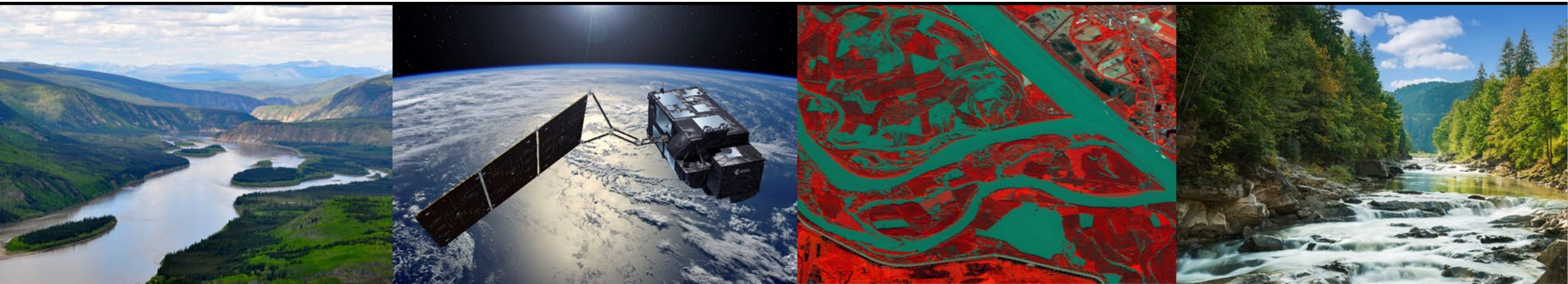


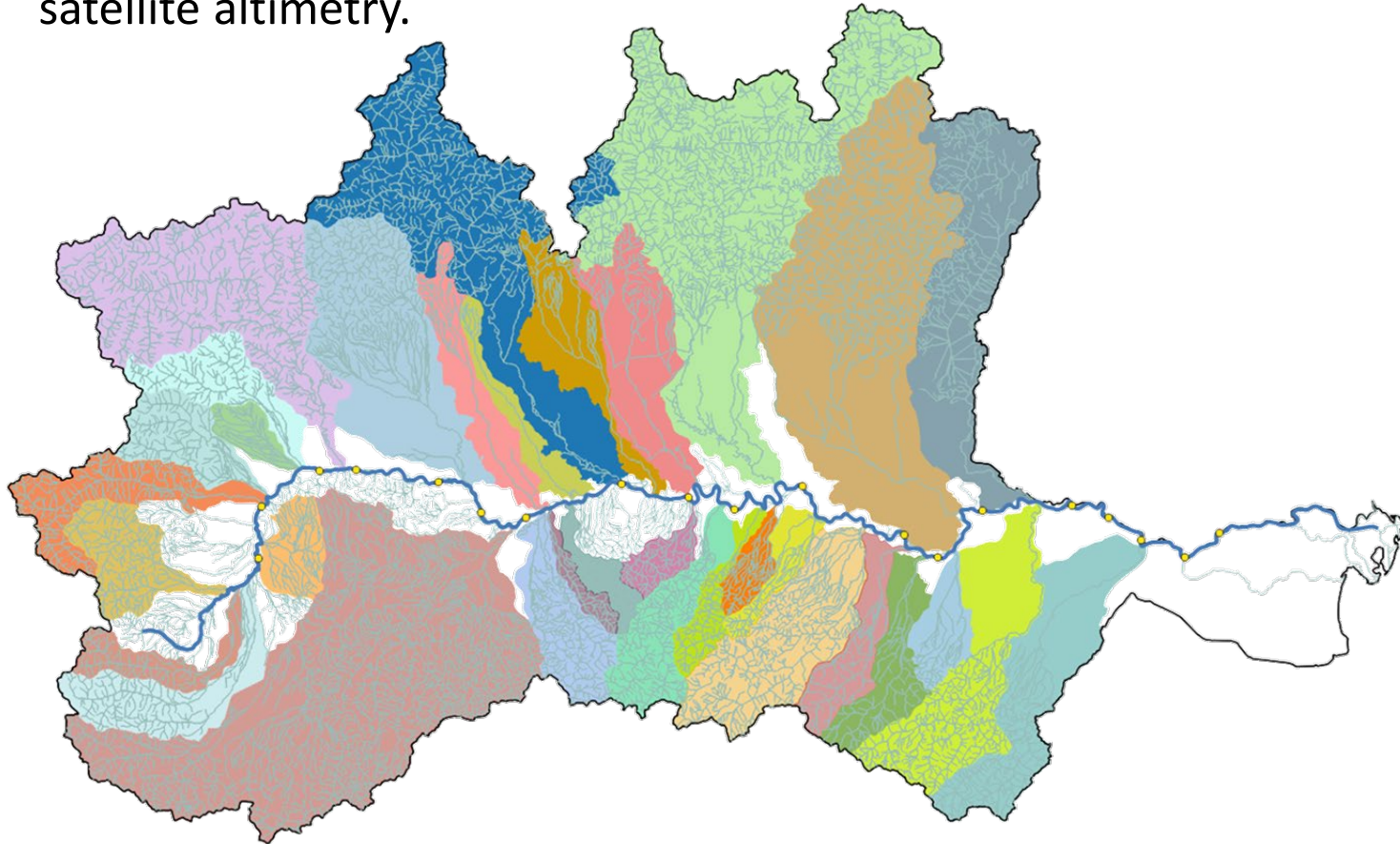
## Validation activities along the Po River: current involvement in ESA projects and future perspectives

