

ET-Sense

Potential of the Sentinel data stream to retrieve evaporation and soil moisture

Diego Miralles | Dominik Rains | Niko Verhoest |
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Evaporation (ET)

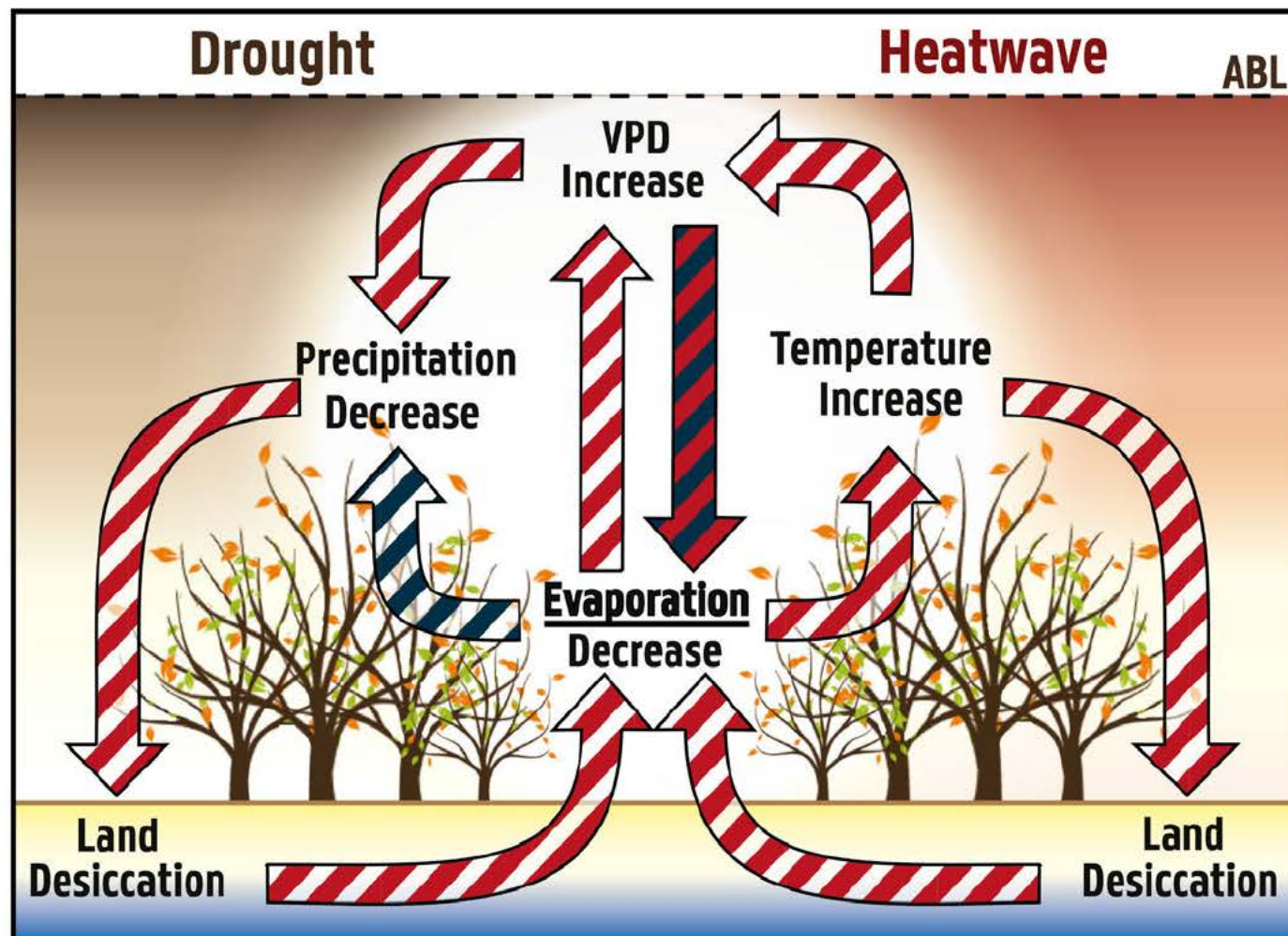
Needed for

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

Yet, poorly understood

- ❖ Scarcity of global measurements
- ❖ No direct observations from space

... However



Miralles *et al.* (2018)

