

Monitoring water use and irrigation performance in agriculture using open access remotely sensed derived data (WaPOR)

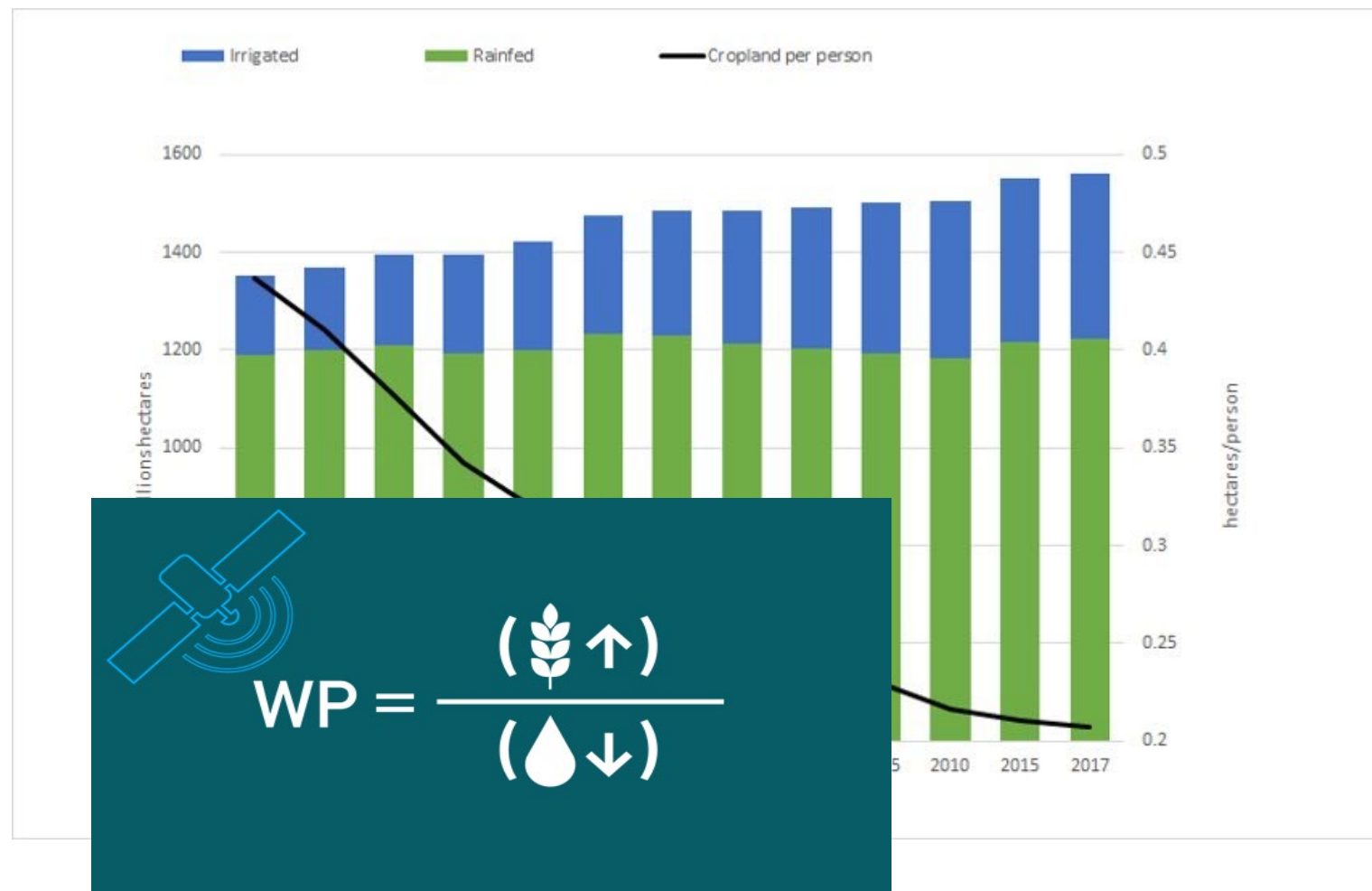
Marloes Mul – Associate Professor of Water Resources Management

We need to produce our food more efficientlyusing less water

Water productivity in agriculture measures the output (kg/ha) per unit of water consumed (m³/ha).

Satellites can help monitor water productivity in cost-effective ways.

Increasing water productivity is now a globally recognized target (SDG 6)



How does WaPOR work?



Collaborating partners



Funded by



Hosted by the Food and Agricultural Organisation of the United Nations

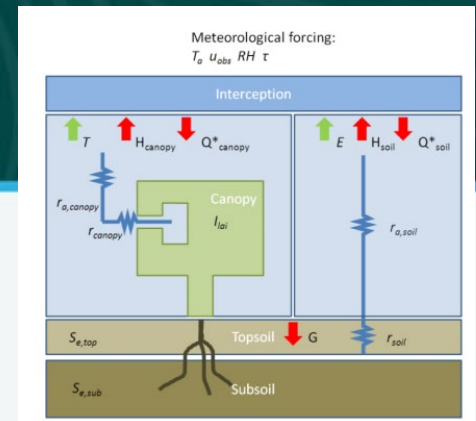
WaPOR Global Database

Available data layers

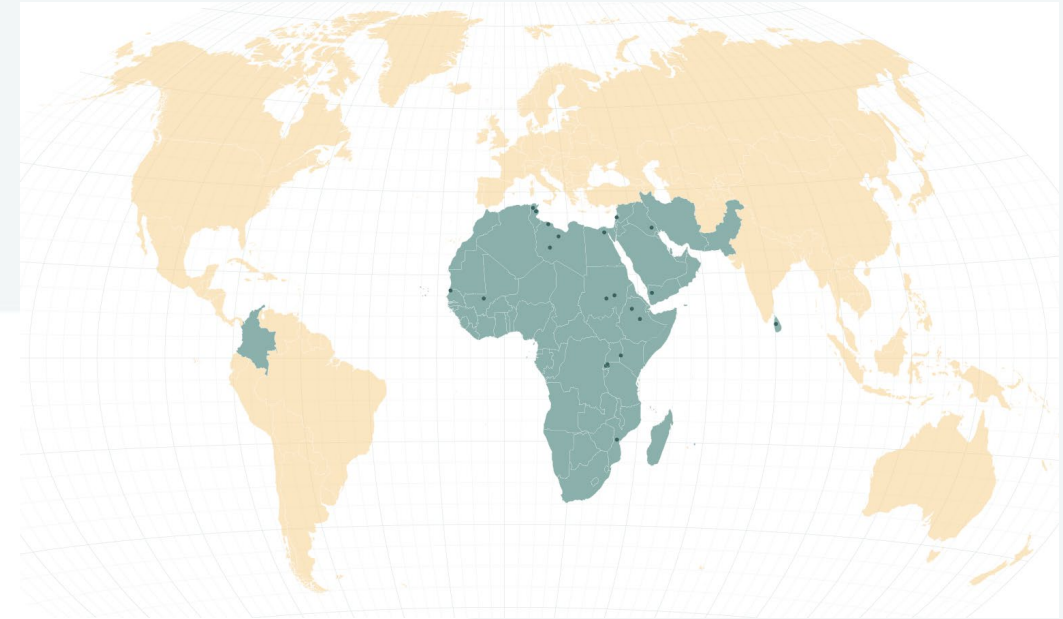
- **PCP** = Precipitation (sourced from CHIRPS)
- **RET** = Reference Evapotranspiration
- **AETI** = Actual EvapoTranspiration and Interception
 - E** = Evaporation
 - I** = Interception
 - T** = Transpiration
- **NPP** = Net Primary Production
- **RSM** = Relative Soil Moisture