*Angelica Tarpanelli and IRPI team*



# Po River Basin

The Po River in Northern Italy is characterized by a single branch morphology flowing 650 km east-west extension in the Po Valley, called Padana Plain. Its characteristics make it particularly suitable for testing remote sensing data and specifically the satellite altimetry.



## MAIN CHARACTERISTICS

- Area = 74'000 km<sup>2</sup>
- Length = 652 km
- Single branch
- Width = from 200 m up to nearly 500 m,
- Lateral floodplains delimited by a system of major embankments with an extent of 5 km.

## Altimetry studies over the Po River

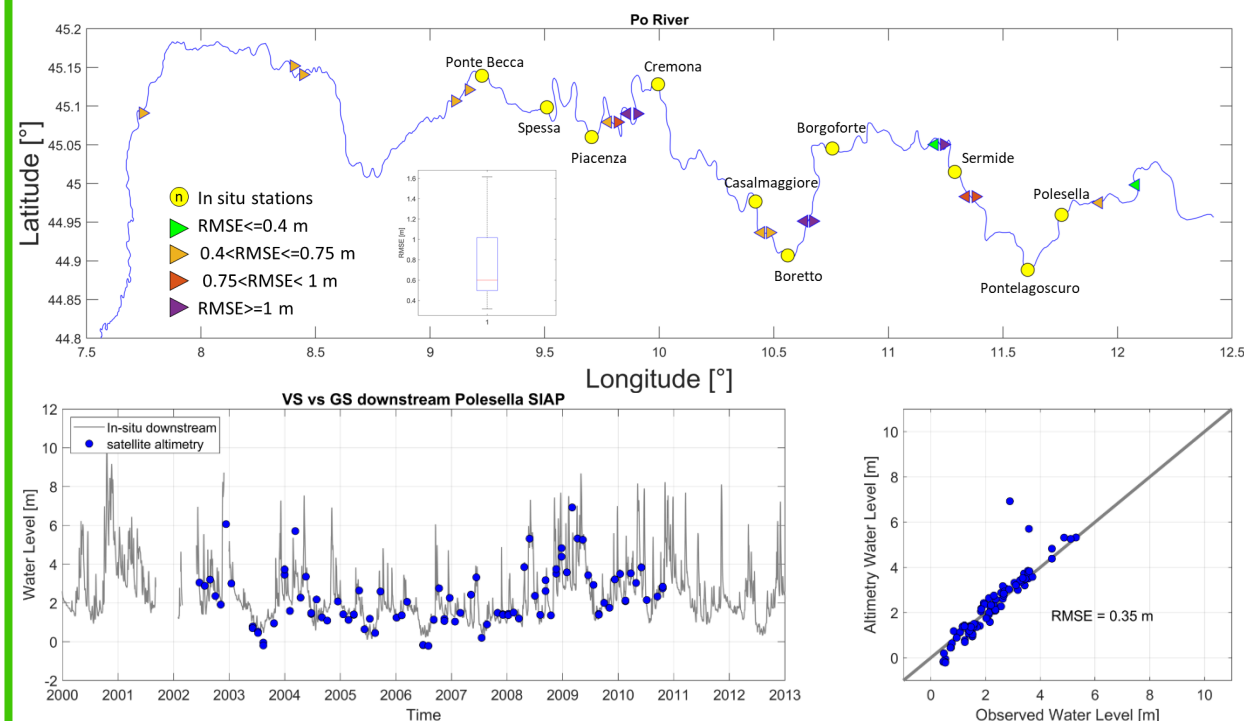
- Tarpanelli et al. 2013 *Remote Sensing*
- Tarpanelli et al. 2013 *Remote Sensing of Environment*
- Domeneghetti et al. 2014 *Remote Sensing of Environment*
- Tarpanelli et al. 2015, *JSTARS*
- Domeneghetti et al. 2015, *Hydrological Processes*
- Tourian et al. 2016 *Water Resources Research*
- Schneider et al. 2018, *Advances in Water Resources*
- Domeneghetti et al. 2018, *Remote Sensing*
- Tarpanelli et al. 2019, *TGRS*
- Tarpanelli et al. 2020, *Remote Sensing*
- Domeneghetti et al. 2021, *Advances in Water Resources*



