

STEREO IV

BEODAY 2026

Liege | Belgium

28 | 05 | 2026



HERMES

Hybrid **E**stimation & **R**emote sensing **M**onitoring of **E**vaporation & **S**oil moisture



Diego.Miralles@UGent.be



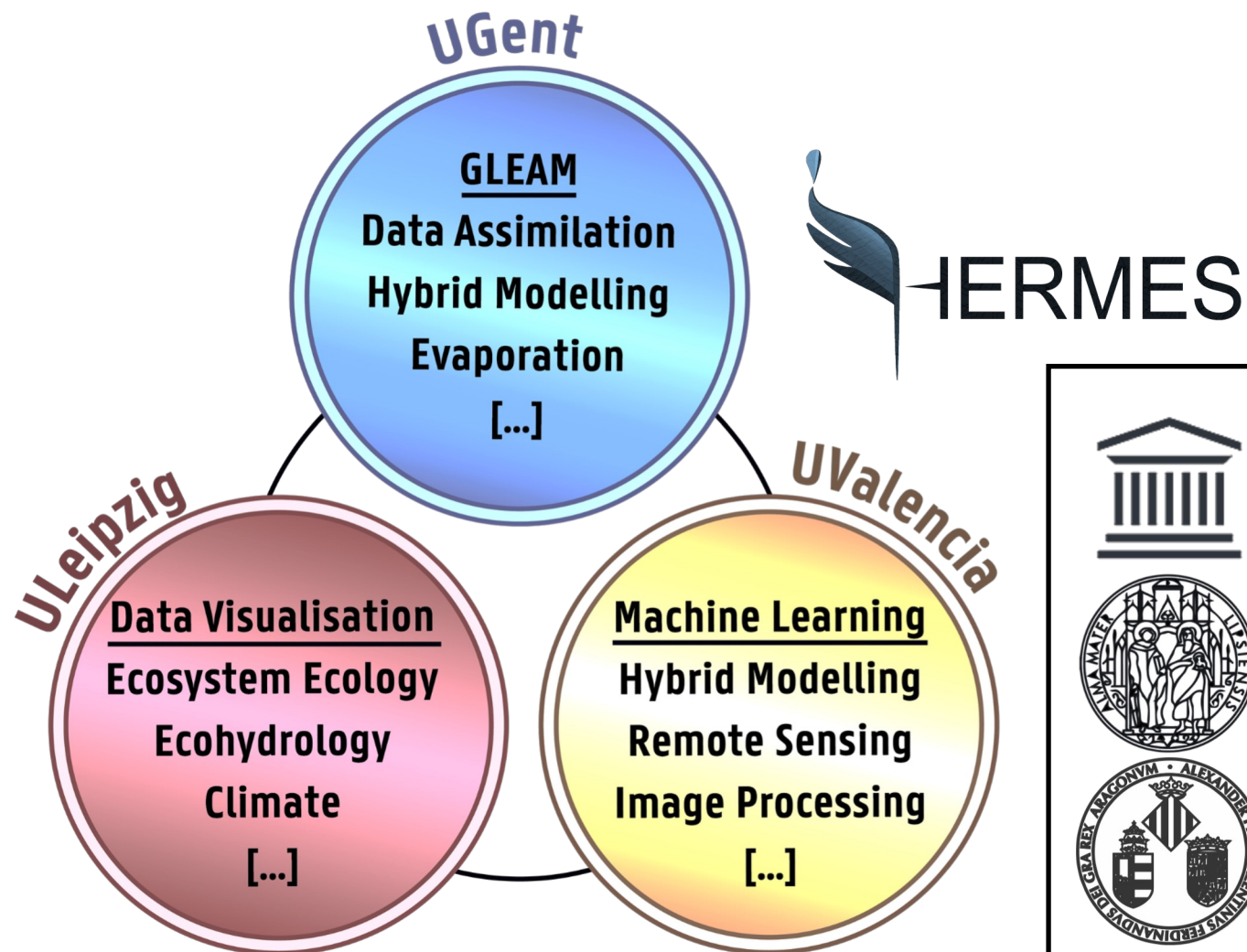
Ghent
University



Leipzig
University



University
of Valencia



Oscar Baez Villanueva
Diego Miralles
Akash Koppa

Olivier Bonte
Fangzheng Ruan
Joppe Massant



Miguel Mahecha
Maximilian Soechting



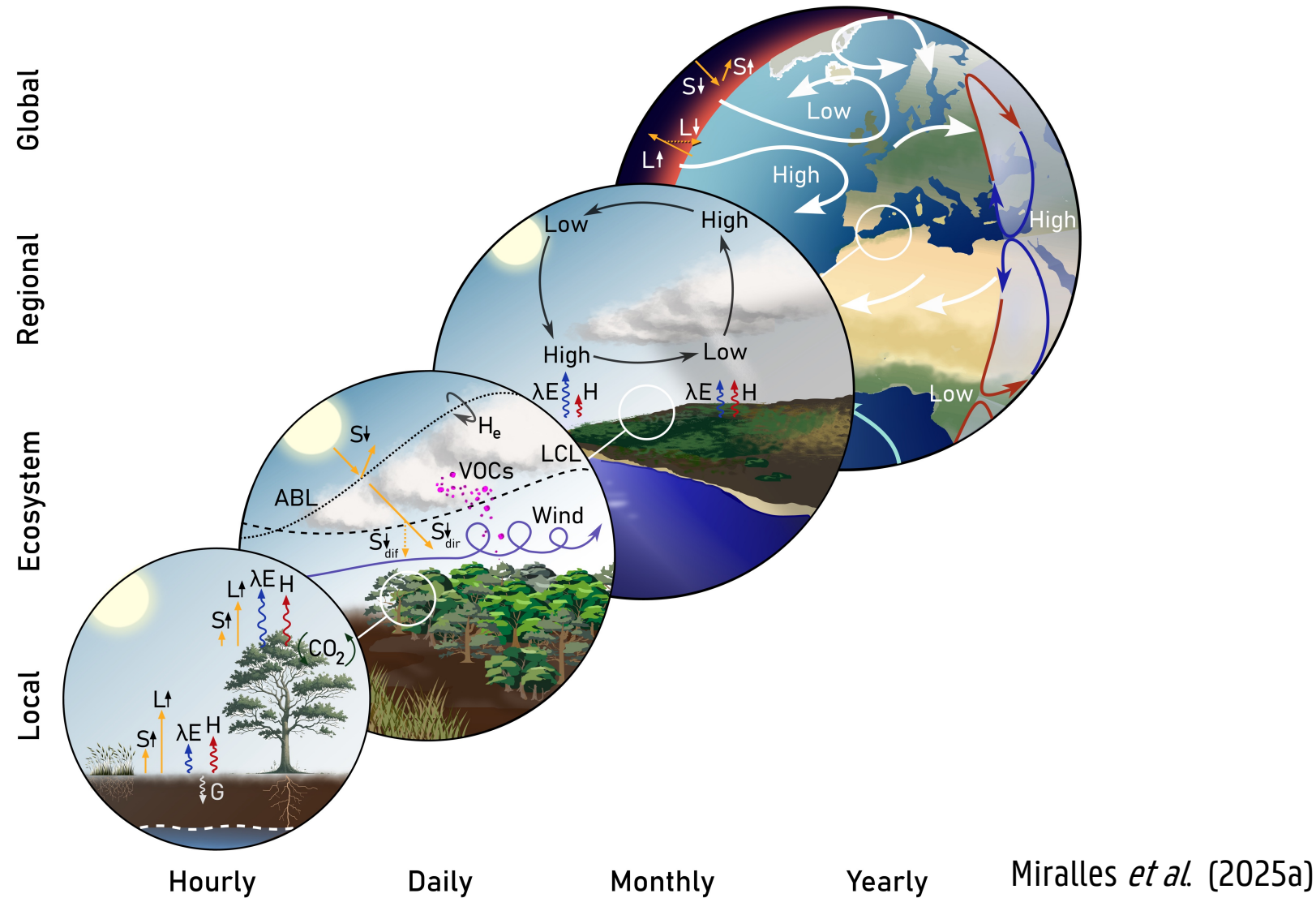
Gustau Camp-Valls
Alvaro Moreno



Evaporation

Necessary

1. Climate change diagnosis
2. Hydrometeorology events
3. Water management
4. Agriculture & food security


Miralles *et al.* (2025a)

Evaporation

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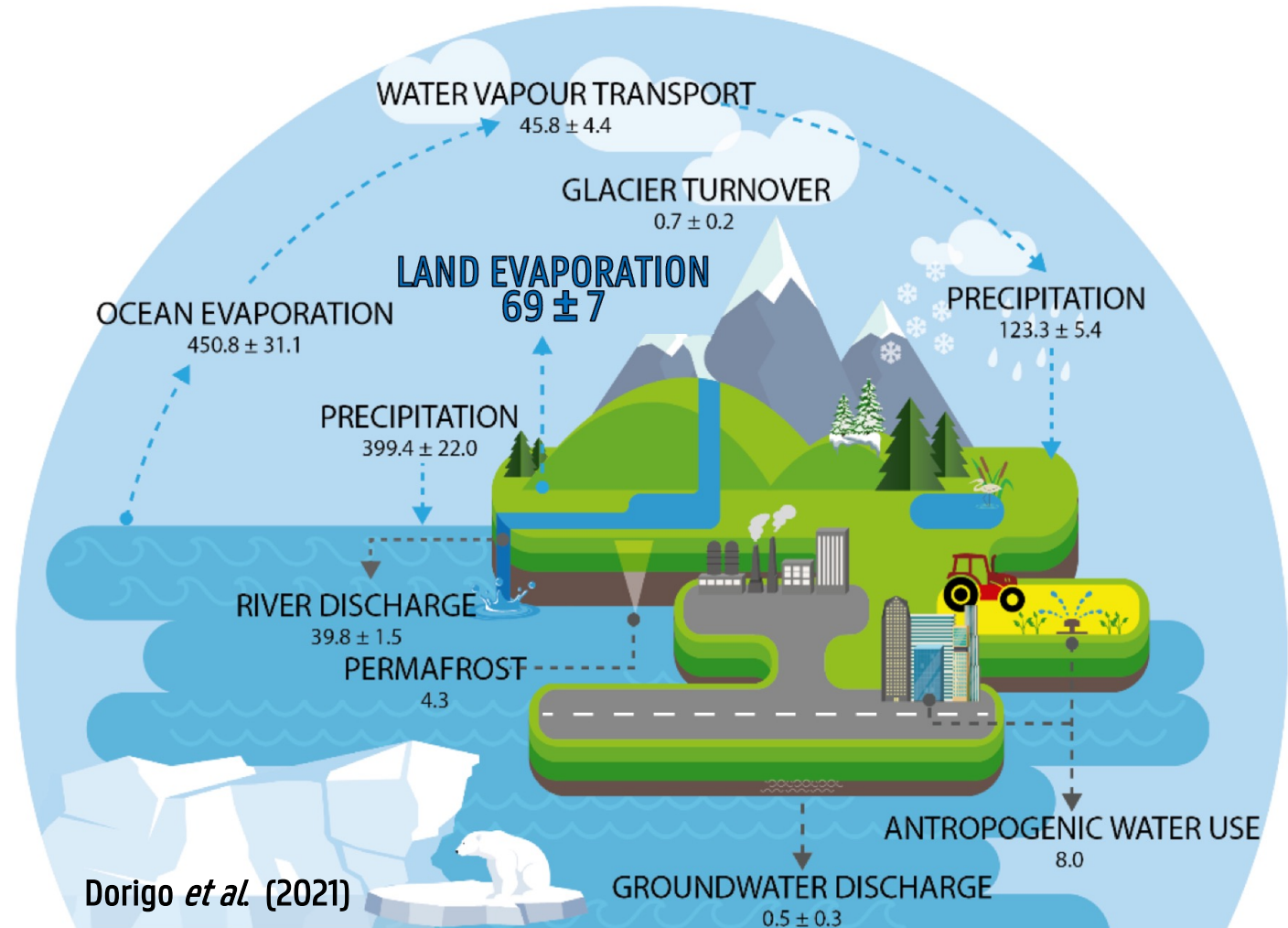
Evaporation