Temporal resolution: daily (PCP and RET), decadal, monthly, annual

Temporal availability: 2018-present (near real time)



ETLook (FAO, 2018)



The global level (300m resolution) that covers the entire globe.



The continental and national / river basin level (100 m ground resolution) Northern and sub-Saharan Africa and the Near East (roughly a square of -30W, -40S, 65E, 40N)

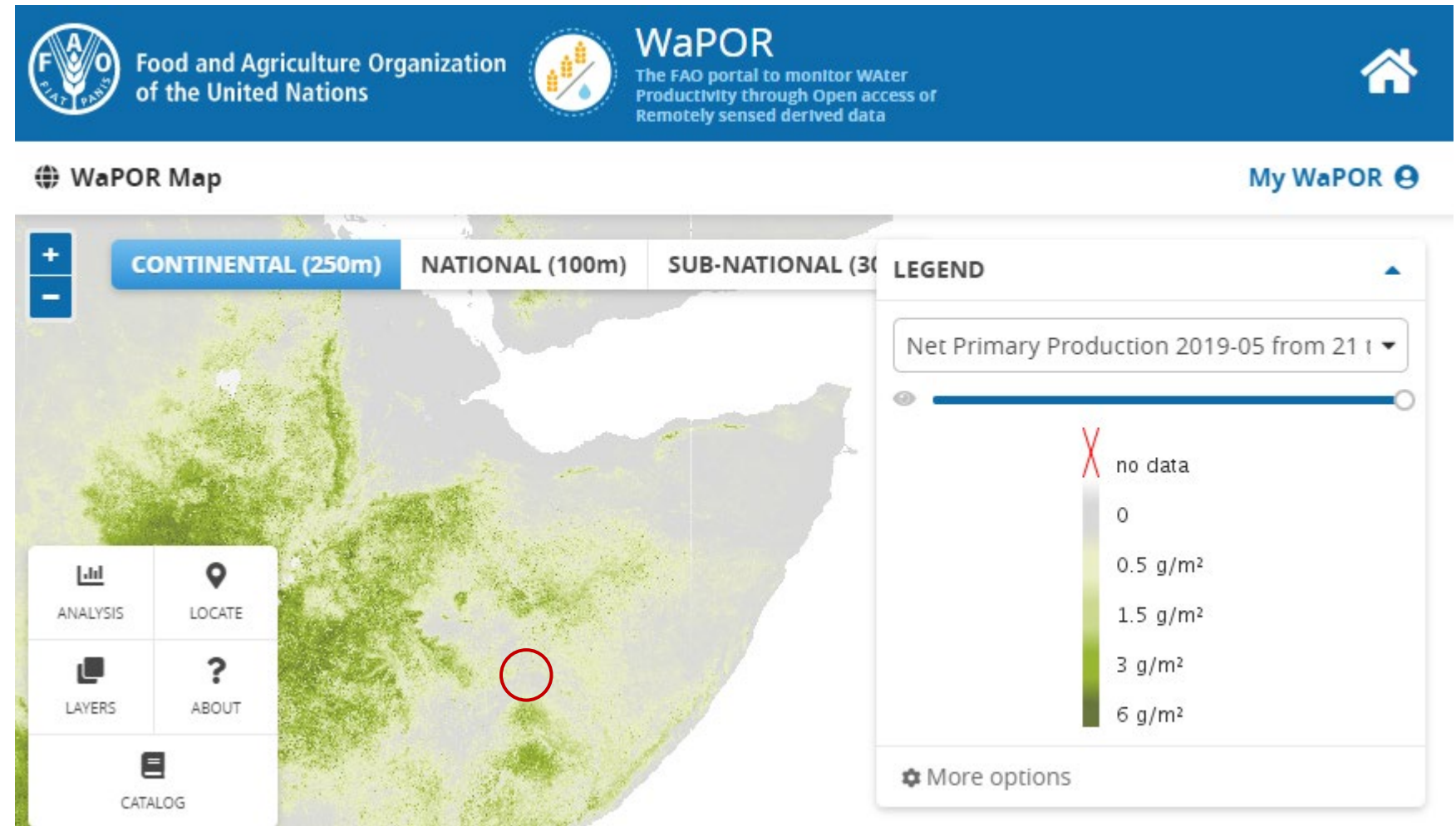


The irrigation scheme and sub-basin (20 m ground resolution) available for these areas:

Monitoring drought impact

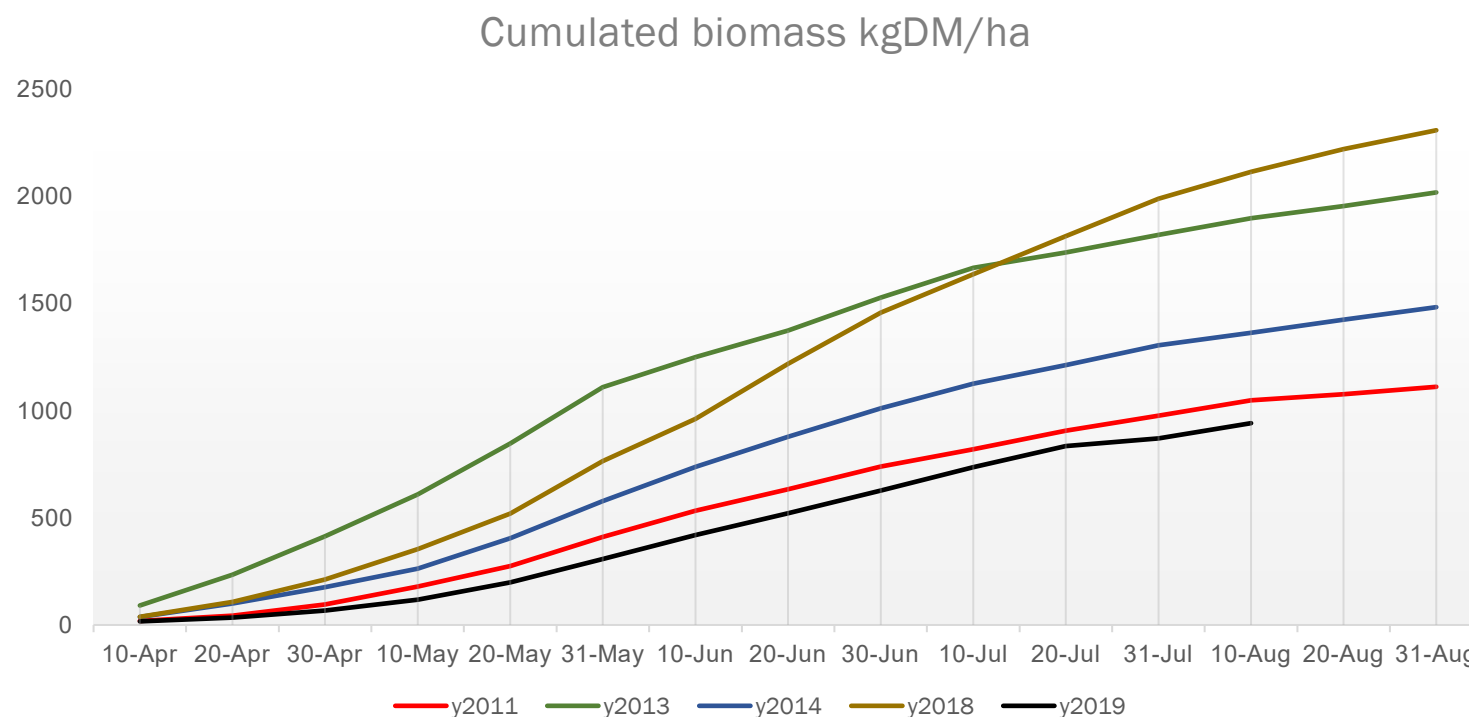
Drought impact on
growing season 2019
– Somalia

Vegetation
development in the
last dekad of May
2018 and 2019



Monitoring drought impact

This year is comparable to 2011 “the worst drought in 60 years”. The chart shows accumulated biomass in the season April–August for different years



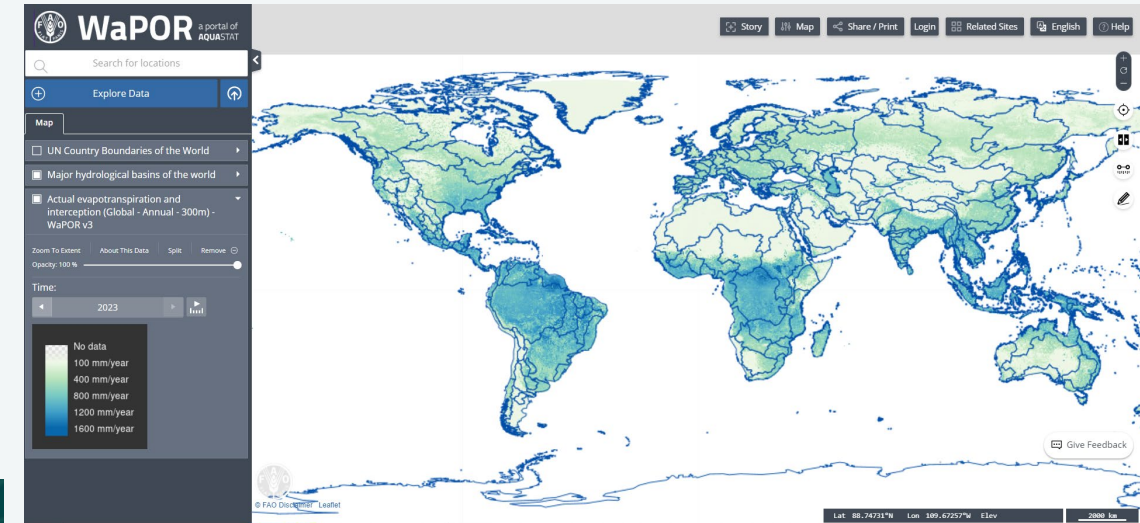
FAOSTAT national Maize + Sorghum (,000 tonnes)
2013 (380)
2014 (-36%)
2011 (-70%)

<https://www.fao.org/in-action/remote-sensing-for-water-productivity/wlpa-introduction/wapor-applications/monitoring-the-impact-of-drought/en/>

Accessing WaPOR data



- WaPOR Portal
- Google Cloud
- Python



WaPOR naming conventions



LL-XX-D (e.g. L2-AETI-D)

LL = level

XX = data type

D = timestep

• Levels

- L1 = Level 1
- L2 = Level 2
- L3 = Level 3

• Data type

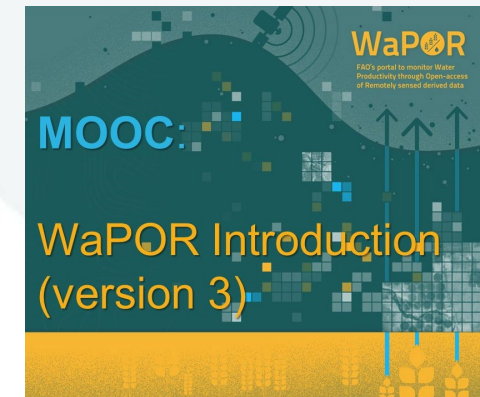
- **AETI** = Actual EvapoTranspiration and Interception
- **E** = Evaporation
- **GBWP** = Gross Biomass Water Productivity (A)
- **I** = Interception
- **NBWP** = Net Biomass Water Productivity (A)
- **NPP** = Net Primary Production (D, M)
- **RSM** = Relative Soil Moisture (D)
- **T** = Transpiration
- **TBP** = Total biomass production (A)
- **PCP** = Precipitation (only L1, 5km resolution)
- **RET** = Reference Evapotranspiration (only L1, 30km resolution)

• Timestep

- **E** = Daily (only PCP and RET)
- **D** = Dekade*
- **M** = Month
- **A** = Annual

