Hasselt, Belgium
14 | 05 | 2024

Towards a digital twin of the terrestrial water cycle

Oscar M. Baez-Villanueva, Luca Brocca, Christian Massari, and Diego Miralles (on behalf of the project consortia)

Oscar.BaezVillanueva@UGent.Be

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- Reliable data and information
- High-performance computing
- Advanced modelling strategies
- Accuracy

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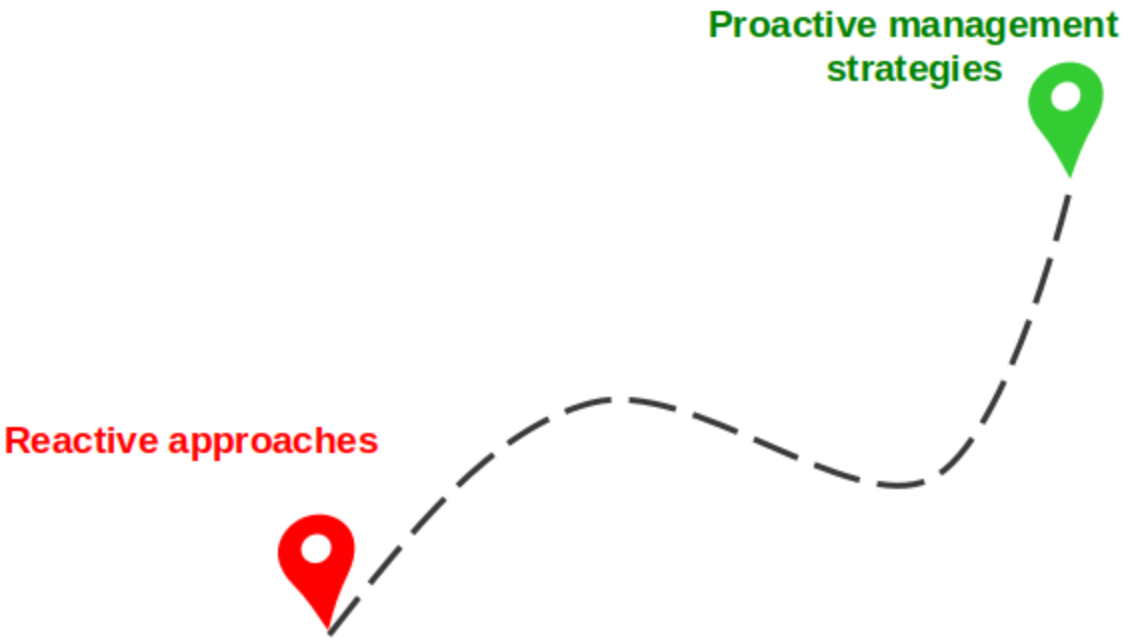
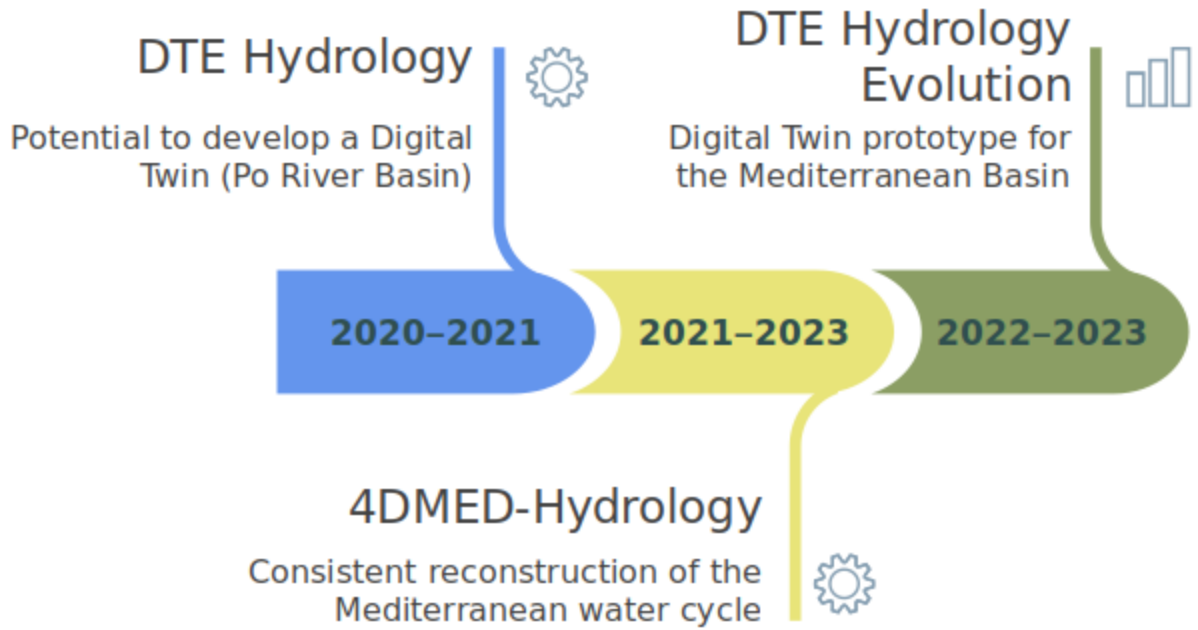


The Road so Far

Reconstruction of the hydrological cycle at high spatial and temporal resolution (Mediterranean region)



