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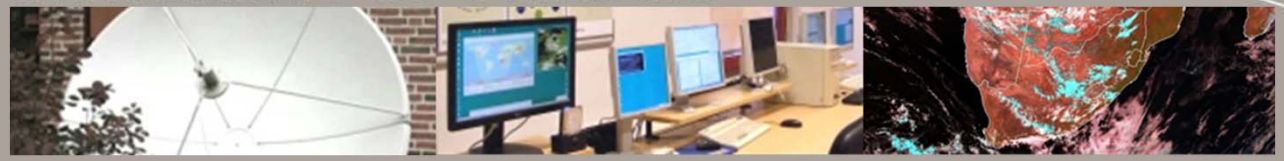
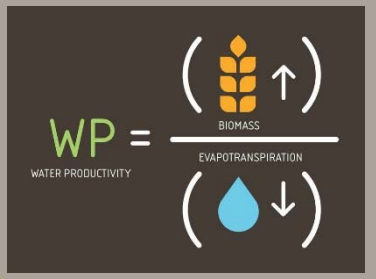
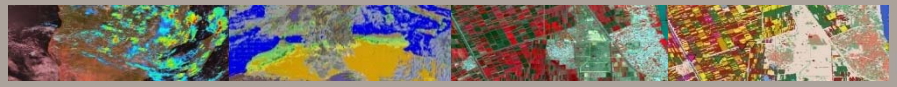


INTRODUCTION TO WATER PRODUCTIVITY & FAO - WAPOR

BEN MAATHUIS / CHRIS MANNAERTS

FACULTY ITC, UNIVERSITY TWENTE, THE NETHERLANDS





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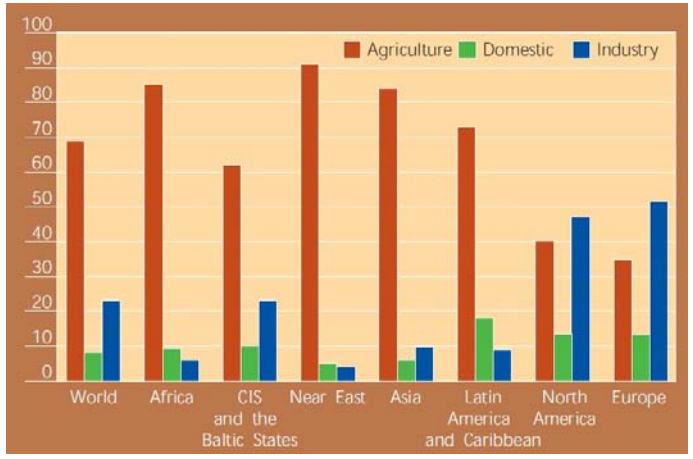
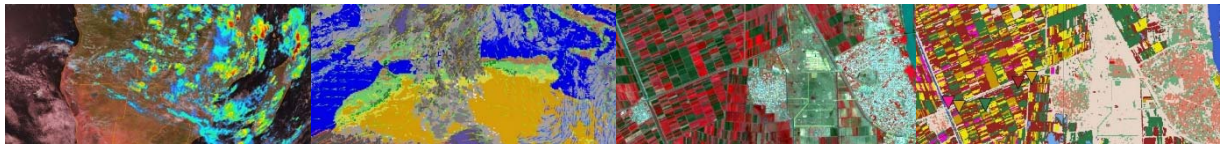
INTRODUCTION: “MORE WITH LESS”

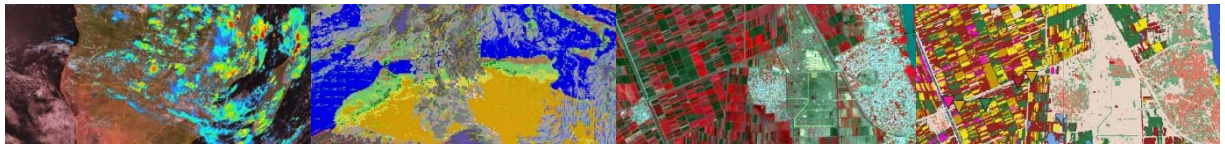
- Achieving food security in the future while using water resources in a sustainable manner is a major challenge;
- In 2050, food needs to be produced for an expected population of between 9 and 10 billion people;
- A lot of water is needed to produce food. Agriculture, as it is practiced today, is responsible for 70% of all freshwater withdrawals in the world.





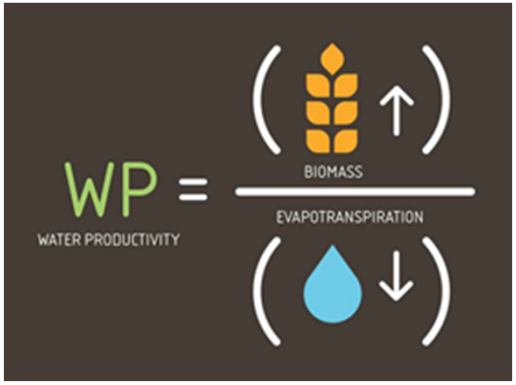
MORE EFFICIENT USE OF WATER

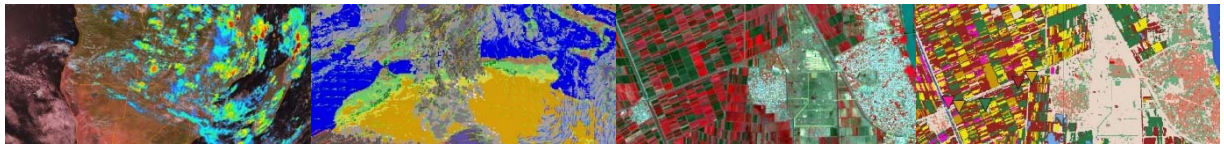
- Increase in agricultural production required to meet demand in 2050 is 50% (48.6%), compared to 2013 baseline (FAO,2017) at a time of increasing pressure on water quantity and quality.
- Against this background, improved crop water productivity is needed.
- Production in agriculture should not only be considered per unit of land(kg/ha),but also expressed in the production per unit of water consumed, or in short Water Productivity (WP).
- Contribute directly to Sustainable Development Goal 6.4 on improved water use efficiency.



WATER PRODUCTIVITY

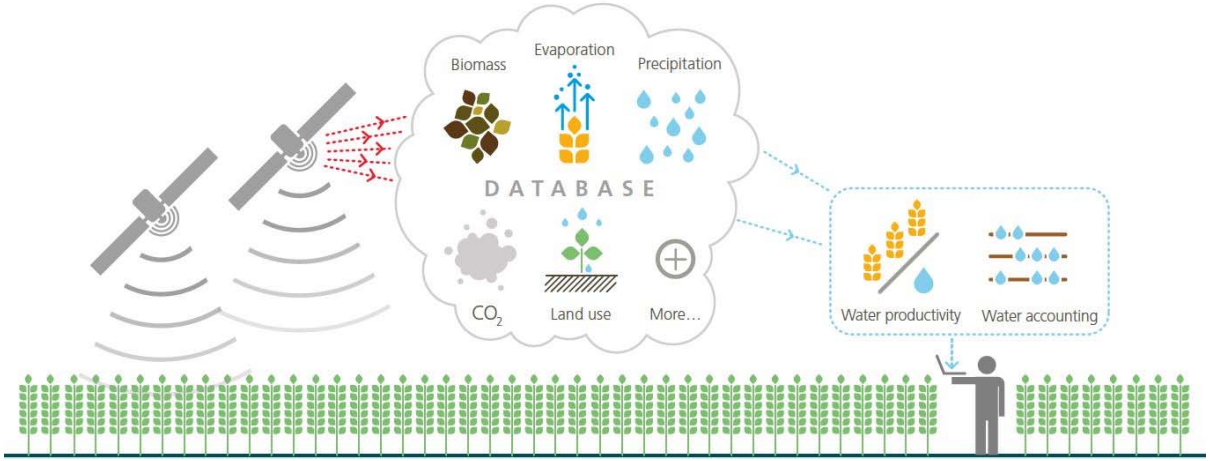
- Water productivity is defined as the quantity or value of output in relation to the quantity of water beneficially consumed to produce this output.
- Can be expressed as biomass, grain or money. For example, the so-called ‘crop per drop’ approach focuses on the amount of product per unit of water.
- Water productivity in agriculture can be expressed as amount of product per unit of water beneficially consumed by the crop.

