

# The river discharge precursor project



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<https://climate.esa.int/fr/projects/river-discharge/>

## Objectives

**Proof-of-concept** of the feasibility of a river discharge ECV product → long term (at least over 20 years) river discharge time series at selected locations from satellite nadir altimeter data and multispectral images, and ancillary data

Duration: 1.5 year (started February 2023)

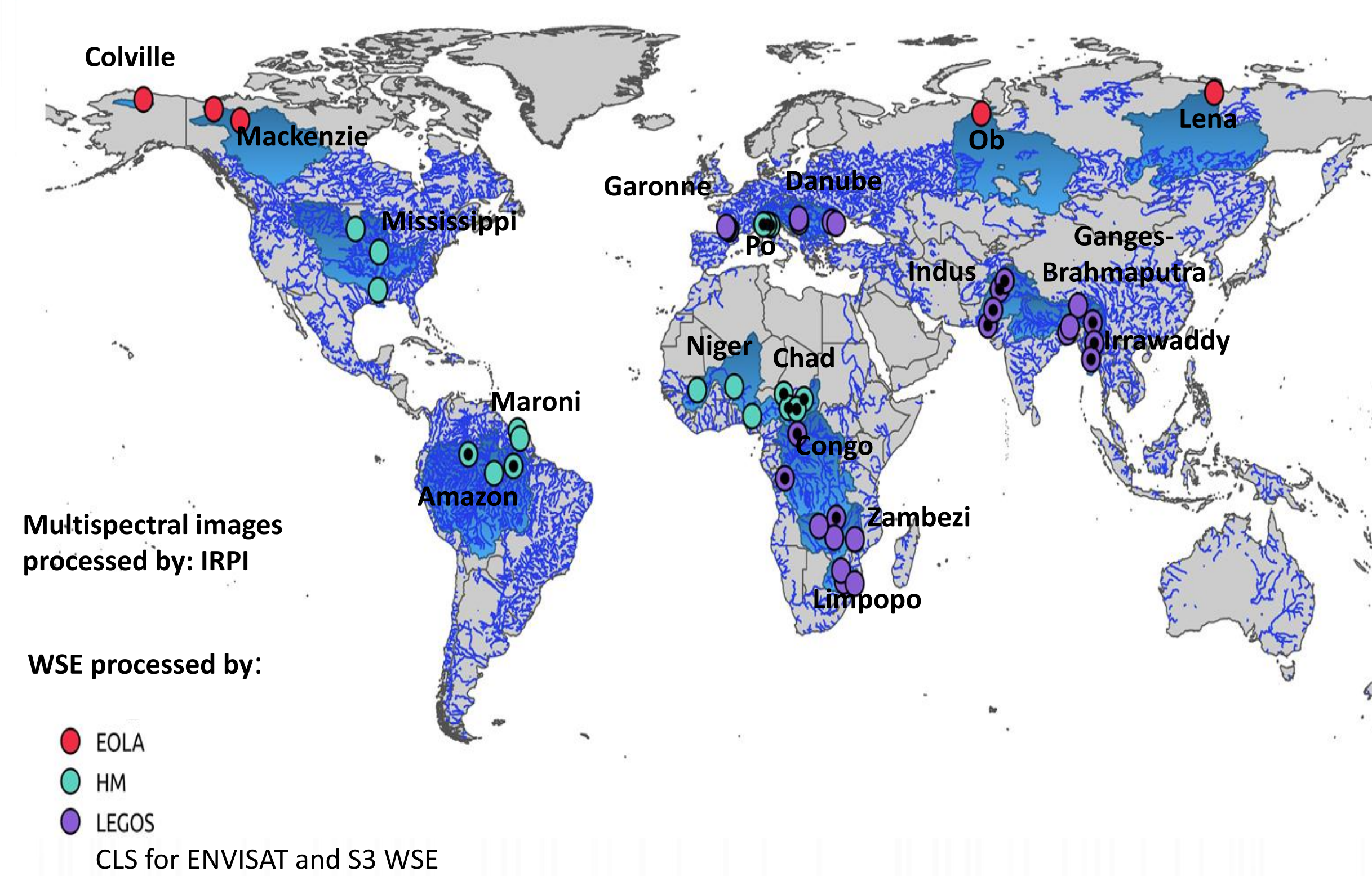
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## User requirements and test sites

