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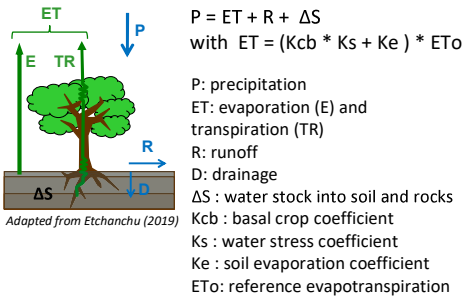
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SCIENTIFIC ISSUE

- What**
- Provides a **daily** estimation of **evapotranspiration (ET)** and its uncertainty at **crop scale**
- Why**
- Improves sustainable water productivity
 - Anticipate water scarcity and variability
 - Manage groundwater and irrigation
- How**
- Combination of soil **energy balance** and soil **water balance** approaches with **assimilation** method
 - Improve **downscaling** method of land surface temperature acquired by sentinel-3 at 1km
 - Waiting for **TRISHNA** and LSTM missions ;-)

METHOD

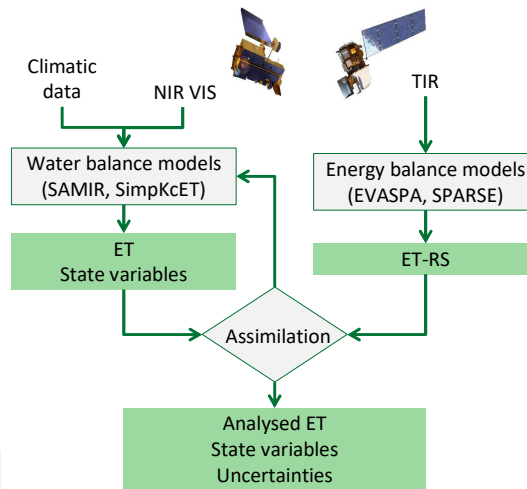
Soil water balance



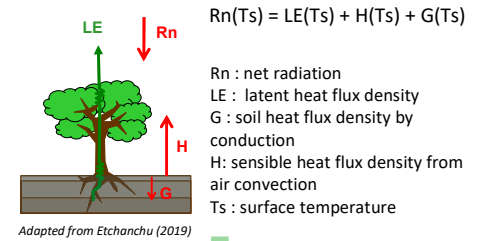
Derive from near infrared (NIR), visible (VIS):
land use map, crop management, vegetation Index,
soil humidity

- + daily ET
- + states variables of soil
- model dependent
- numerous ancillary data

Assimilation scheme



Soil energy balance



Derive from thermal Infrared (TIR)

	LANDSAT 8-9	LANDSAT 8-9T	ASTER	ECOSTRESS	SENTINEL 3	TRISHNA	SAR	LSTM
Begin	2013	2028	1999	2018	2016-2018	2024	2027	2028
TIR (8-12μm)	2	5	5	5	3	4	5-7	5
TIR GSD (m)	100	60	90	70	1000	57-90	60	50
Revisit (days)	16	6	16		27	2-3	3	2

- + indirect measurement of ET
- + accurate
- instantaneous
- coarse temporal /spatial resolution (presently)

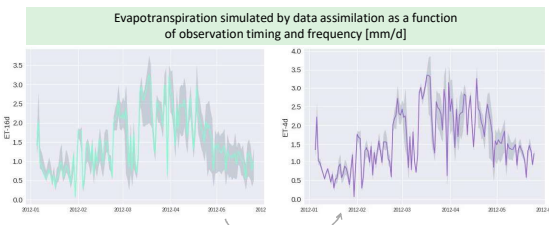
APPLICATION

Assimilation

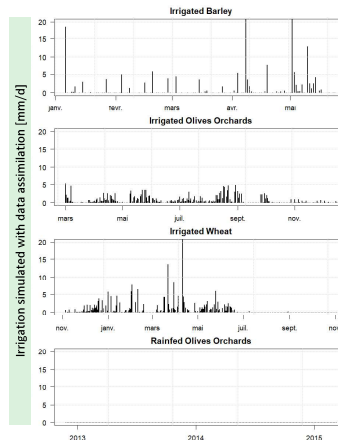
We have conducted **observation system simulation experiment** to evaluate the capacities of the proposed assimilation method and test revisit impact on ET simulations.

Simulated ET. The uncertainty represents the set of possible ET chronicles as a function of the satellite revisit timing.

- with frequency of 16 days :
- with frequency of 4 days :



→ The higher the revisit frequency, the less uncertainty there is in the simulation, but the more weight the measurement uncertainty has in the total uncertainty estimate.

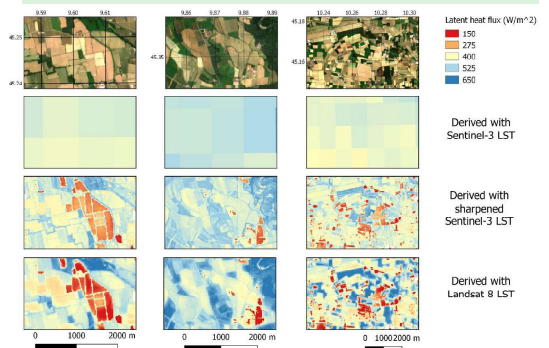


→ The assimilation enable to characterize properly ancillary data of ET as irrigation process.

Downscaling with SEN-ET method

TIR data from the Sentinel-3 satellites (1 km resolution) are sharpened using images acquired by high-resolution optical sensors on board of the Sentinel-2 satellites (20 m).

Sentinel-2 true colour composites (top row) and instantaneous latent heat fluxes derived using Sentinel-3 LST, DMS sharpened Sentinel-3 LST and Landsat-8 LST using images acquired on the morning of the 17th of May 2017 (from Guzinsky and Nieto, 2019)



Guzinsky and Nieto (2019) show that in an agricultural context the ET obtained using the two data sources is of comparable accuracy when compared against flux tower measurements.

PERSPECTIVES

- Characterize the uncertainty of analyzed ET with downscaled data assimilation.
- Evaluate the reliability of the approach in a wider range of climatic and vegetation conditions.

- In order to apply the method on a large scale, the assimilation scheme will have to be optimized to reduce computation time and data volume.

- Improve the SEN-ET methodology by further constraining the sharpening through the use of sentinel-1 radar data. This should limit the actual uncertainties of the ET estimates.