climate change initiative

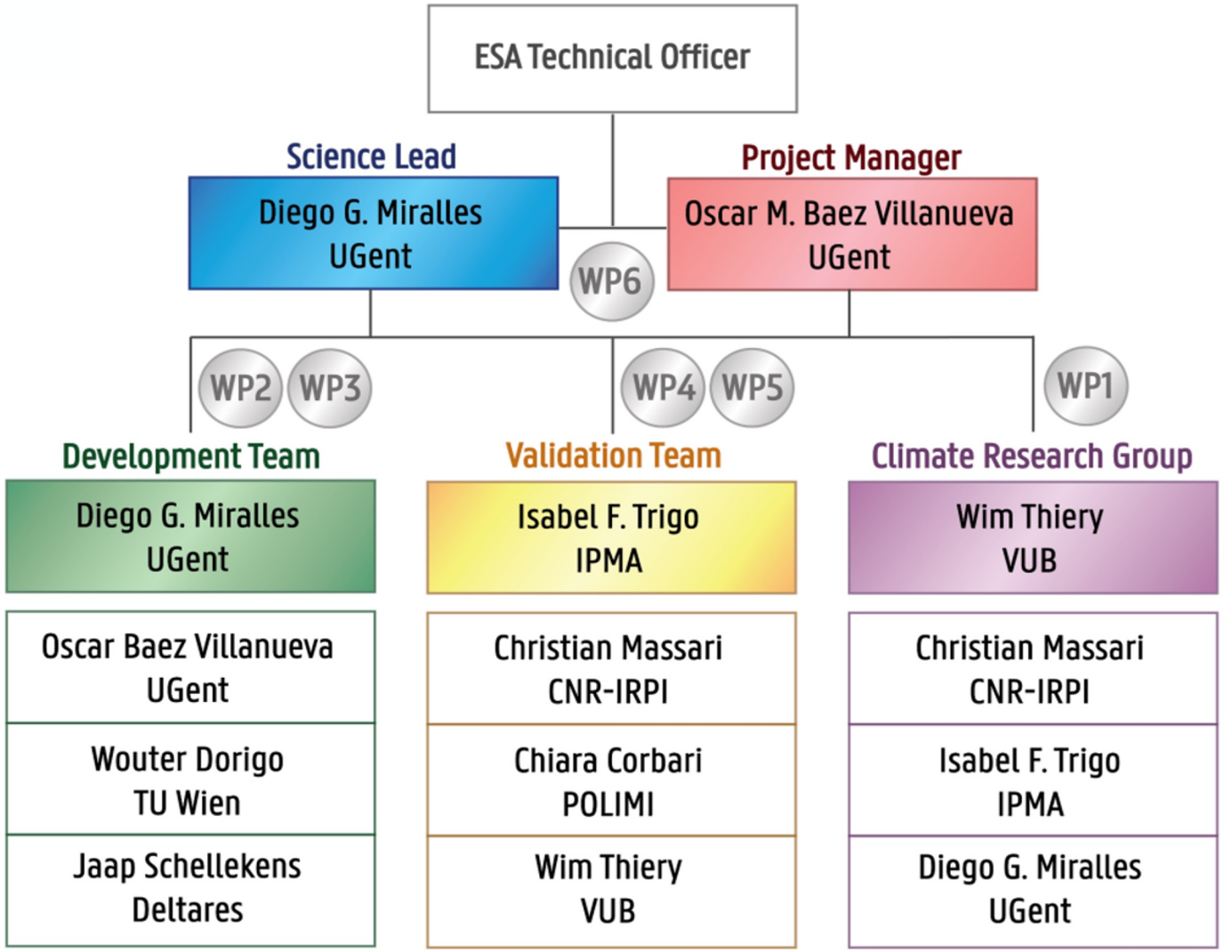
LAND EVAPORATION

CCI colocation & CMUG integration meeting 2026

Diego G. Miralles (on behalf of the consortium)

land evaporation

TEAM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UGent
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WP2
WP3
WP4
WP5
WP1
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GOAL

To enhance the ESA CCI ECV portfolio by **developing a long-term high-accuracy land evaporation dataset**, including components and turbulent fluxes