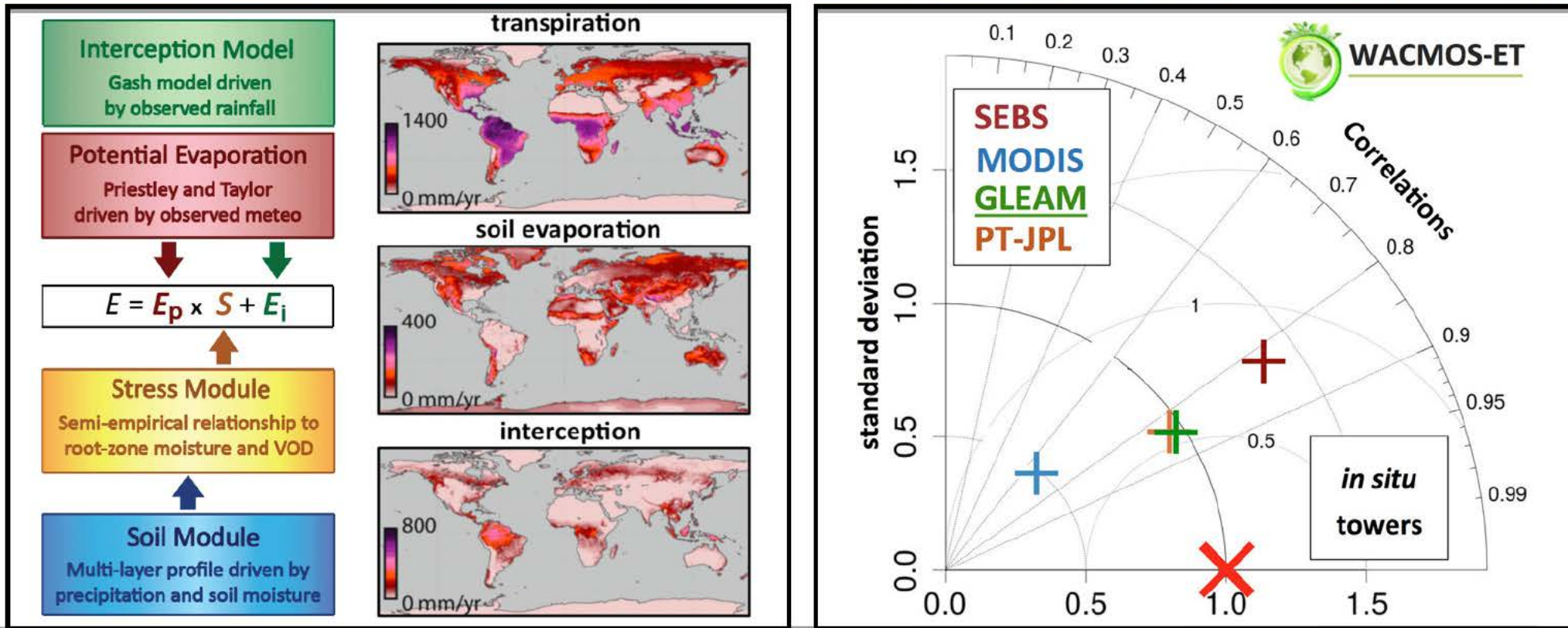
Satellites?

- ❖ Efforts limited to **combining observable drivers** in statistical or physical models

DRIVERS	(SUB-) DAY	SEASON	(MULTI-) YEAR	(MULTI-) DECADE
Radiation	Green	Green	Green	Green
Soil moisture	Green	Green	Green	Green
Precipitation	Green	Green	Green	Green
Temperature	Green	Green	Green	Green
Vegetation state	White	Green	Green	Green
Specific humidity	Green	Green	Green	Green
Wind speed	Green	Grey	Grey	Green
[CO ₂]	Grey	Grey	Grey	Green
Land properties	Grey	Grey	Grey	Green
Soil nutrients	Grey	Grey	Grey	Green

GLEAM @ High Resolution

Towards estimating land evaporation at field scales using GLEAM, a new study published in *Remote Sensing*. Access the full paper [here](#).