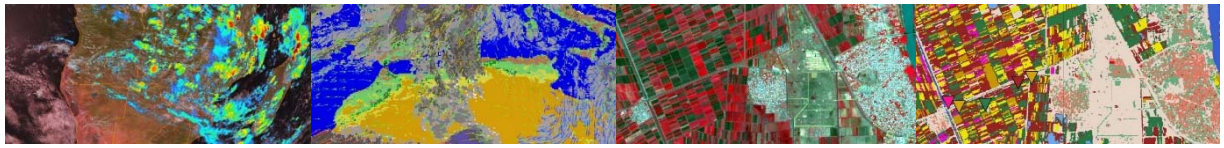




WAPOR: USE OF RS IN WP ASSESSMENT

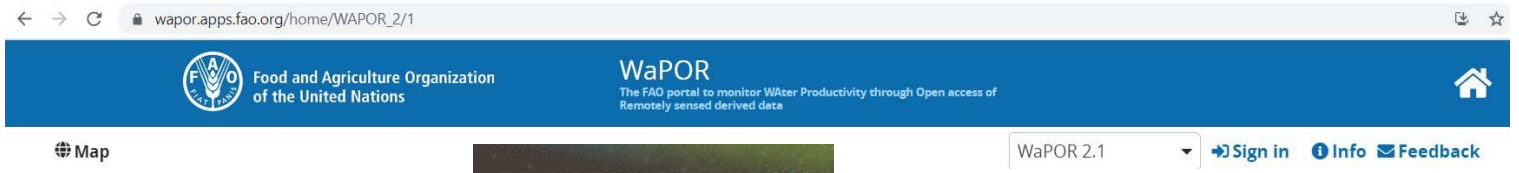
- Improving water productivity allows for better managing water demand in agriculture.
- Systematic monitoring helps to evaluate water productivity gaps and identify appropriate solutions for closing these gaps.
- Remote Sensing can help monitor water productivity in an objective and cost effective way and show the spatial variability.





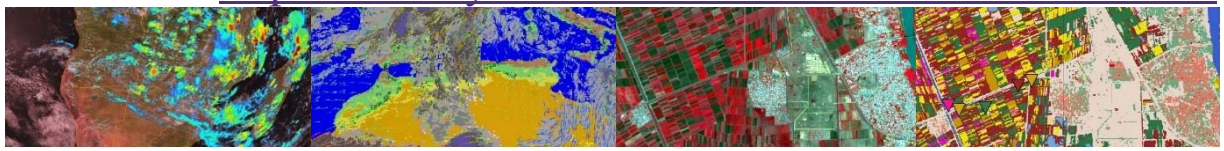
WAPOR DATA BASE

- WaPOR is the FAO portal to monitor Water Productivity through Open access of Remotely sensed derived data. It monitors and reports on agriculture water productivity over Africa and the Near East and provides open access to the water productivity database and its thousands of underlying map layers. It allows for direct data queries, time series analyses, area statistics and data download of key variables associated to water and land productivity assessments.



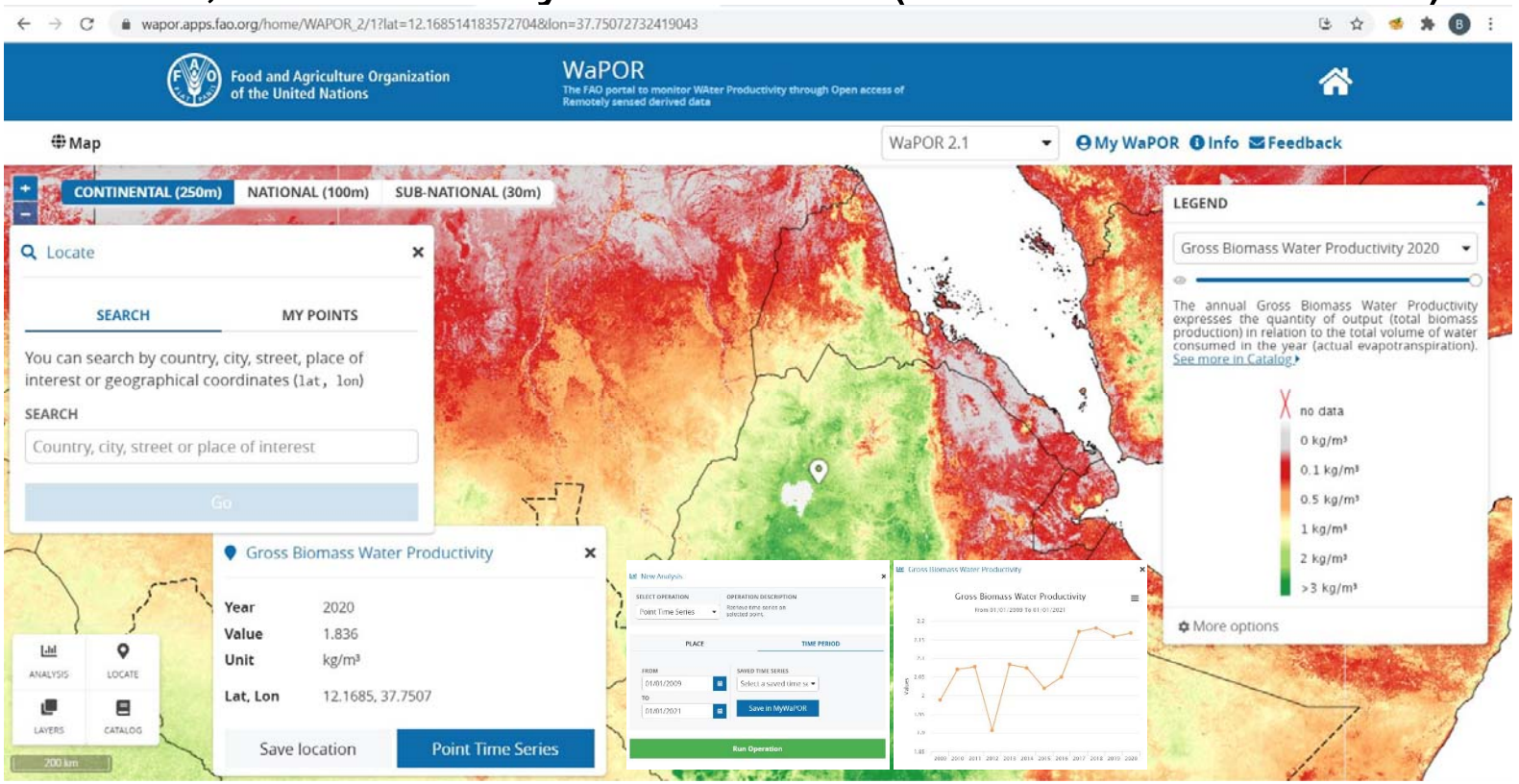
- Introduction WaPOR:

https://www.youtube.com/watch?v=ZX7SOhk97hA



WAPOR DATA BASE – VERSION 2

- 3 levels, online analysis – level 1(Africa and MidEast)