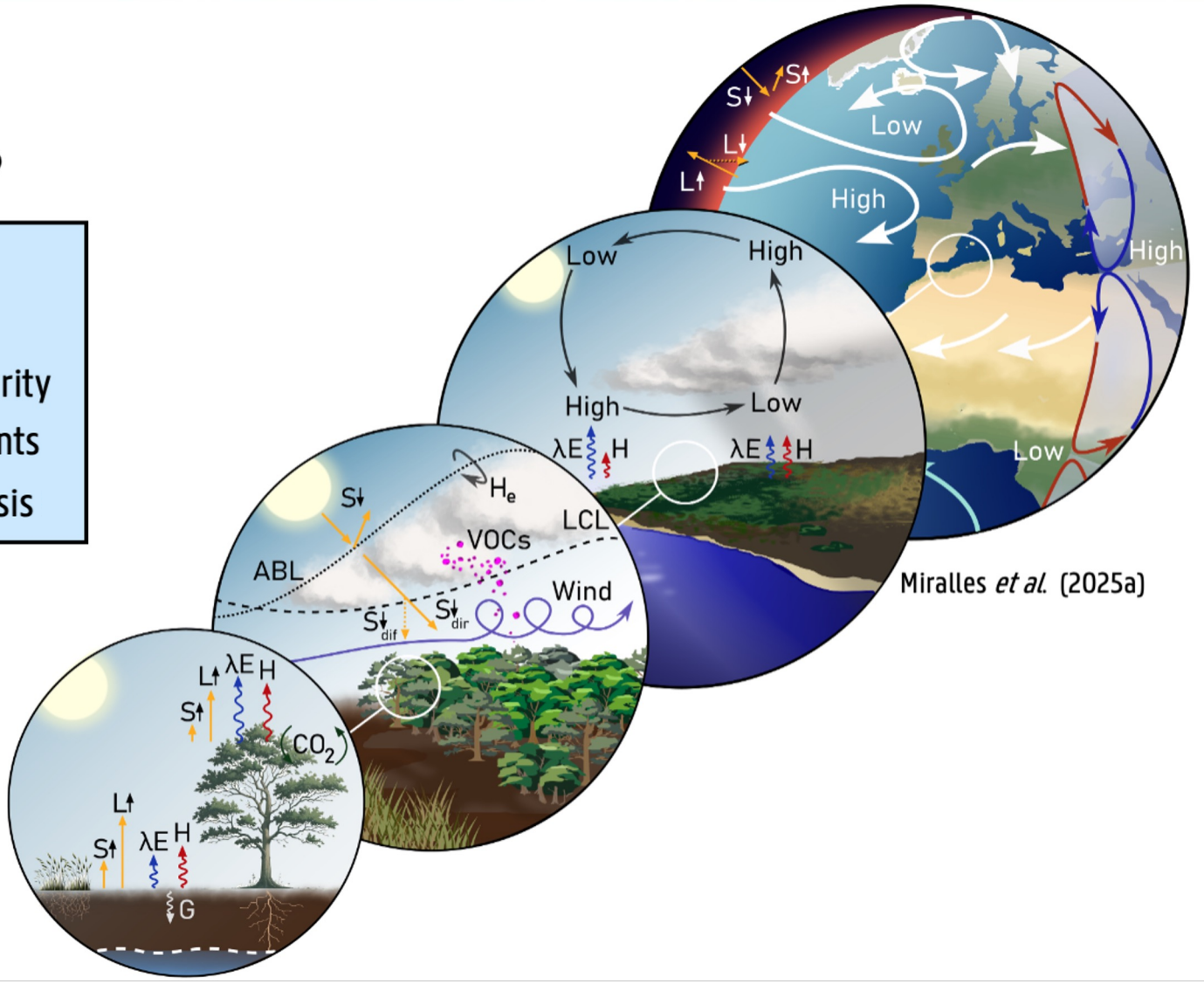
land evaporation

MOTIVATION

Why Evaporation?

Necessary

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



Miralles *et al.* (2025a)

MOTIVATION

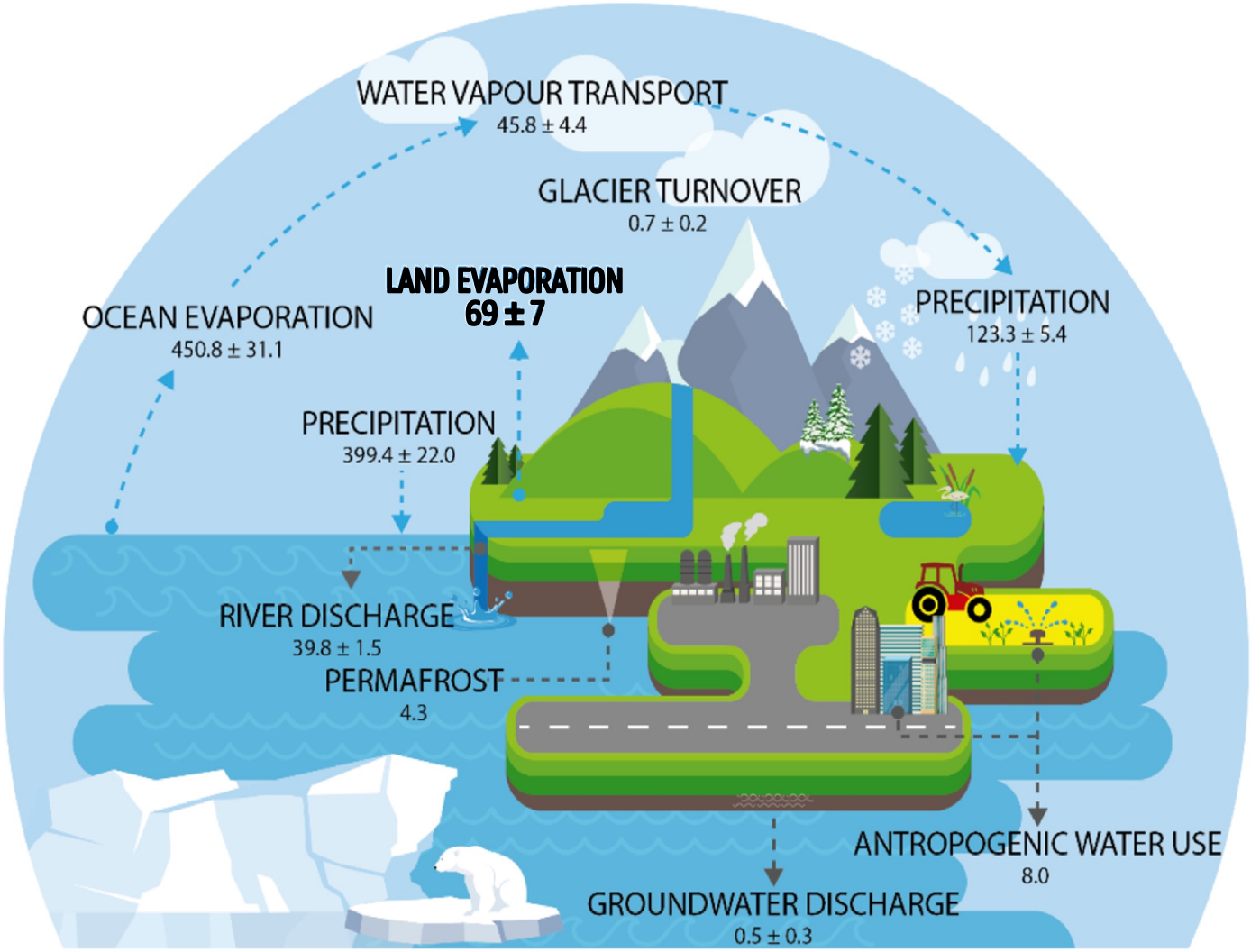
Why Evaporation?