Global land-surface evaporation estimated from satellite-based observations

D. G. Miralles¹, T. R. H. Holmes^{1,2}, R. A. M. De Jeu¹, J. H. Gash¹, A. G. C. A. Meesters¹, and A. J. Dolman¹



Hydrology and Earth System Sciences

nature
geoscience

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van Heerwaarden⁴, Vilà-Guerau de Arellano⁵

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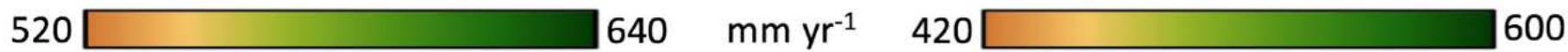
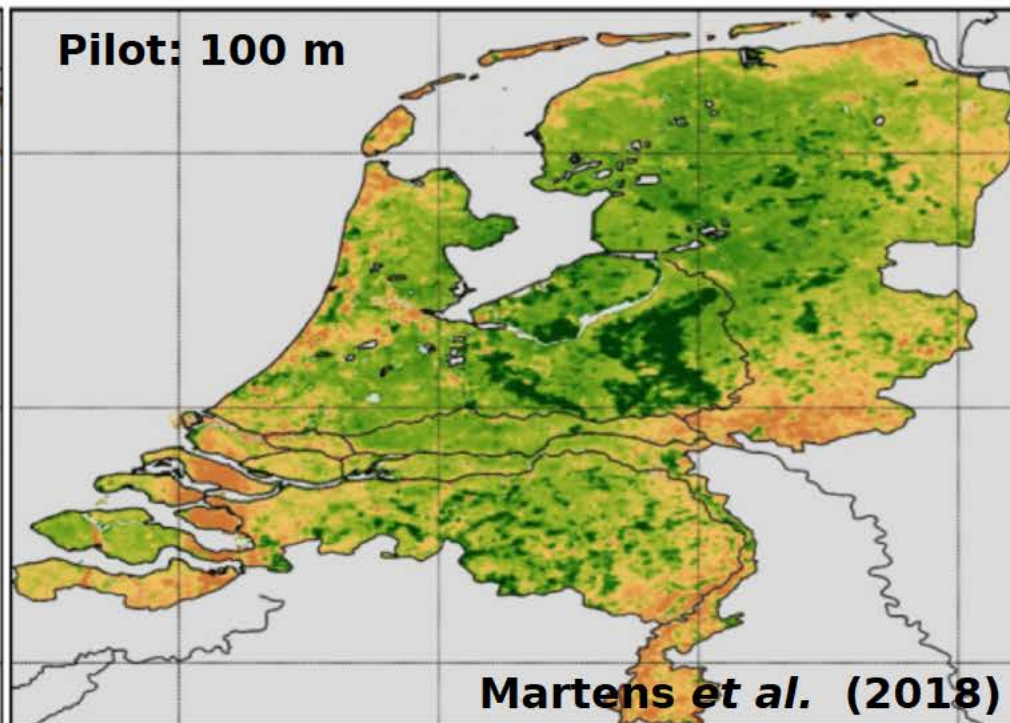
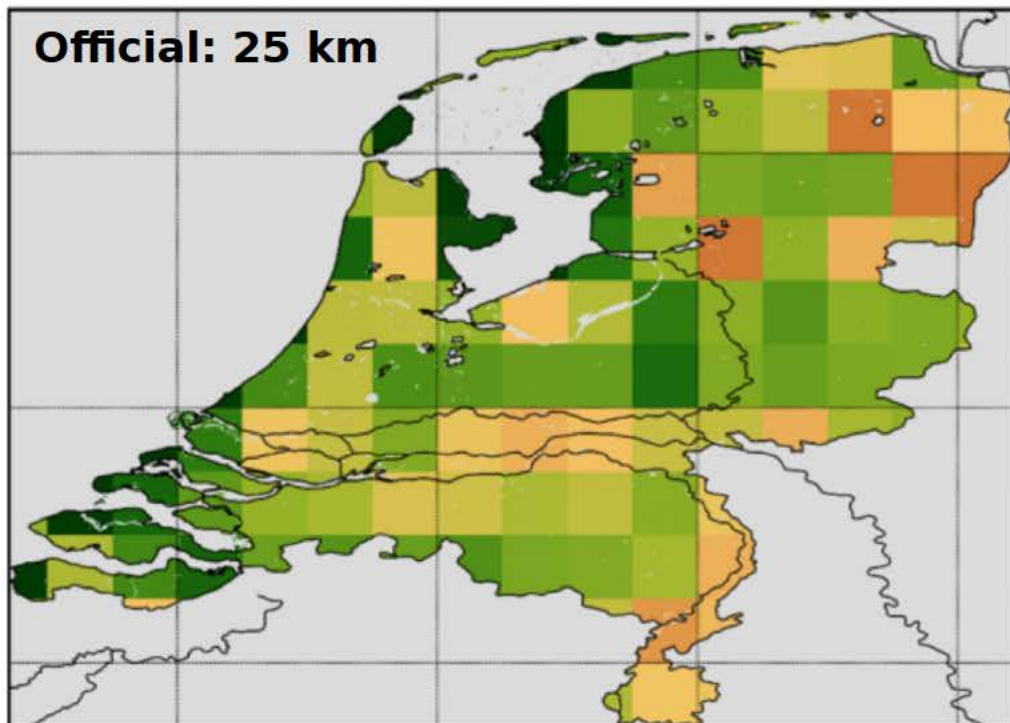
El Niño–La Niña cycle and recent trends in continental evaporation