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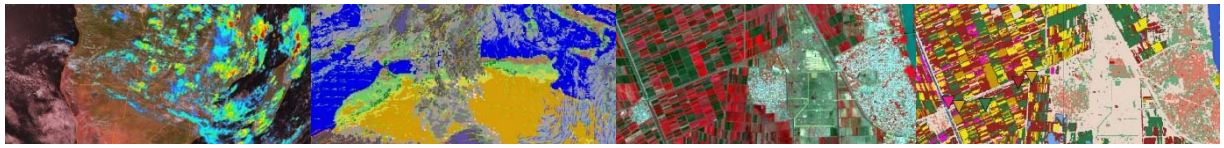
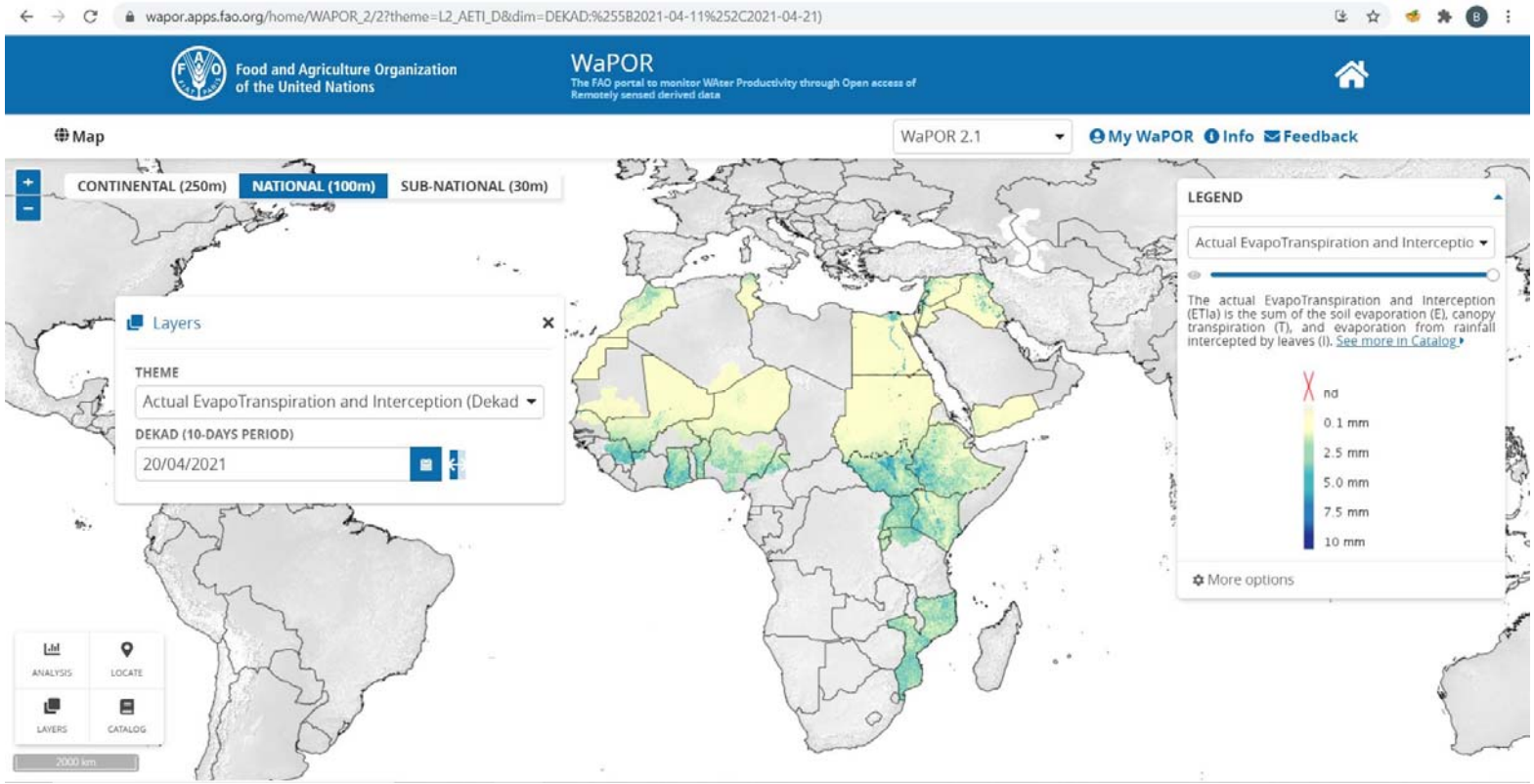
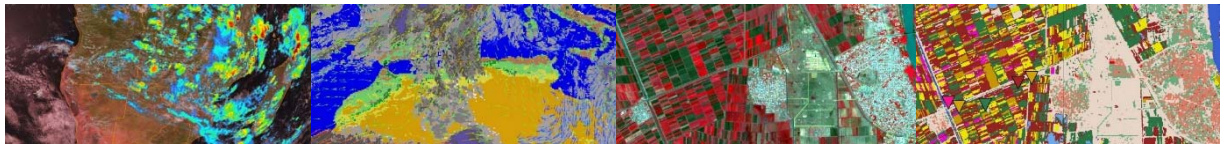


WAPOR DATA LAYERS

- Differs per level – level 2 (selected countries / basins)





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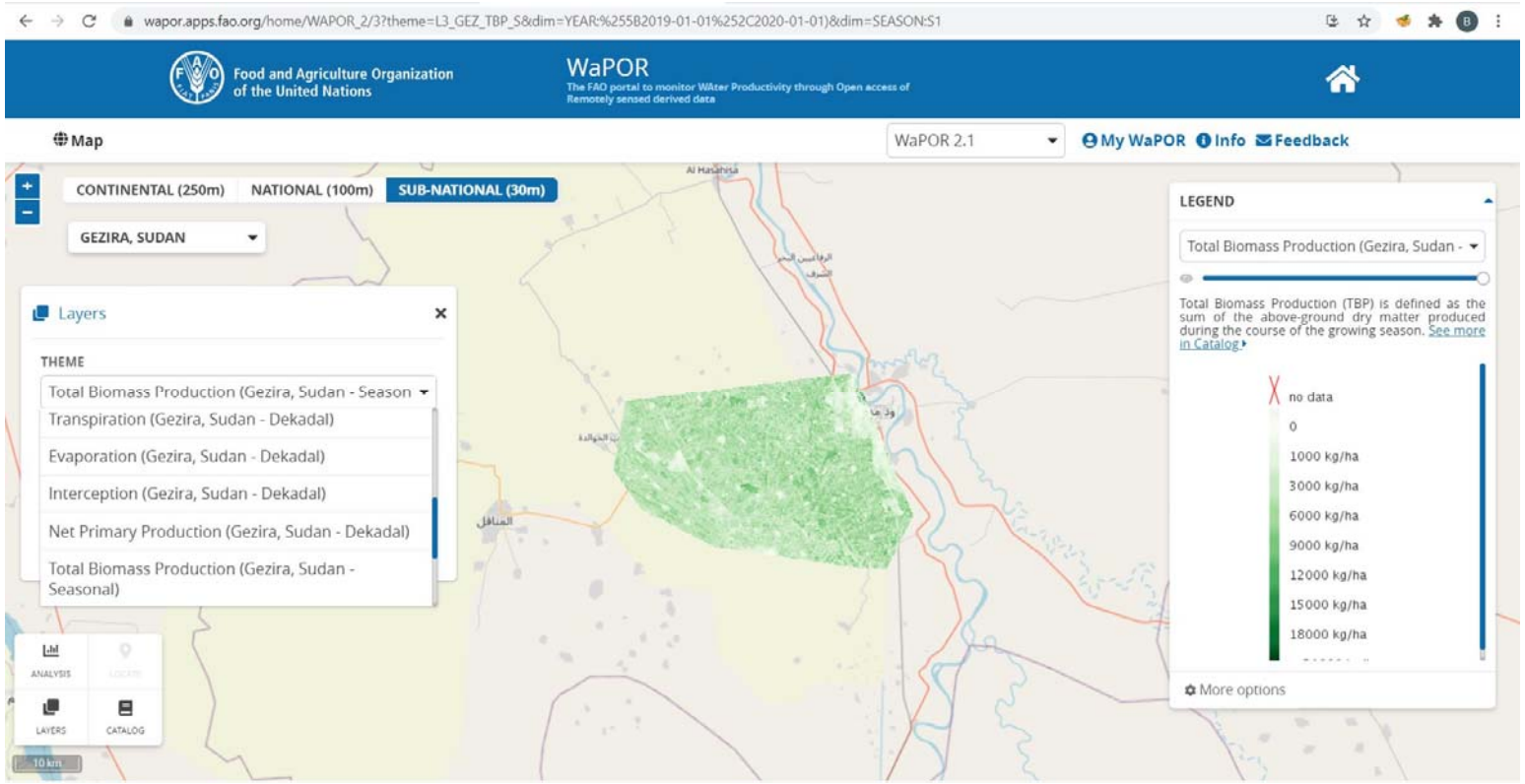
WAPOR DATA LAYERS

- Differs per level – here level 3 (selected areas)