Necessary

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

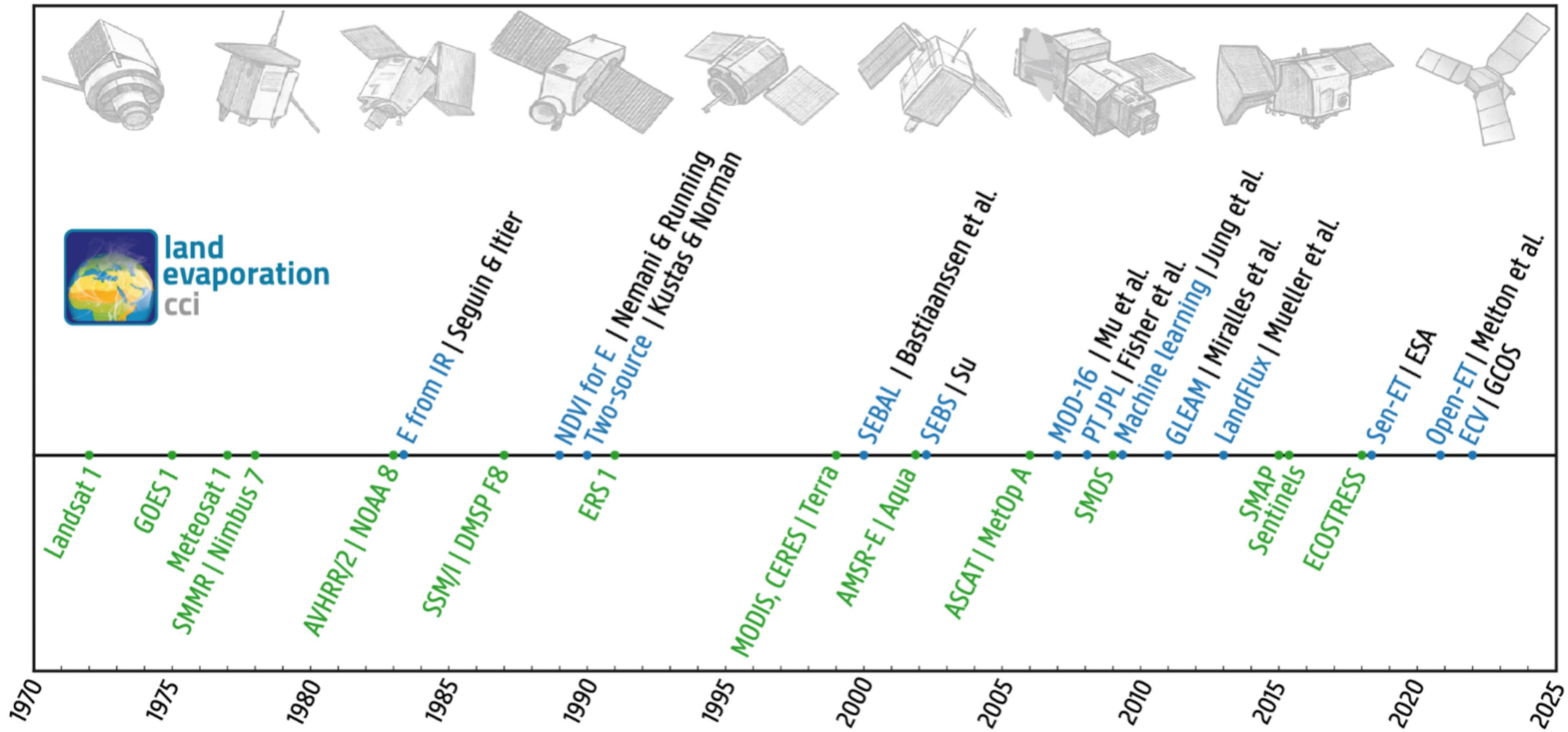
Highly uncertain

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



Dorigo *et al.* (2022)