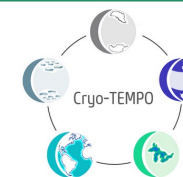
# ESA Projects

# FDR4ALT

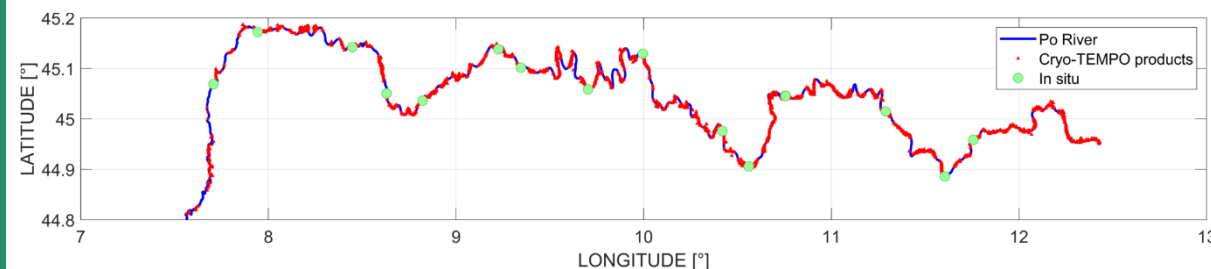
Fundamental Data Records for Altimetry aims at generating innovative Earth system data records and Thematic Data Records based on the exploitation of measurements acquired by the altimeter and radiometer instruments onboard **ERS-1, ERS-2** and **ENVISAT**. The goal is to serve the different communities involved in long term data exploitation over the different Earth surfaces: ocean, coastal, **inland water**, ice sheets, sea ice and atmosphere.