Miralles *et al.* 2014



nature
climate change

Science Satellites reveal contrasting responses of regional climate to the widespread greening of Earth

Giovanni Forzieri,^{1*} Ramdane Alkama,¹ Diego G. Miralles,² Alessandro Cescatti¹

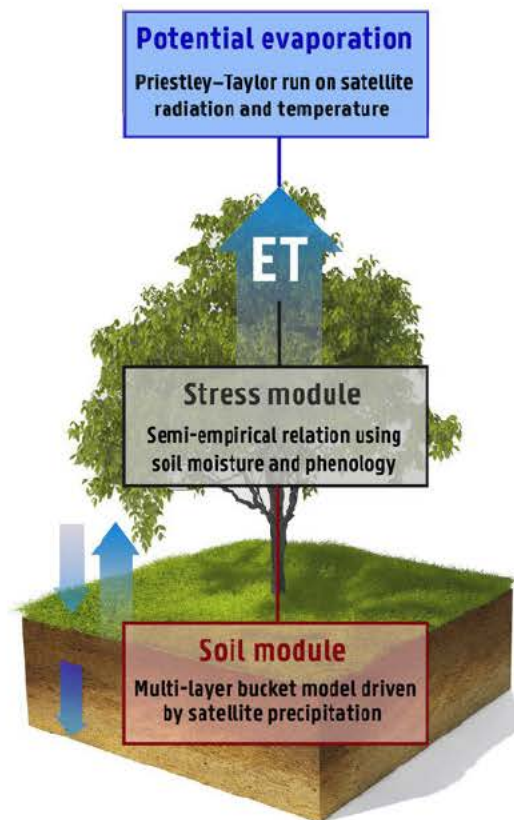


-  Climate change diagnosis
-  Hydroclimatic extremes
-  Water management
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ET-Sense