Necessary

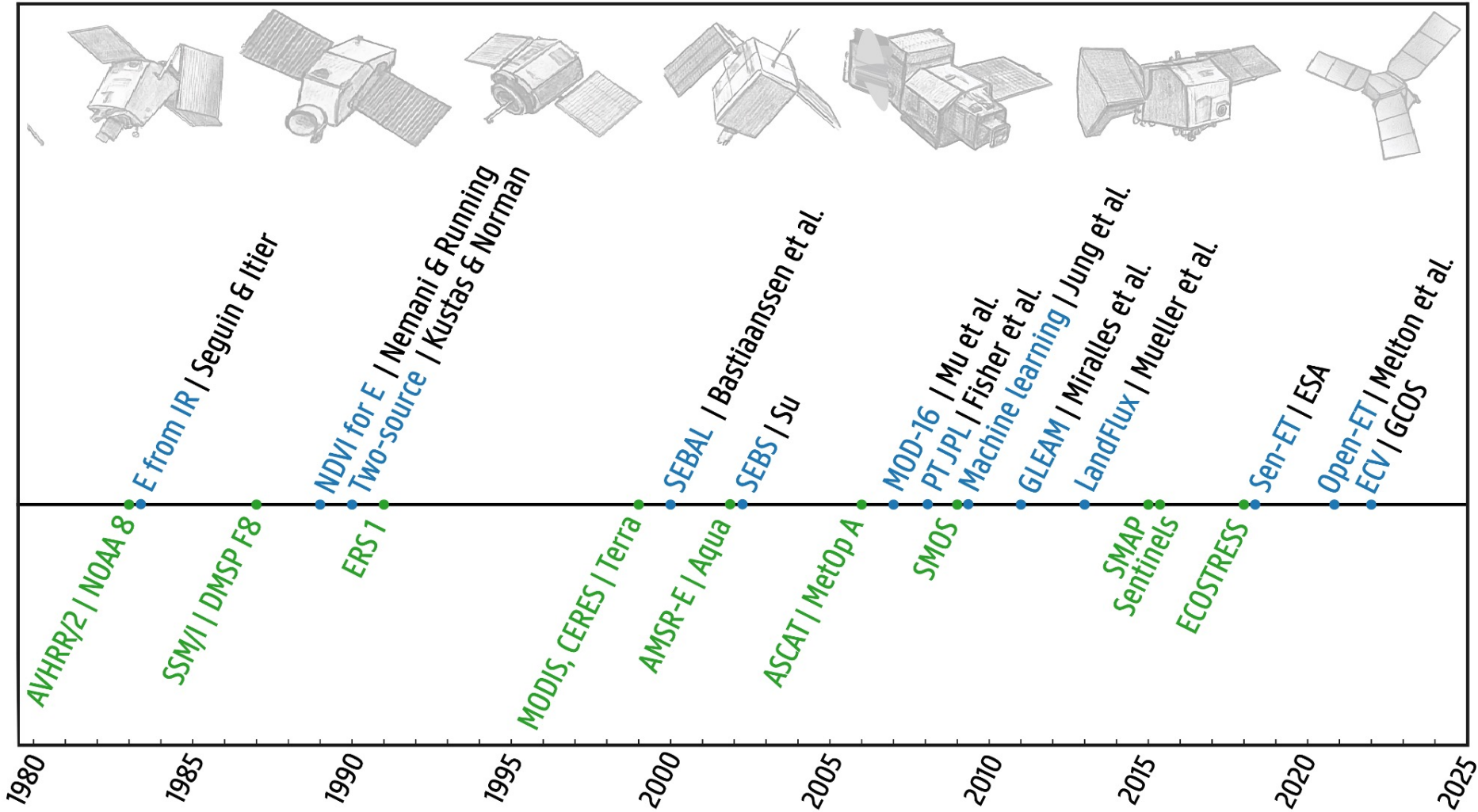
1. Climate change diagnosis
2. Hydrometeorology events
3. Water management
4. Agriculture & food security

Highly uncertain

1. Scarcity of global measurements
2. Difficult to model
3. 'Invisible': not directly observable from space



Evaporation remote sensing



Evaporation datasets

Agriculture & water management

SEBAL	Bastiaanssen <i>et al.</i> (2000)
SEBS	Su <i>et al.</i> (2001)
METRIC	Allen <i>et al.</i> (2007)
Dis/ALEXI	Anderson <i>et al.</i> (2011)
STIC	Mallick <i>et al.</i> (2014)
FEST-EWB	Corbari <i>et al.</i> (2011)
ETLook	Bastiaanssen <i>et al.</i> (2012)

1. **Thermal** IR / energy balance
2. **Instantaneous** snapshots
3. **Discontinuous** cloud cover
4. **High-res:** 30 m to 1 km
5. **Short** records
6. **Local** to regional



Evaporation datasets

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Climate

PT-JPL	Fisher <i>et al.</i> (2008)	ETMonitor	Hu and Jia (2015)
FLUXCOM	Jung <i>et al.</i> (2009)	PML	Zhang Y. <i>et al.</i> (2016)
NTSG	Zhang Ke <i>et al.</i> (2010)	HOLAPS	Loew <i>et al.</i> (2016)
PM-MOD16	Mu <i>et al.</i> (2011)	WECANN	Alemohammad <i>et al.</i> (2017)
GLEAM	Miralles <i>et al.</i> (2011)	WaPOR	FAO (2020)
BESS	Ryu <i>et al.</i> (2011)	SITH	Zhang K. <i>et al.</i> (2024)
LSA-SAF	Ghilain <i>et al.</i> (2011)	X-BASE	Nelson <i>et al.</i> (2024)

1. **Process-based** or ML
2. **Daily** to monthly
3. **Continuous** (reanalysis reliance)
4. **Coarse:** from 1 km to 1°
5. **Multidecadal** records
6. **Global** extent

Evaporation datasets

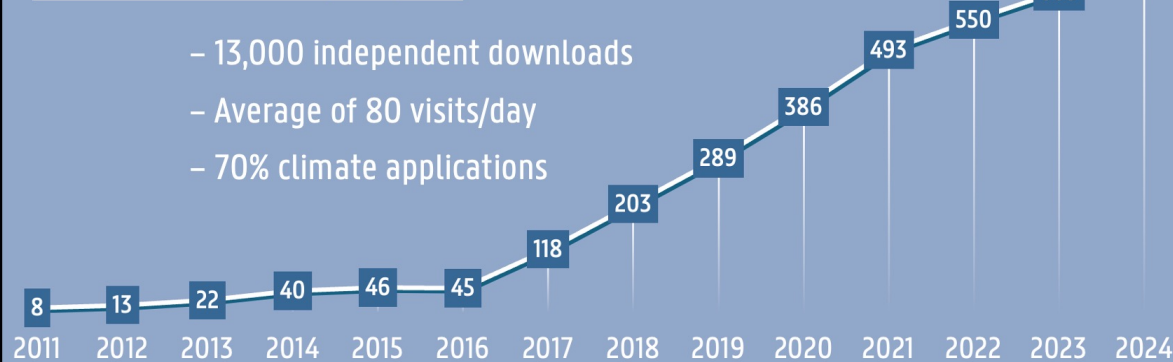
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Climate

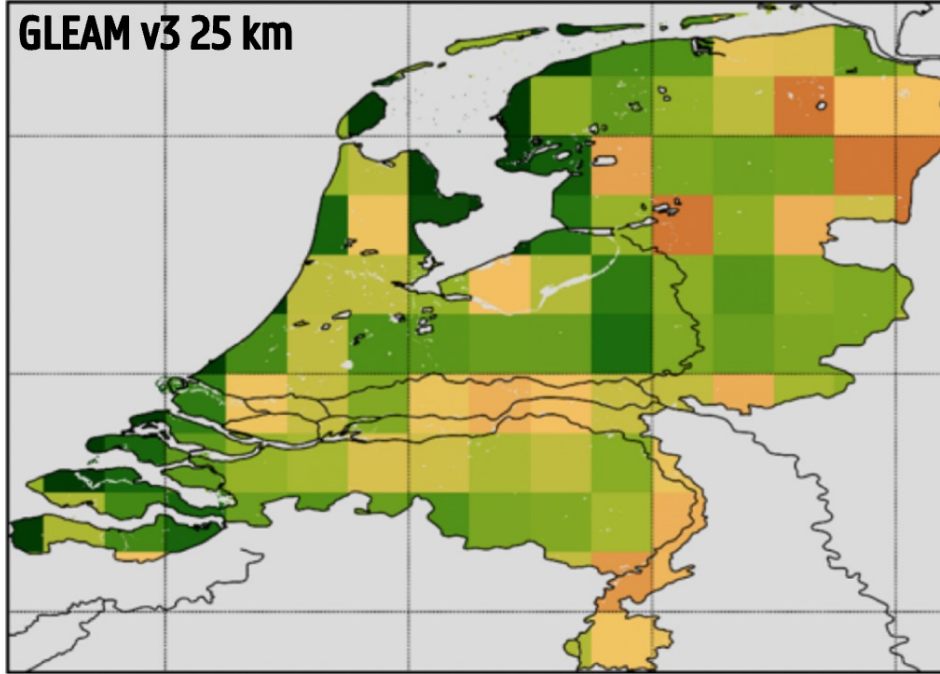
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Dataset citations per year



