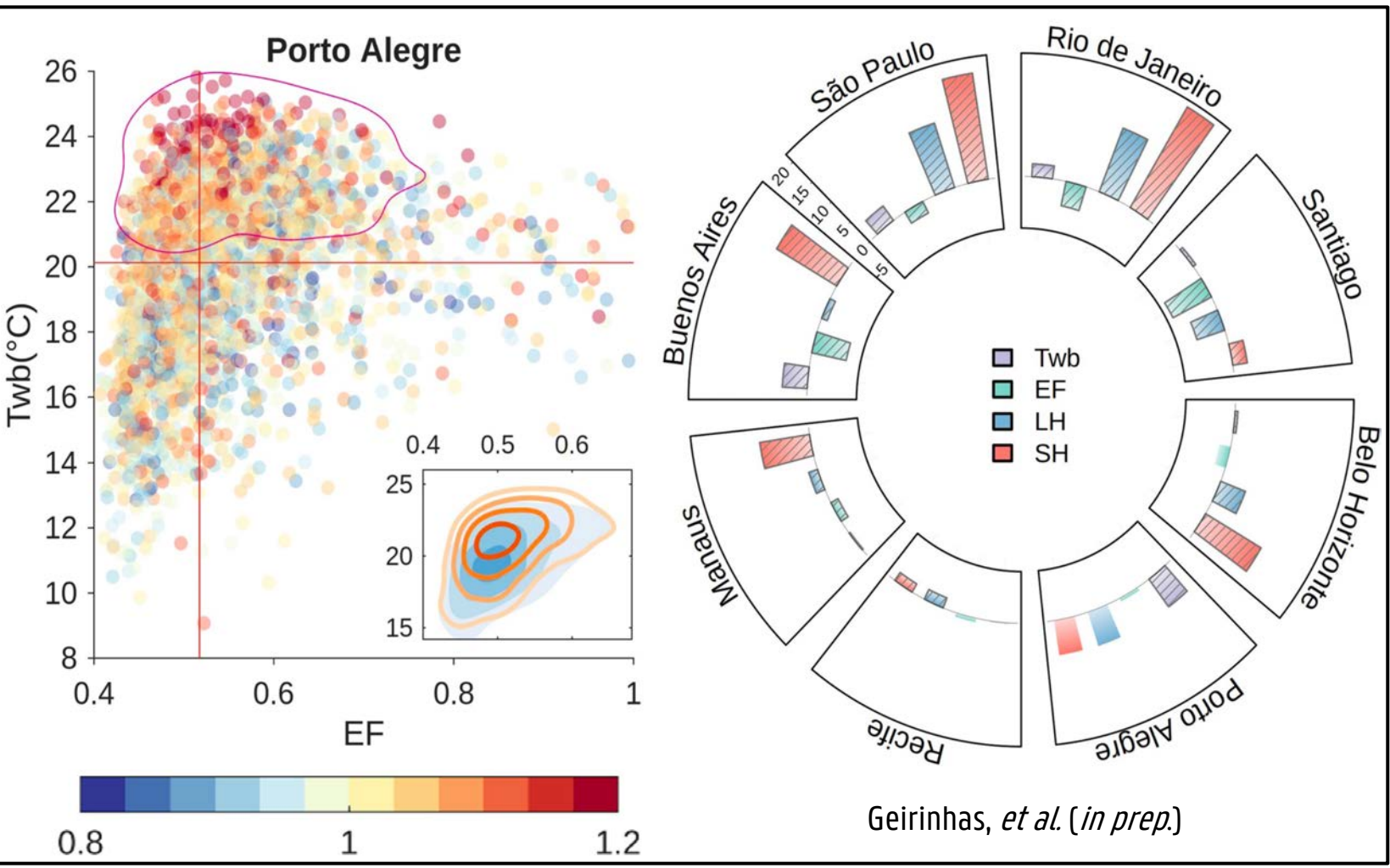
METEOROLOGICAL

CLIMATOLOGICAL

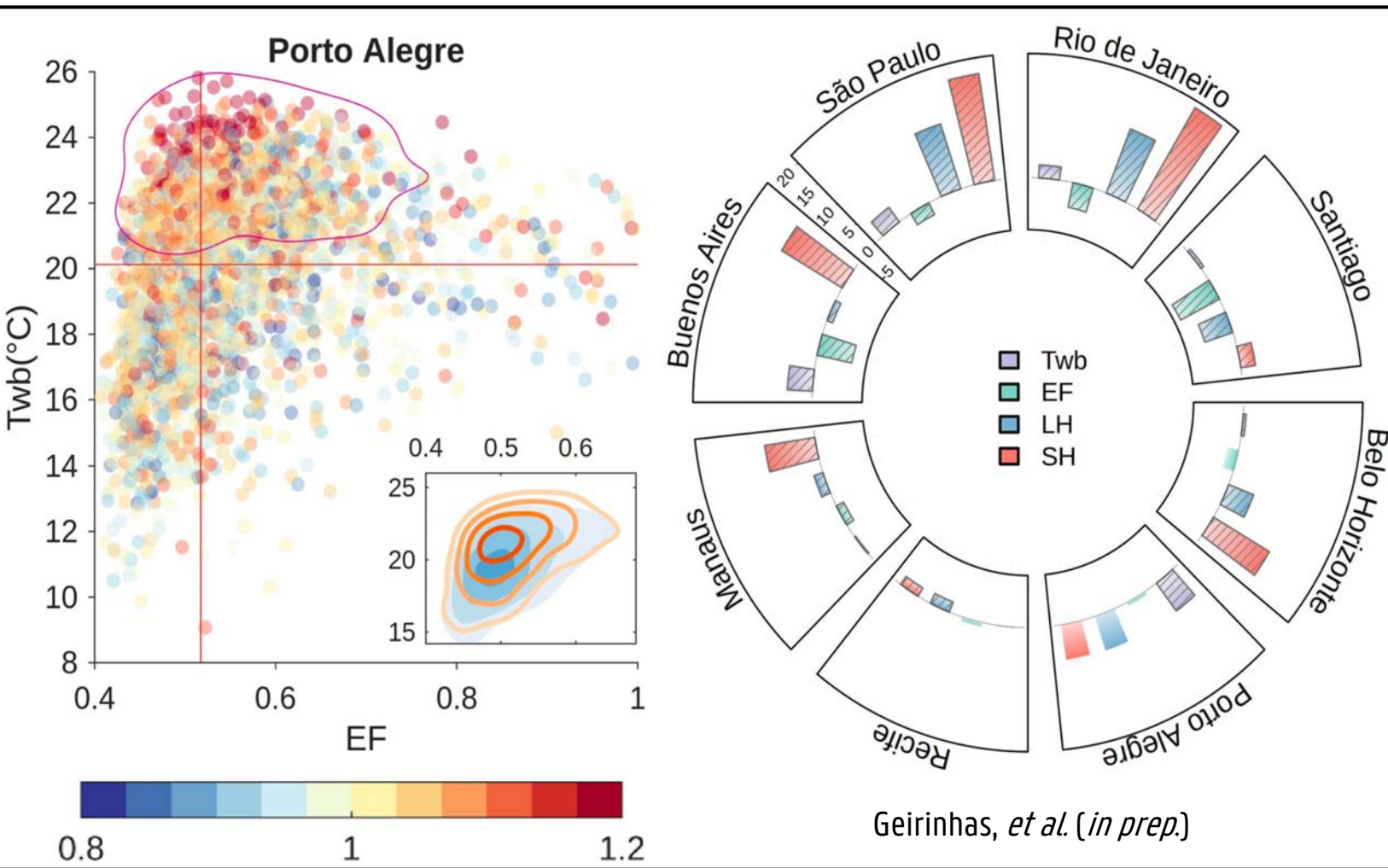




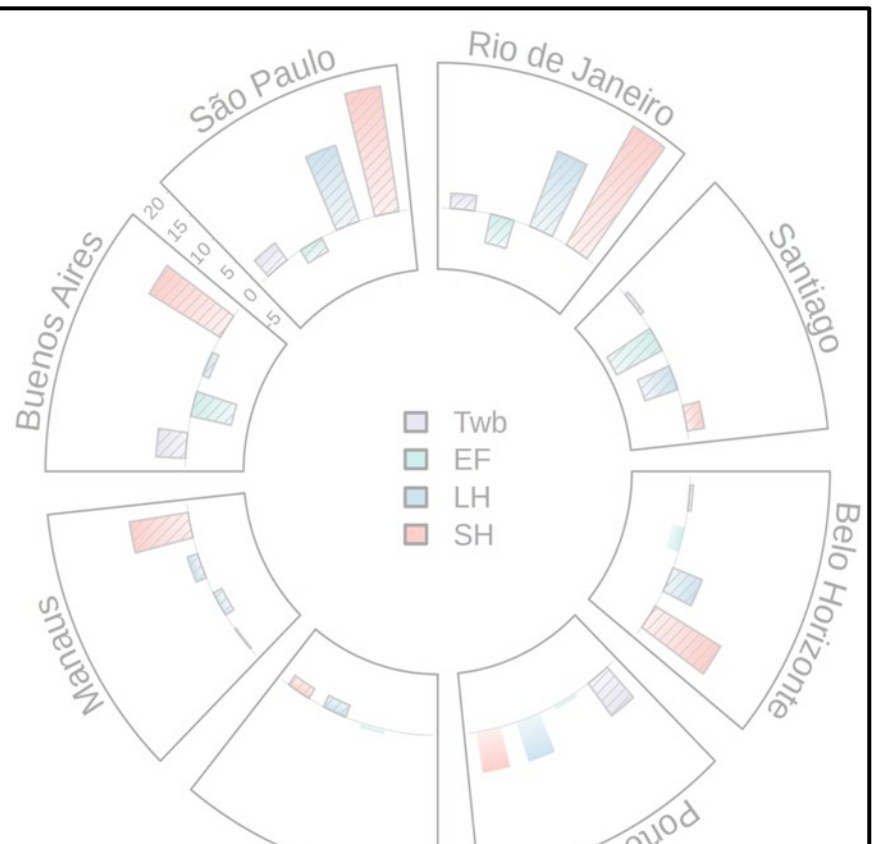
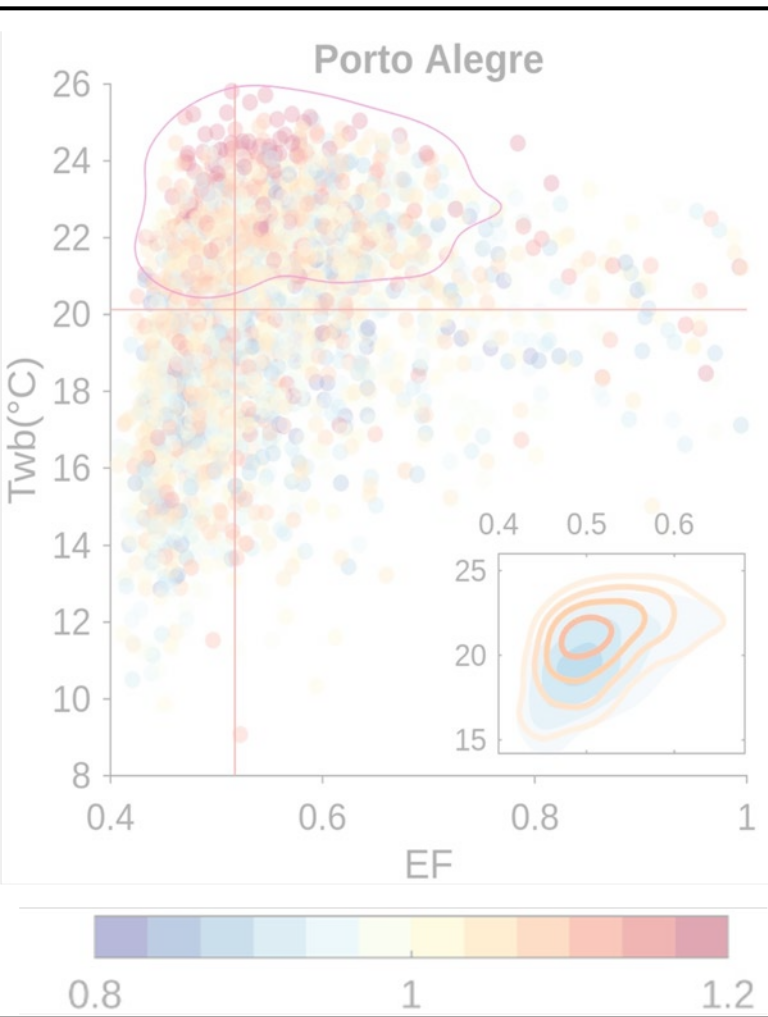
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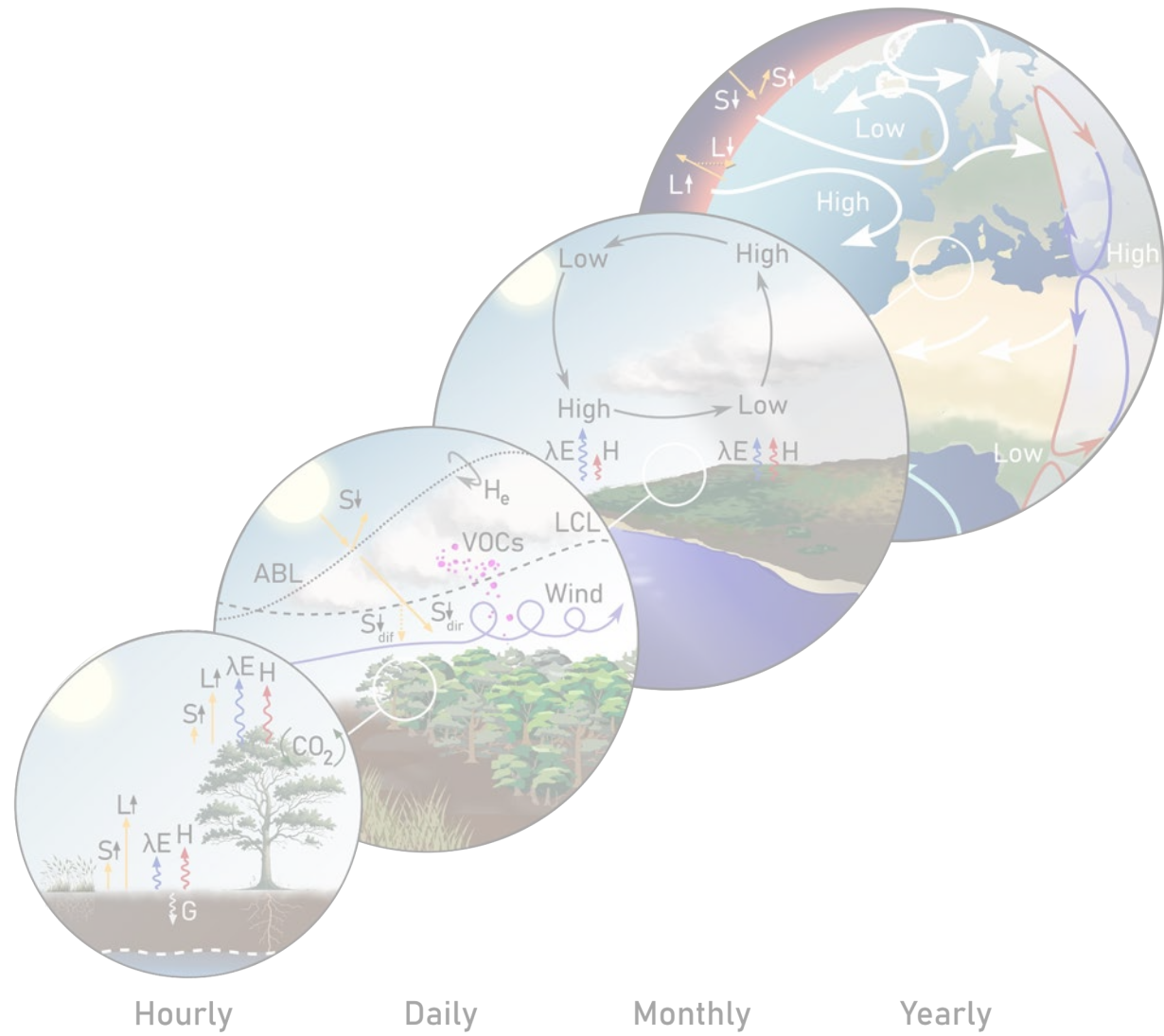
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EGU26-10094 | Orals | [ITS4.19/CL0.10](#) ★
The influence of soil moisture on wet-bulb temperature extremes and excess mortality in South America
 João L. Geirinhas, Diego G. Miralles, Daniel F. T. Hagan, Renata Libonati, and Djacinto M. dos Santos
 Thu, 07 May, 16:40–16:50 (CEST) ■ Room 2.17