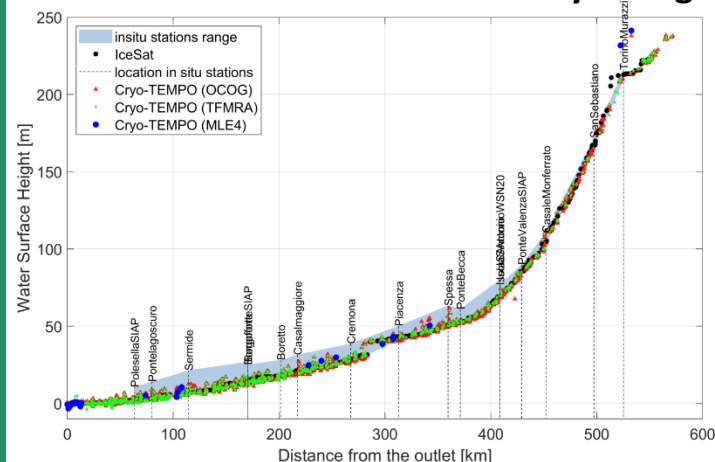
# Cryo-TEMPO



The Cryo-TEMPO study aims to deliver **CryoSat-2** products, that are easily accessible to new communities of non-altimeter experts and end users. The study will generate five new thematic products, covering Sea Ice, Land Ice, Polar Ocean, Coastal Ocean and **Inland Water**.



## Evaluation for hydrological applications



- River discharge estimation
- Flow duration curve for water resources management
- Trend analysis for climate change assessment

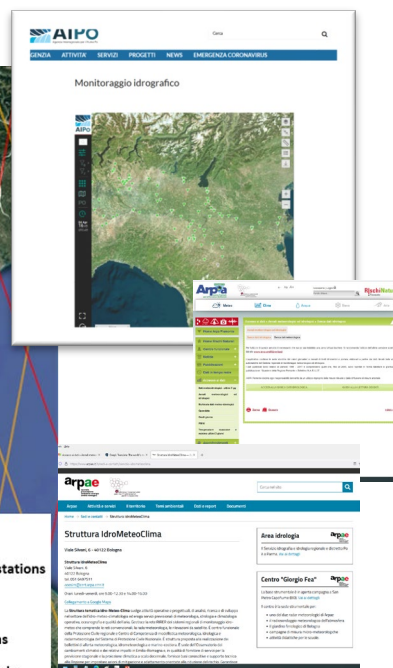
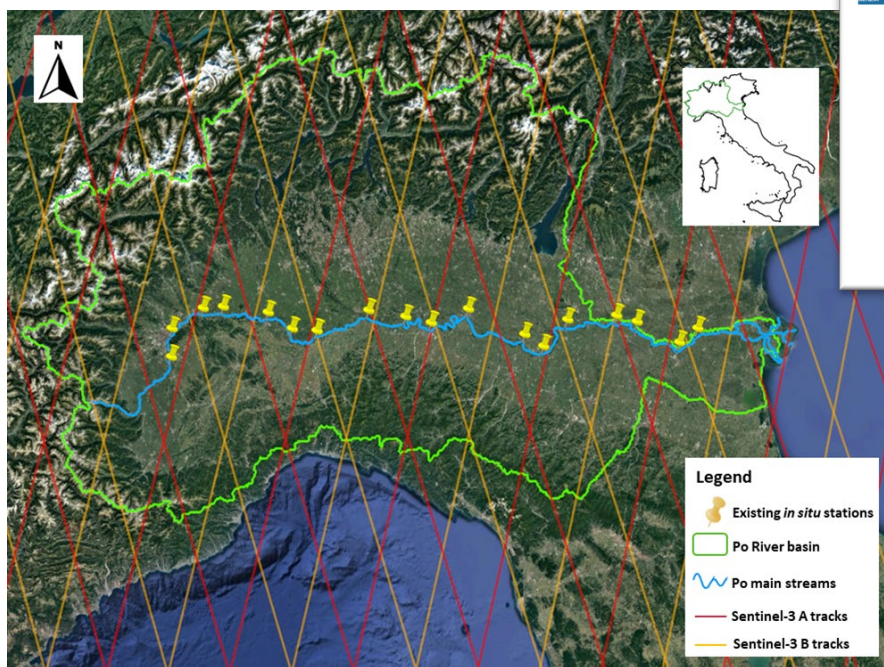
# ESA Projects