STATE OF THE ART

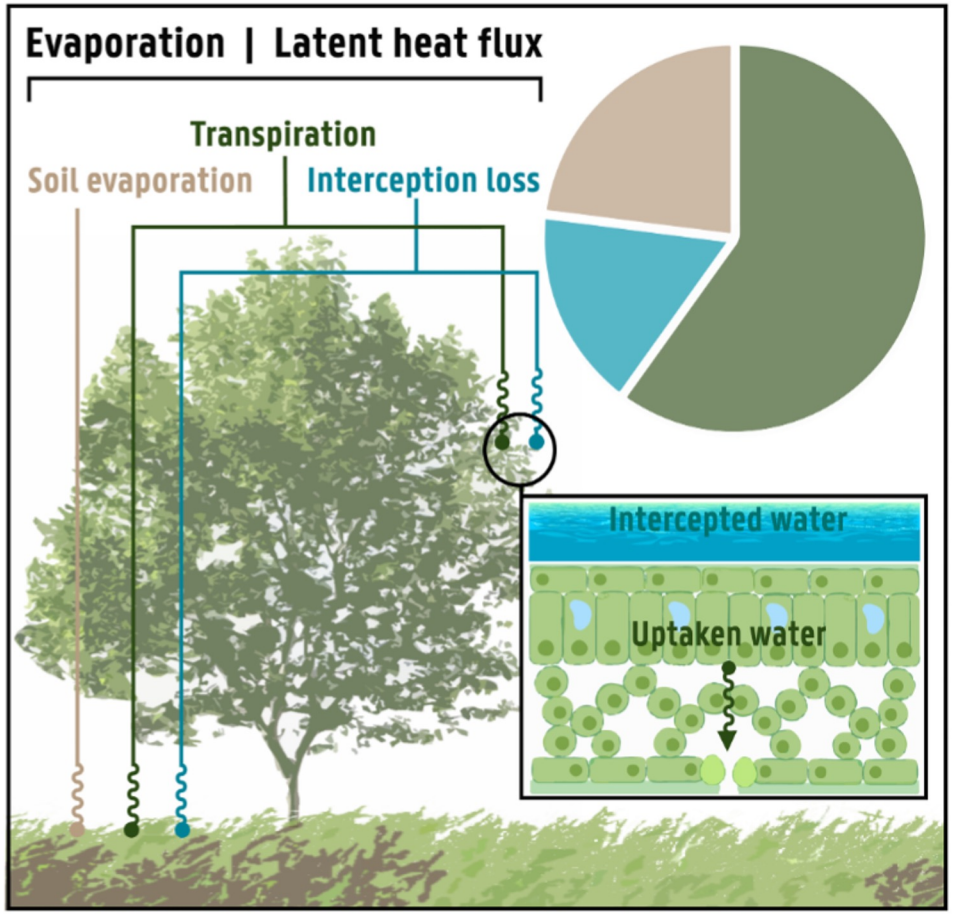


STATE OF THE ART

ECV Criteria

1. Relevance: Critical for the climate system
2. Cost effectiveness: Archiving data is affordable
3. Feasibility: Deriving it globally is feasible

GCOS ECV (2022)



Miralles *et al.* (2020)

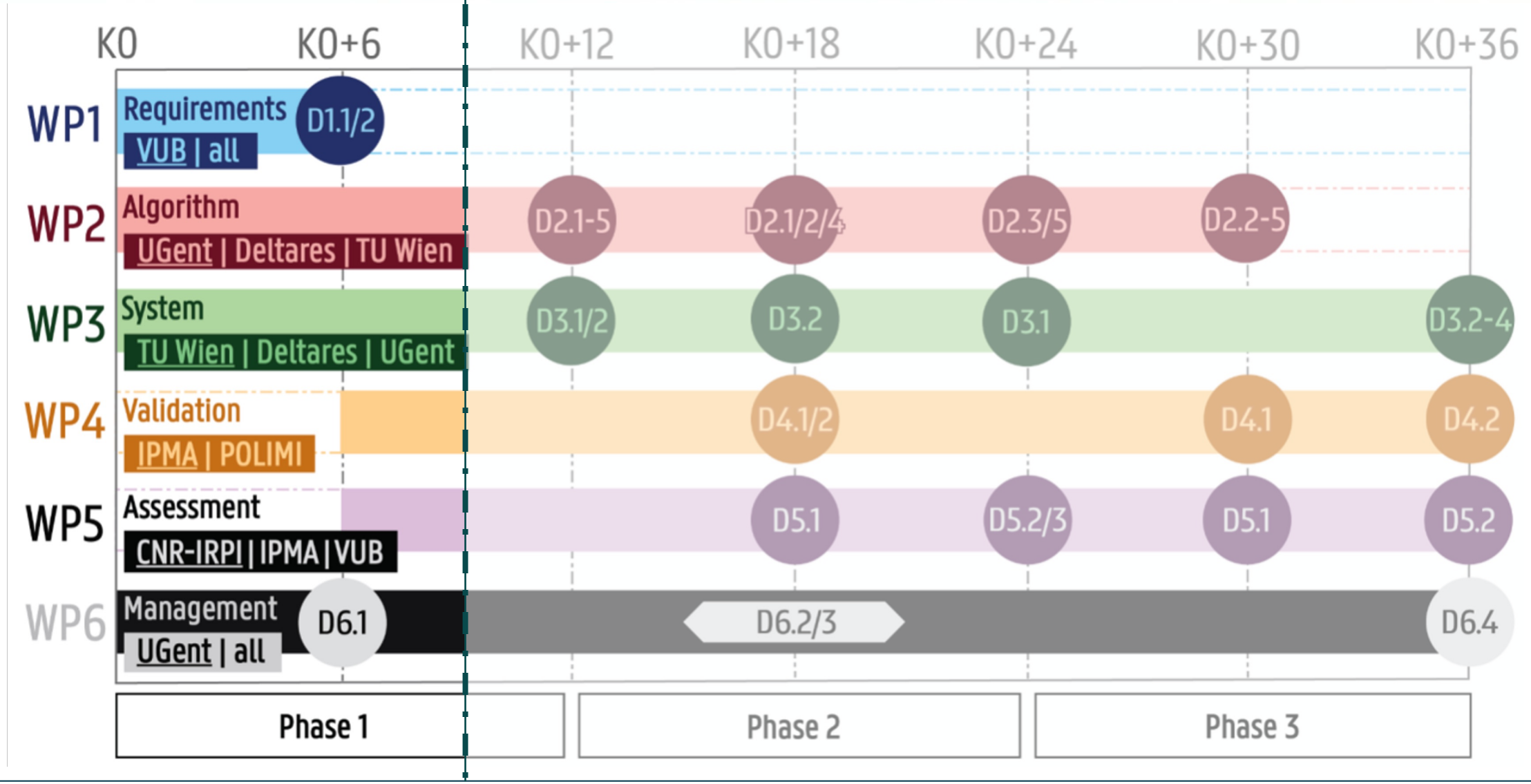
OBJECTIVES

GOAL

To enhance the ESA CCI ECV portfolio by developing a long-term high-accuracy land evaporation dataset, including components and turbulent fluxes

01	Requirements	Establish the requirements of the climate science and service communities	WP1
02	Algorithm	Develop a state-of-the-art land evaporation algorithm	WP2
03	System	Implement a processing system to generate and deliver the products	WP3
04	Validation	Ensure accuracy, reliability, and usability of the products	WP4
05	Assessment	Assess the suitability for various climate and hydrometeorological applications	WP5
06	Management	Efficiently manage and coordinate the project	WP6