1. Continuous and stable
2. Long-term since 1980
3. Detailed partitioning
4. Soil moisture constraints
5. Multi-satellite data
6. Hybrid learning from *in situ*

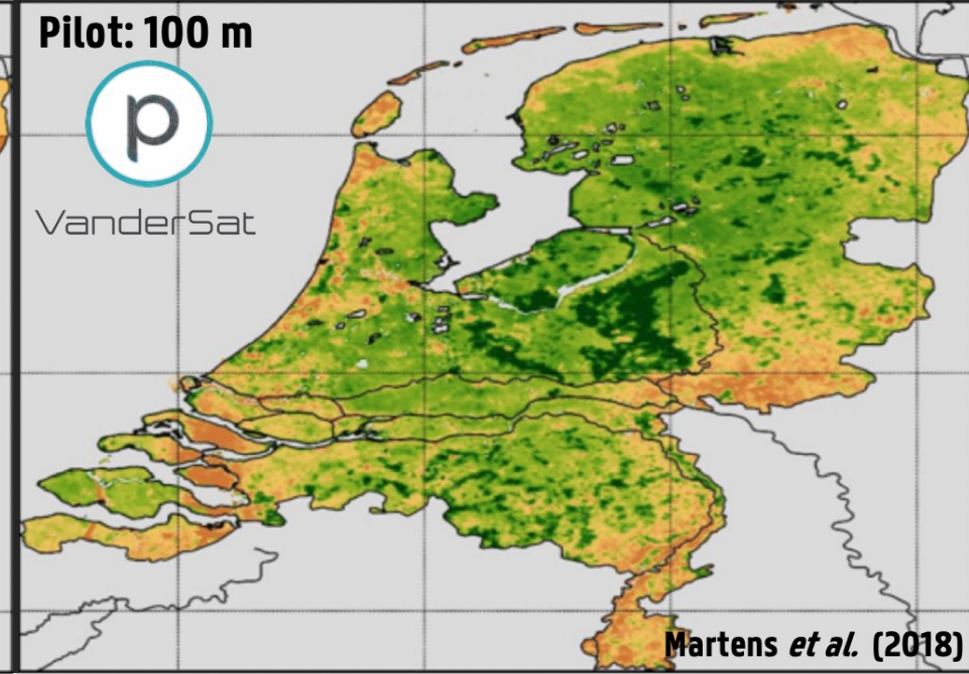
GLEAM v3 25 km



Pilot: 100 m



VanderSat



Martens *et al.* (2018)

520  640

mm yr⁻¹

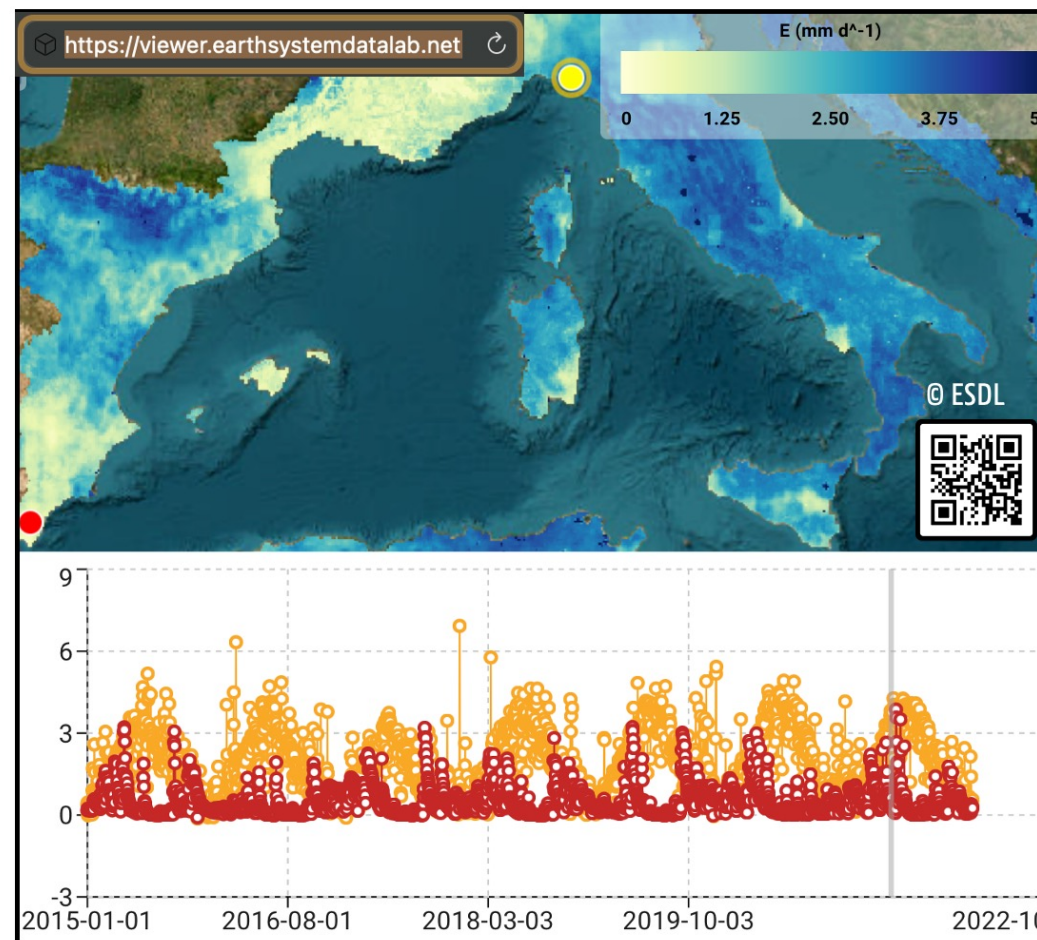
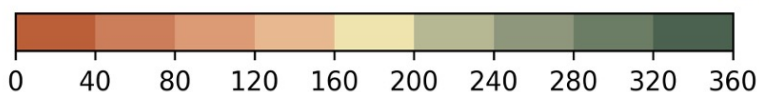
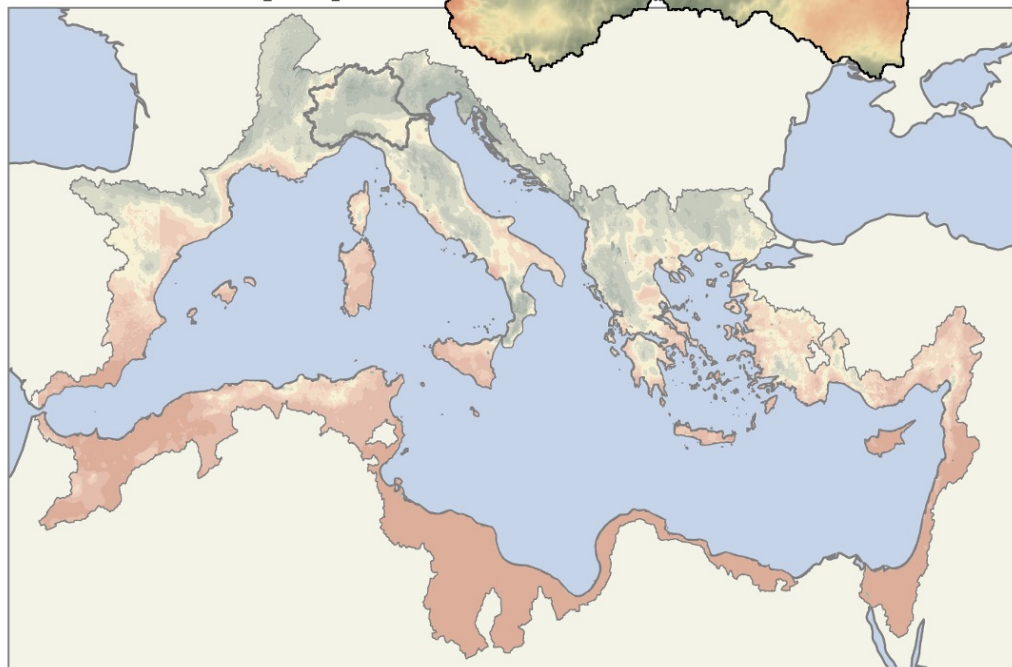
420  600

-  Climate change diagnosis
-  Hydroclimatic extremes
-  Water management
-  Agriculture & food security

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2017–2021 JJA E [mm]



ET-Sense | 4DMED Hydrology | DTE Hydrology

 HERMES

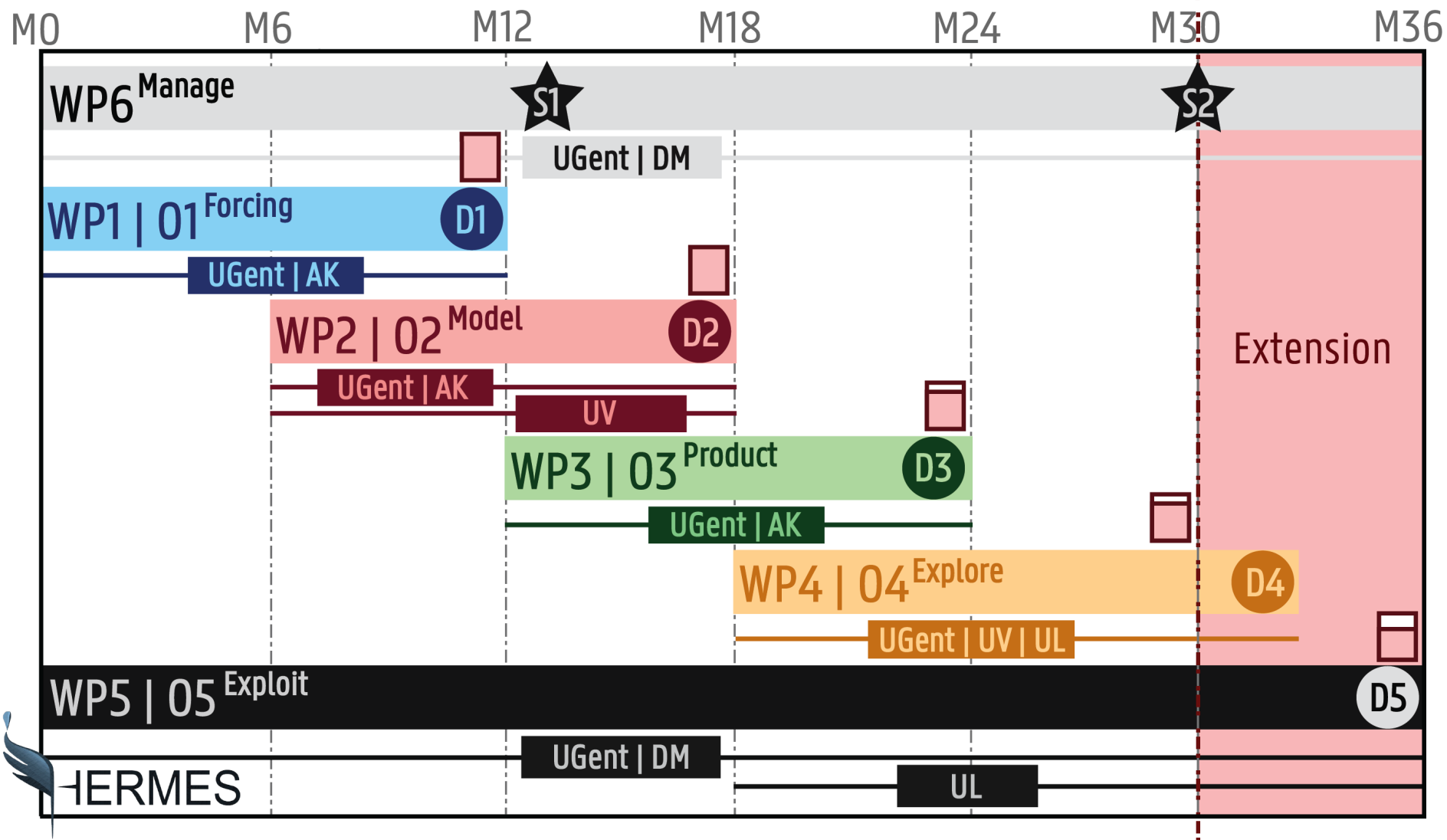
Goal | High-resolution dataset of E and SM for entire Meteosat disk

Framework | 3 years | 3 partners | 1 post-doctoral scientist + [...]