The Road so Far

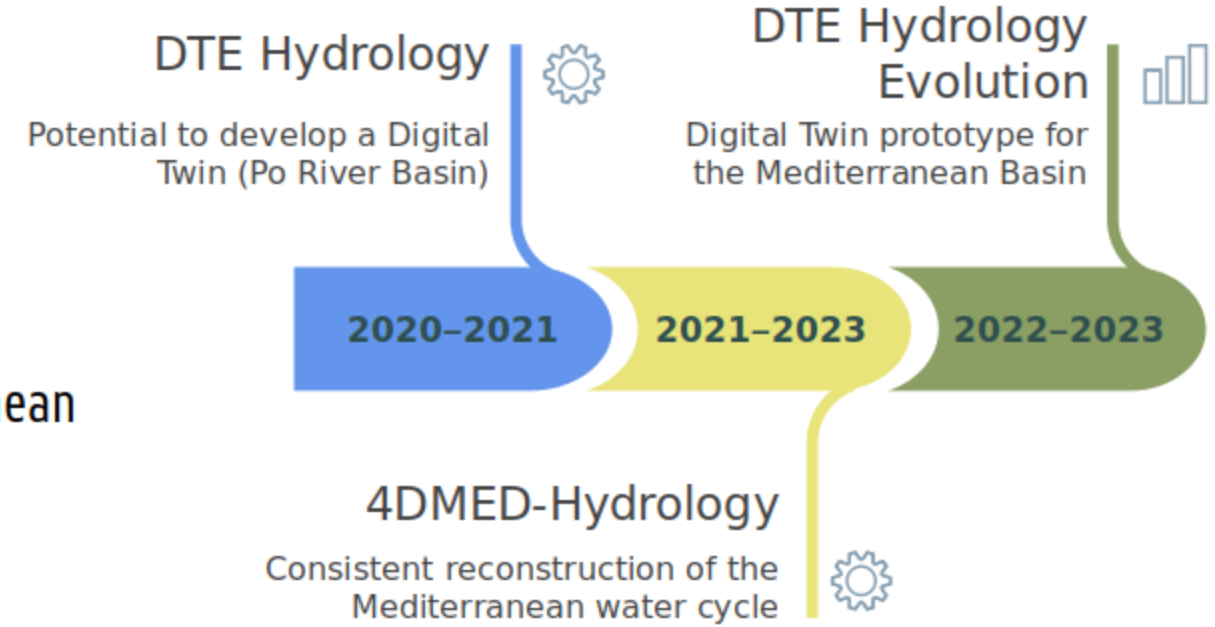
Reconstruction of the hydrological cycle at high spatial and temporal resolution (Mediterranean region)

Digital Twin prototype for the entire Mediterranean basin, which can be used for the:

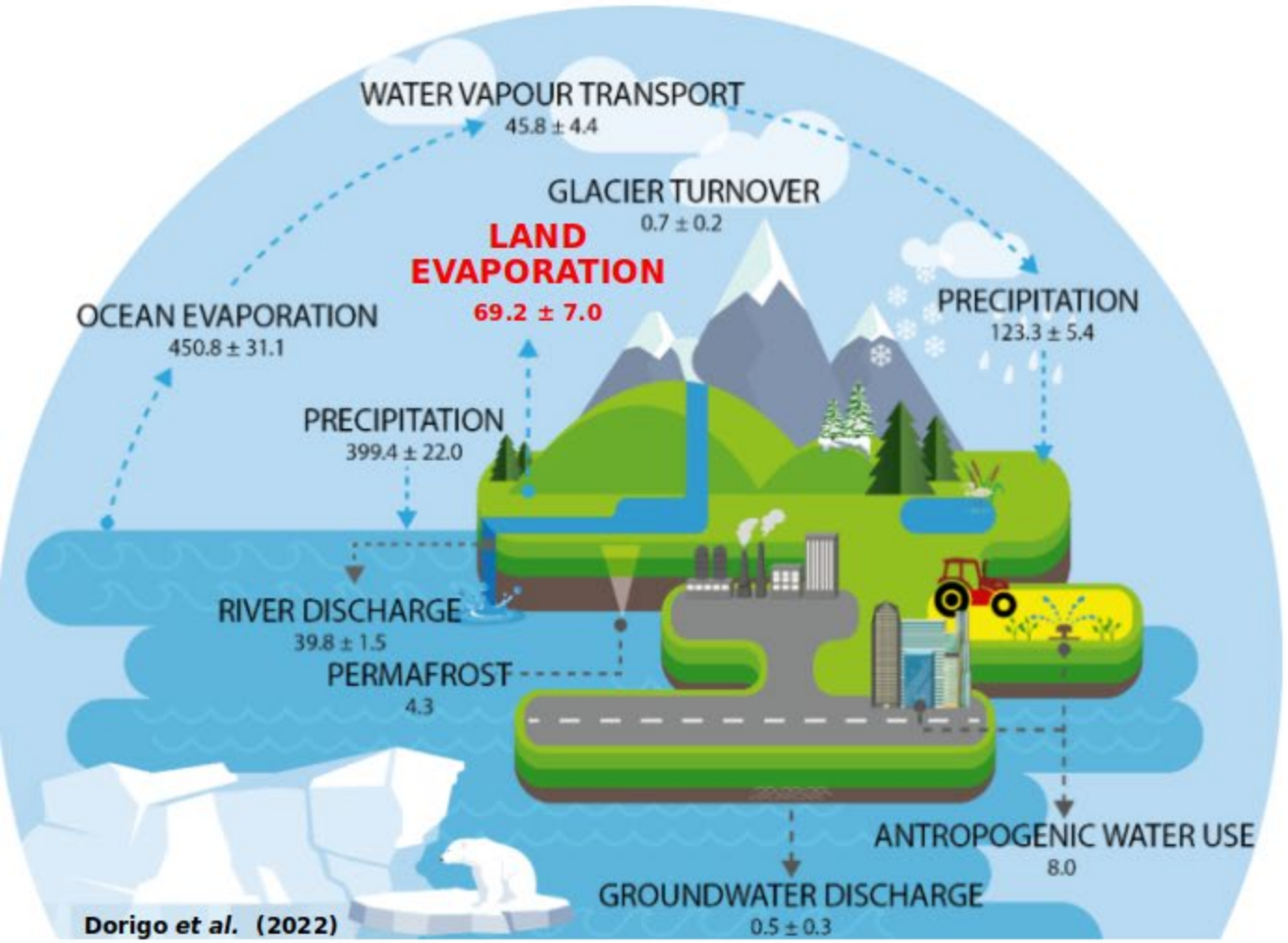
a) Prediction of hydrological extremes

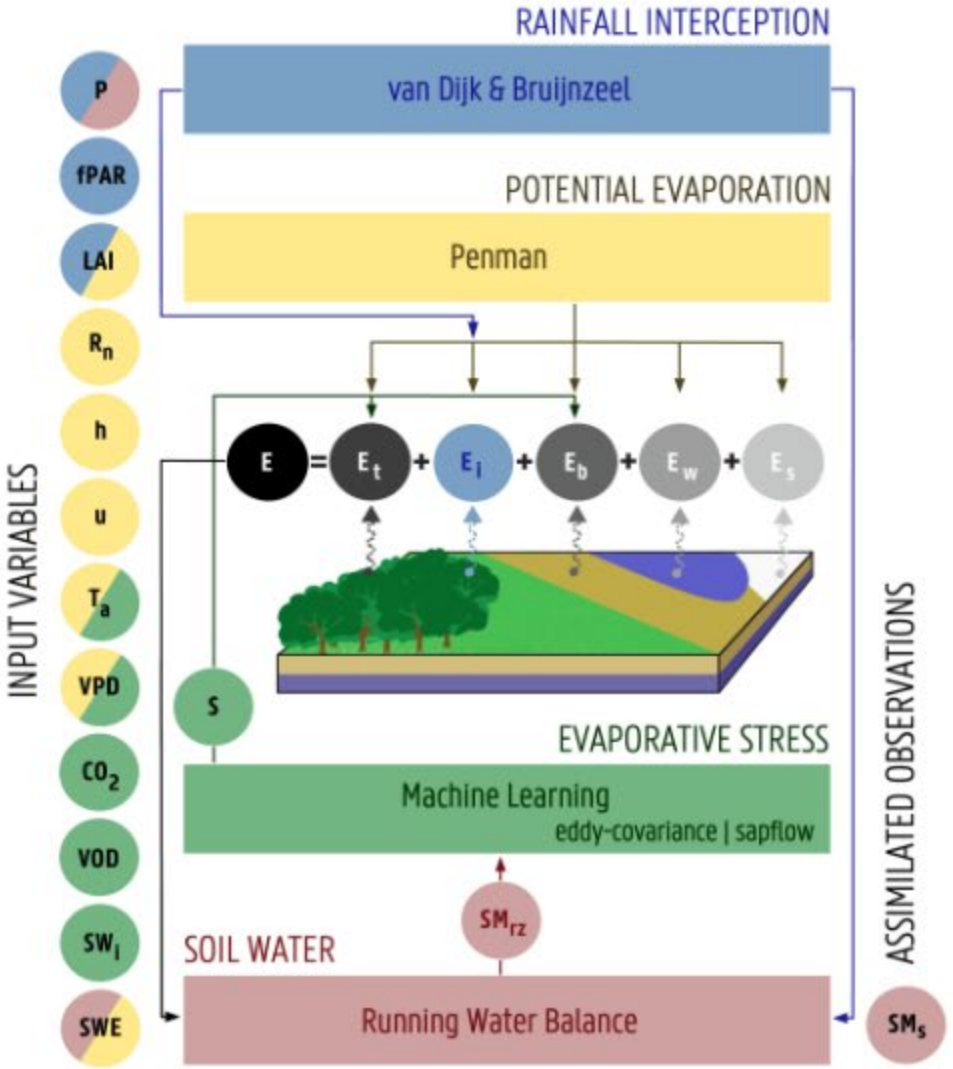
b) Analysis of plausible changes in the system

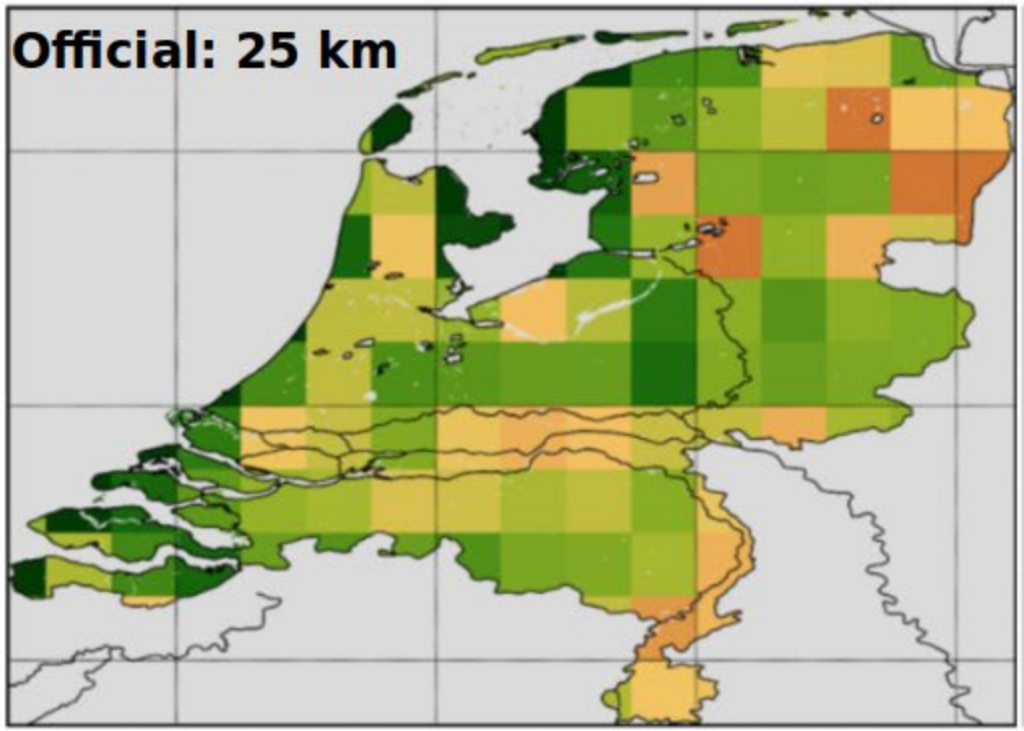