High-resolution evaporation for Europe

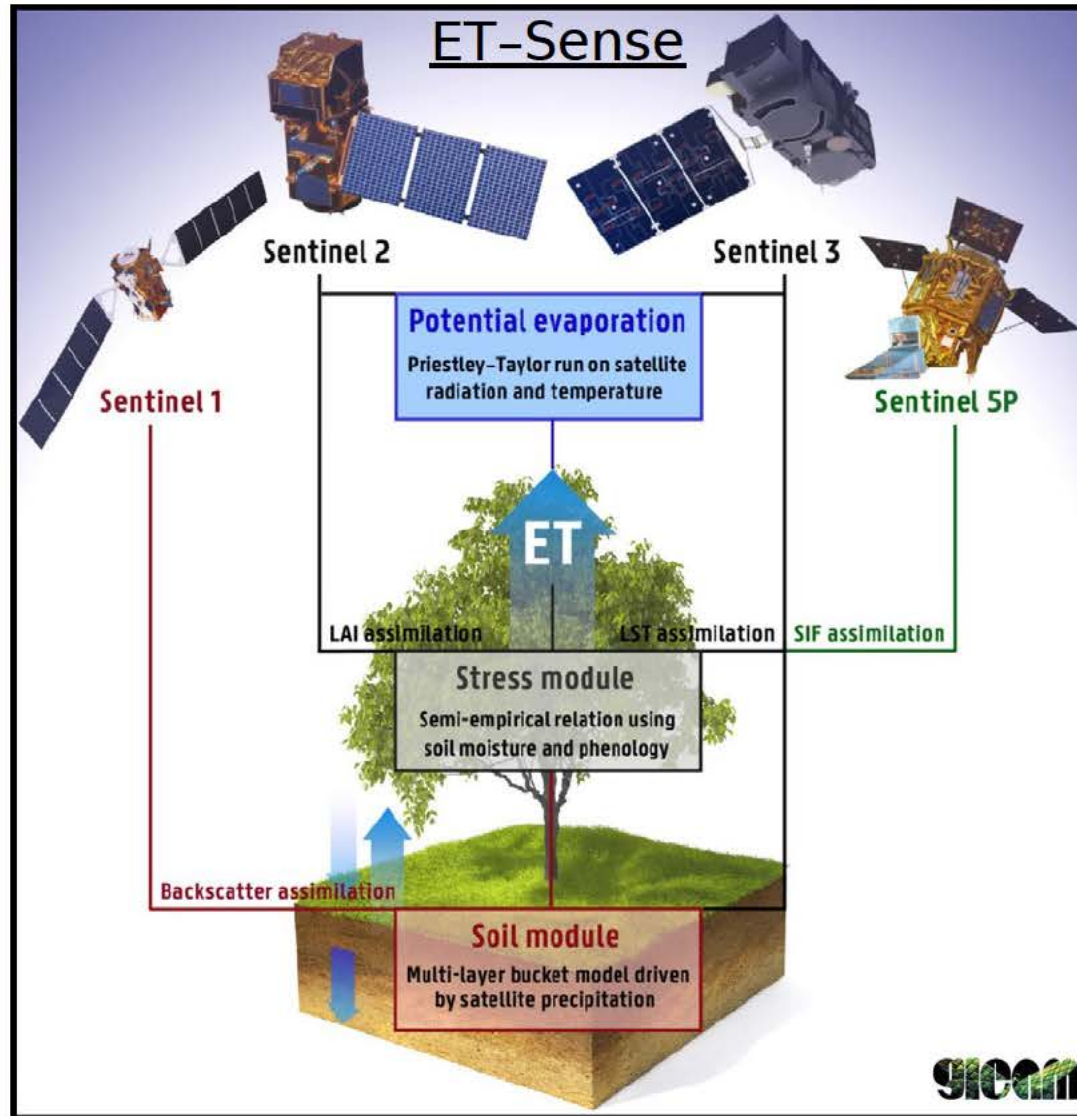


Sentinel 1

- ❖ MW, SAR
- ❖ 5x20 m | 1-2 days
- ❖ From 2014
- ❖ Assimilation of backscatter into **soil moisture**

Sentinel 2

- ❖ VIS, (N)IR
- ❖ 10x10 - 60x60 m | 2-3 days
- ❖ From 2015
- ❖ **Vegetation** properties to represent phenology



Sentinel 3

- ❖ IR-MW
- ❖ 1 km | 1 day
- ❖ From 2016
- ❖ **Temperature** to represent demand and stress

Sentinel 5P

- ❖ VIS-IR (spectrometer)
- ❖ 7x7 km | 1 day
- ❖ From 2017
- ❖ **SIF** to represent vegetation activity and transpiration