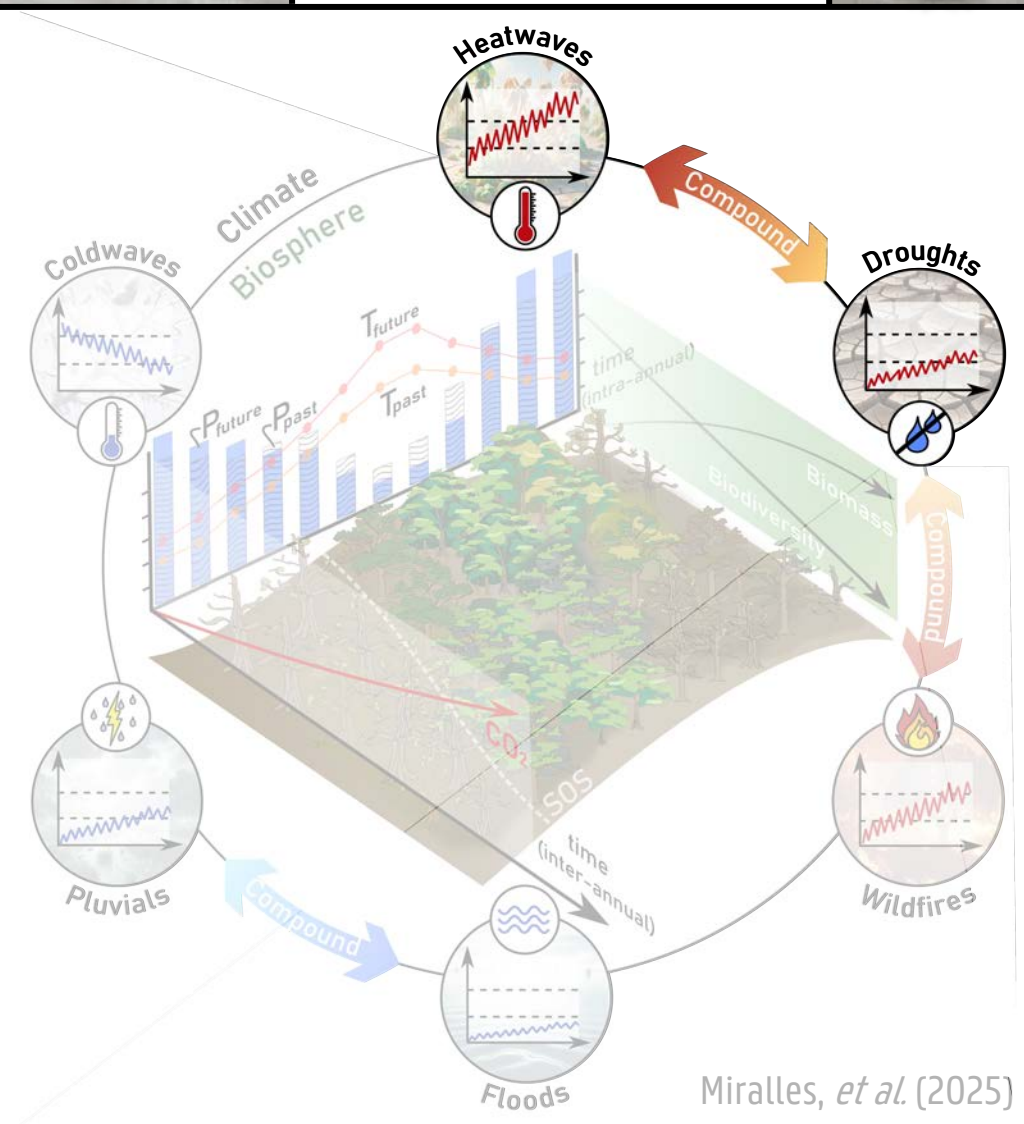


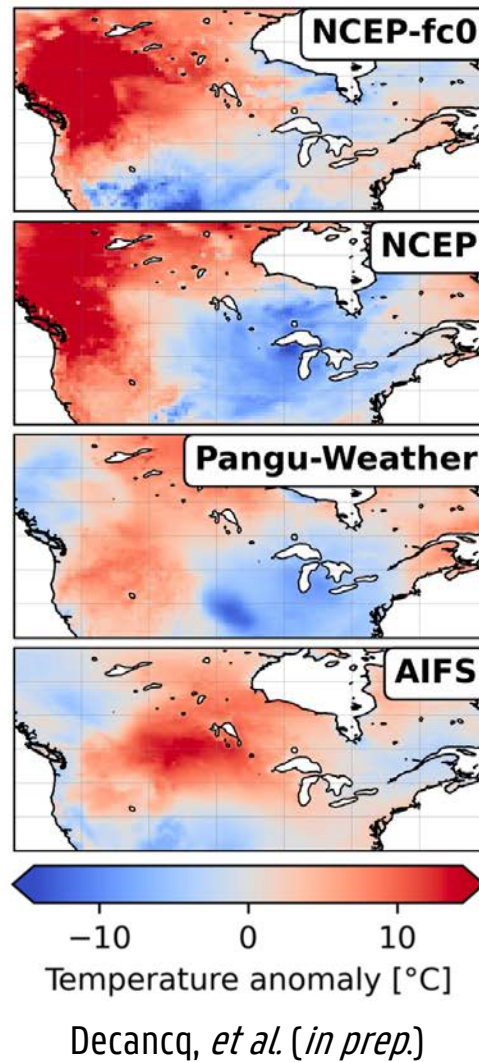
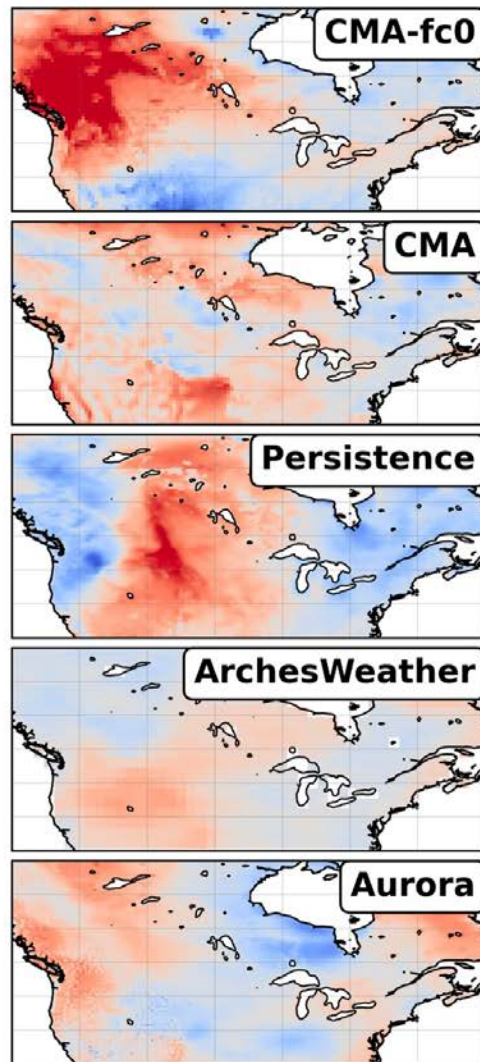
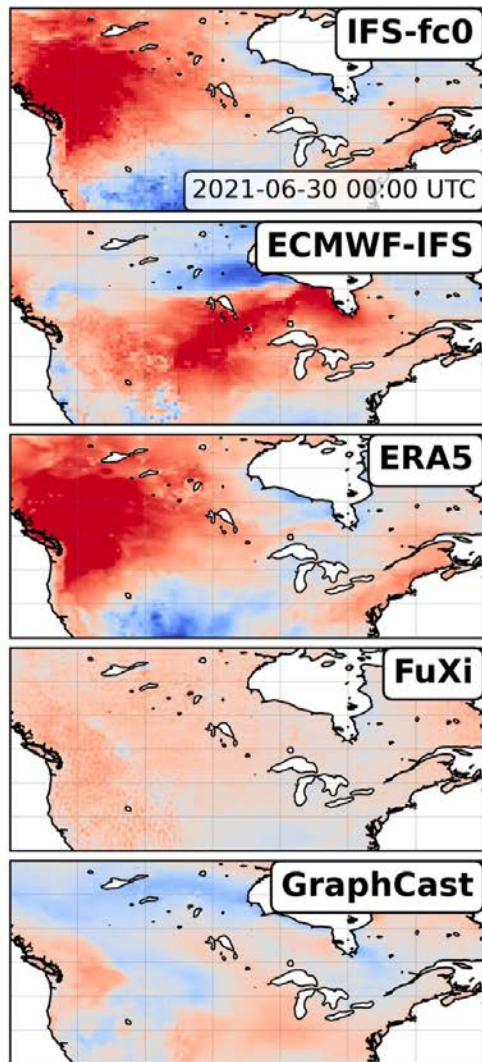
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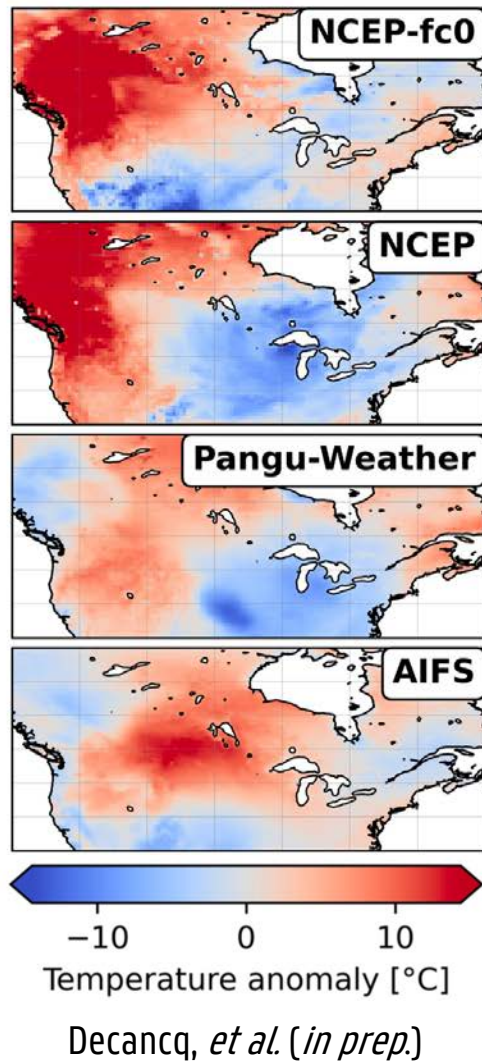
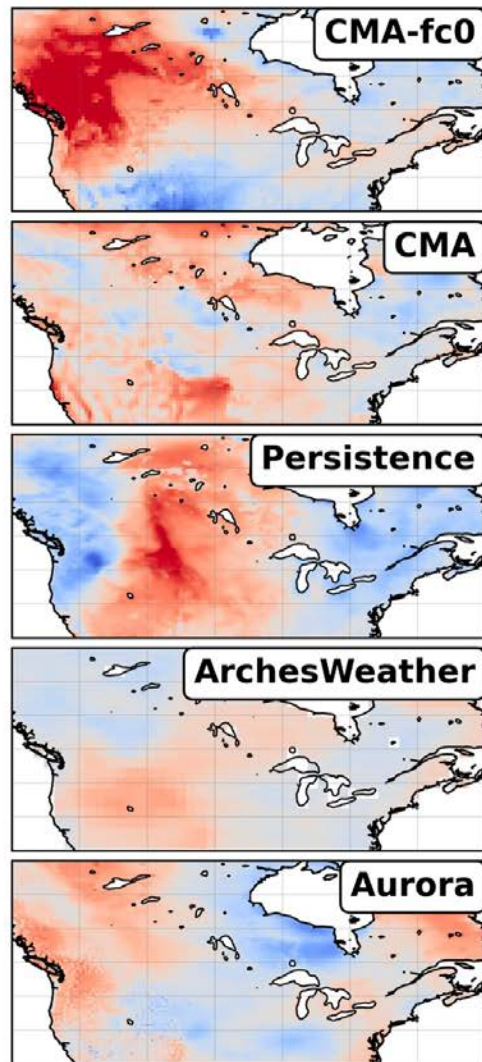
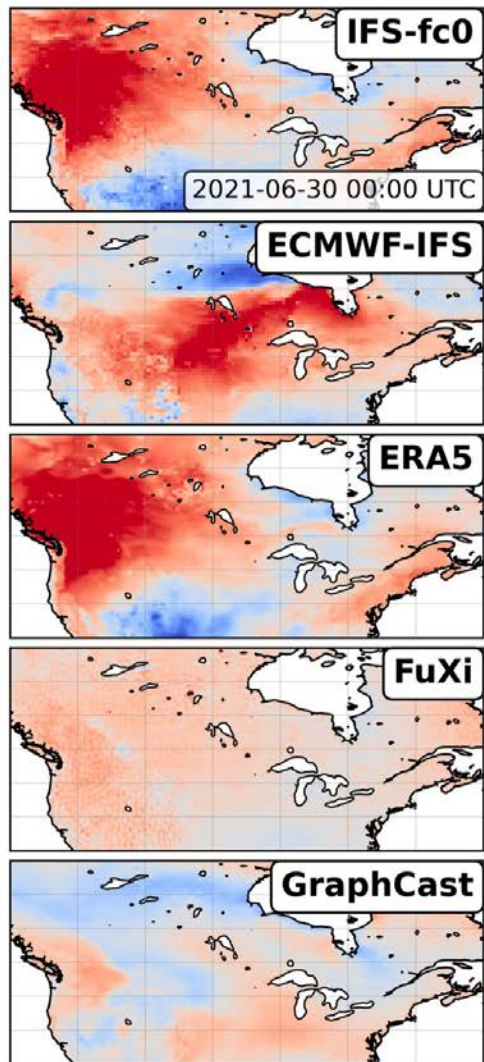
CLIMATOLOGICAL





Decancq, *et al.* (in prep.)