*10 days, 3 dekades in one month – 3rd dekade different number of days

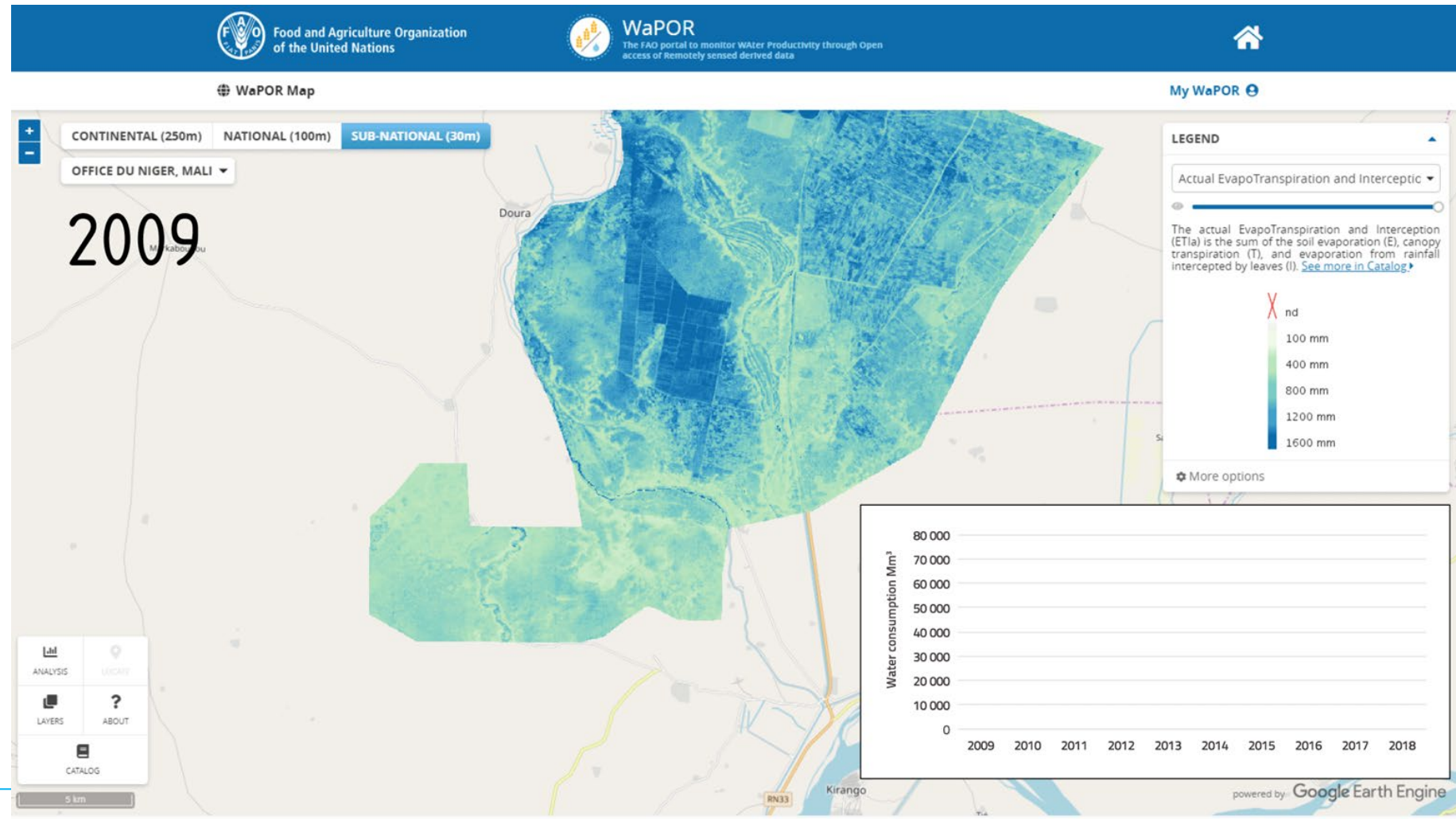
- Learn more:

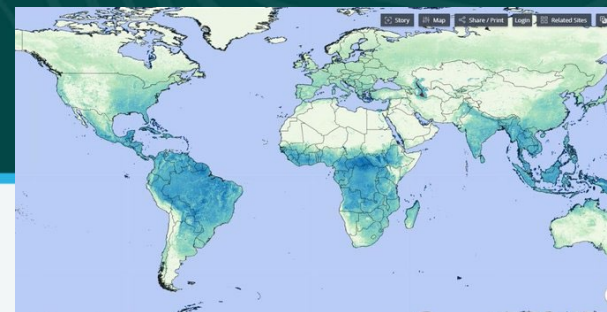


Monitoring water consumption in irrigation

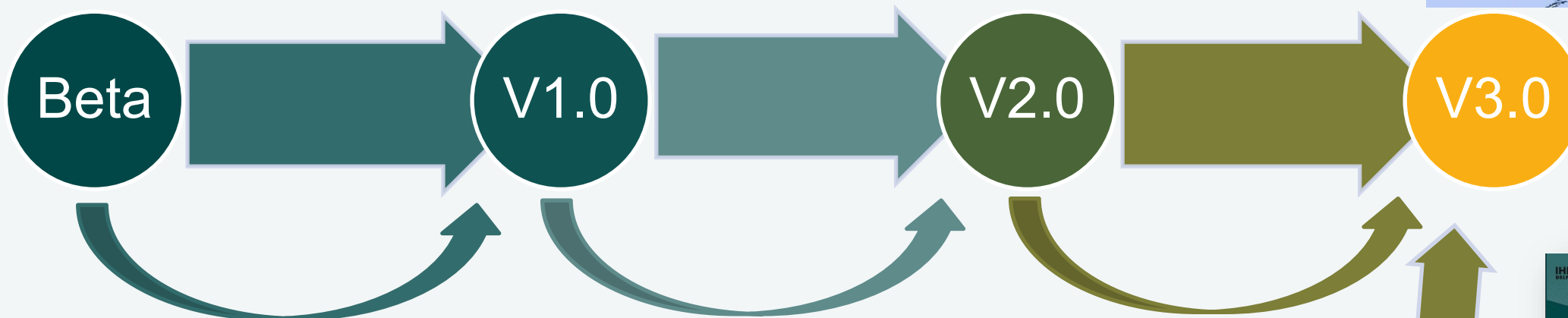
With WaPOR, local institutions can easily monitor the amount of water consumed in irrigated areas and develop better informed water allocations at times of water scarcity.

Map shows actual evapotranspiration = water consumed by crops





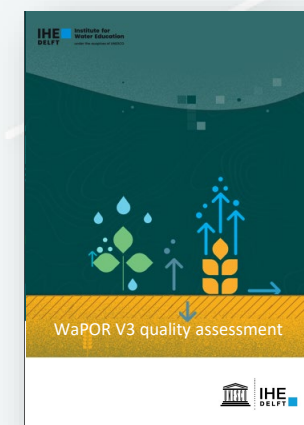
The road to WaPOR version 3.0



UNIVERSITY
OF TWENTE.