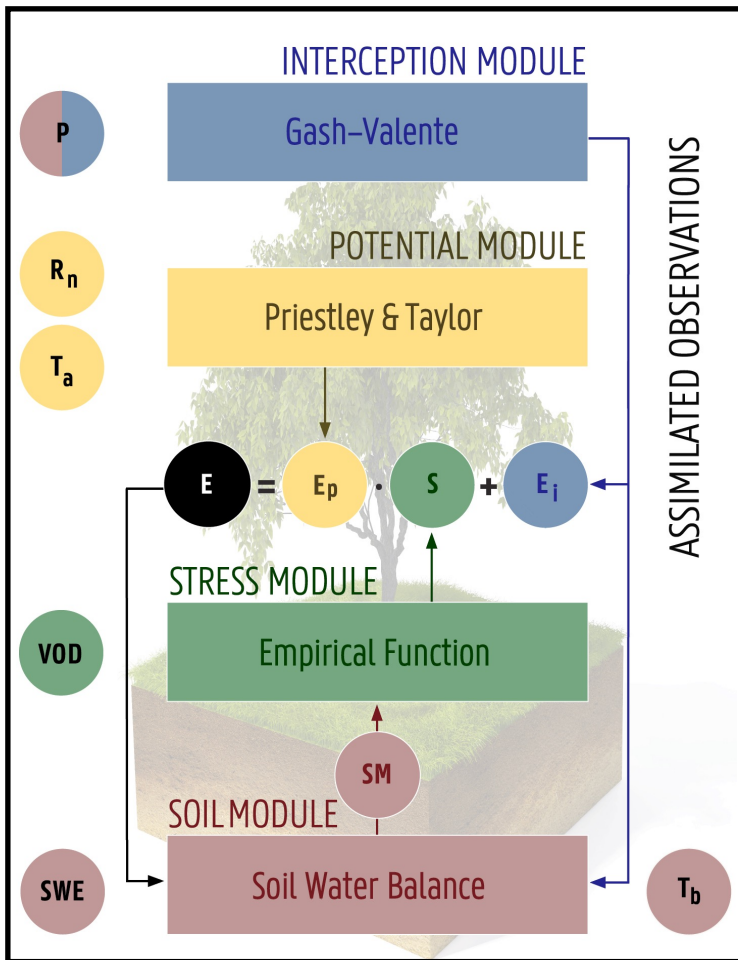
Expertise | Remote sensing | Hybrid modelling | ecohydrology

Impact | Climate research | water management | agricultural science

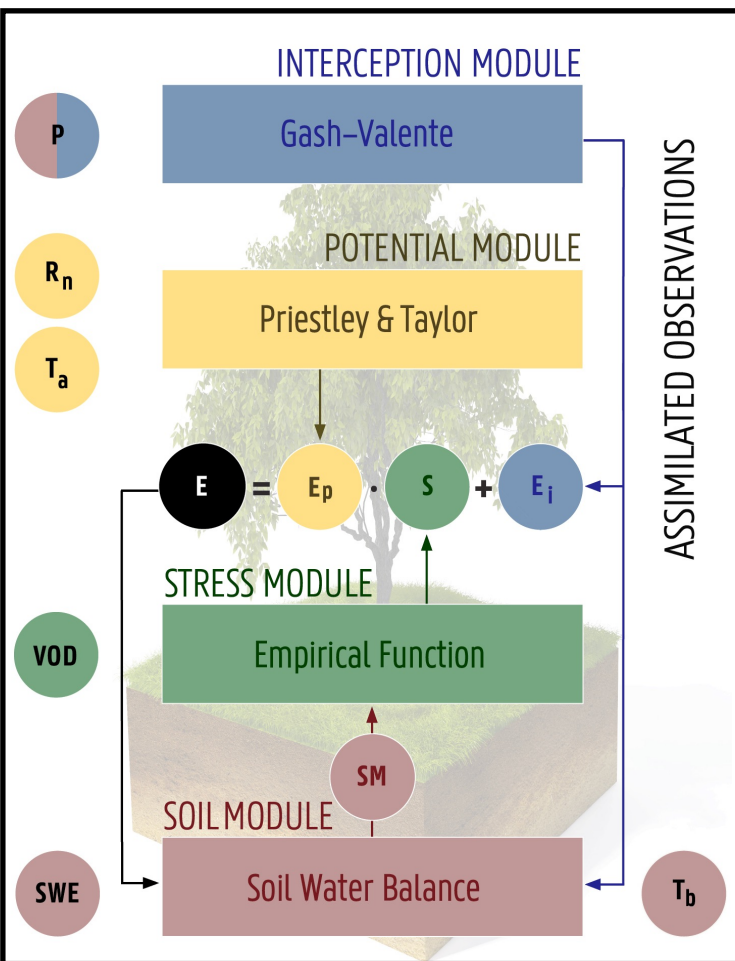




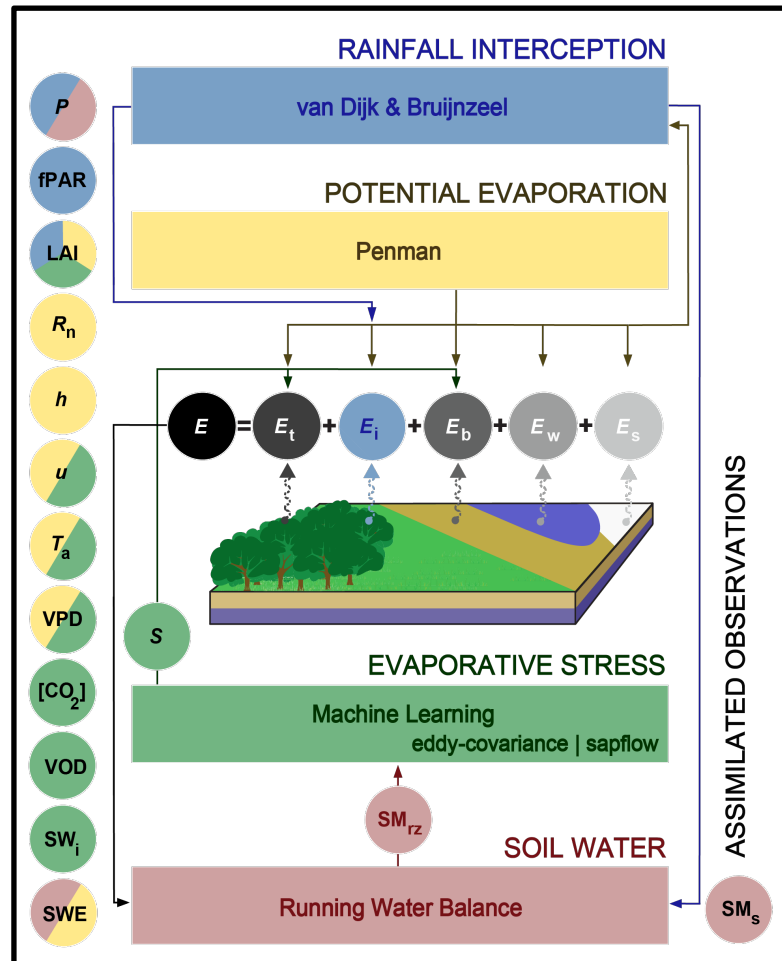
GLEAM v3 | Martens *et al.* (2017)



GLEAM v3 | Martens *et al.* (2017)



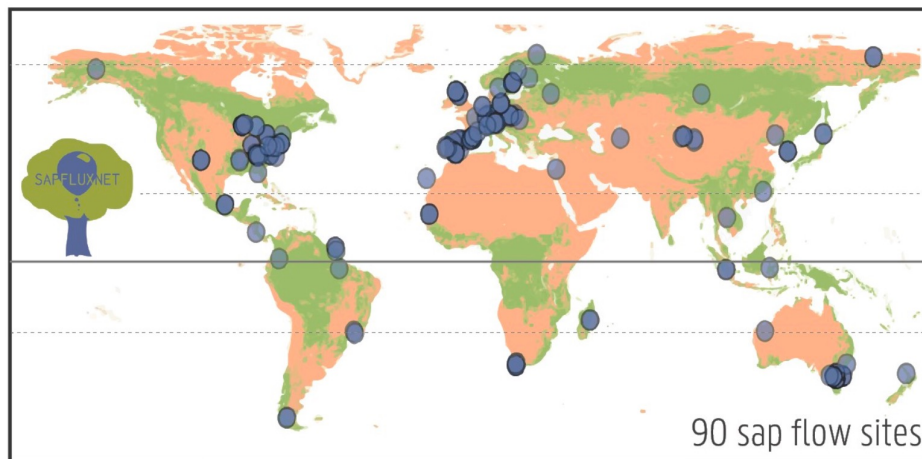
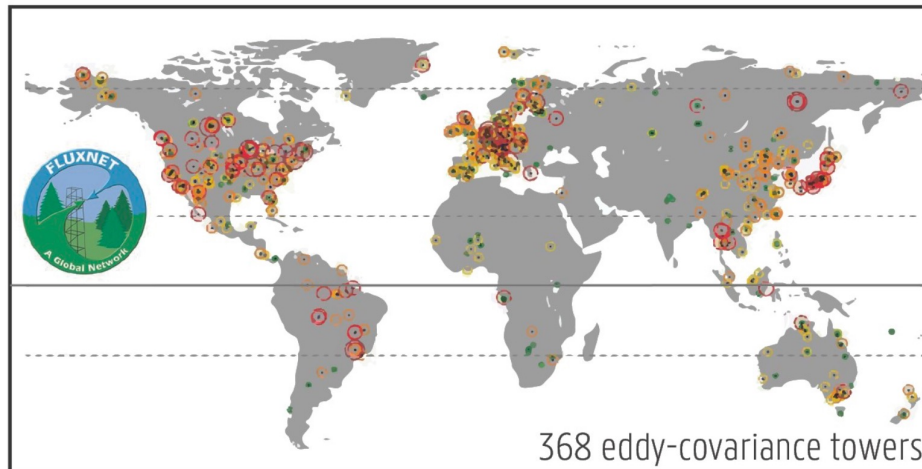
GLEAM4 | Miralles *et al.* (2025)