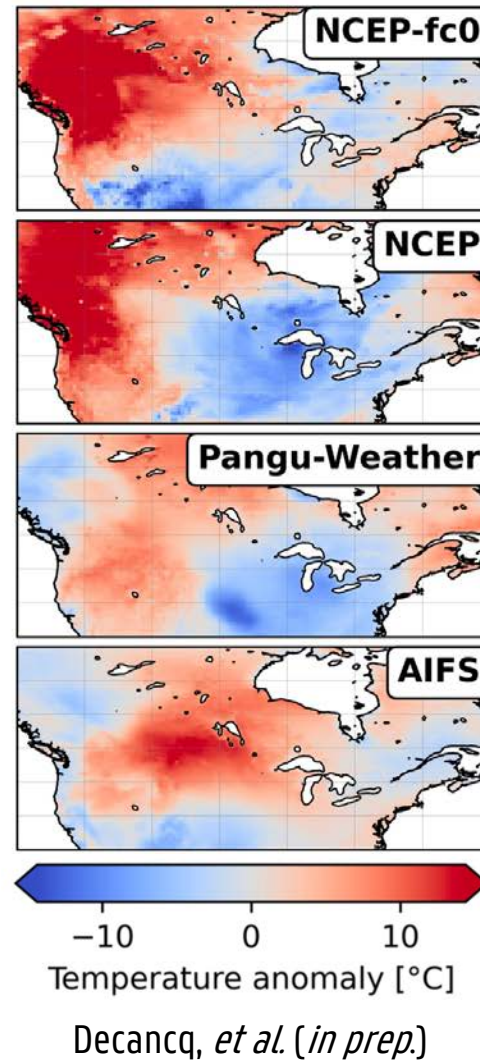
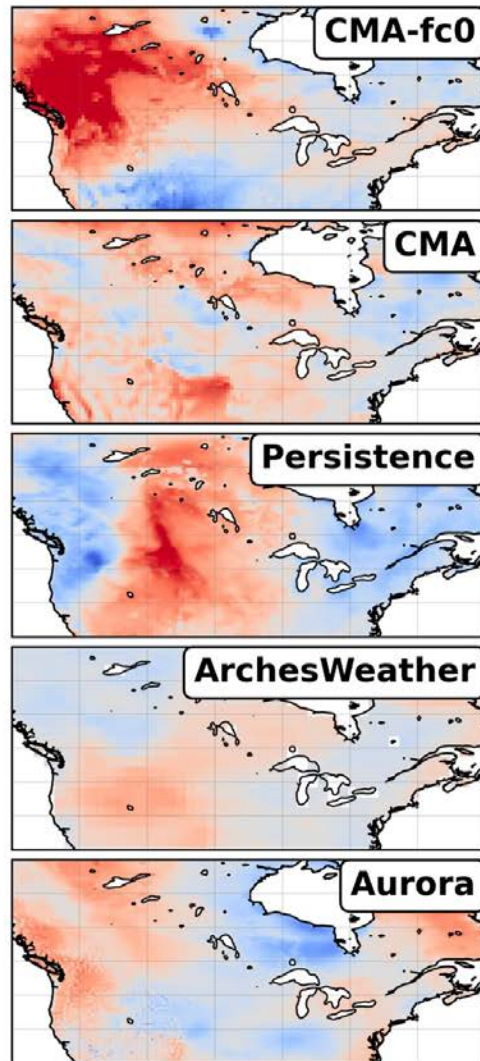
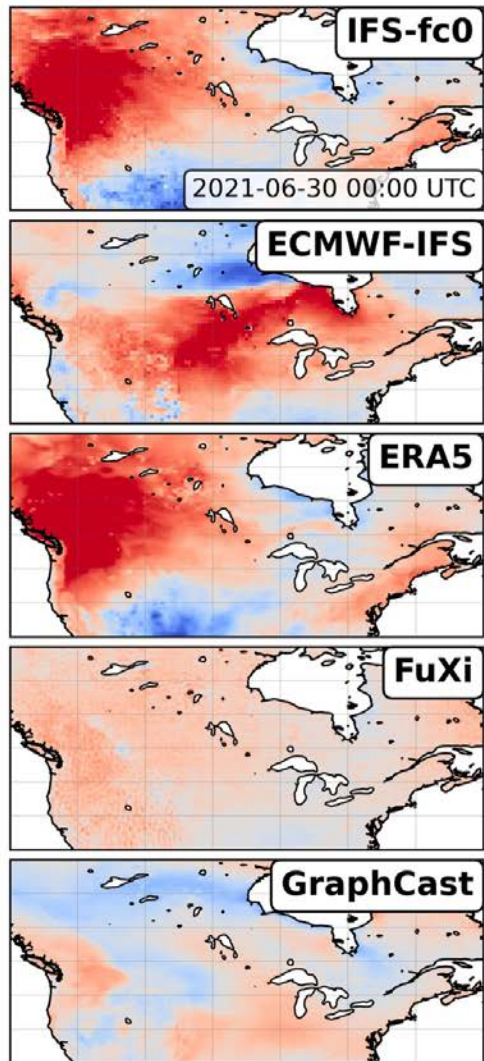
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- ❖ AIFS shows potential, balancing skill and physical realism
- ❖ Next: evaluating land representation and potential of considering land feedbacks



-10 0 10
Temperature anomaly [°C]