WORKFLOW

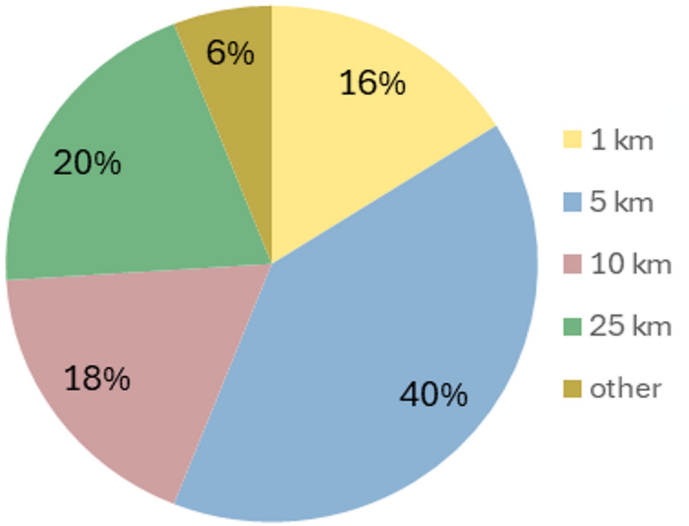

K0
K0+6
K0+12
K0+18
K0+24
K0+30
K0+36
WP1
Requirements
VUB | all
D1.1/2
WP2
Algorithm
UGent | Deltares | TU Wien
D2.1-5
D2.1/2/4
D2.3/5
D2.2-5
WP3
System
TU Wien | Deltares | UGent
D3.1/2
D3.2
D3.1
D3.2-4
WP4
Validation
IPMA | POLIMI
D4.1/2
D4.1
D4.2
WP5
Assessment
CNR-IRPI | IPMA | VUB
D5.1
D5.2/3
D5.1
D5.2
WP6
Management
UGent | all
D6.1
D6.2/3
D6.4
Phase 1
Phase 2
Phase 3

USER REQUIREMENTS

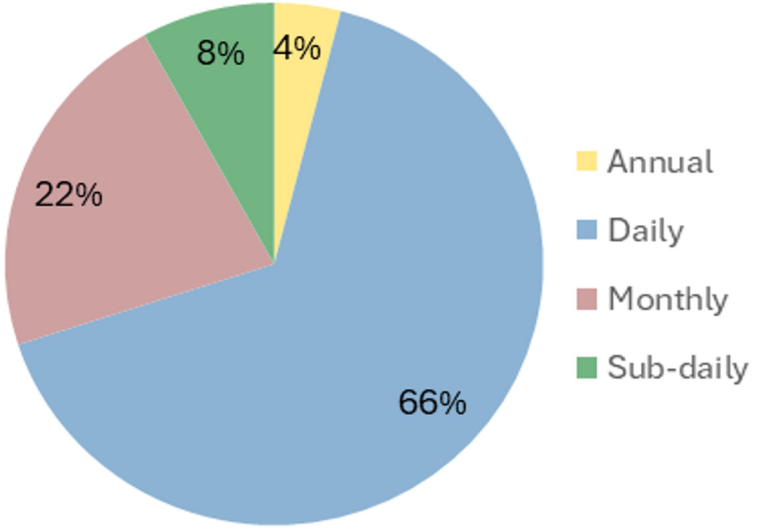
Community consultation, interviews with potential key users, and literature review