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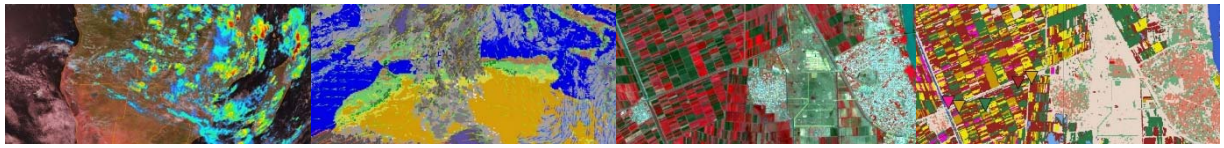
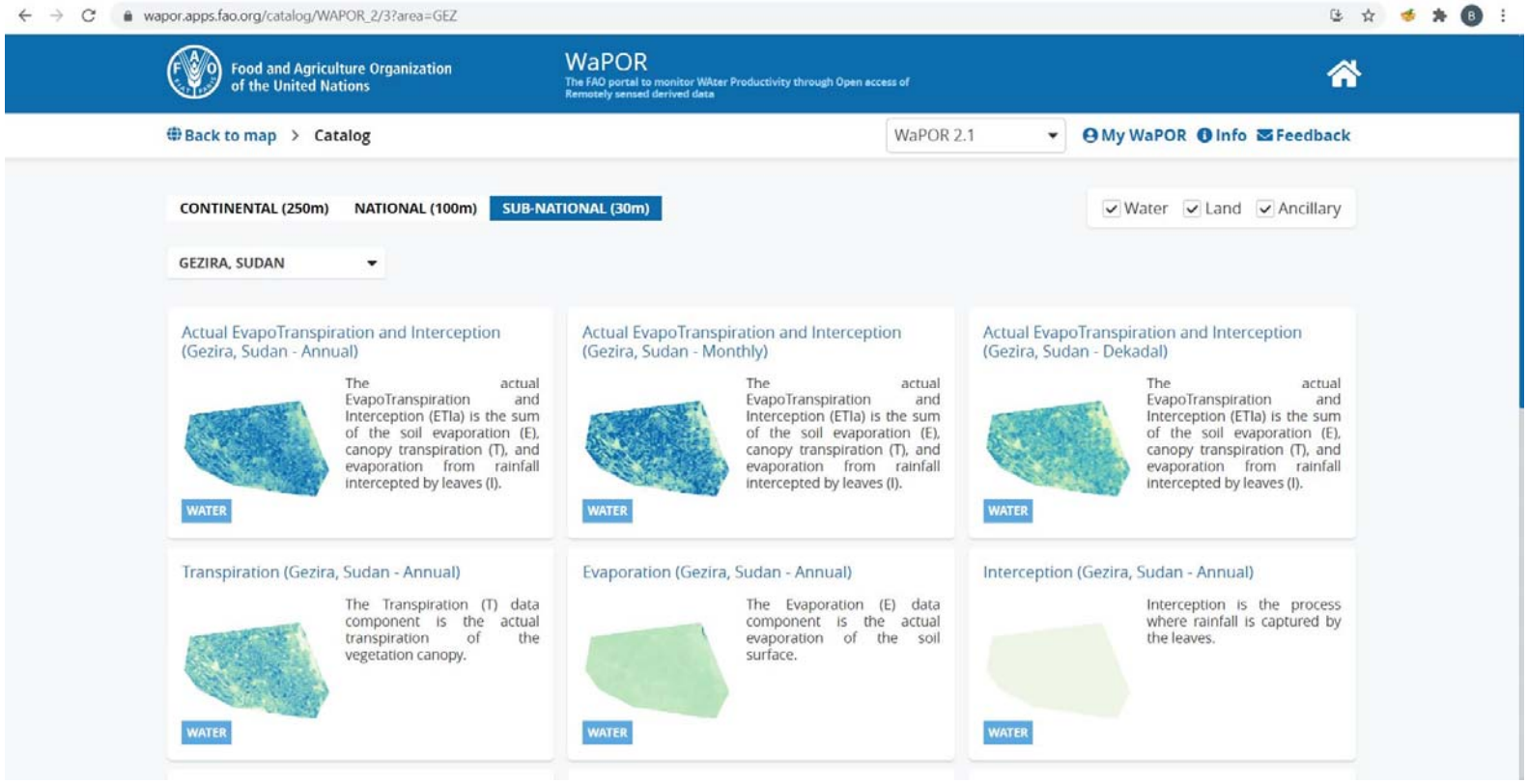
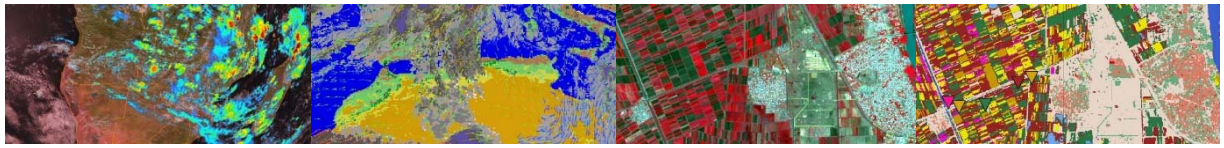


WAPOR DATA CATALOG

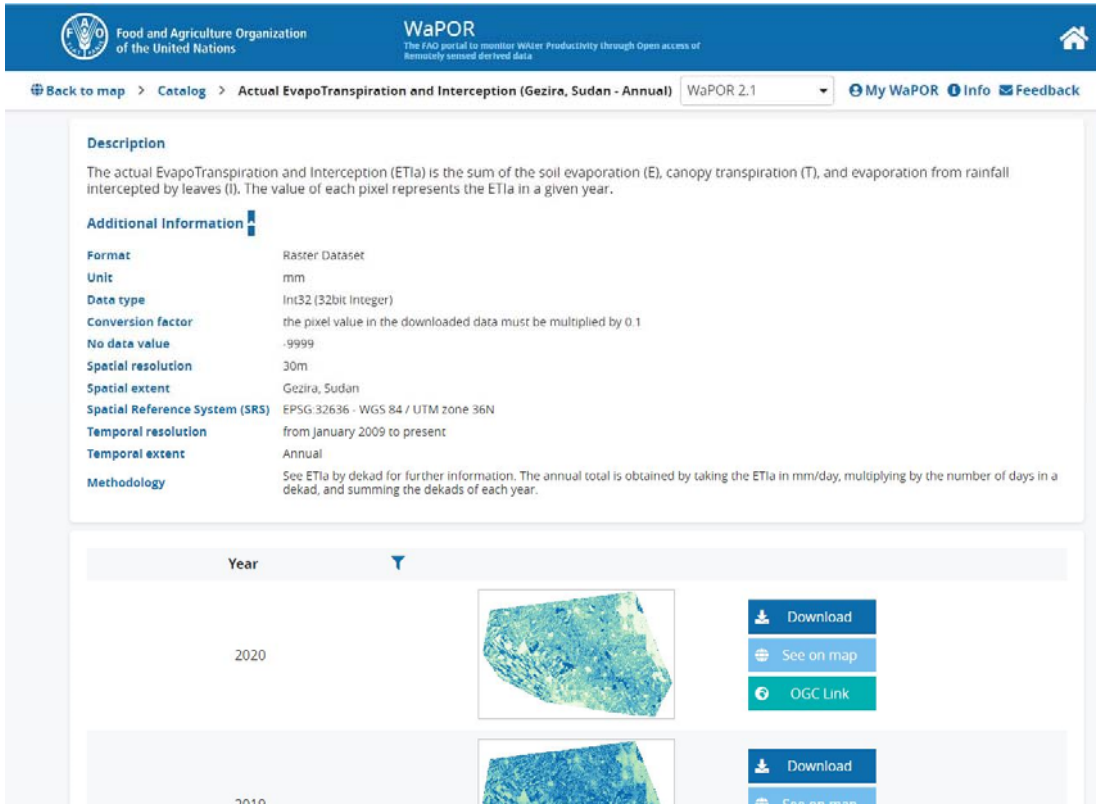
- All data (per level) is well documented