c) Development of proactive water management strategies

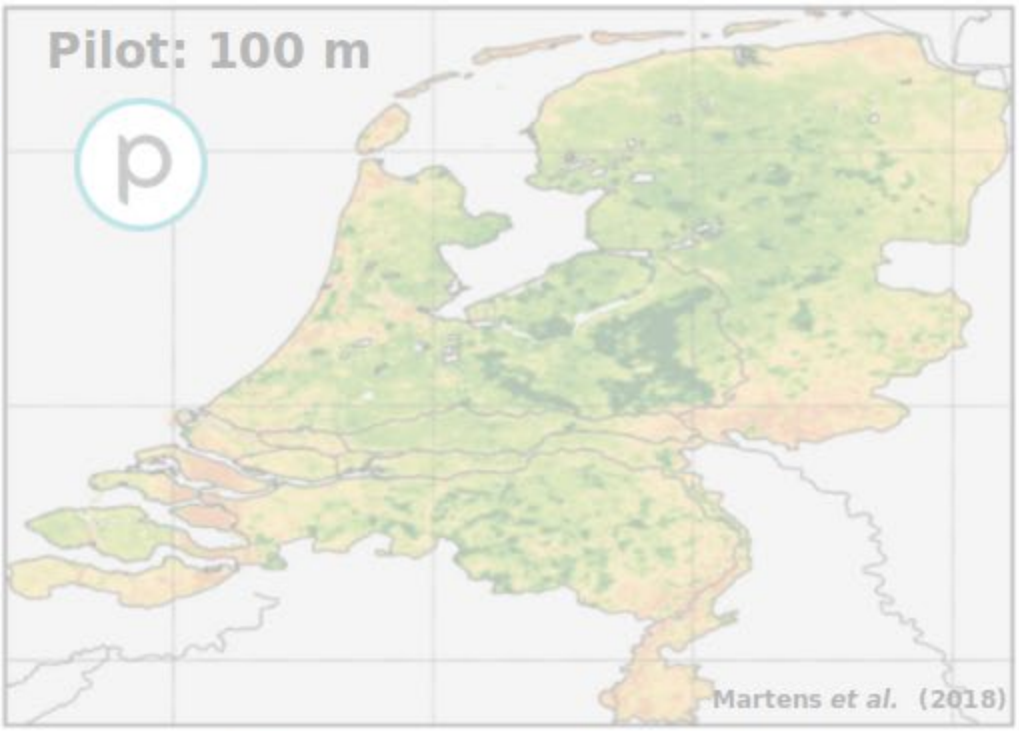



The Digital Twin Earth (DTE) Hydrology platform
reconstructs and simulates hydro
2D