Input data



**IHE
DELFT** Institute for
Water Education
under the auspices of UNESCO

April 2017

August 2018

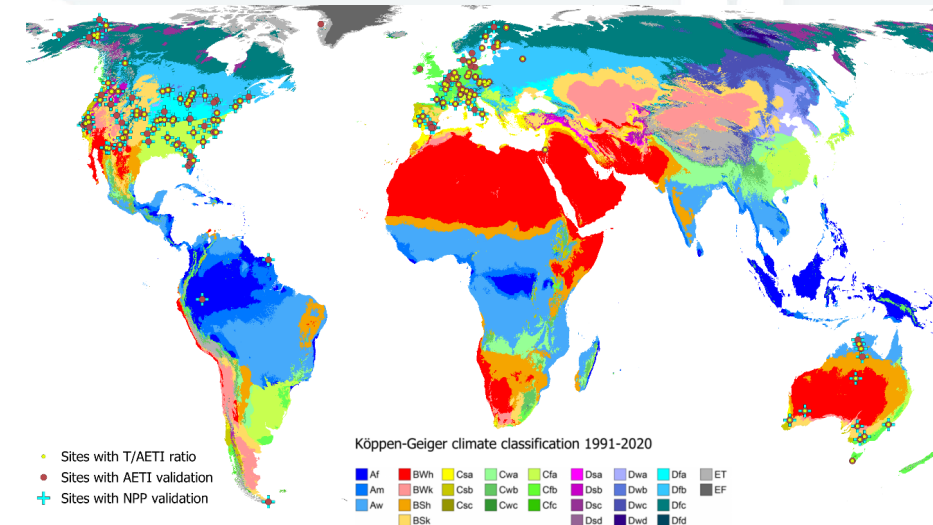
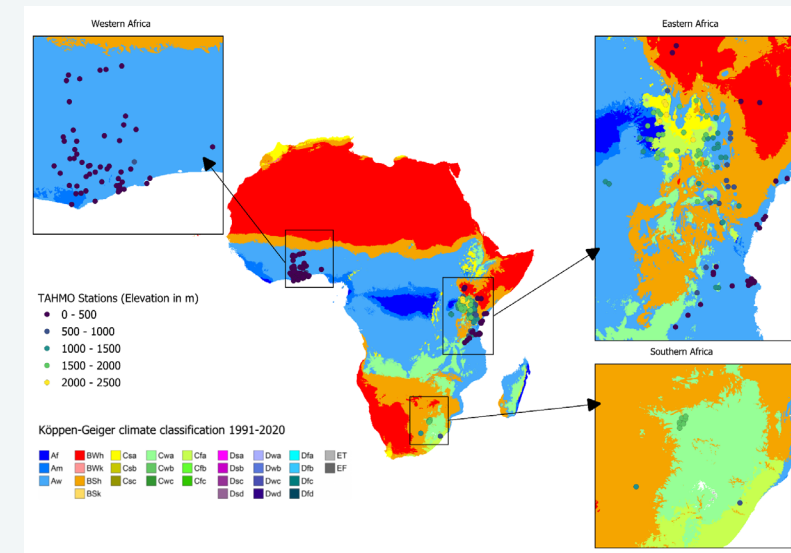
June 2019

October 2023

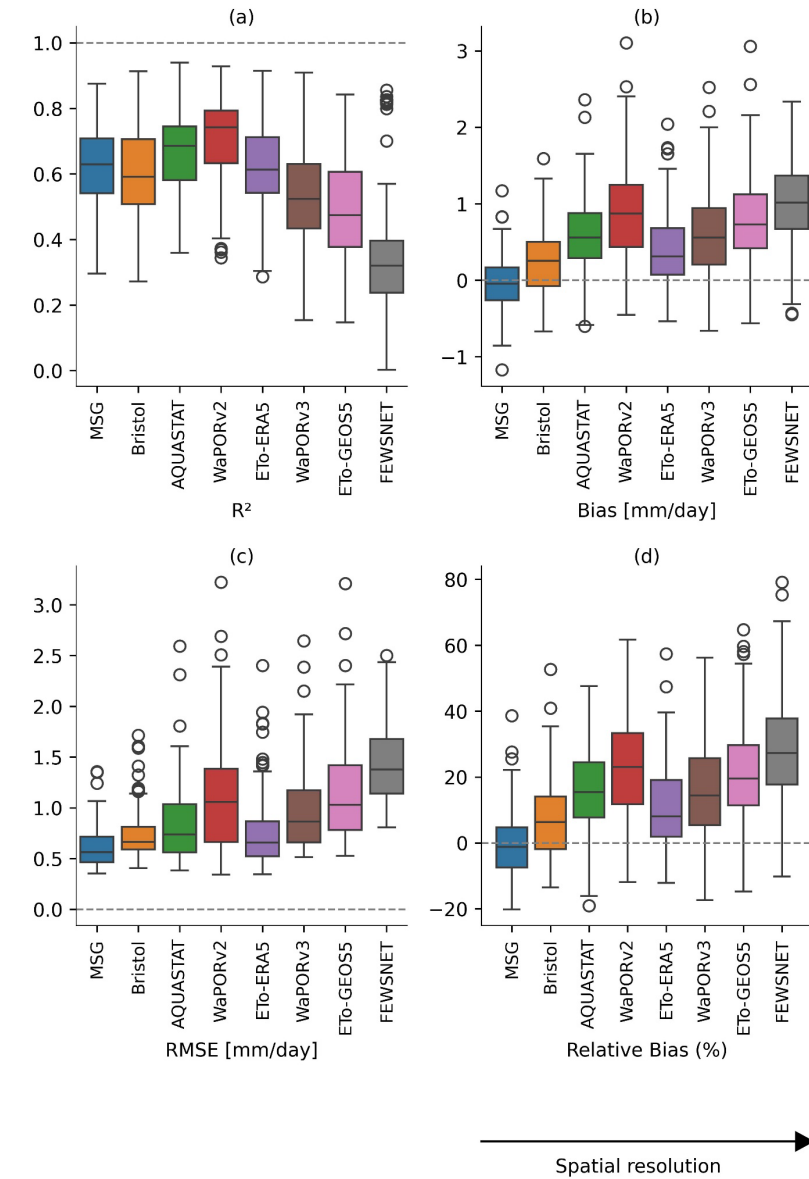
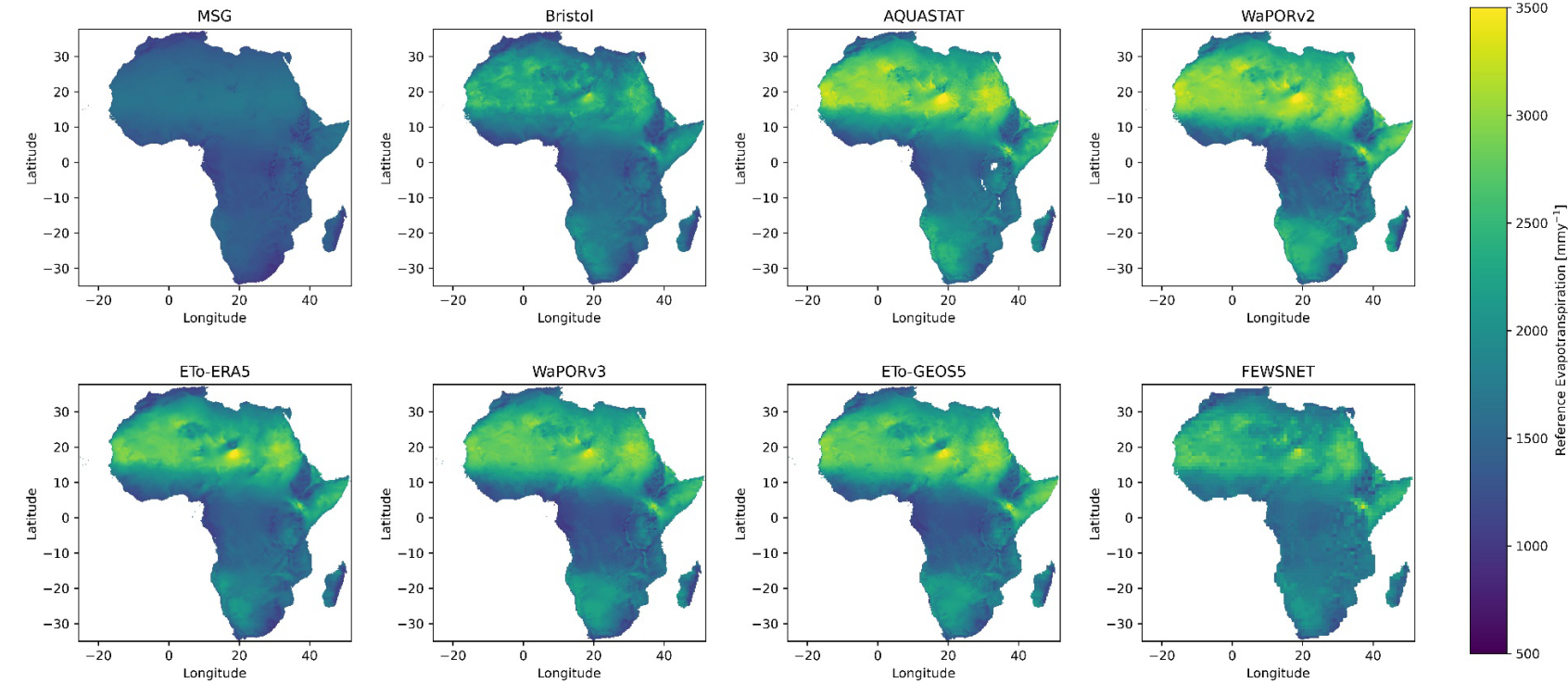
WaPOR version 3 validation