## St3TART



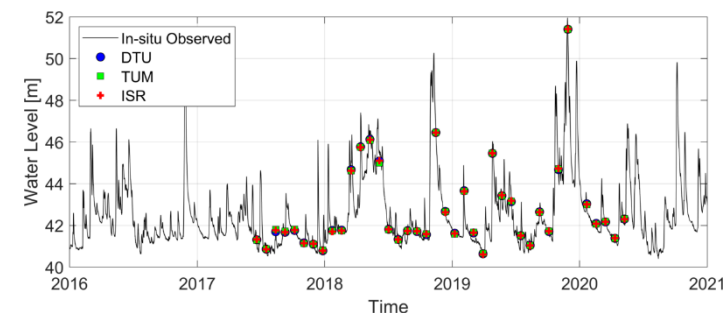
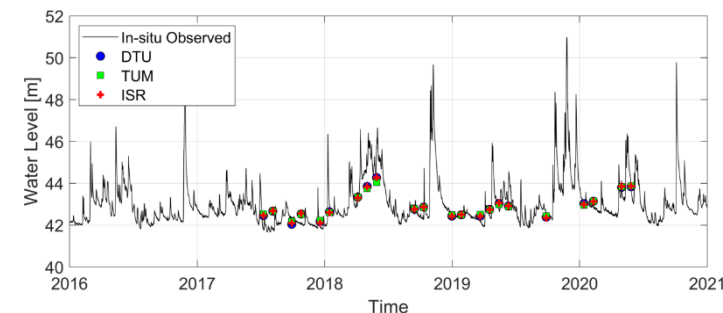
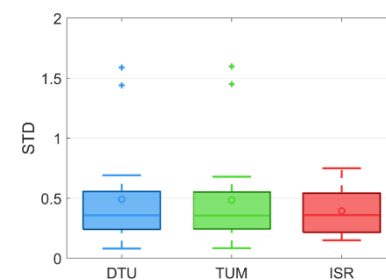
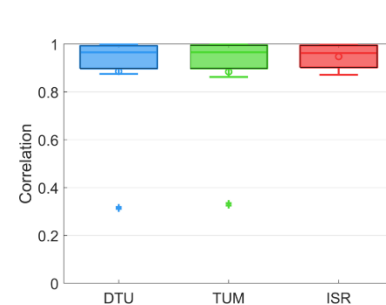
The St3TART project aims to provide a supply of fiducial reference measurements (FRMs) in support of the ESA

**Sentinel-3** (S3) Mission Cal/Val activities through the preparation of a roadmap and a preliminary proof of concept on terrestrial surfaces of interest, i.e. **inland water** bodies (lakes, reservoirs, rivers, including estuarine areas), sea ice and land ice areas (ice sheets, mountain glaciers).



## HYDROCOASTAL

The project aims to maximise exploitation of altimeter measurements in the coastal zone and **inland waters**, by evaluating and implementing new approaches to process SAR and SARin data from **CryoSat-2**, and SAR altimeter data from **Sentinel-3A** and **Sentinel-3B**. The main target is to link together and better understand the **interactions processes between river discharge and coastal sea level** and assess the global products generated in terms of their scientific impact.



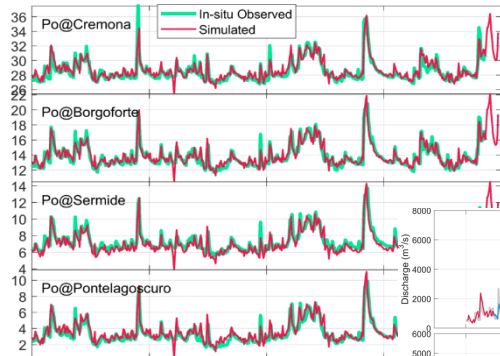


# ESA Projects

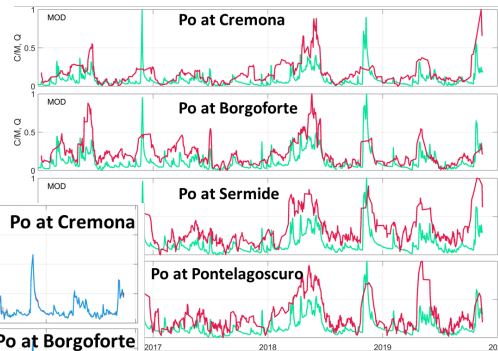
## RIDESAT

RIDESAT project aimed to develop a new methodology for the joint exploitation of altimeter and NIR band for river flow monitoring and discharge estimation.