WATER VAPOUR TRANSPORT
45.8 ± 4.4
GLACIER TURNOVER
0.7 ± 0.2
LAND EVAPORATION
69.2 ± 7.0
OCEAN EVAPORATION
450.8 ± 31.1
PRECIPITATION
123.3 ± 5.4
PRECIPITATION
399.4 ± 22.0
RIVER DISCHARGE
39.8 ± 1.5
PERMAFROST
4.3
ANTROPOGENIC WATER USE
8.0
GROUNDWATER DISCHARGE
0.5 ± 0.3
Dorigo et al. (2022)

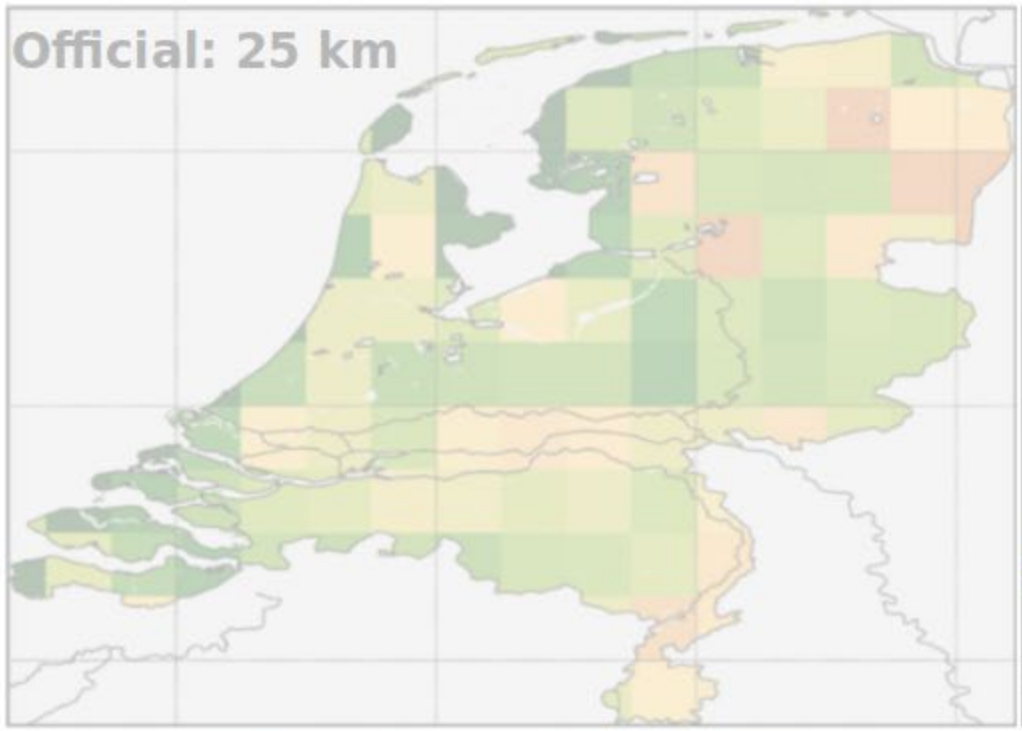

RAINFALL INTERCEPTION
van Dijk & Bruijnzeel
POTENTIAL EVAPORATION
Penman
INPUT VARIABLES
P
fPAR
LAI
R_n
h
u
T_a
VPD
CO_2
VOD
SW_l
SWE
$E = E_t + E_i + E_b + E_w + E_s$
S
EVAPORATIVE STRESS
Machine Learning
eddy-covariance | sapflow
SM_{rz}
SOIL WATER
Running Water Balance
SM_s
ASSIMILATED OBSERVATIONS

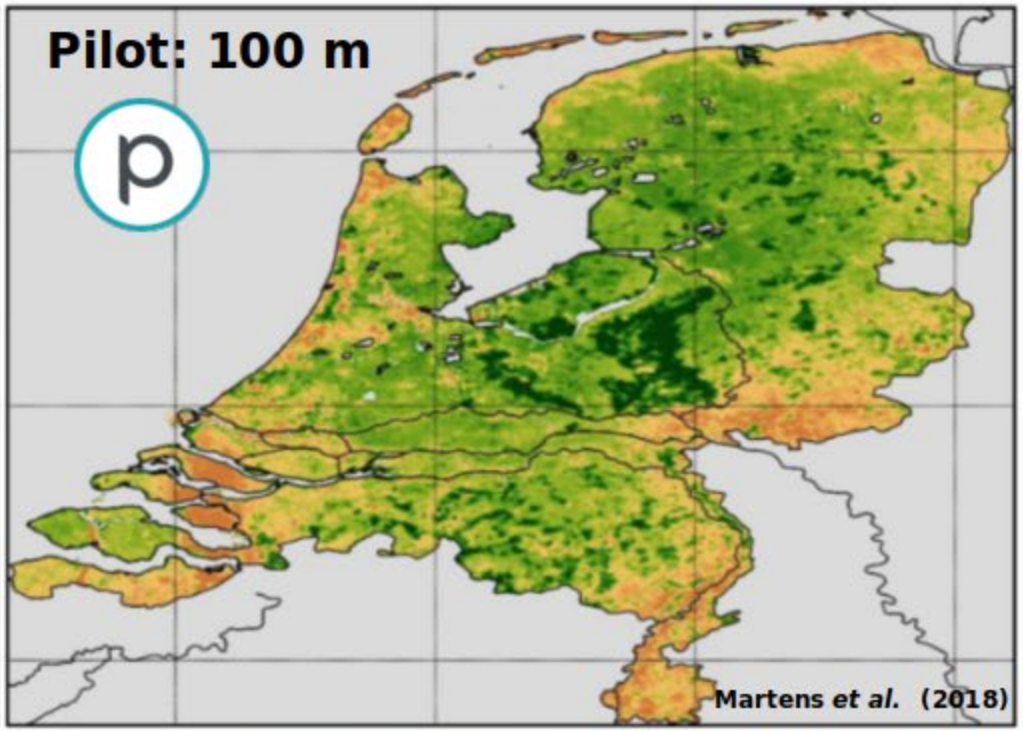




520 640 mm yr^{-1} 420 600

- Climate change diagnosis
- Hydroclimatic extremes
- Water resources management
- Agricultural practices and food security