Type of validations

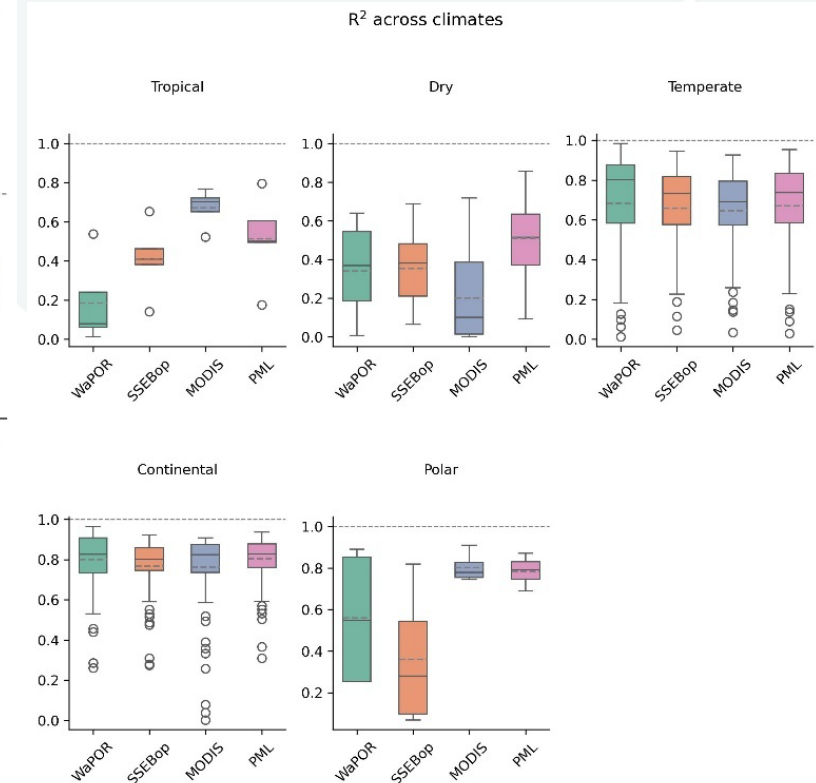
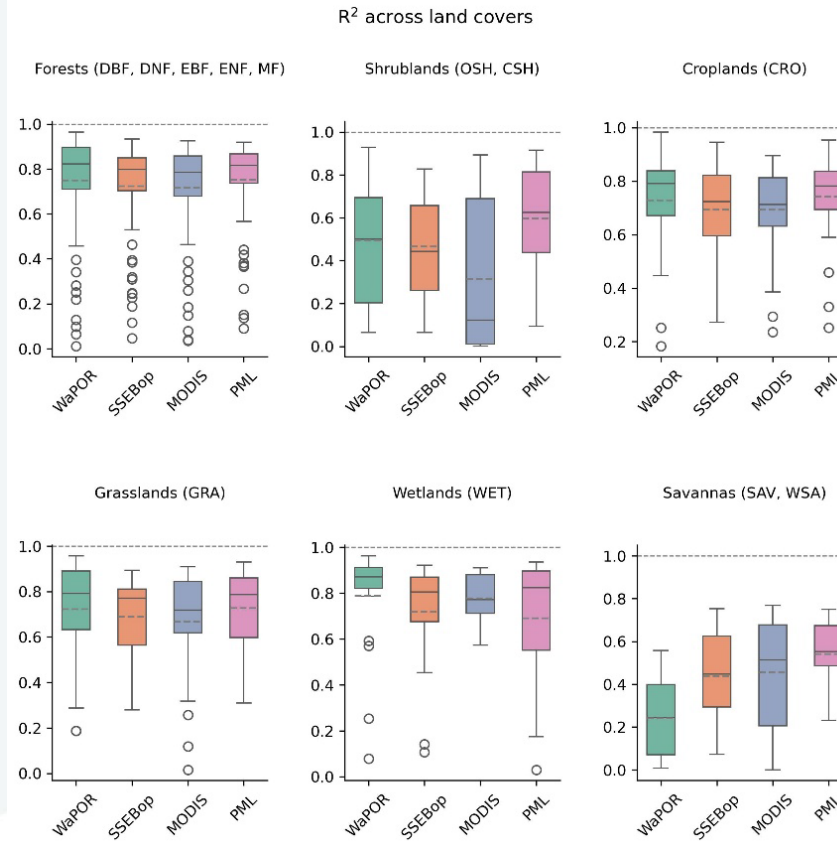
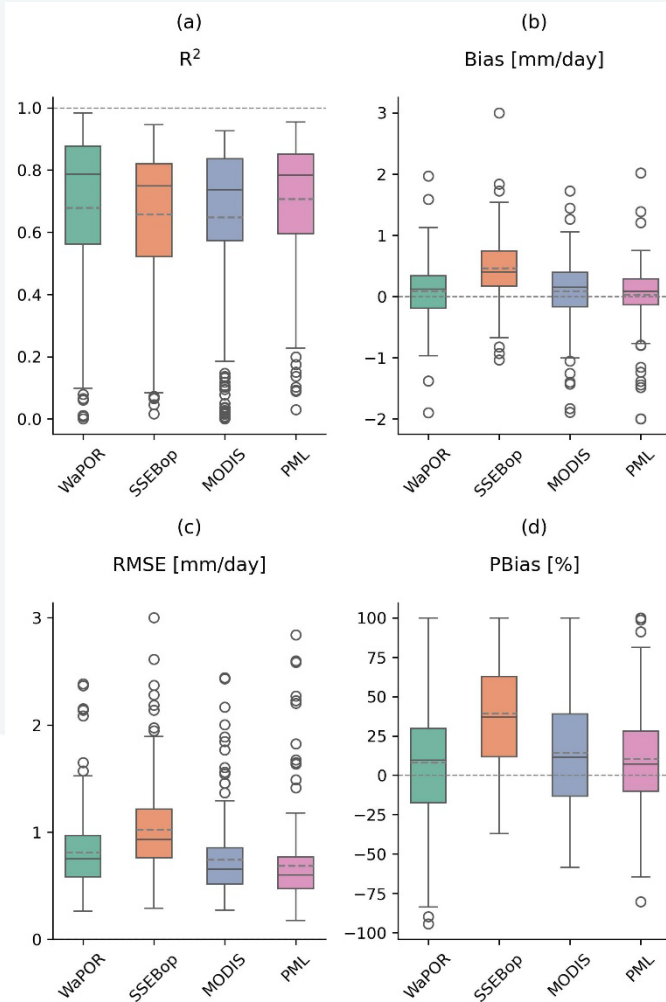
- Validation against ground stations
 - Climatic stations (RET)
 - Eddy Covariance stations (AETI, T/AETI, NPP)
- Comparison with other data products:
 - Eg MODIS, PML, Copernicus, SSEBop
- Comparison to auxiliary data (water balance)
- Plausibility checks (eg zonal statistics – land cover classes)
- WaPOR consistency between layers (WP)