scientific data

www.nature.com/scientificdata

OPEN DATA DESCRIPTOR **GLEAM4: global land evaporation**

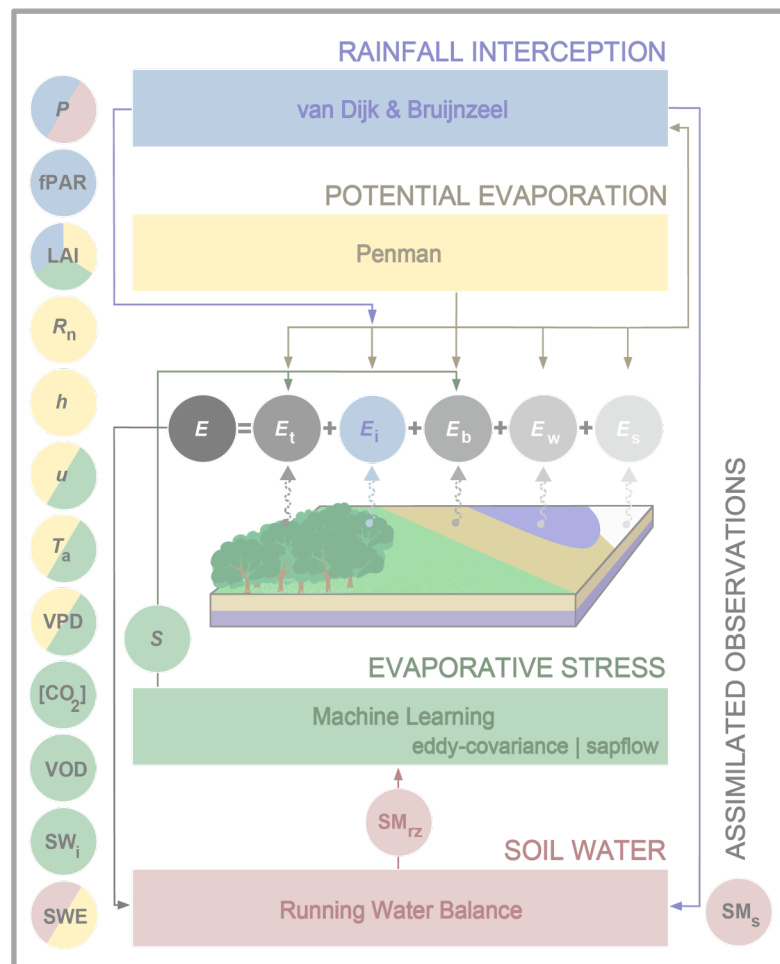




New GLEAM4.3a Data

New 4.3a release already available under Downloads; and GLEAM4 paper available [here](#)

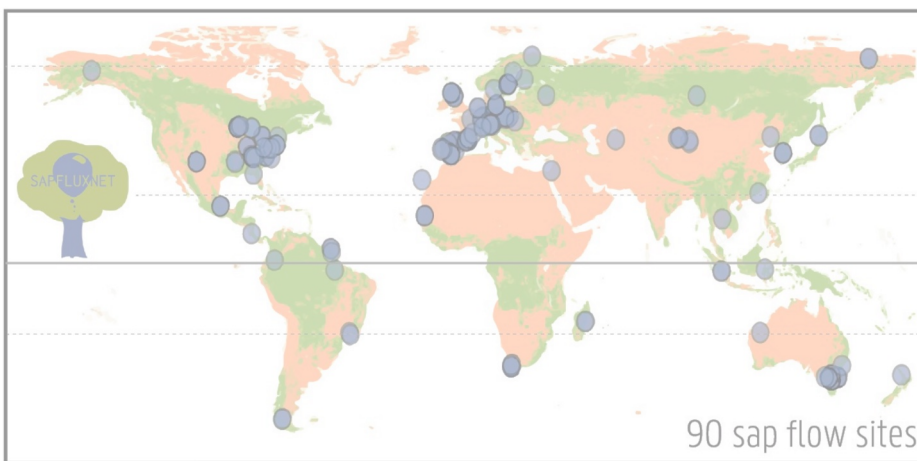
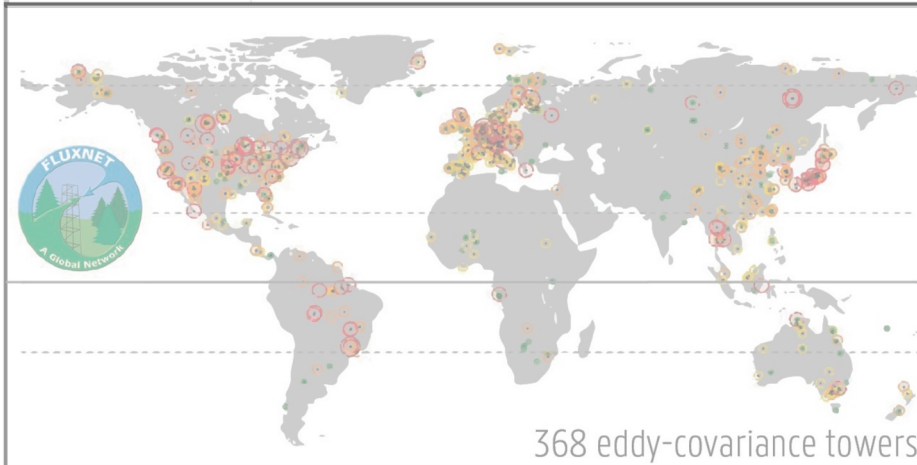
GLEAM4 | Miralles *et al.* (2025)



scientific data

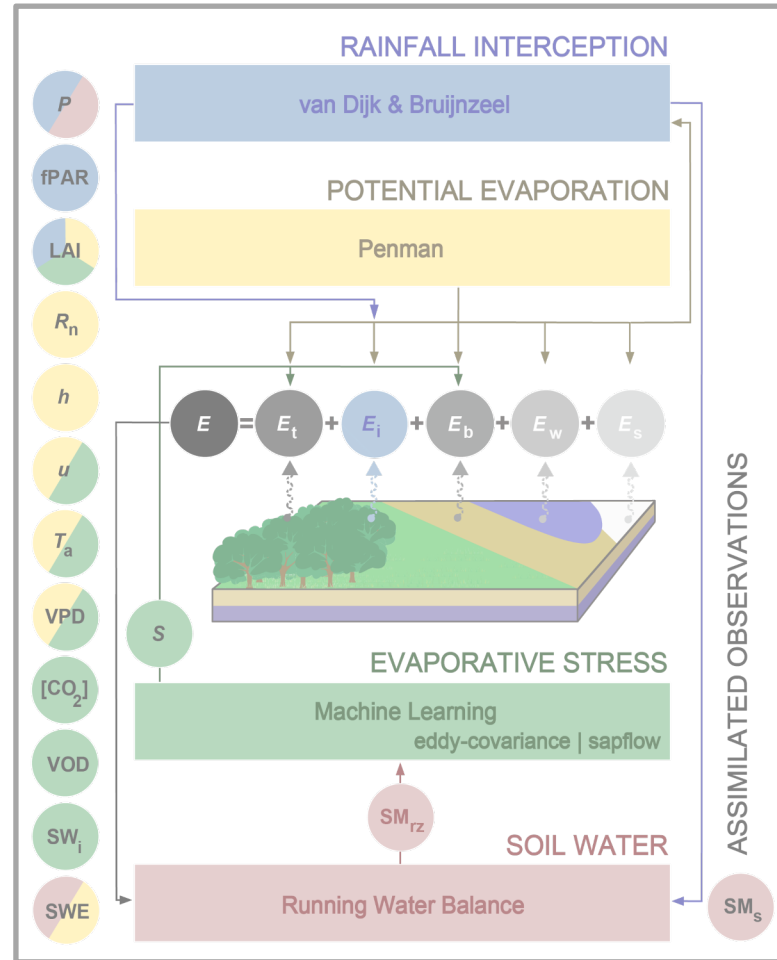
www.nature.com/scientificdata

OPEN DATA DESCRIPTOR **GLEAM4: global land evaporation**



P	MSWEPv2.8 & CHESAv2.1
fPAR	MCD15A3Hv6.1 & MOD44Bv6.1
LAI	MCD15A3Hv6.1 & MOD44Bv6.1
R_n	MSG & MODIS (LST, α , ϵ)
h	GEDI
u	ERA5
T_a	MSWXv1 & CHESAv2.1
VPD	MSWXv1
[CO ₂]	CAMS
VOD	VODCA
SW _i	MSG [DSSF]
SWE	GlobSnowv3.0 & AMSR-E L3
fW	MOD44Wv6.1
fB, fTC, fH	MCD15A3Hv6.1 & MOD44Bv6.1
Soil Properties	HiHydroSoil v2.0