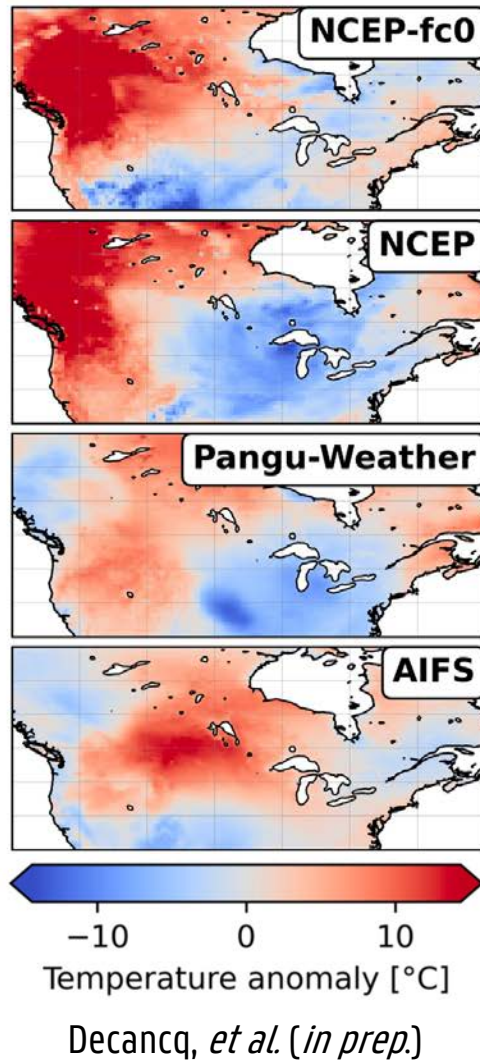
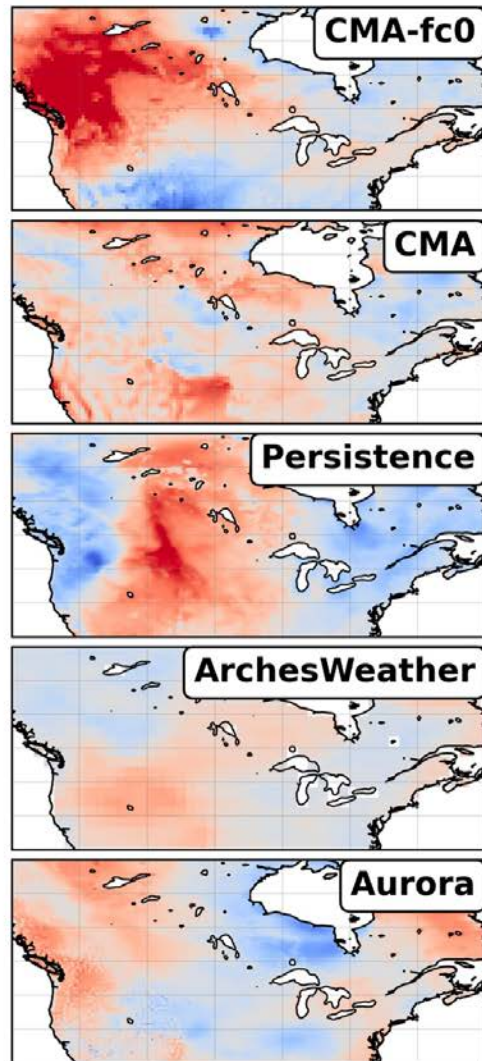
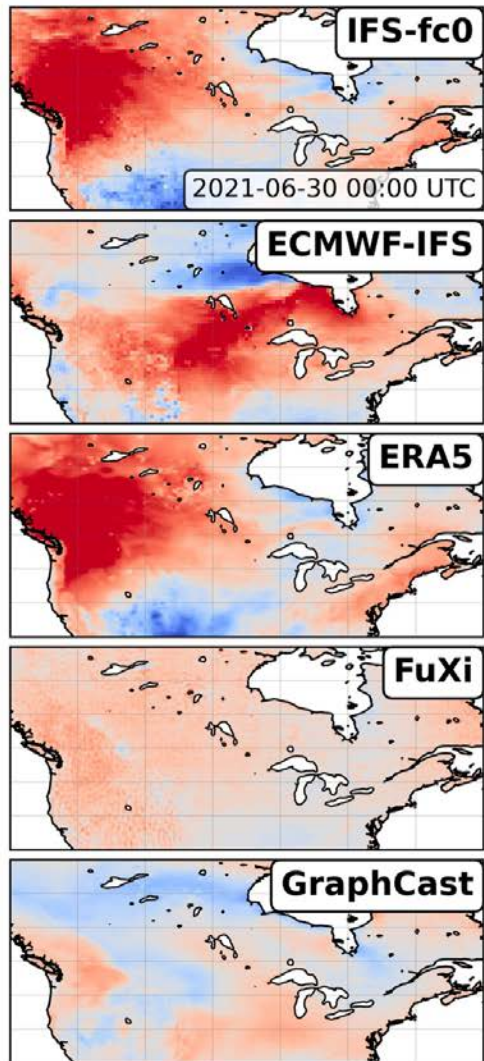
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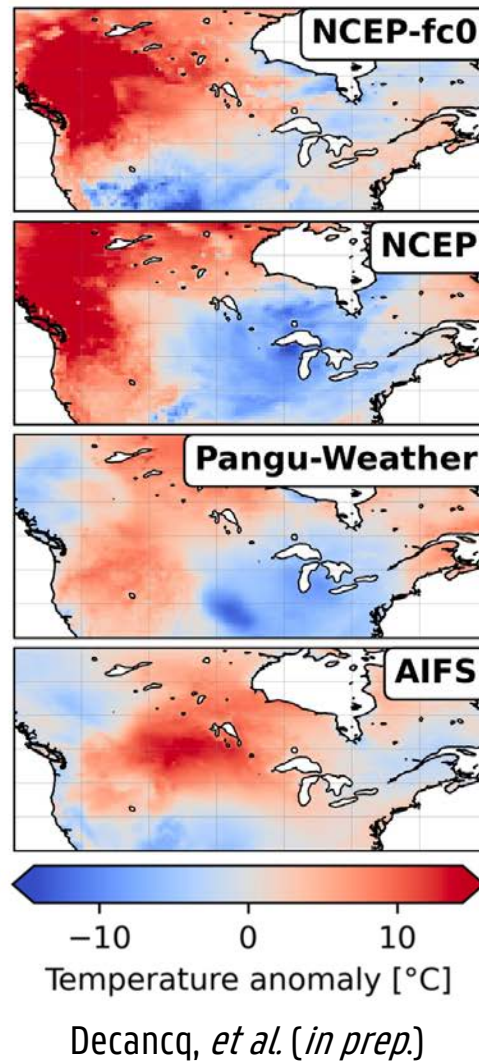
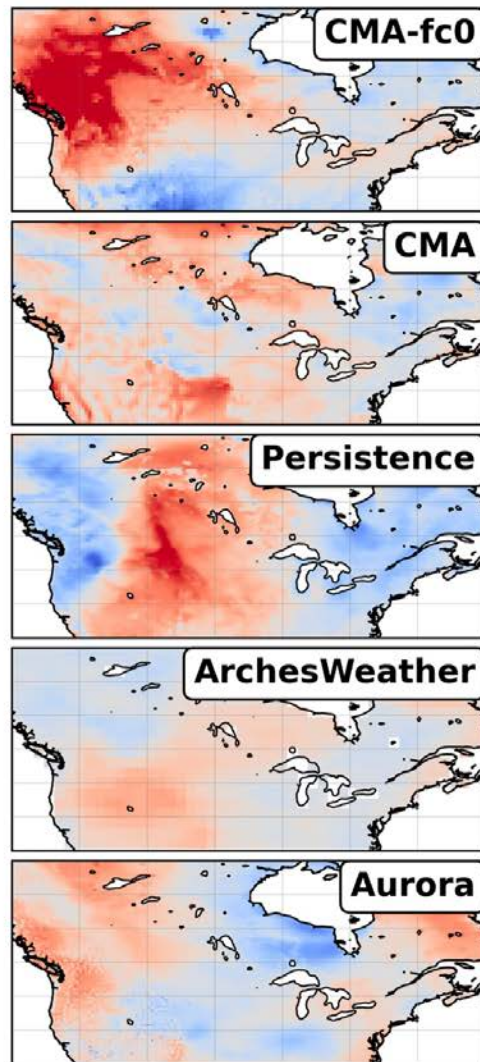
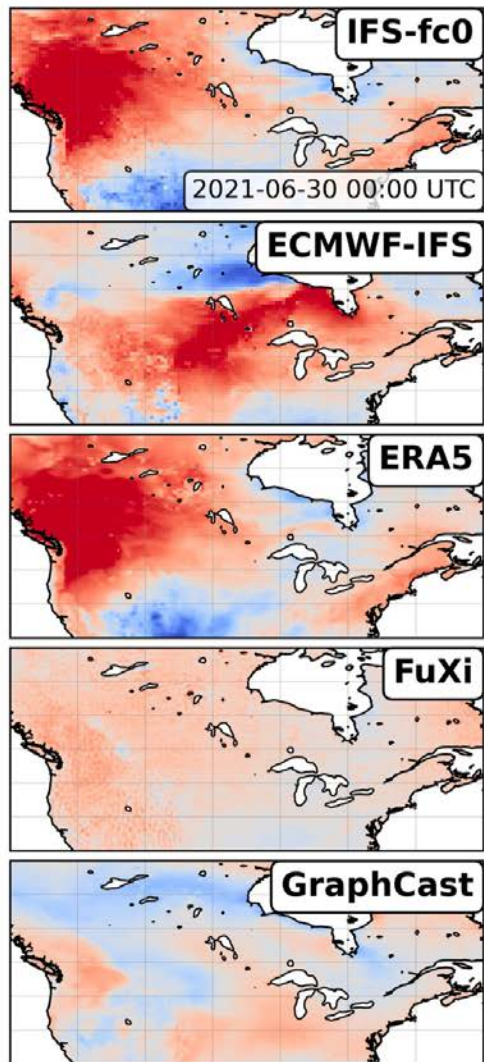