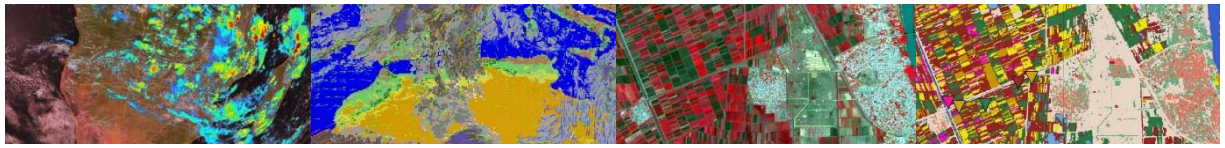




WAPOR DATA DOWNLOAD

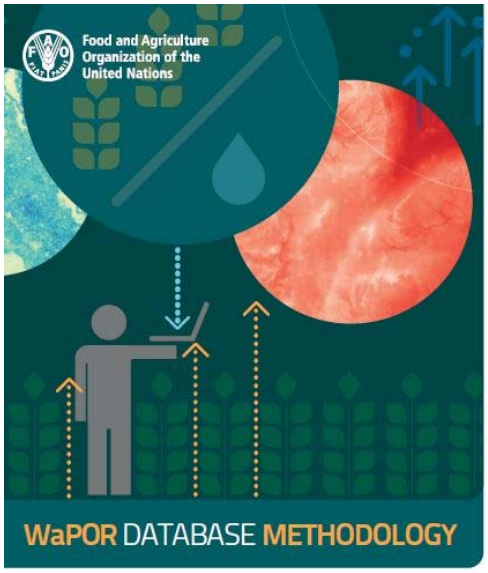
- Allows for data download (if signed in) – geotif format

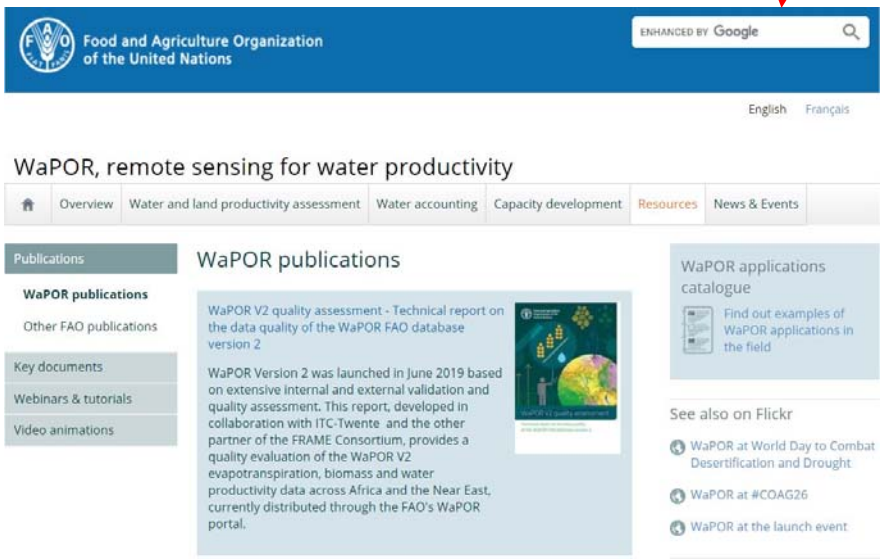




WAPOR DATA BASE METHODOLOGY

- Calculation procedures to derive WP and other data layers





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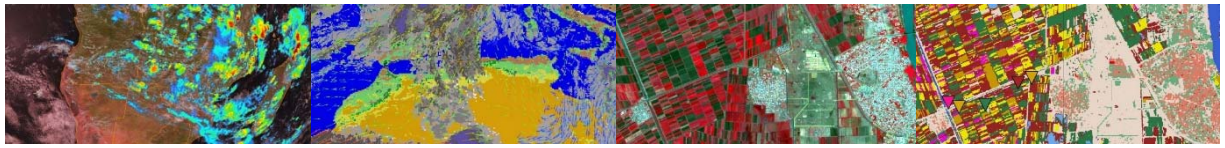
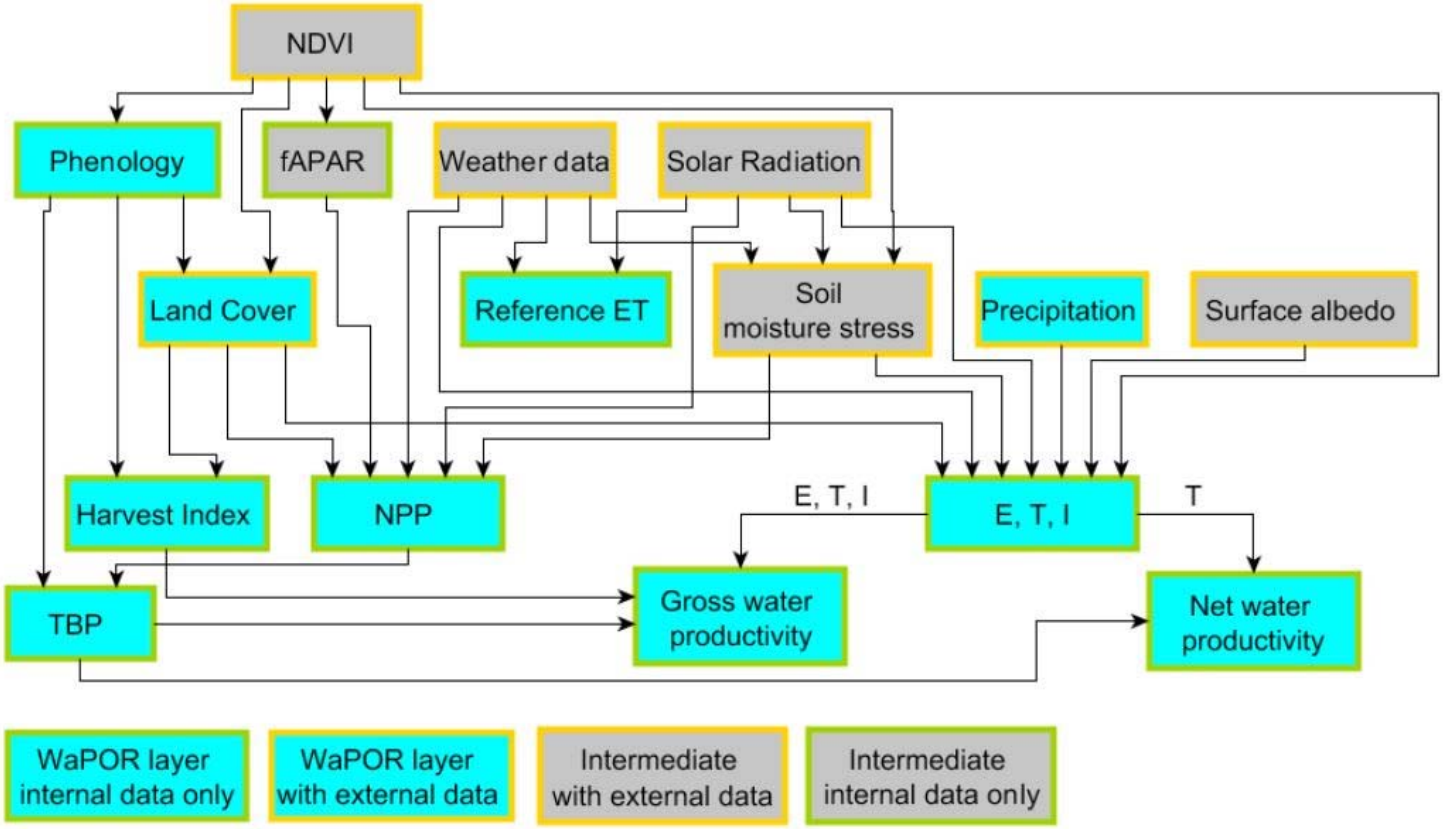
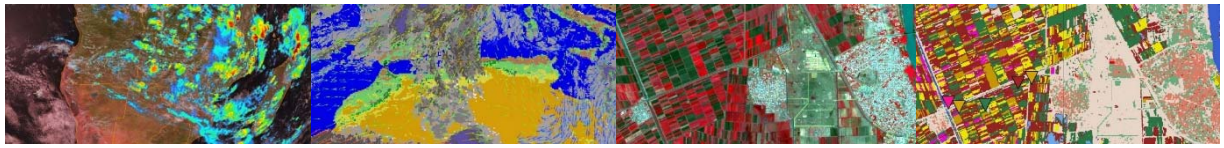