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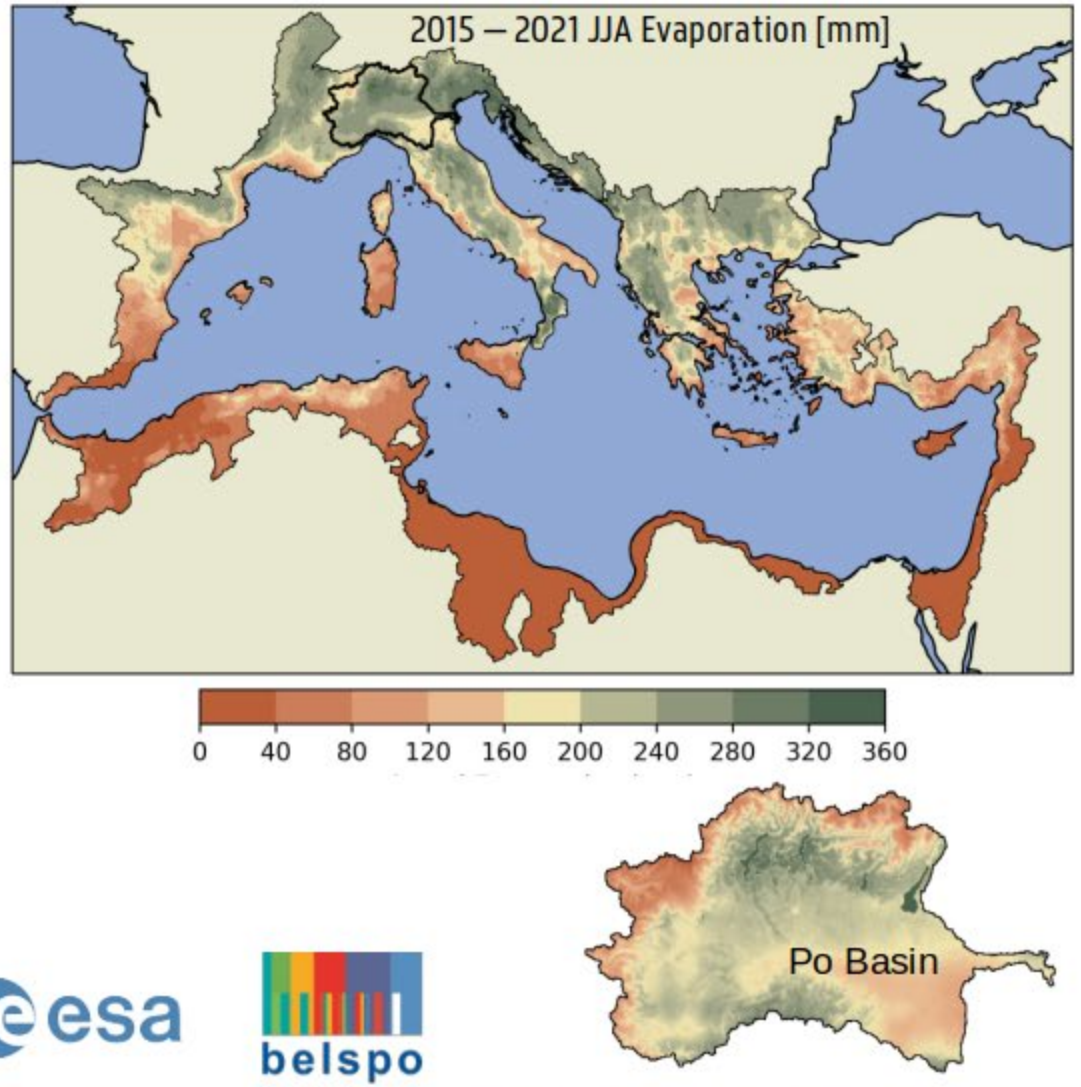
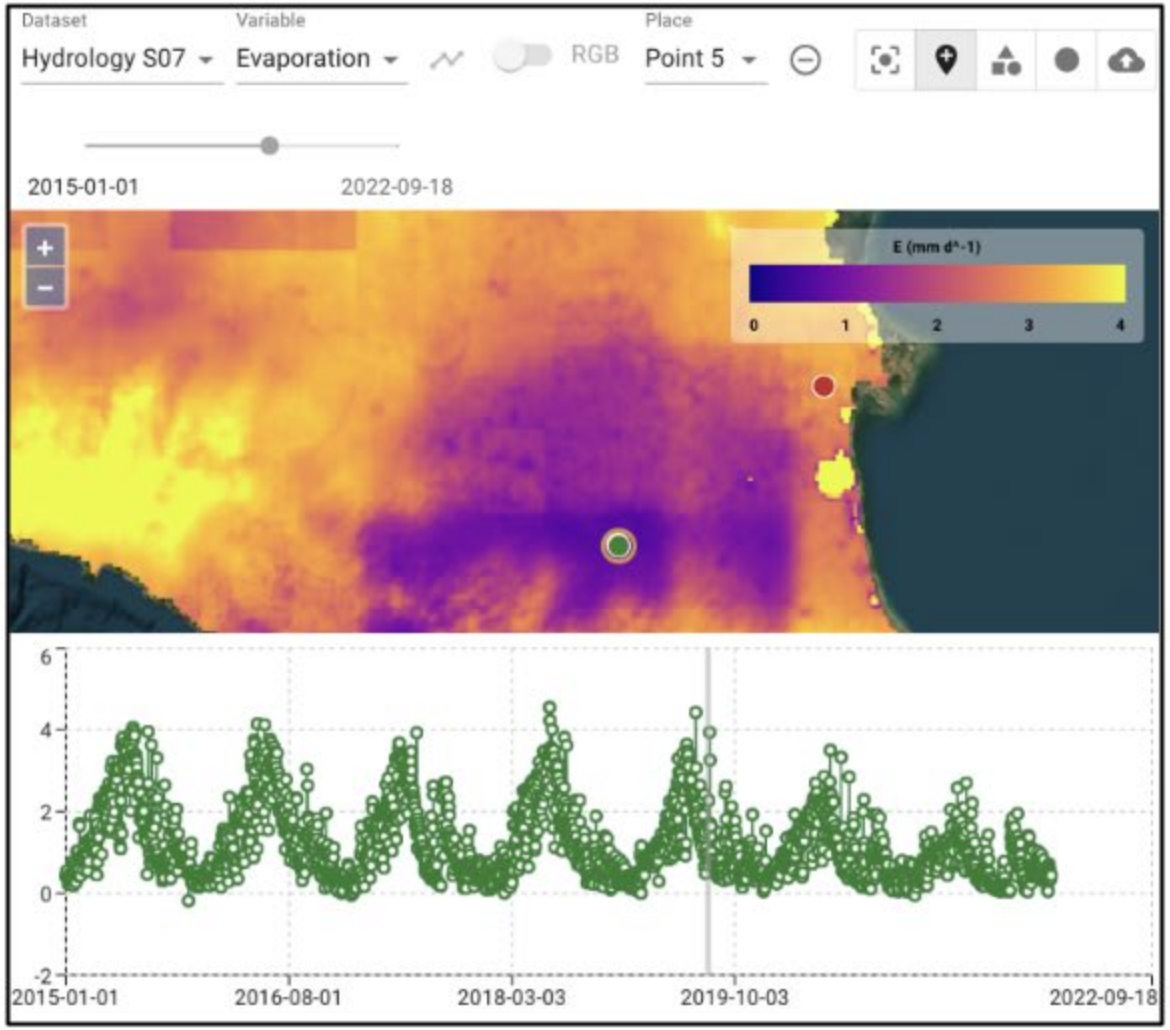
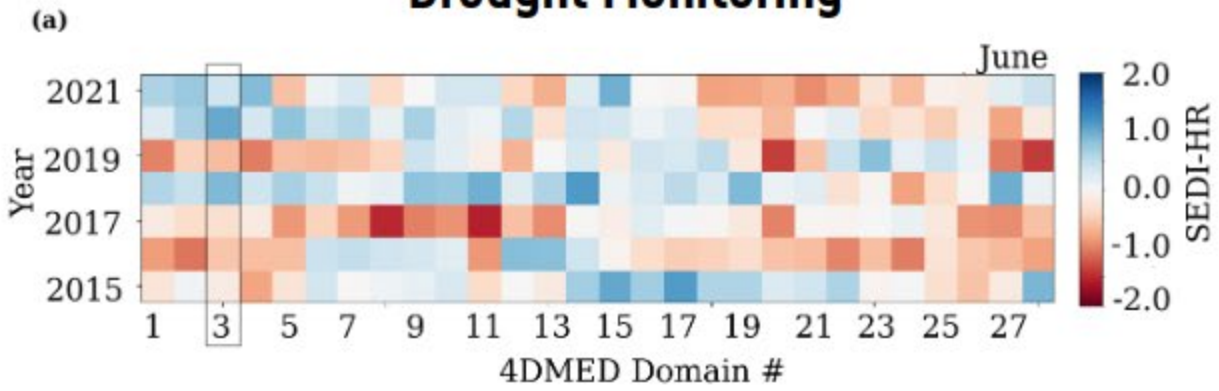
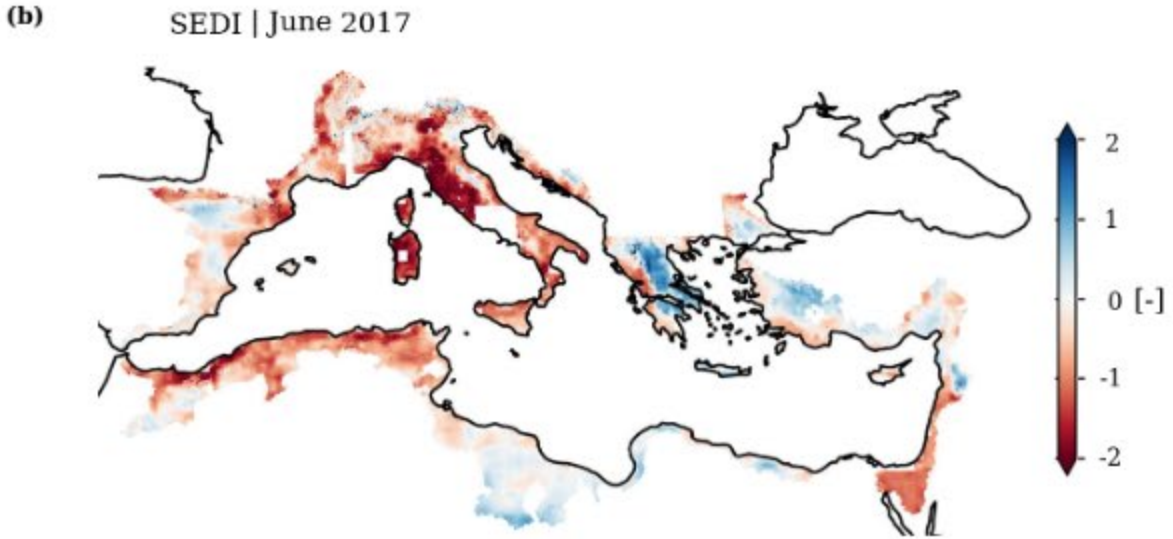