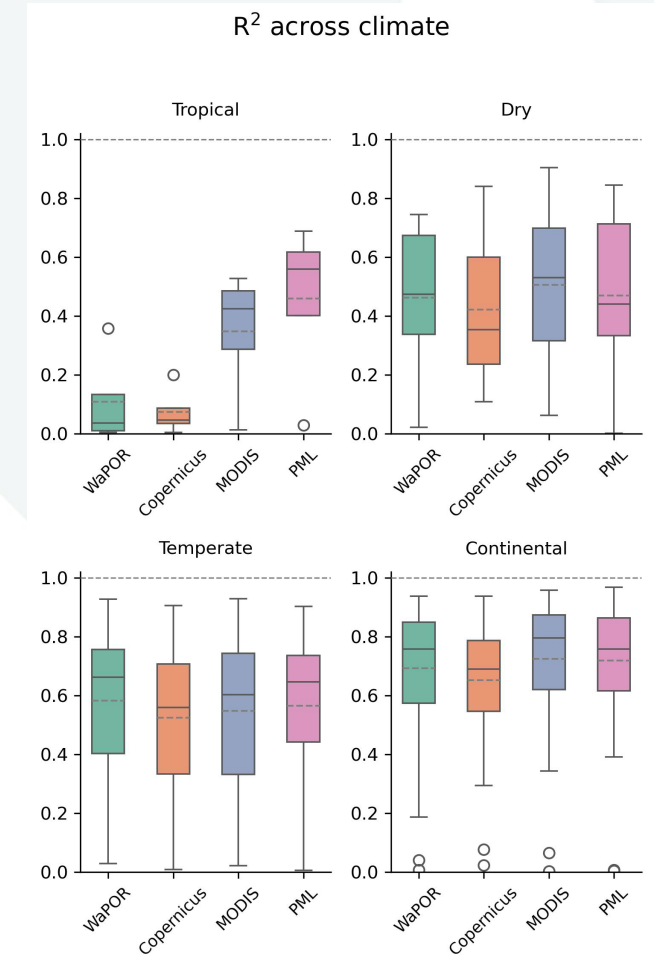
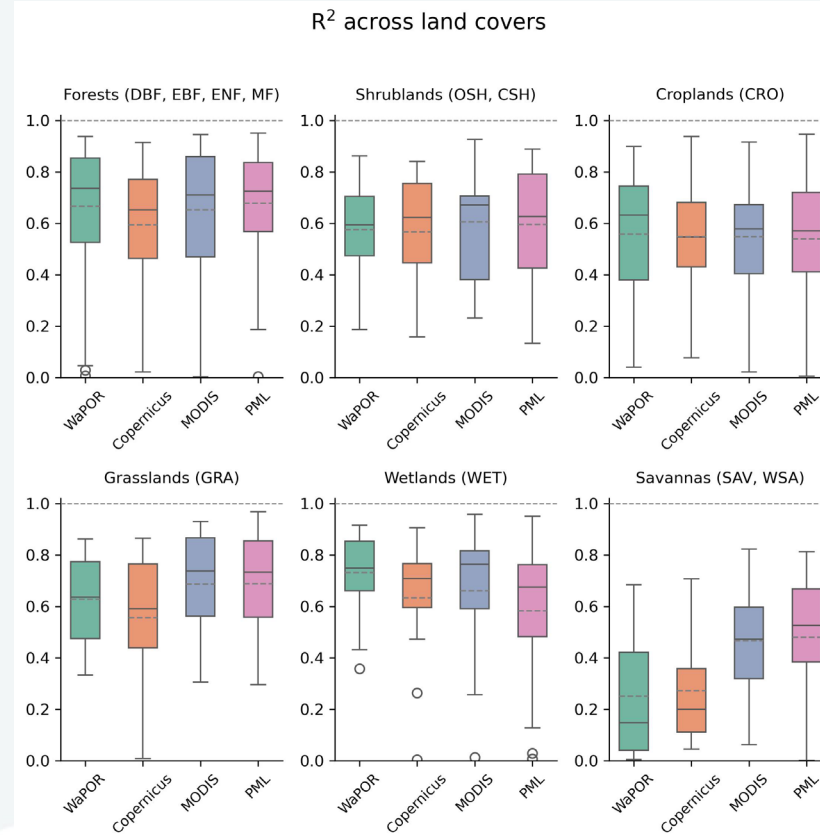
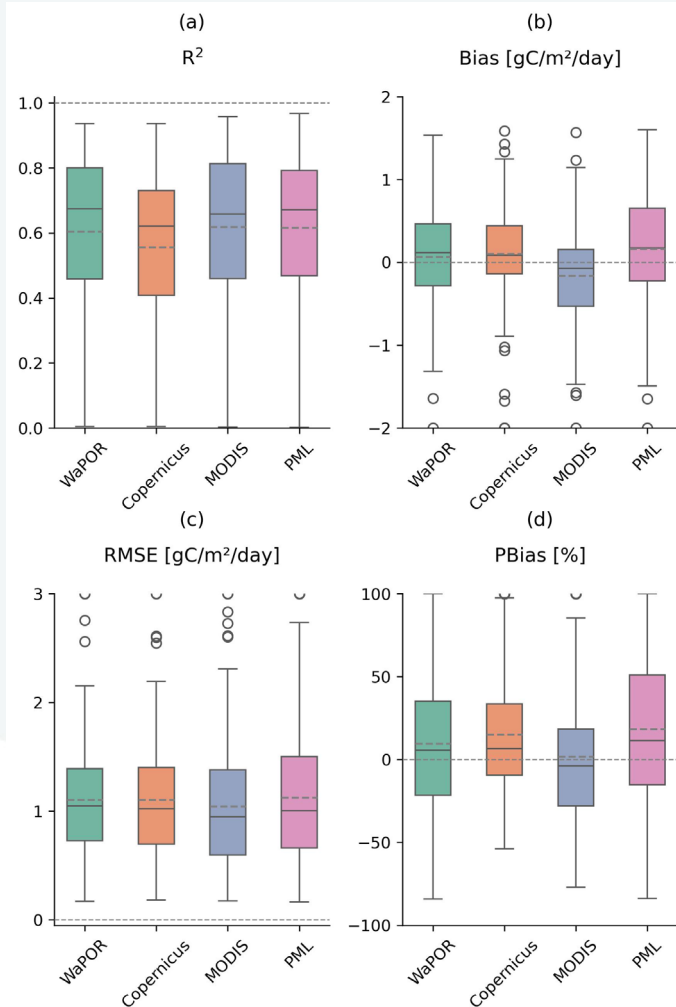
Reference ET