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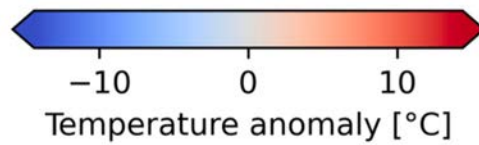
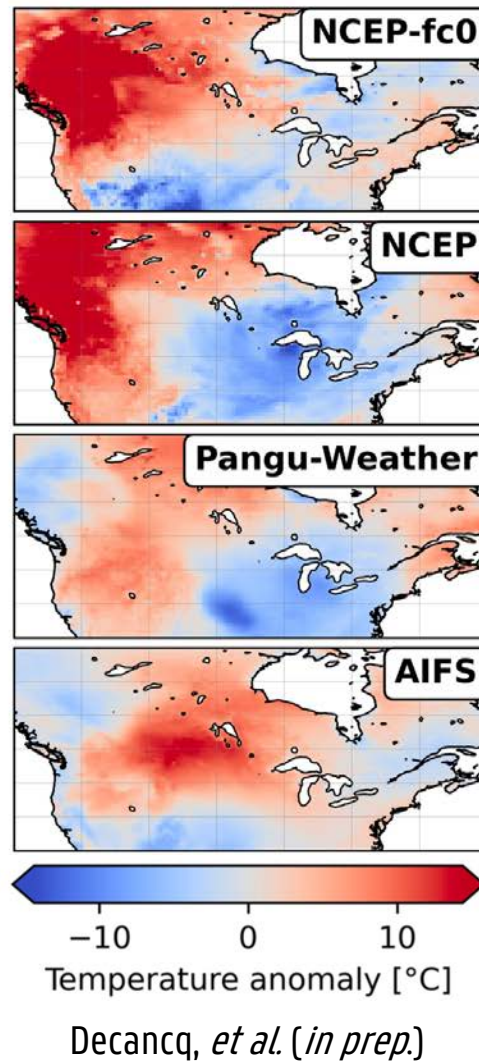
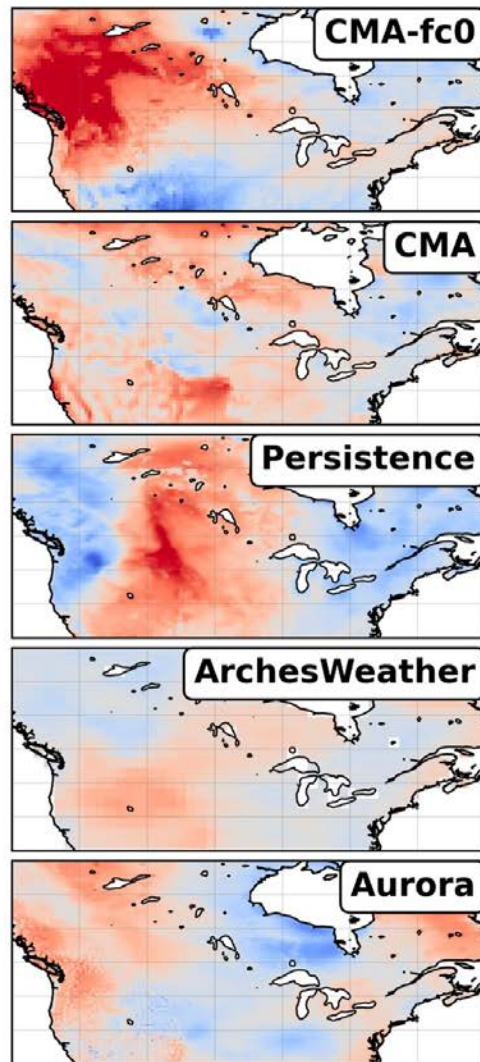
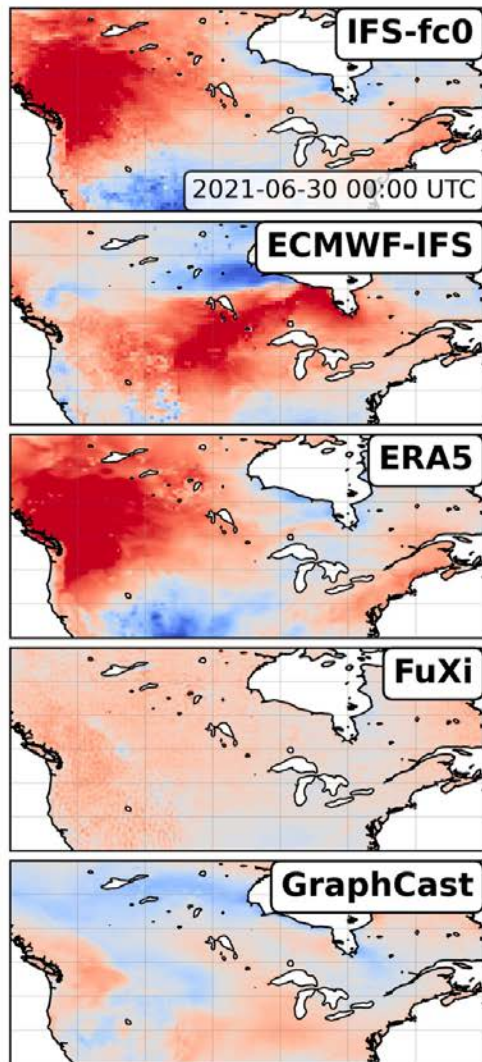
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Decancq, *et al.* (in prep.)