2015 – 2021 JJA Evaporation [mm]
0 40 80 120 160 200 240 280 320 360
Po Basin


Dataset
Hydrology S07
Variable
Evaporation
RGB
Place
Point 5
2015-01-01
2022-09-18
E (mm d^-1)
0 1 2 3 4
6 4 2 0 -2
2015-01-01 2016-08-01 2018-03-03 2019-10-03 2022-09-18

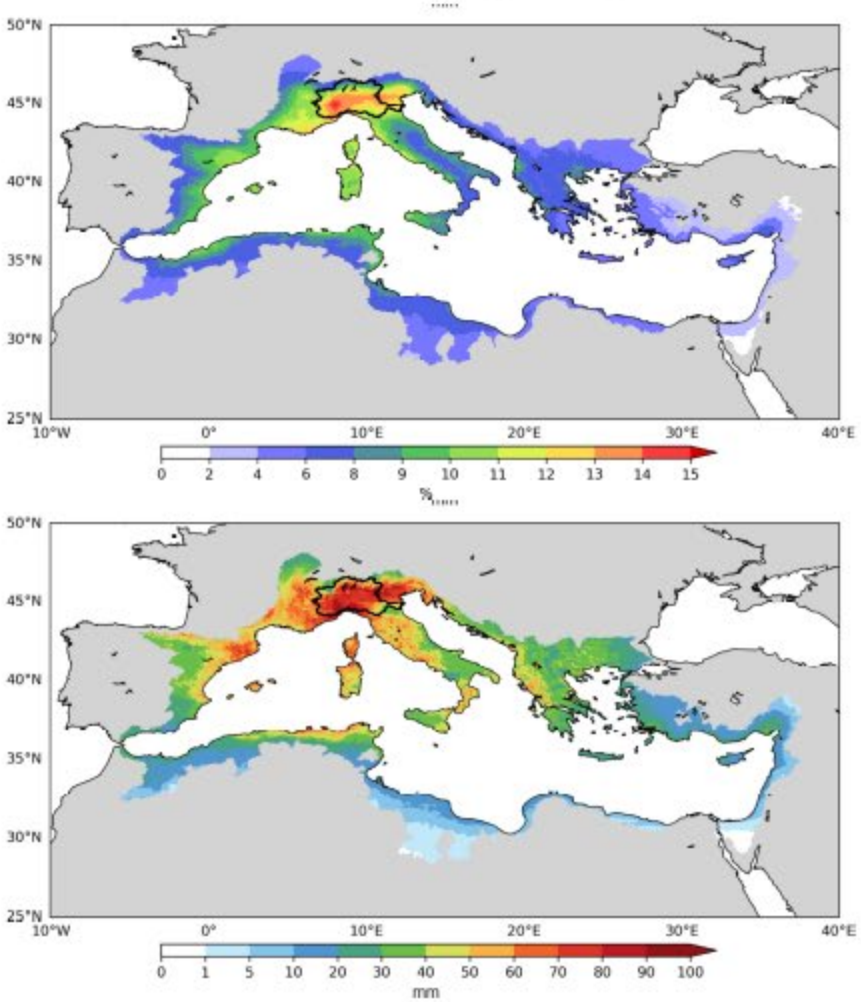
esa belspo

Drought Monitoring





Moisture Recycling



Overall objective:

To yield a first-of-its-kind, high-resolution, high accuracy, gap-free, evaporation and root-zone soil moisture dataset over the Meteosat Disk that considers the influence of irrigation