AETI validation with stations



NPP validation with stations



WaPOR data is easily accessible through its portal and API

Precipitation

- The WaPOR portal also provides access to CHIRPS precipitation data

AETI

- The global WaPOR AETI product evaluation showed the best or similar good performance compared to the other products both at EC station and basin scale.

T/AETI

- Transpiration is overestimating compared to AETI. Advise not to use this dataset

NPP

- The WaPOR NPP product shows the best performance against the station data, including Cropland stations, however the performance is lower than for the WaPOR AETI product.

Other

- Version 2 (2009-2023) and version 3 (2018-present) have significant differences and should not be used as is in evaluating trends



Operationalising WaPOR analyses through dashboards

Mwea irrigation scheme

Rice cultivation

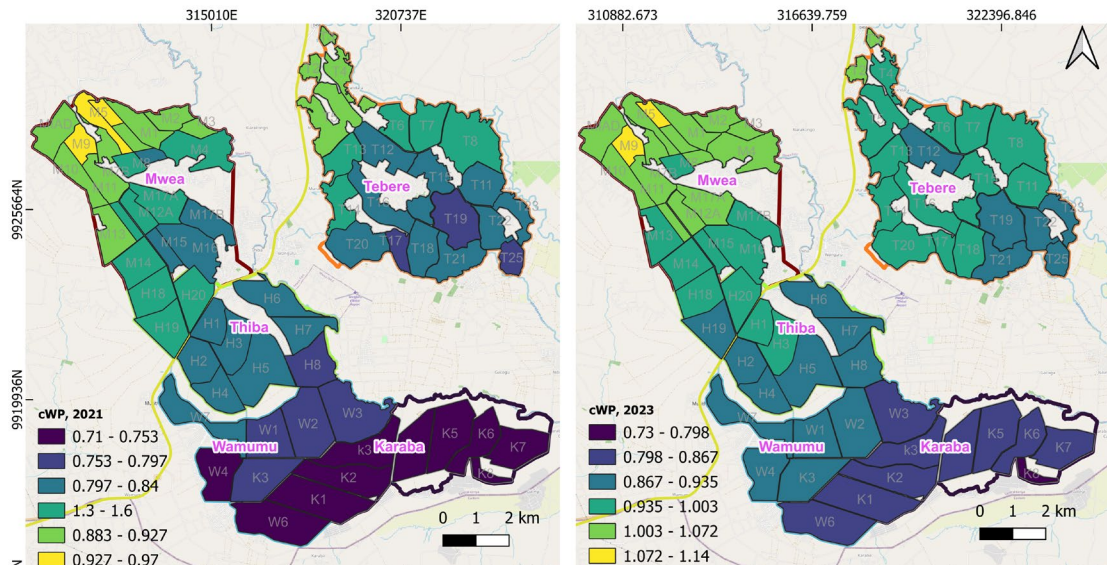
Smallholder farmers

Operated by National Irrigation Authority

Irrigation performance indicators:

- Land productivity/ yield (as part of reporting cycle)
- Irrigation efficiency
- Adequacy
- Beneficial fraction
- Equity

Developing an interactive dashboard



WaPOR selected to receive the 2023 GEO SDG Award in recognition of its groundbreaking contribution to the Sustainable Development Goals



wapor.apps.fao.org

wapor@fao.org

www.fao.org/in-action/remote-sensing-for-water-productivity



Project website: <http://wateraccounting.un-ihe.org/>

 IHE Delft - Water Accounting

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