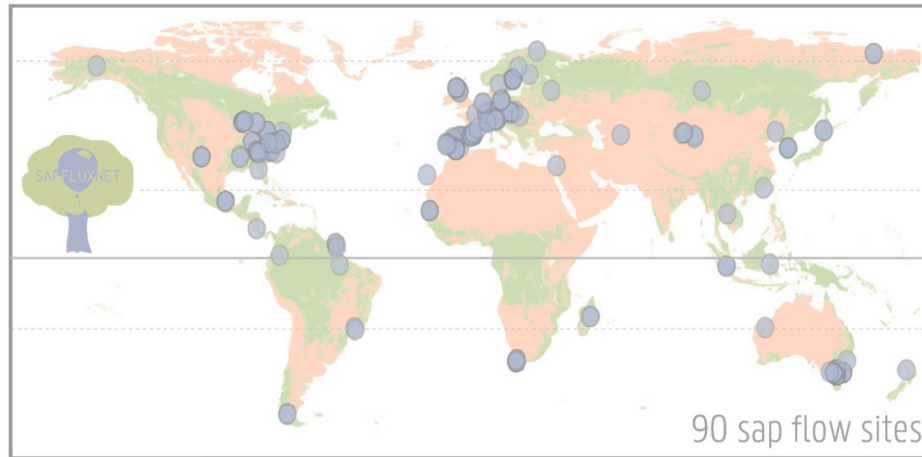
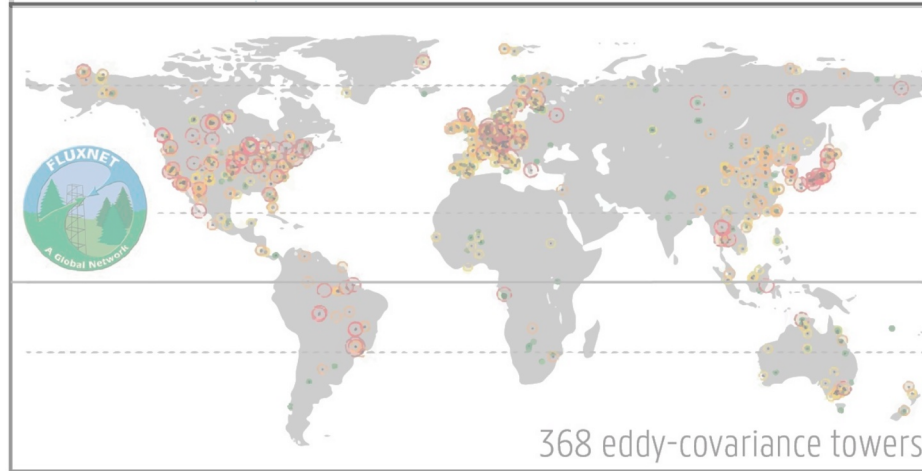
GLEAM4 | Miralles *et al.* (2025)



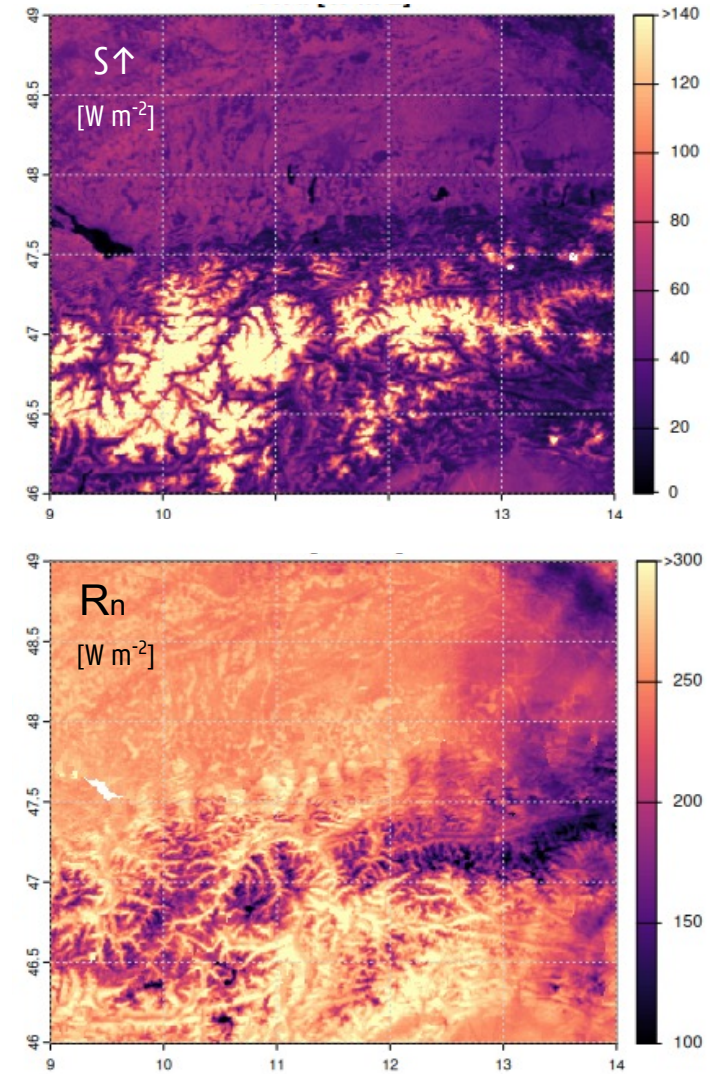
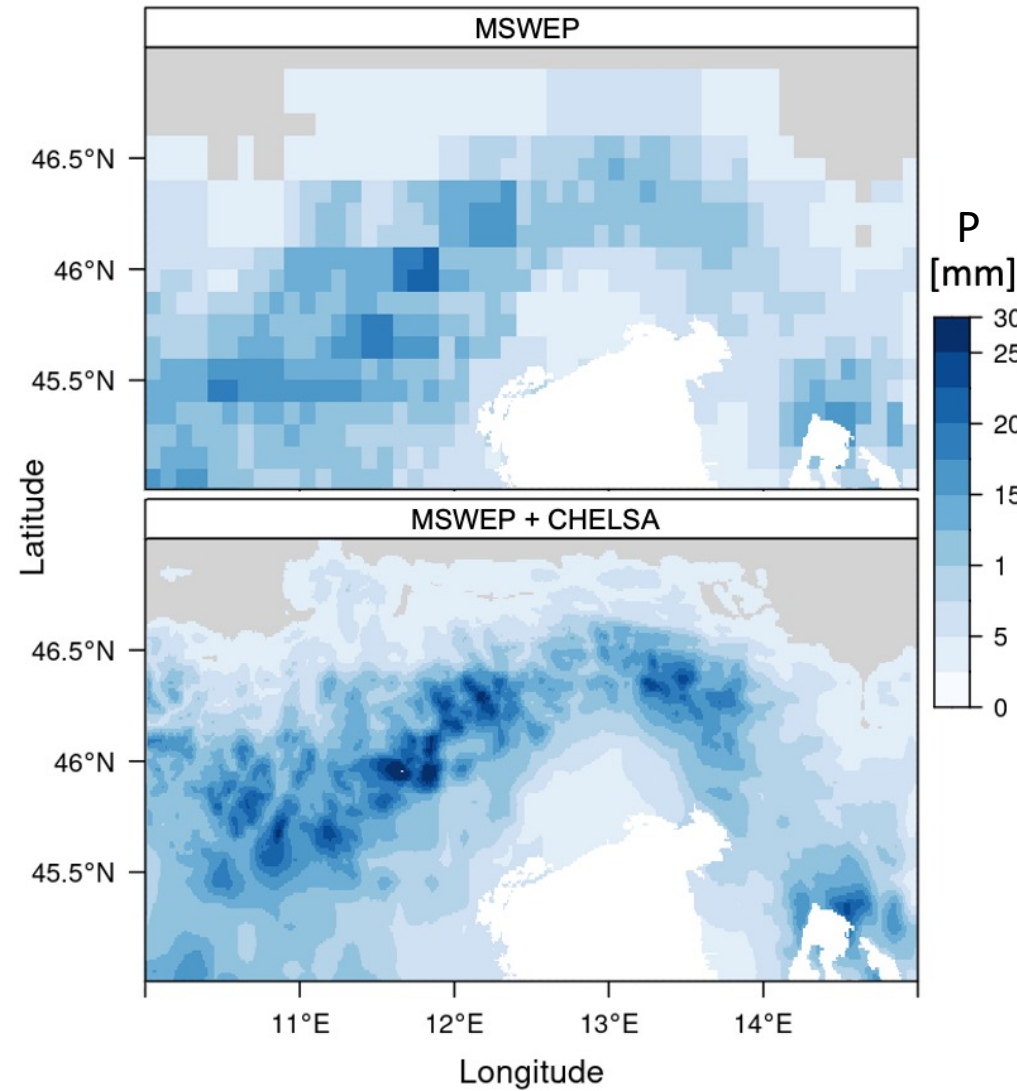
scientific data