belspo

Two STEREO projects

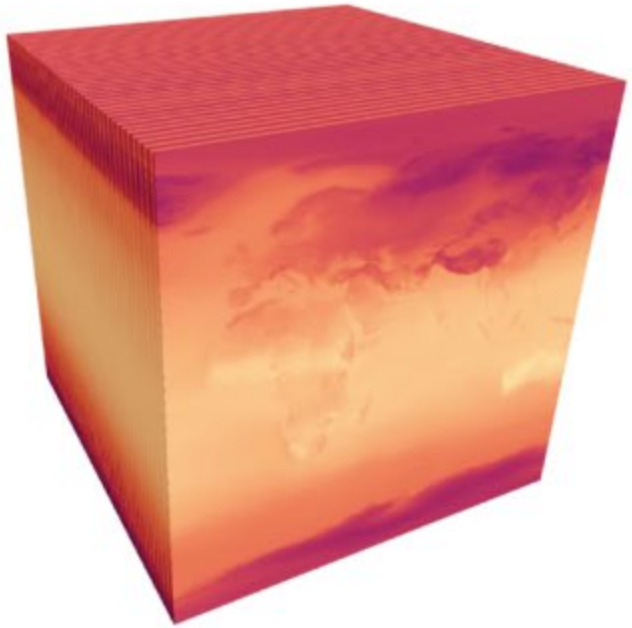
- ET-Sense
- HERMES

Coverage:
Meteosat disk

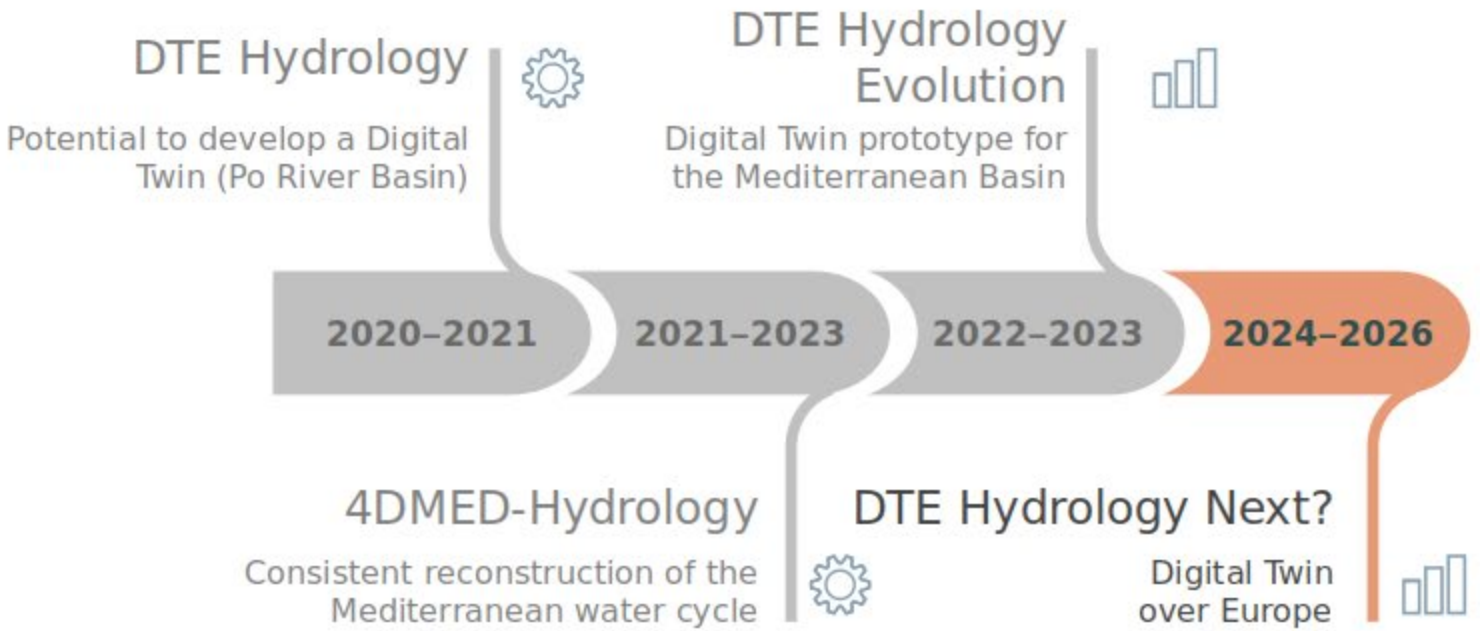
Lon: 80°W – 80°E
Lat: 80°N – 80°S

Temporal resolution:
Daily

Spatial resolution:
1 kilometer

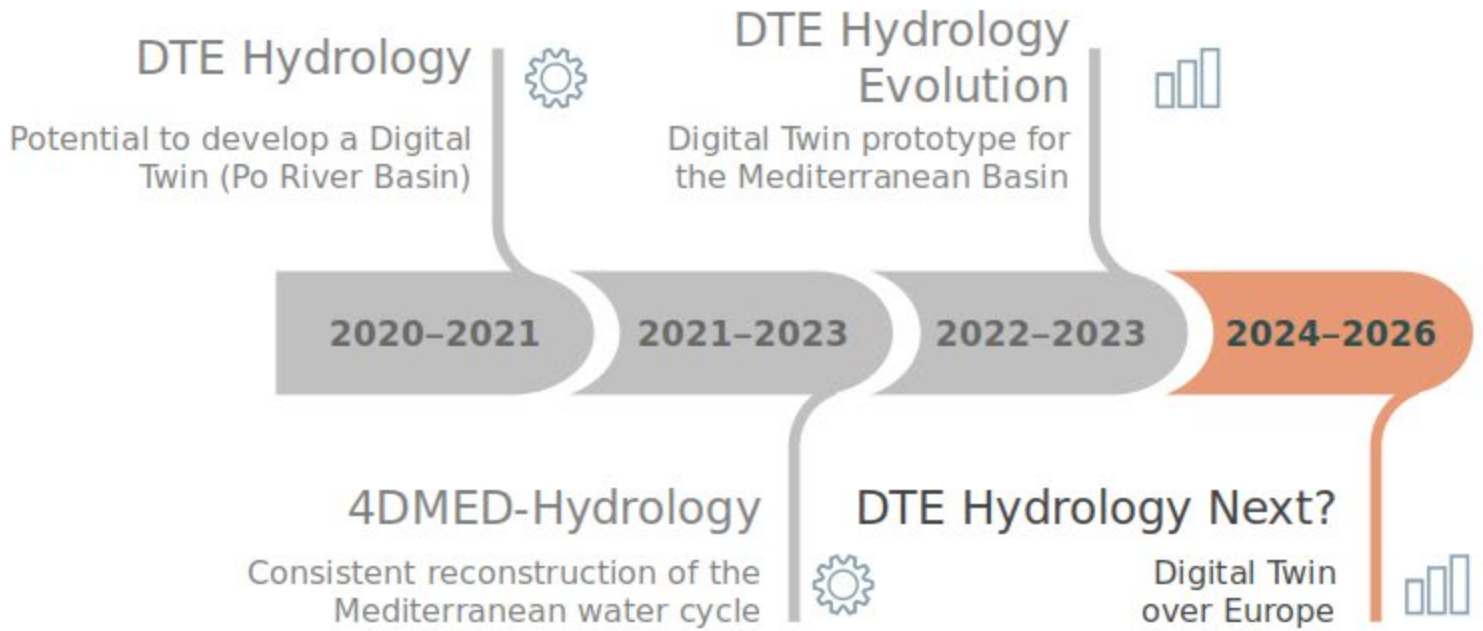


Development of a Digital Twin of the water cycle over Europe



Development of a Digital Twin of the water cycle over Europe

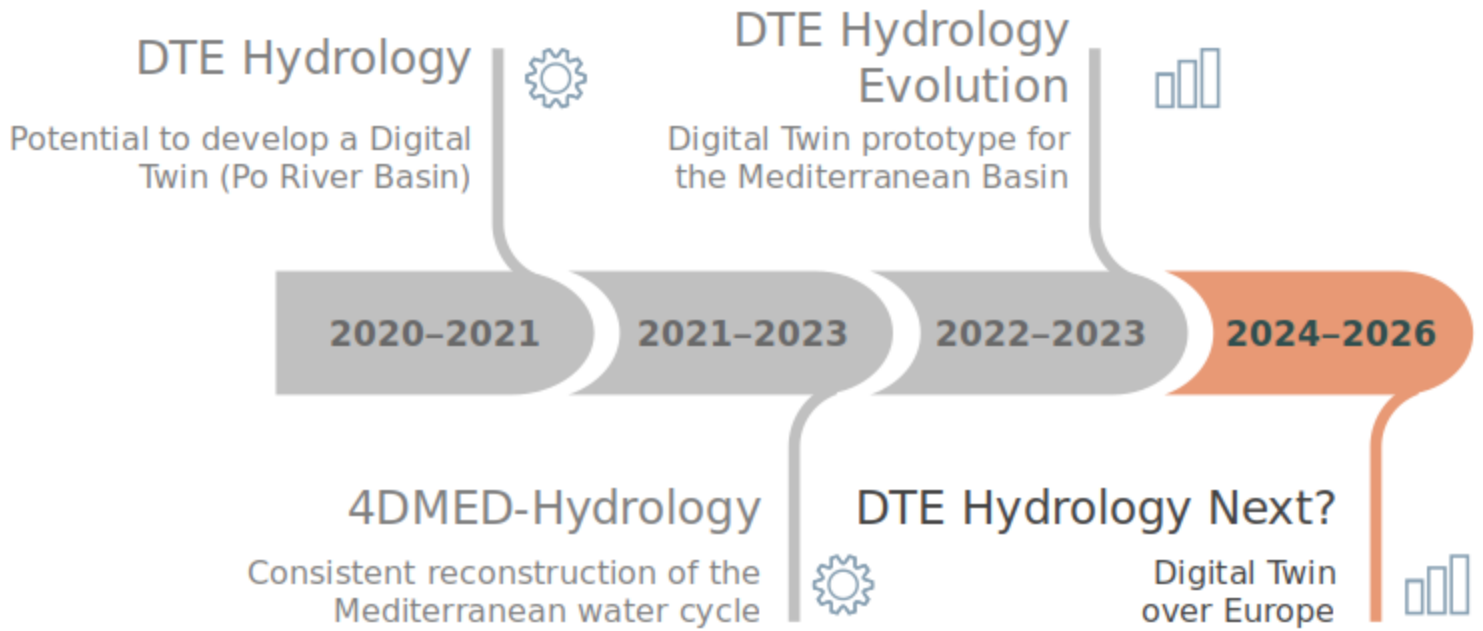
Additionally, test the framework in case studies of Africa and Central America



Development of a Digital Twin of the water cycle over Europe

Additionally, test the framework in case studies of Africa and Central America

Cloud-based infrastructure for retrieval of datasets, visualisation purposes, and full interaction with simulations



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Belgian Earth Observation Day 2024

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