Resolution

Spatial

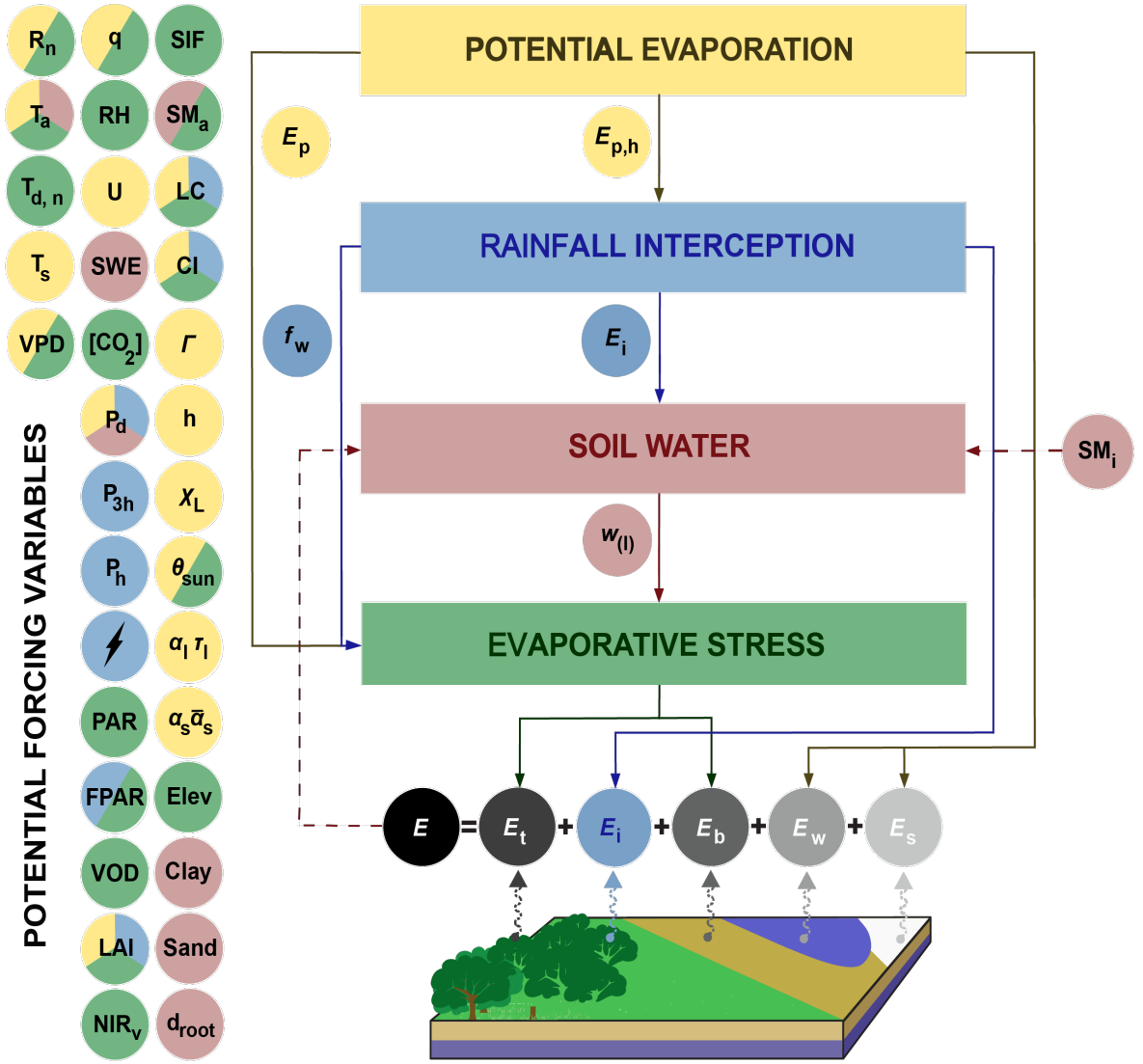


Temporal

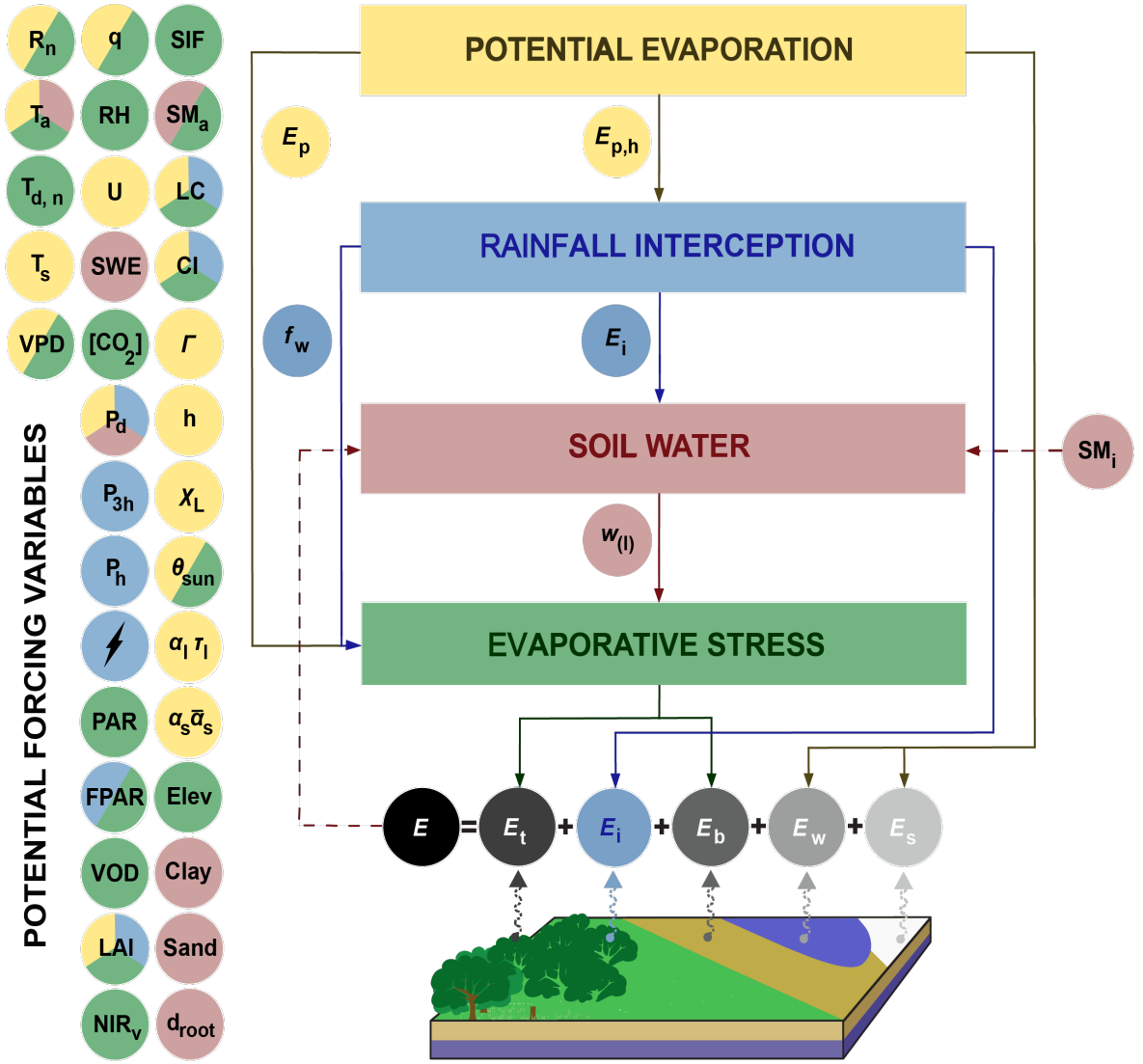


– **Tier 1 | Long-term climate record: 1980–now, 0.1°, daily**
– Tier 2 | Fully EO-based record: 2000–present, 1km, daily