	RMSE	R2	ACC	CORR	SPECTRAL
Climatology	3.6	0.22			
Persistence	5.2	-0.8	0.01	0	0.91
ECMWF-IFS	4.2	-0.7	0.29	0.16	0.9
CMA	4.2	-1.4	0.3	0.19	0.88
NCEP	4.5	-0.3	0.34	0.23	0.9
Pangu-Weather	4.2	-0.2	0.27	0.16	0.71
FuXi	3.3	0.33	0.41	0.24	0.18
ArchesWeather	3.4	0.22	0.37	0.23	0.38
AIFS	3.9	-0	0.32	0.21	0.81
GraphCast	4.1	-0.2	0.25	0.19	0.75
Aurora	4	-0.1	0.29	0.16	0.61

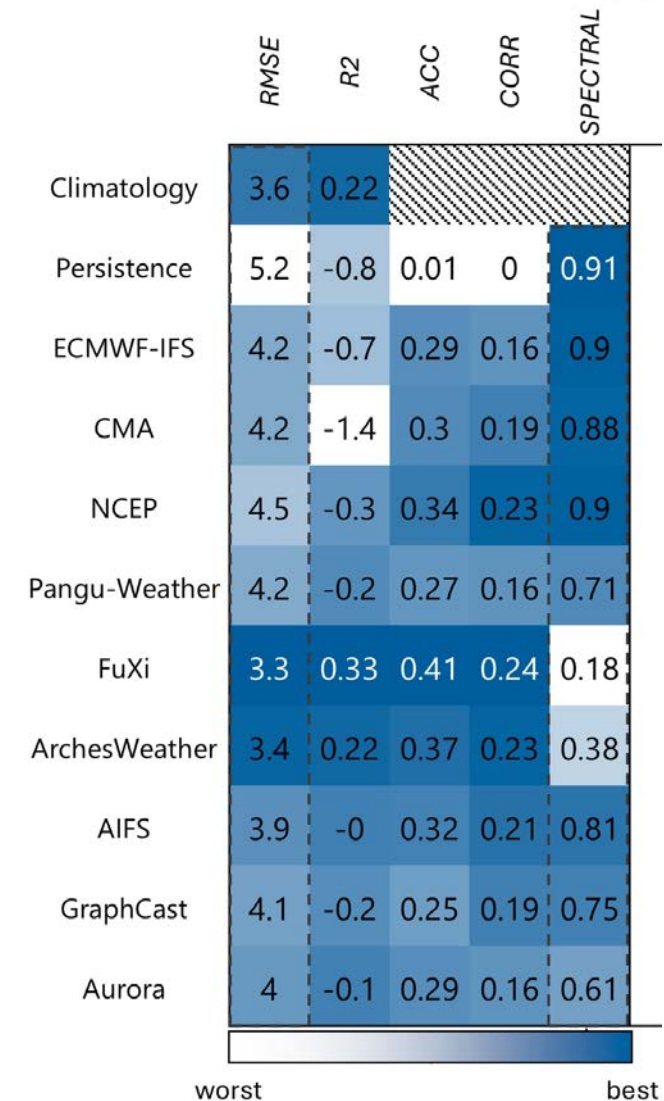
worst best



EGU26-6412 | **ECS** | Orals | **AS1.4** ★
Weather Emulators Push the Frontier of Heat Extremes Forecasting
 Cas Decancq, Thomas Mortier, Jessica Keune, and Diego Miralles
 Tue, 05 May, 11:50–12:00 (CEST) ■ Room 1.61/62