### Altimetry



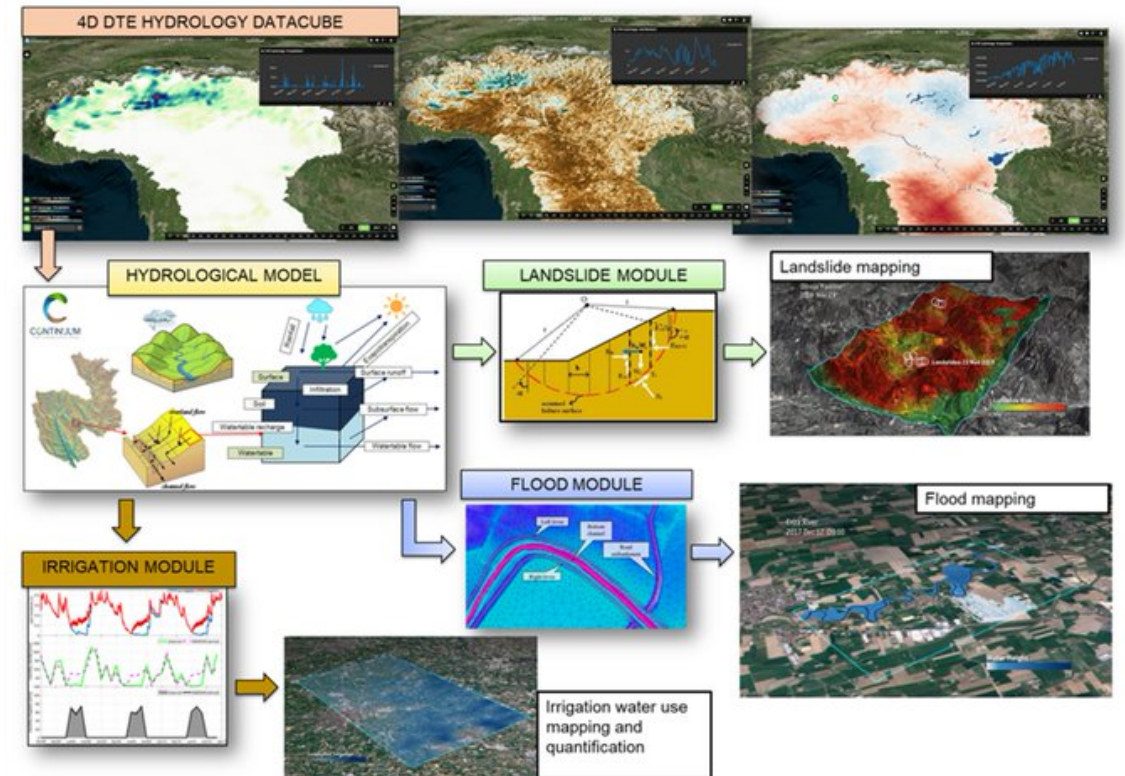
### NIR band



### River discharge

## DTE-HYDROLOGY

The Digital Tween Earth - Hydrology project aims at fostering a fast step forward towards establishing a solid scientific and technical basis to realise a Digital Twin Earth focused on the water cycle, hydrological processes and their interaction with human activities at unprecedented resolutions (1 km, sub-daily, 2015-2019) and accuracies.



# Future perspectives:

Because the Po River is not in the 1day CAL/VAL orbit, we are waiting for months before to test the satellite data there. 😊

*We are looking forward to work with SWOT data for numerous applications (e.g. calibration and/or assimilation hydrological models, validation of other satellite missions, water balance assessment for DTE...)*

## In the meanwhile...

- We are developing a **global product of NIR band to be integrated with the altimetry global datasets** already available from several laboratories (DAHITI, HydroSAT, Theia-Hydroweb, Copernicus) for producing a **global river discharge product**.
- We are developing an algorithm for **estimating bathymetry** to be used for flow area calculation