DEVELOPMENT



DEVELOPMENT



Step 1: Definition of Modular Design

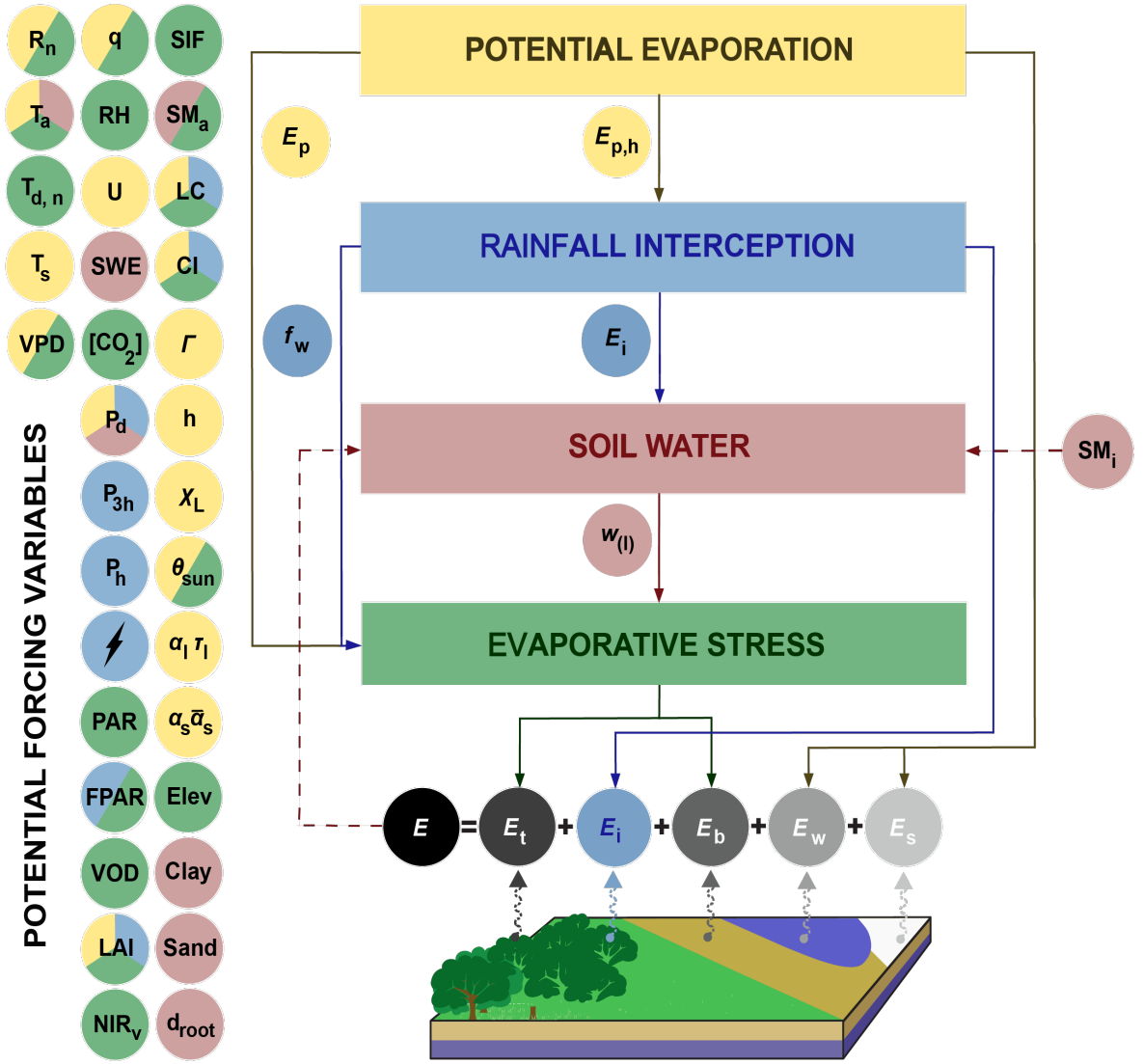
- **Penman vs. Priestley–Taylor vs. Milly–Dunne**
- G (none, fixed fraction, Wang-Bras)
- Can.-soil radiation (none, Beer-Lambert, Big leaf)
- Aerodynamic conductance (Thom, simplifications)
- PT coefficient (standard, optimised, theoretical, AI-relation)

- **Van Dijk & Bruijnzeel vs. Valente–Gash**
- Canopy capacity (constant, linear or log with LAI)
- Canopy fraction (FPAR , LAI based)
- Drainage function (threshold, exponential)
- E rate (constant, fixed E/P, Ep-constrained)
- P rate (monthly max, daily max, lightning freq.)

- **Running water balance vs. API vs. no soil**
- DA (Newtonian nudging vs. Kalman, scaling vs. CDF matching, one vs. multiple layers, TCA vs. innovation based algorithm)
- API param. (Linear vs. non-linear model)
- Snow melt (none, SWE obs.-obs., modelling)

- **Canopy conductance vs. empirical**
- Empirical (SWC, SWC and VOD, SIF and PAR)
- Canopy conductance (Jarvis - Kumar, Jarvis - Mu, Ball-Woodrow-Berry, remote sensing based)