www.nature.com/scientificdata

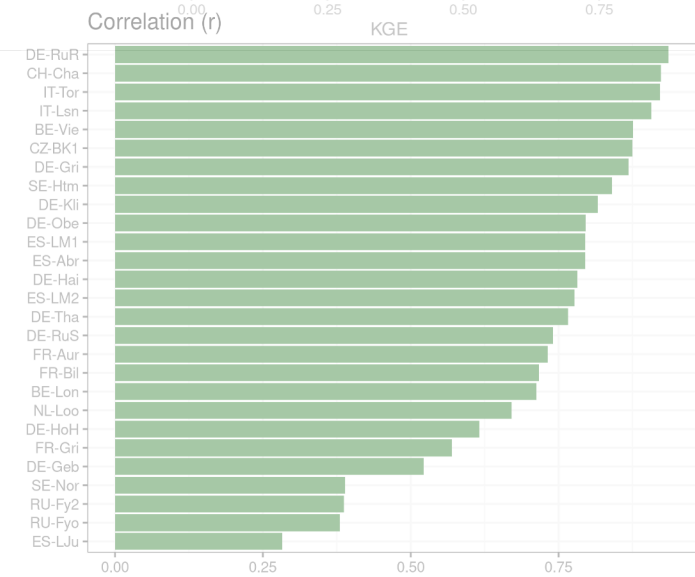
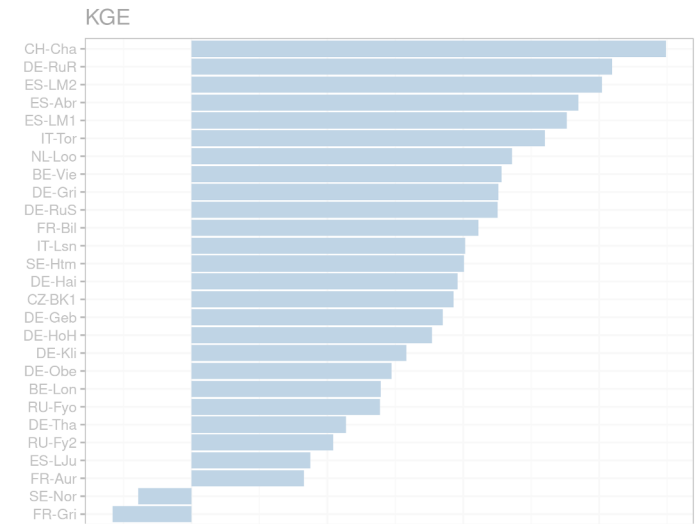
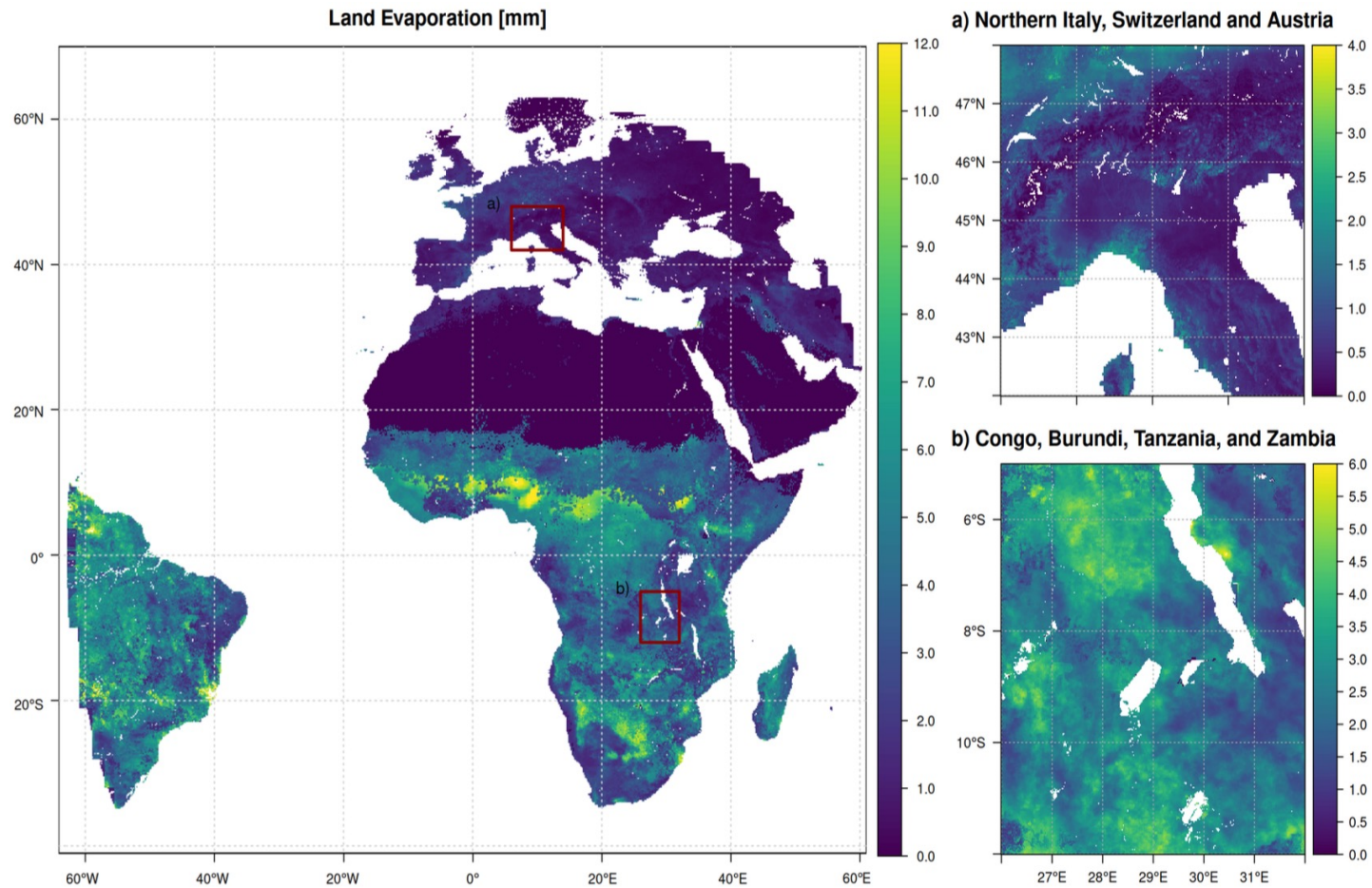
OPEN DATA DESCRIPTOR GLEAM4: global land evaporation



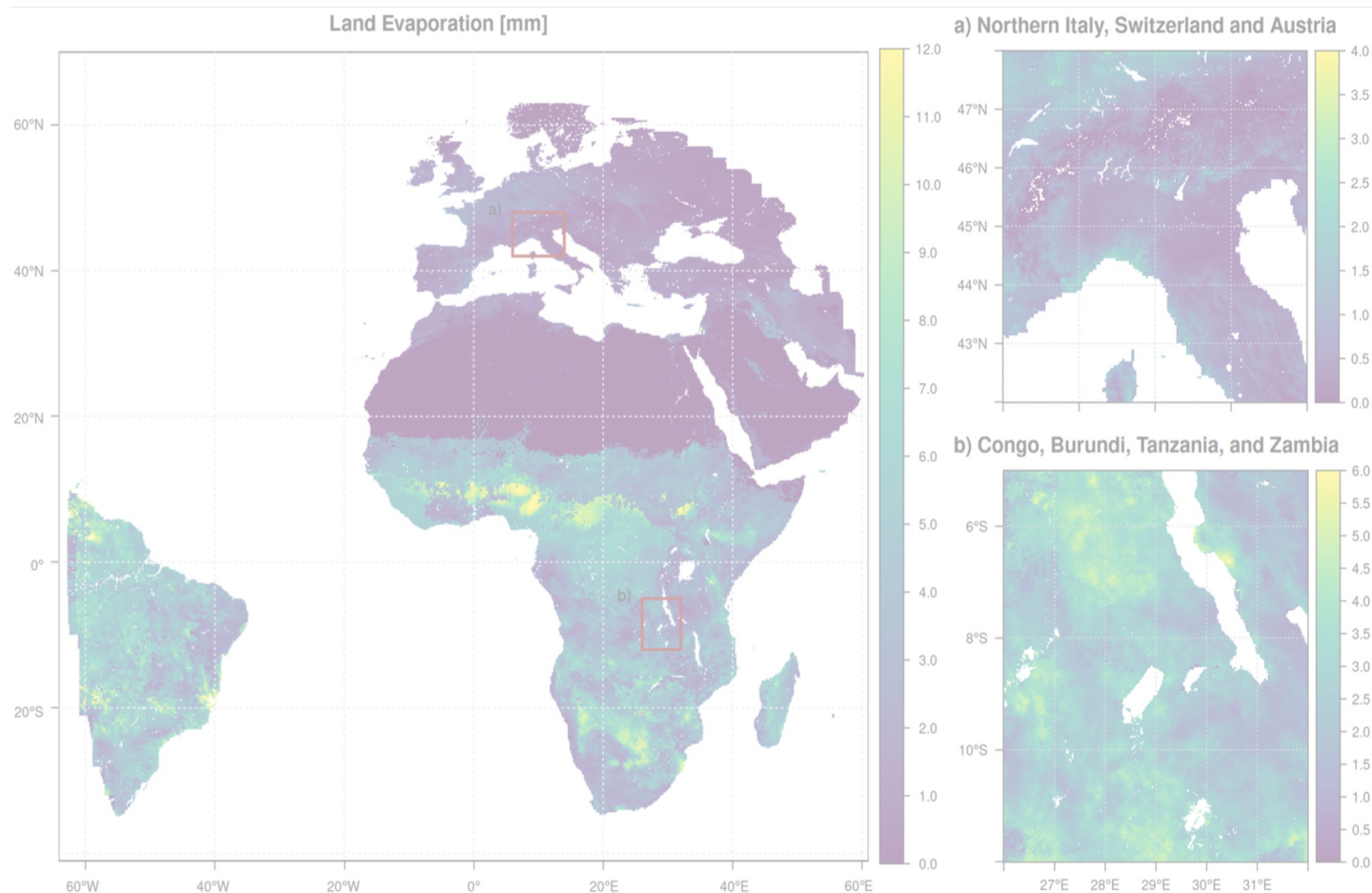
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[CO ₂]	CAMS
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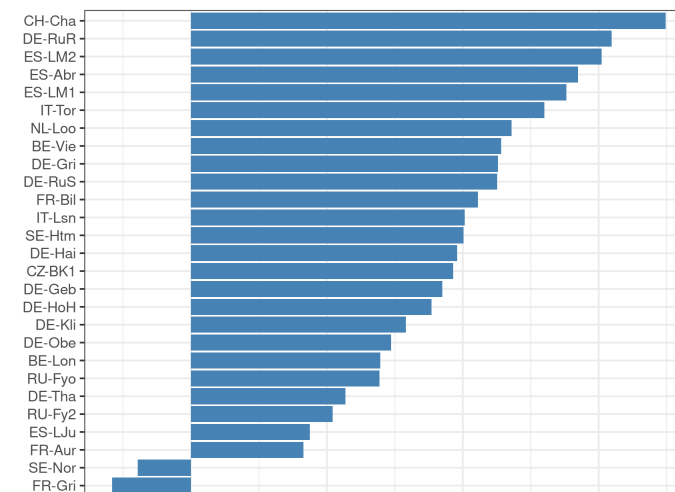
- ❖ Dataset for **2018–2022** validated across **27 sites**
- ❖ **Irrigation** module already included



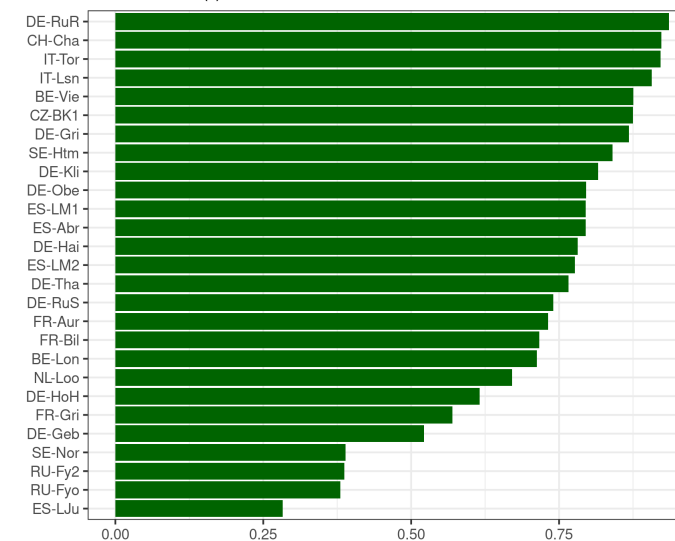
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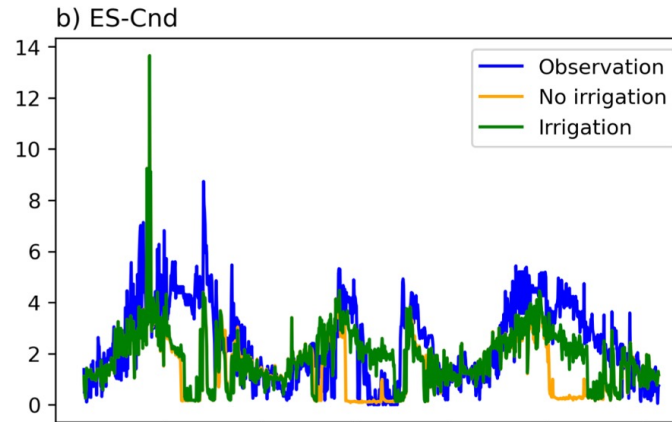
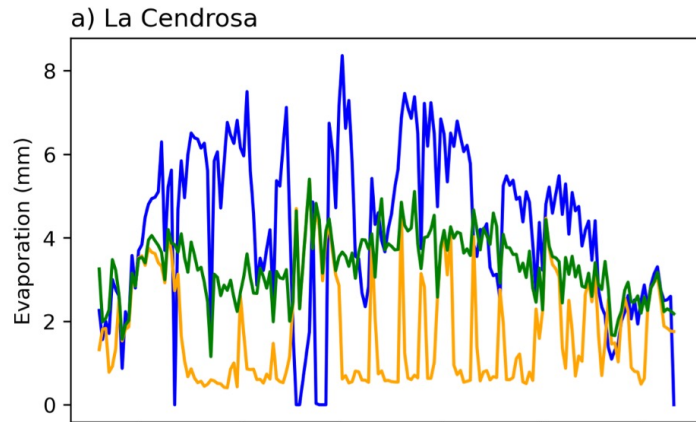