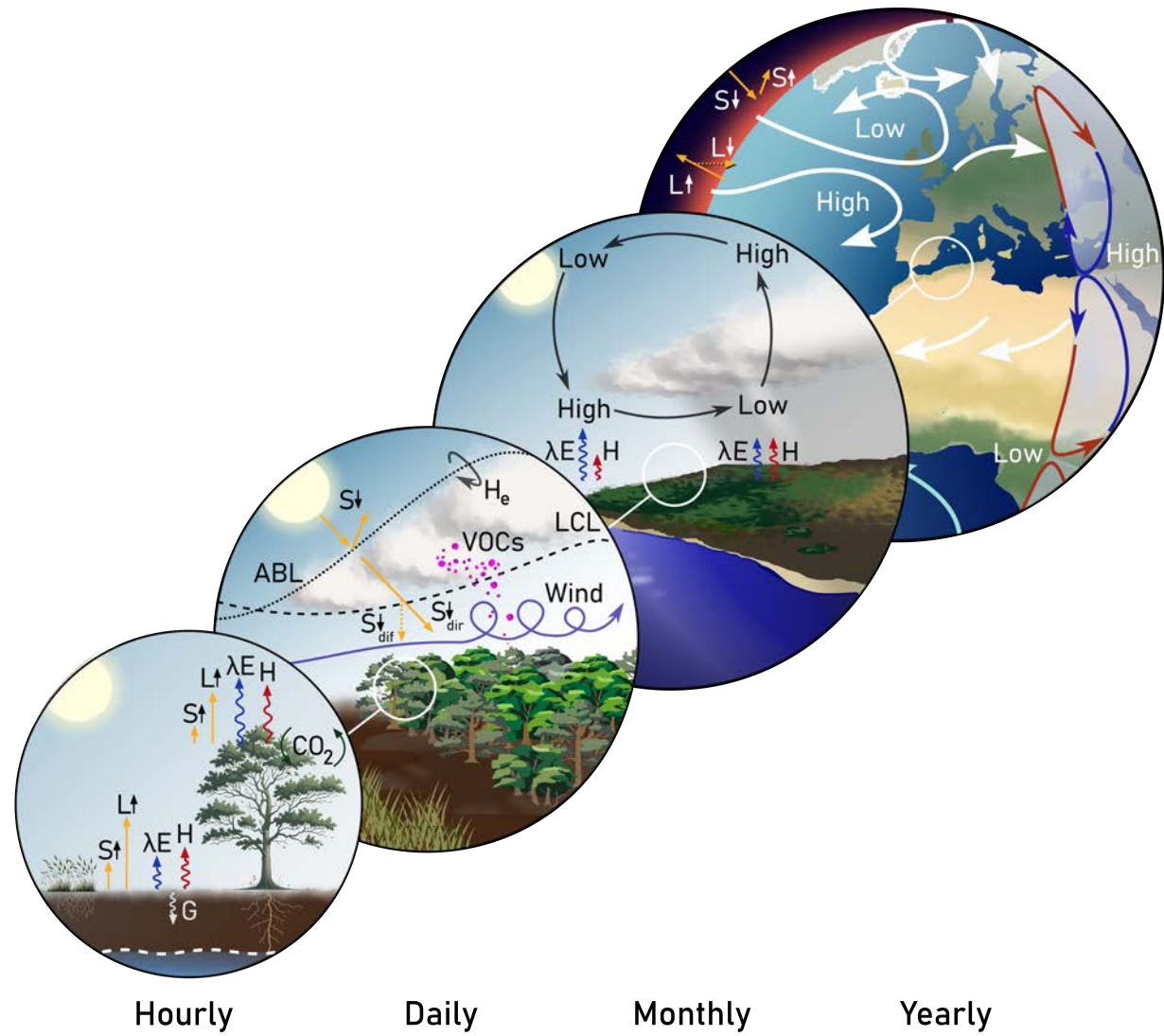


EGU26-5045 | **ECS** | Posters on site | **CL5.10** ★
A Self-Supervised Analogue Framework for Probabilistic Subseasonal Forecasting of Heat Extremes
 Thomas Mortier, Cas Decancq, Marc Lemus-Cánovas, Damián Insua-Costa, and Diego G. Miralles
 Wed, 06 May, 08:30–10:15 (CEST) ■ Hall X5 | X5.196



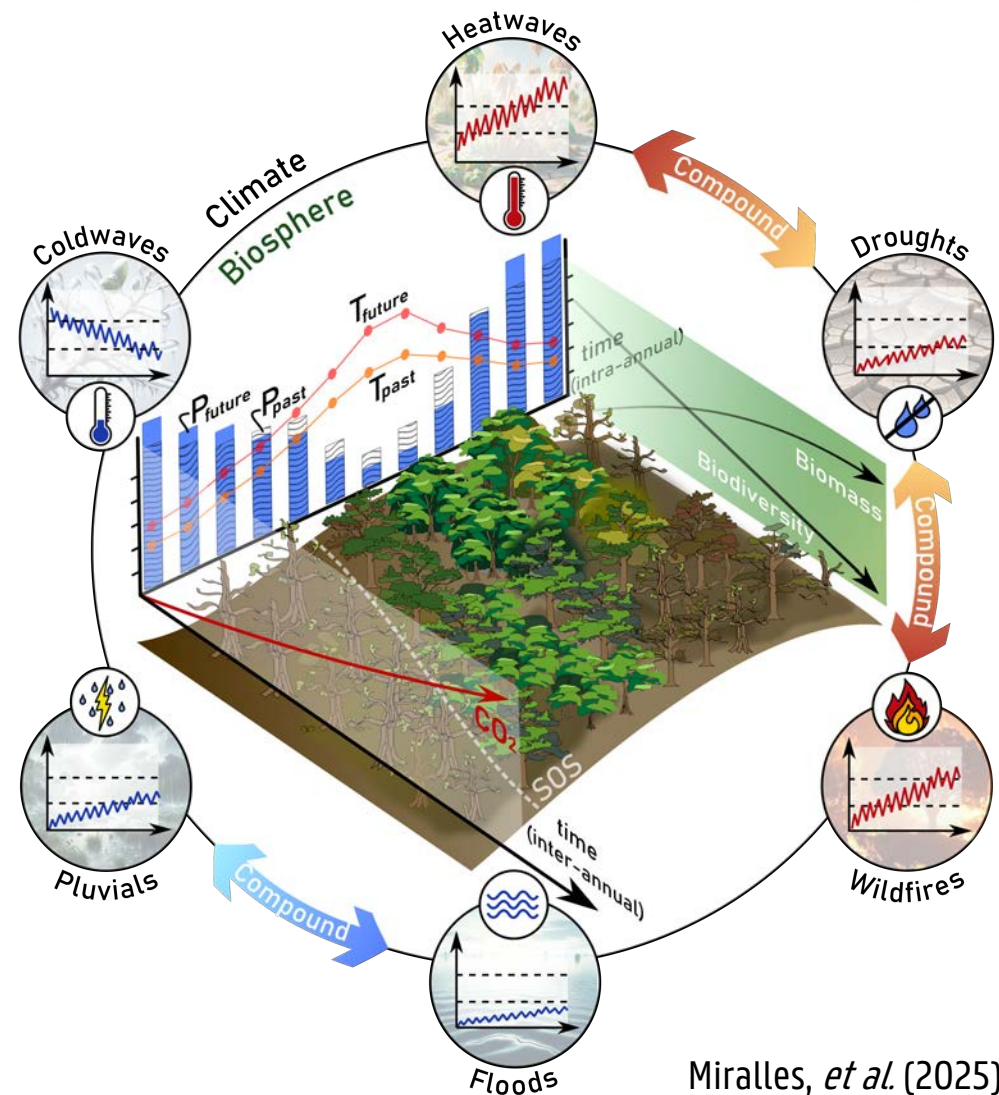


Global
Regional
Ecosystem
Local



METEOROLOGICAL

CLIMATOLOGICAL



Miralles, et al. (2025)

From ecosystem stress to circulation response: Biophysical feedbacks during droughts and heatwaves

Diego G. Miralles

D. Hagan, O. Baez-Villanueva, K. Delbare, V. Deman, J. Geirinhas, C. Decancq, T. Mortier [...]