DEVELOPMENT



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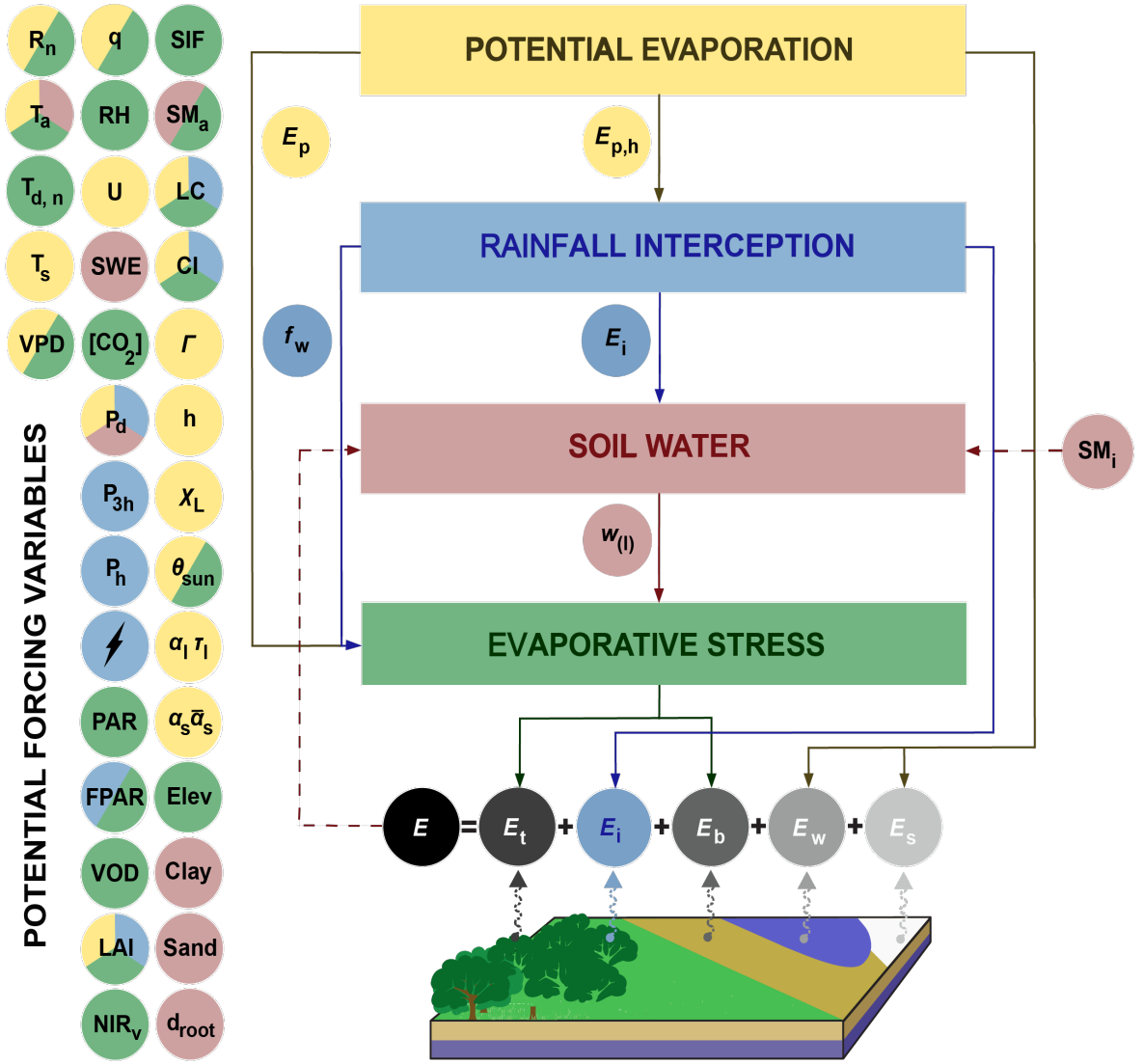
Step 2: Evaluation & Algorithm Selection

- Site-level execution of plausible permutations
- Perturbed forcing data & multi-product choice
- Validation vs. eddy covariance & interception campaigns
- Computation of epistemic and forcing uncertainties
- Model selection: simplicity, performance, EO reliance
- Introduction and selection of ML stress function

DEVELOPMENT



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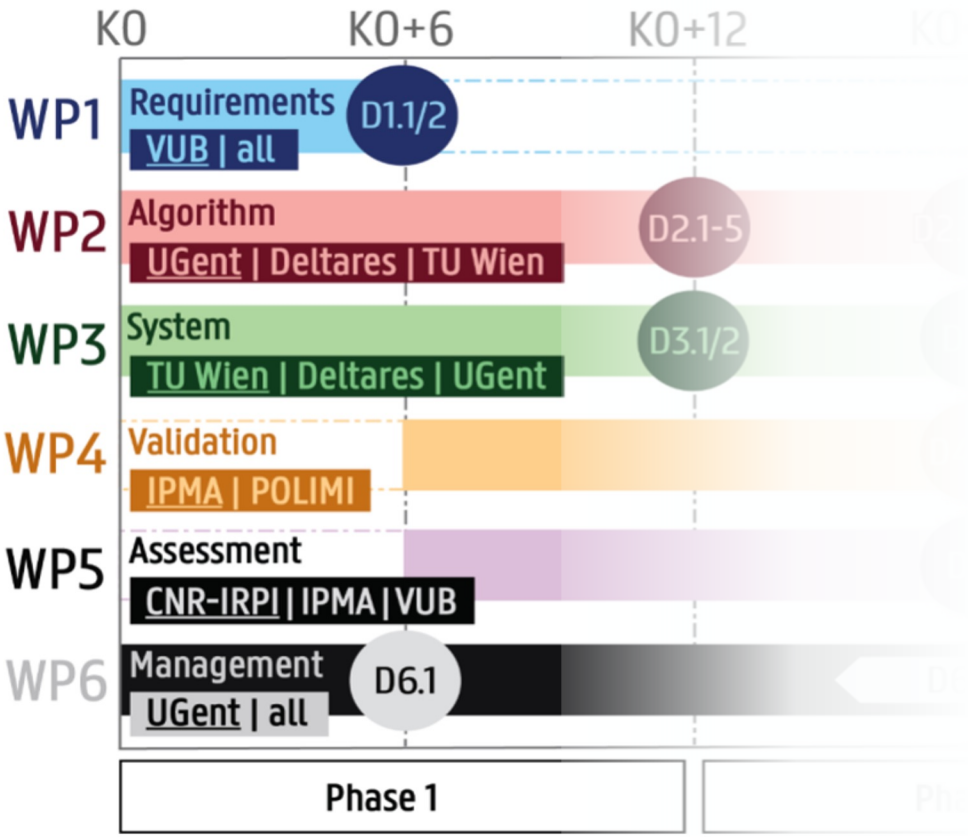
Step 3: Global Production

- **Tier 1 | Long-term climate record: 1980–now, 0.1°, daily**
- Tier 2 | Fully EO-based record: 2000–present, 1km, daily

NEXT

GOAL To enhance the ESA CCI ECV portfolio by developing a long-term high-accuracy land evaporation dataset, including components and turbulent fluxes



User requirements have been assessed	WP1
Algorithm modular design has been developed	WP2
Selection of algorithms at site level to be performed	WP2
Uncertainty quantification framework being developed	WP2
Work on processor and data collection to be continued	WP3
Validation and test cases currently starting	WP4 WP5


esa
climate.esa.int/en/Cross_ECV_Projects/Land-Evaporation
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