DATA COMPONENT FLOW CHART



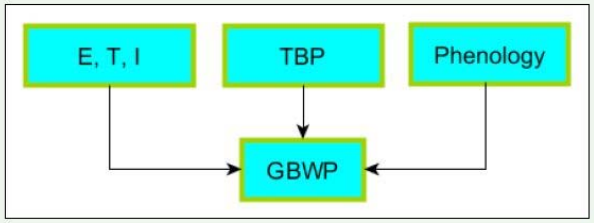


$$GBWP = \frac{TBP}{E + T + I}$$

GROSS BIOMASS WATER PRODUCTIVITY

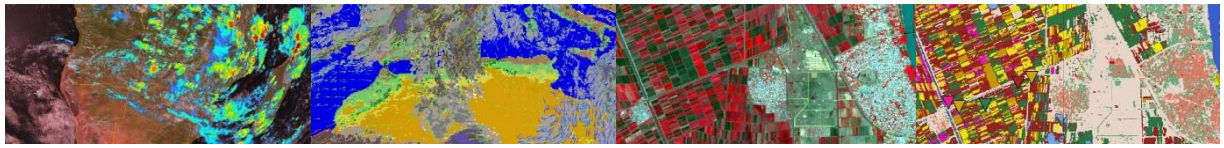
- The Gross Biomass Water Productivity (GBWP) expresses the quantity of output (biomass production) in relation to the total volume of water consumed in a given period

Gross biomass water productivity in relation to other data components



- Calculating GBWP requires input from total biomass production, evaporation, transpiration and interception, and phenology if calculated on seasonal time step.
- No external data source is required to calculate GBWP.
- The output is not used in any other data component.

Where TBP is total biomass production in kgDM/ha, E is evaporation, T is transpiration and I is interception, all in mm. The following data is used for calculating GBWP: TBP, E, T, I, and phenology if calculated on seasonal time step.

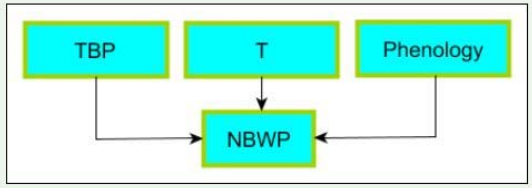


$$NBWP = \frac{TBP}{T}$$

NET BIOMASS WATER PRODUCTIVITY

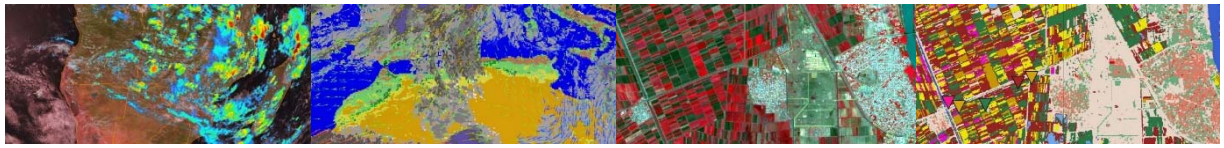
- The Net Biomass Water Productivity (NBWP) expresses the quantity of output (total biomass production) in relation to the volume of water beneficially consumed (through canopy transpiration) in the year, and thus net of soil evaporation.

Net biomass water productivity in relation to other data components



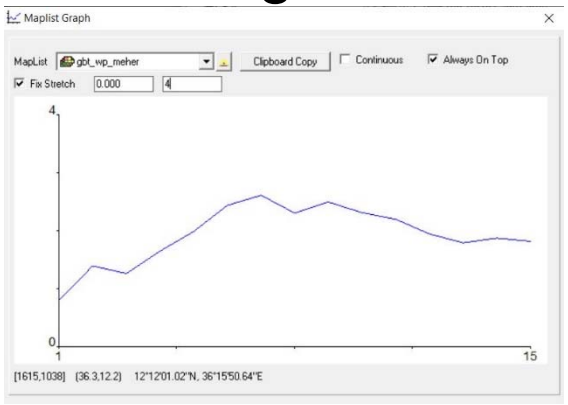
- Calculating NBWP requires input from total biomass production, transpiration, and phenology if calculated on seasonal time-step.
- No external data source is required to calculate NBWP.
- The output is not used in any other data component.

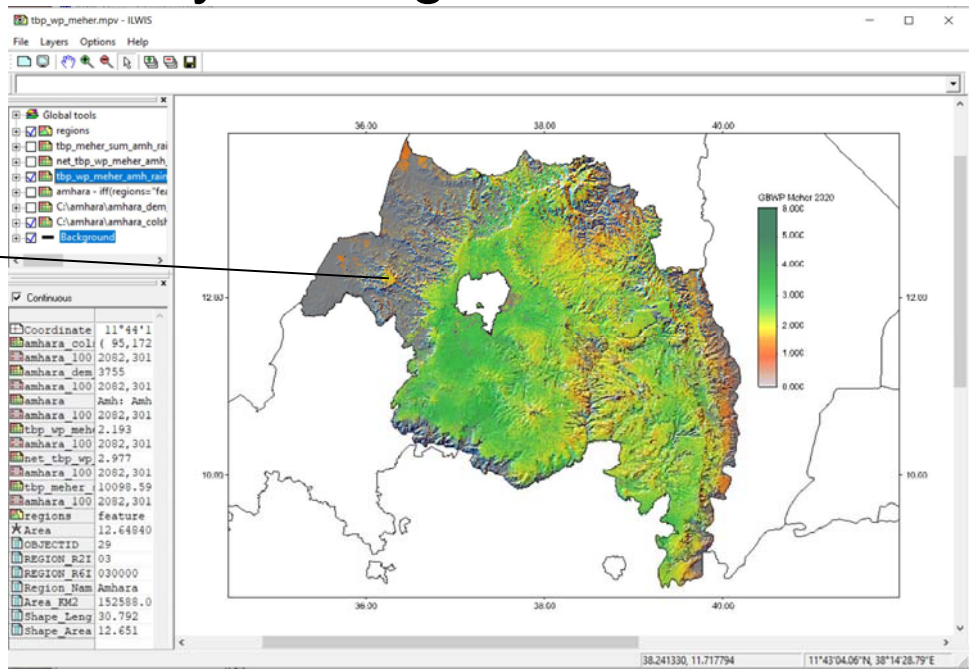
Where TBP is total biomass production in kgDM/ha and T is transpiration in mm. The following data is used for calculating NBWP: TBP, T, and phenology if calculated on seasonal time-step.



GBWP EXAMPLE AMHARA REGION ETHIOPIA

- For the Meher (rainy) season (dekad 16 – dekad 30), rainfed agricultural areas only – using level 2 data

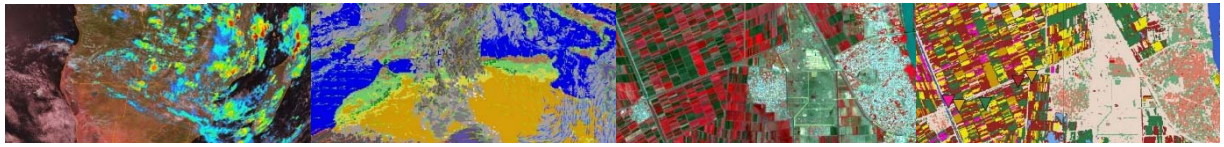




Overview of biomass water Productivity data components

Data component	Unit	Range	Use	Temporal resolution
GBWP	kg/m³	0 to 6[1]	Measures quantity of dry biomass output in relation to consumptive water use	Seasonal (further aggregated to user-defined)
NBWP	kg/m³	0 to 6	Measures quantity of dry biomass output in relation to transpiration (or beneficial water consumption)	Seasonal (further aggregated to user-defined)

[1] Range observed in WaPOR area, but theoretical range could go up to 25.