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Diego Miralles



Niko Verhoest

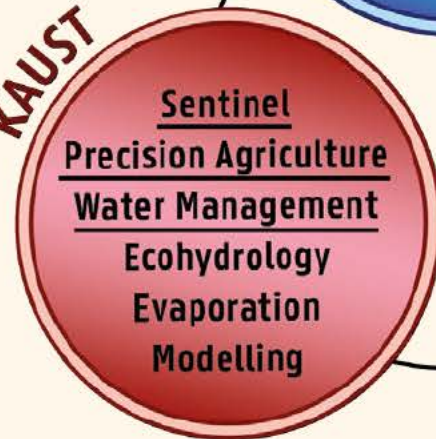


Dominik Rains



Matt McCabe

KAUST

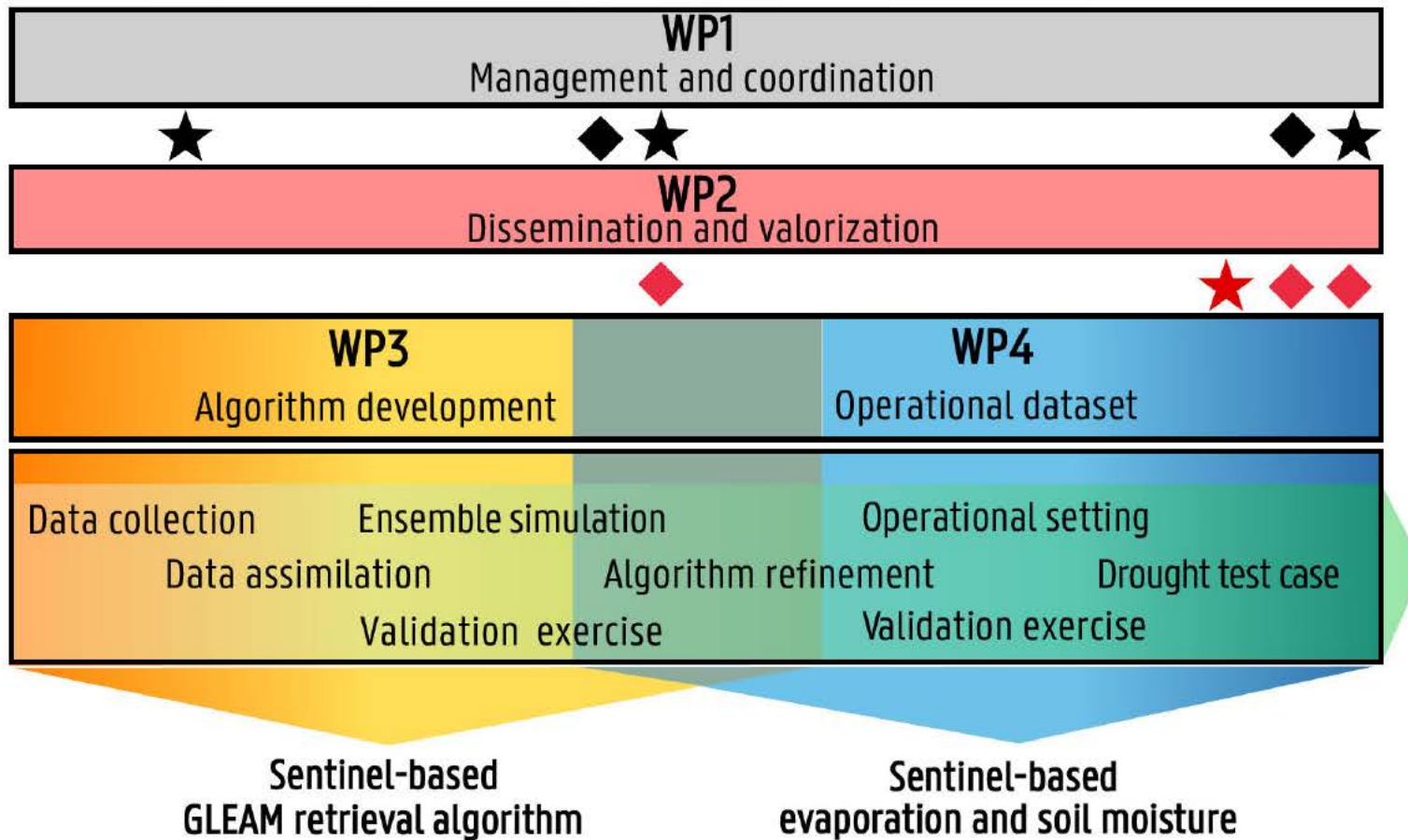


VanderSat



Richard de Jeu

| 2019 JFMA | 2019 MJJA | 2019 SOND | 2020 JFMA | 2020 MJJA | 2020 SOND |



◆ Steering committee meeting	◆ Publication submission
★ Project report delivery	★ Mapserver operational

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WP3 | Algorithm

OBJECTIVE 1: To build a Sentinel data assimilation system for GLEAM

1. GLEAM adaptation to integrate backscatter, LAI, LST, SIF
2. New data assimilation and extension into ensemble mode
3. Run at FLUXNET and ISMN site level
4. Validation of time series (FLUXNET, ISMN)

WP4 | Dataset

OBJECTIVE 2: To develop and deliver an operational dataset of ET (and soil moisture)

1. Run at pan-European scale and code optimisation
2. Uncertainty analyses, validation and inter-comparison
3. Operational setting and *online mapserver*
4. Test case of 2018 drought event



Model

- Implemented optimised version in Python
- expanded code to run in ensemble mode with perturbations
- coupled code to Kalman Filter

Data

- Surface datasets for Europe with 1 km
- Sentinel 3 Level 2 LST data
- Sentinel 3 SYN data

Next steps

- Validation
- Incorporate LST and LAI