KGE

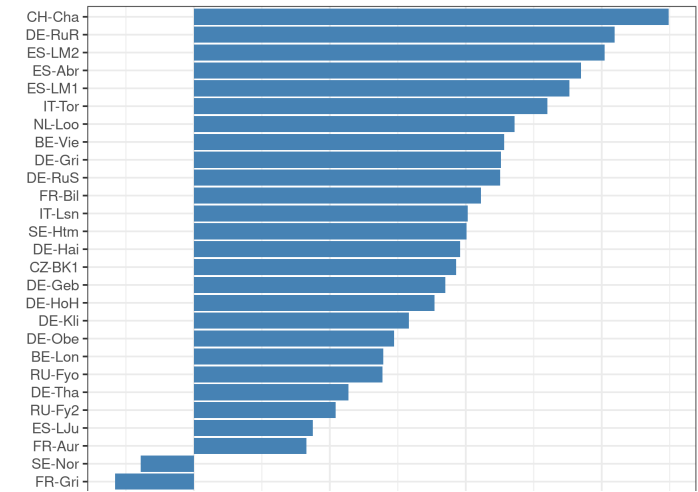


Correlation (r)

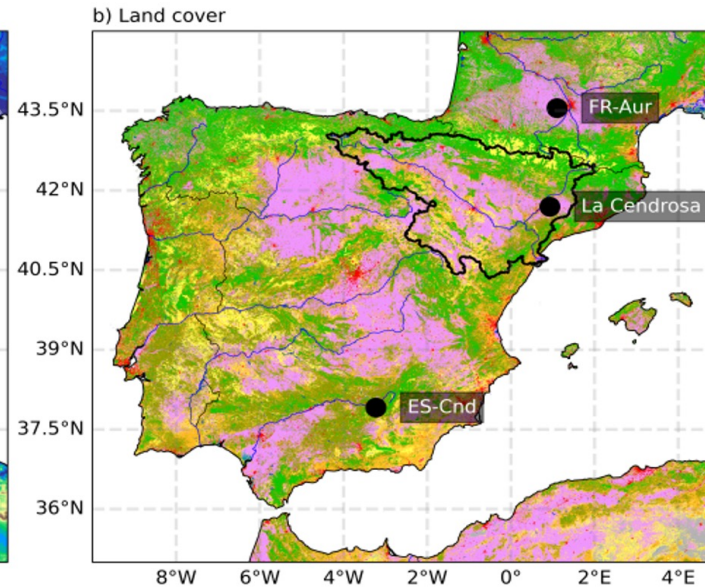
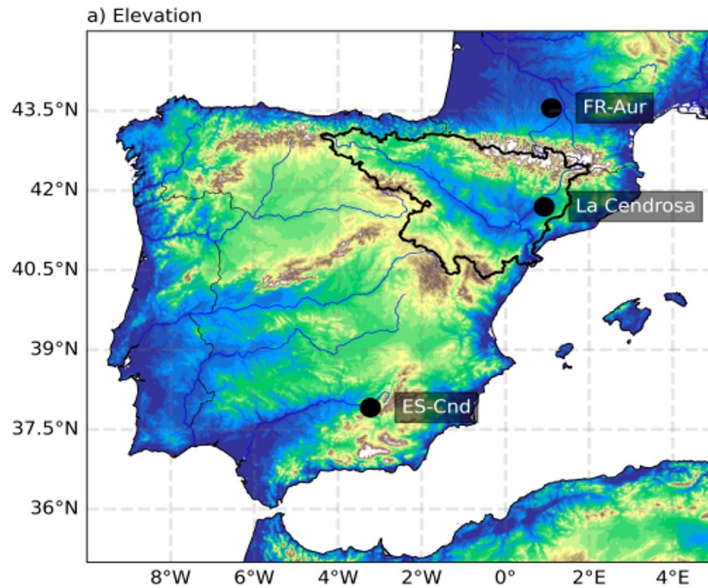
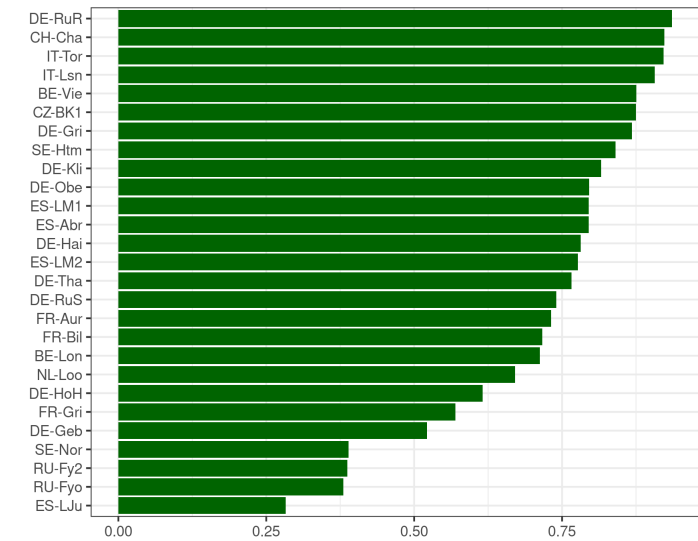




KGE



Correlation (r)



Baez-Villanueva *et al.* (in review)


UNIVERSITÄT
LEIPZIG

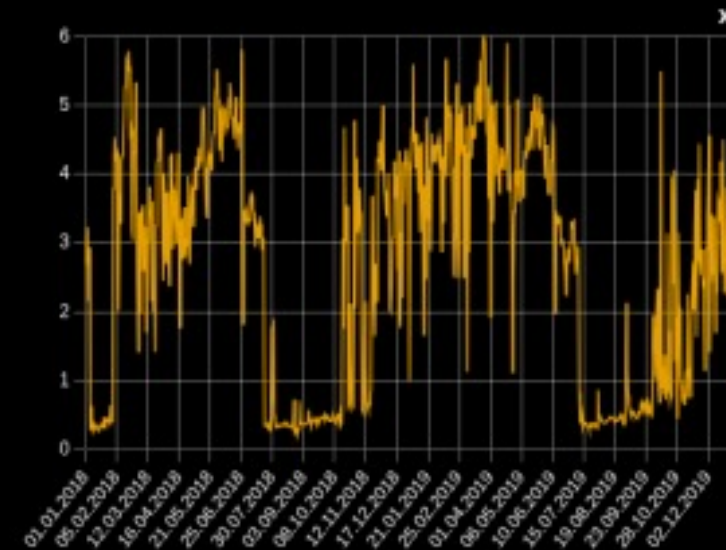
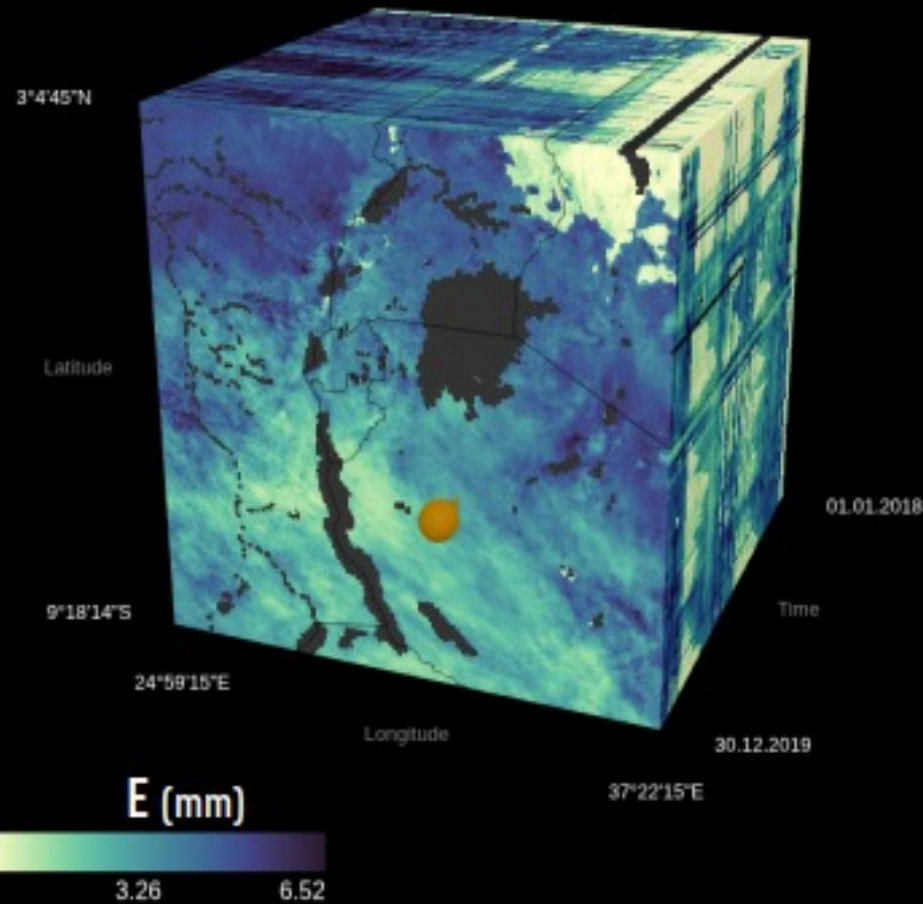

Lexcube



HERMES


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Download currently visible data subset


<https://gleam.lexcube.org/>

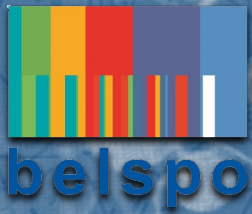
Accomplished

- ❖ Final hybrid E algorithm including irrigation (GLEAM4.3a)
- ❖ Compilation of forcing at 1km and execution over Meteosat disk
- ❖ Validated datacube of E, E components, and SM

Ongoing

- ❖ Extension to global (ESA)
- ❖ Exploration of AI for super-resolution and artifacts smoothing





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