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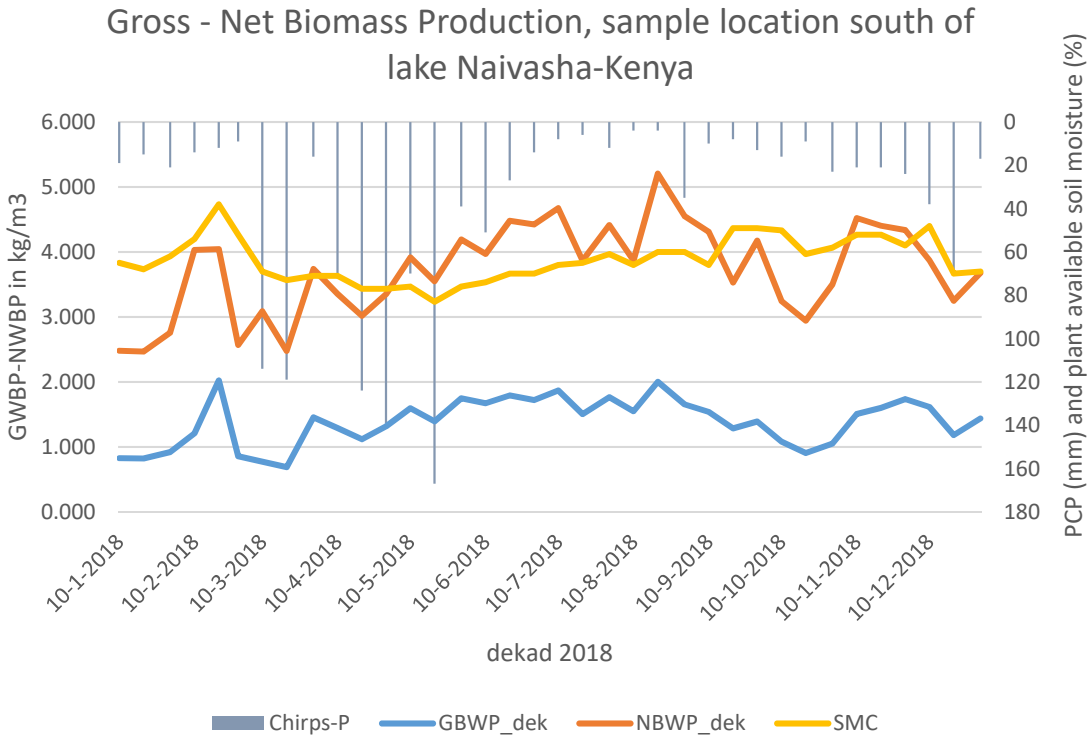
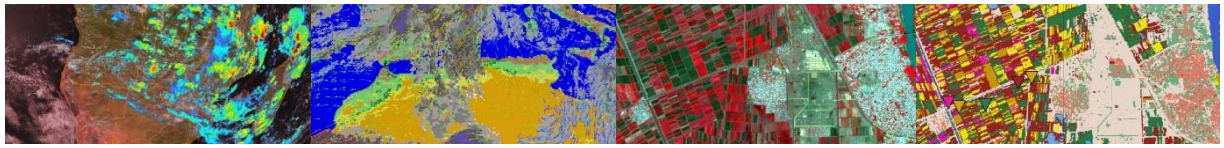
EXAMPLE CALCULATION (EXCEL)

- Calculation procedure to derive GBWP / NBWP
- See: WP_Calc_manual.xlsx





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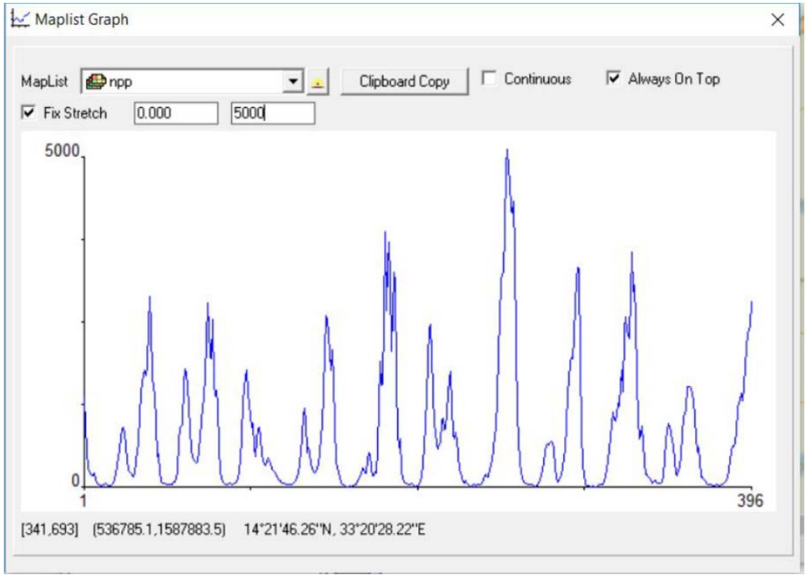
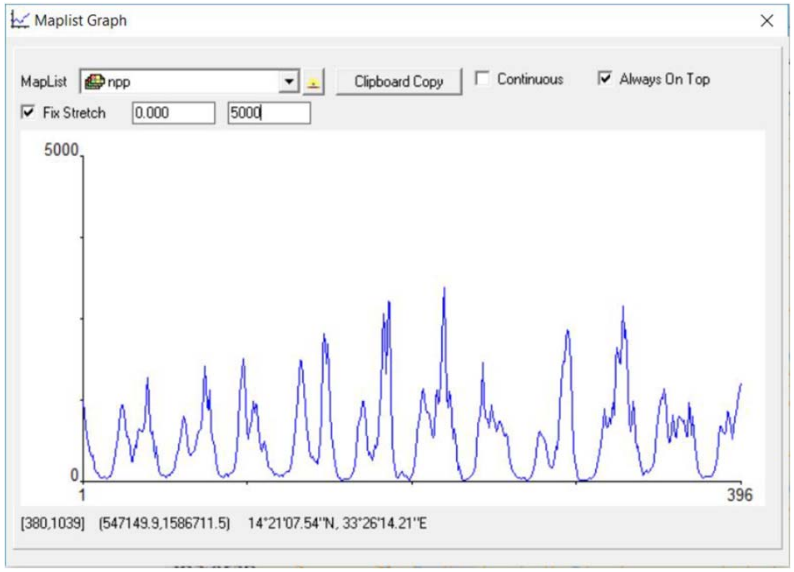
TIME SERIES ASSESSMENT, EXAMPLE NPP

- NPP profiles (2009-2020) Gezira – left profile having cotton and right profile having onions during the Nov 2019 survey. The variations may be due to crop rotations, weather, climate and irrigation and field practices, a/o other influences.





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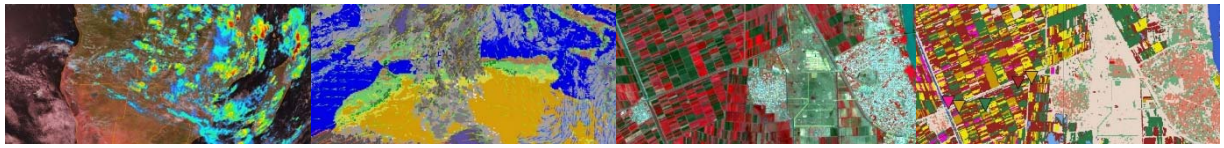
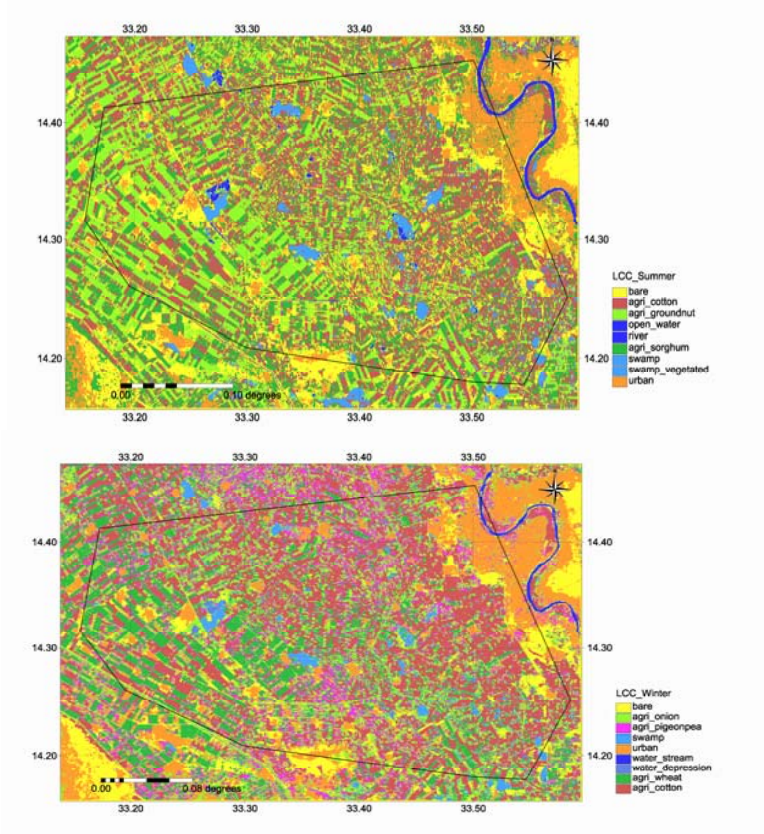
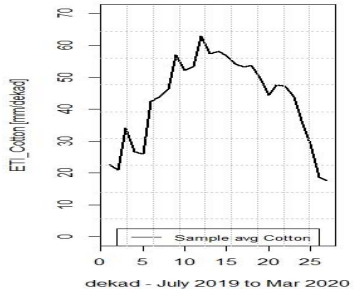
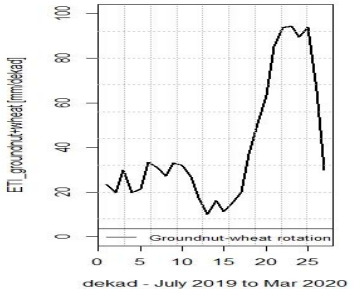


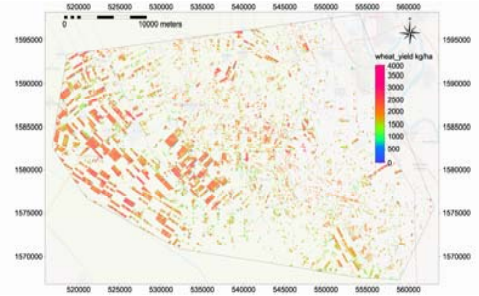
CROP WATER PRODUCTIVITY / YIELD

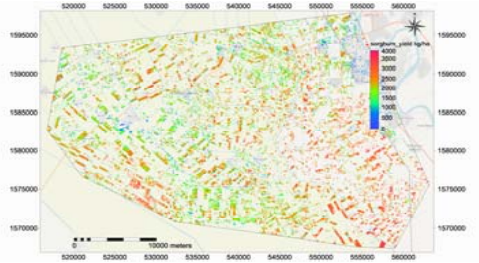
- Example Gezira study (level 3)

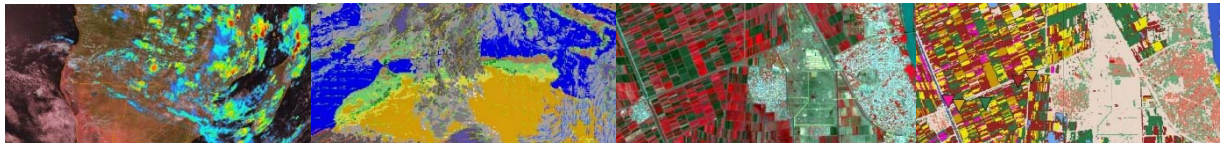












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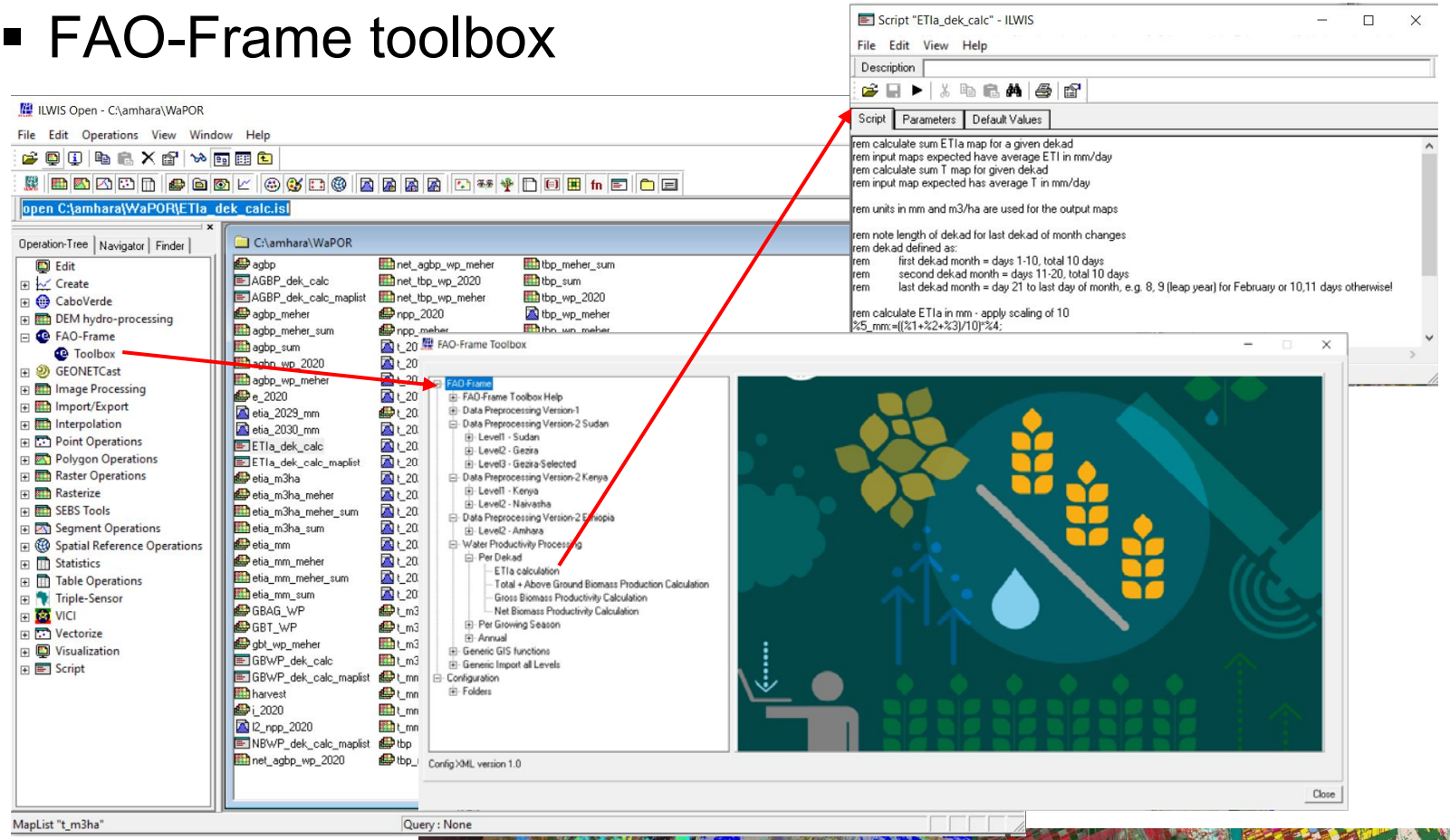
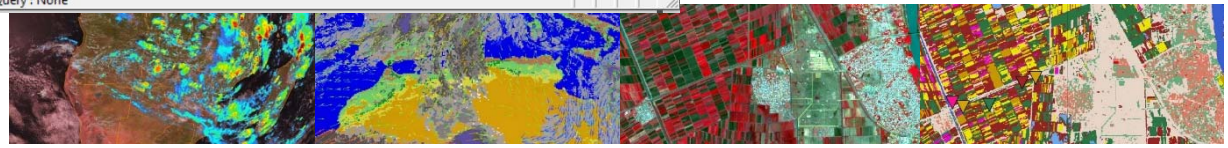
IMPORT DATA AND CALCULATION IN ILWIS

- FAO-Frame toolbox





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