**Main threshold requirements from User Requirements:**

At least 20 years' time series (from 2002-2022) at EO observation sampling dates, over 18 river basins (with different climatic zones and anthropization, include exorheic and endorheic basins), sites should cover the basin outlet and different drainage area

**18 test basins and 50 sites**



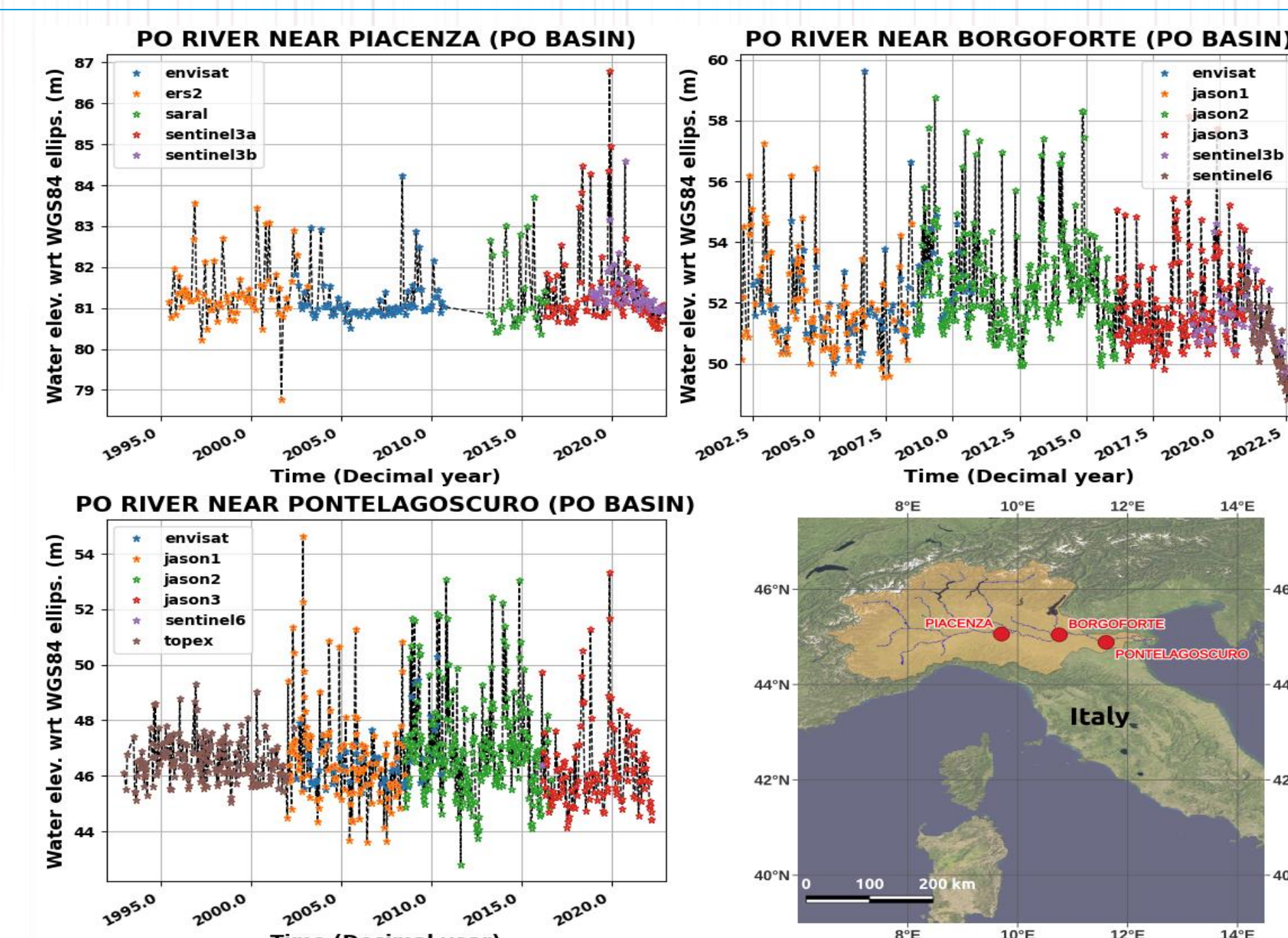
## Eo data processing

### Water Surface Elev. (WSE)

Nadir altimetry: Topex, Jason-1/2/3, ERS-2, Envisat, Saral, Sentinel-3/6

WSE per mission/multimission since 2002, 2 sites with no WSE, 4 sites < 15y

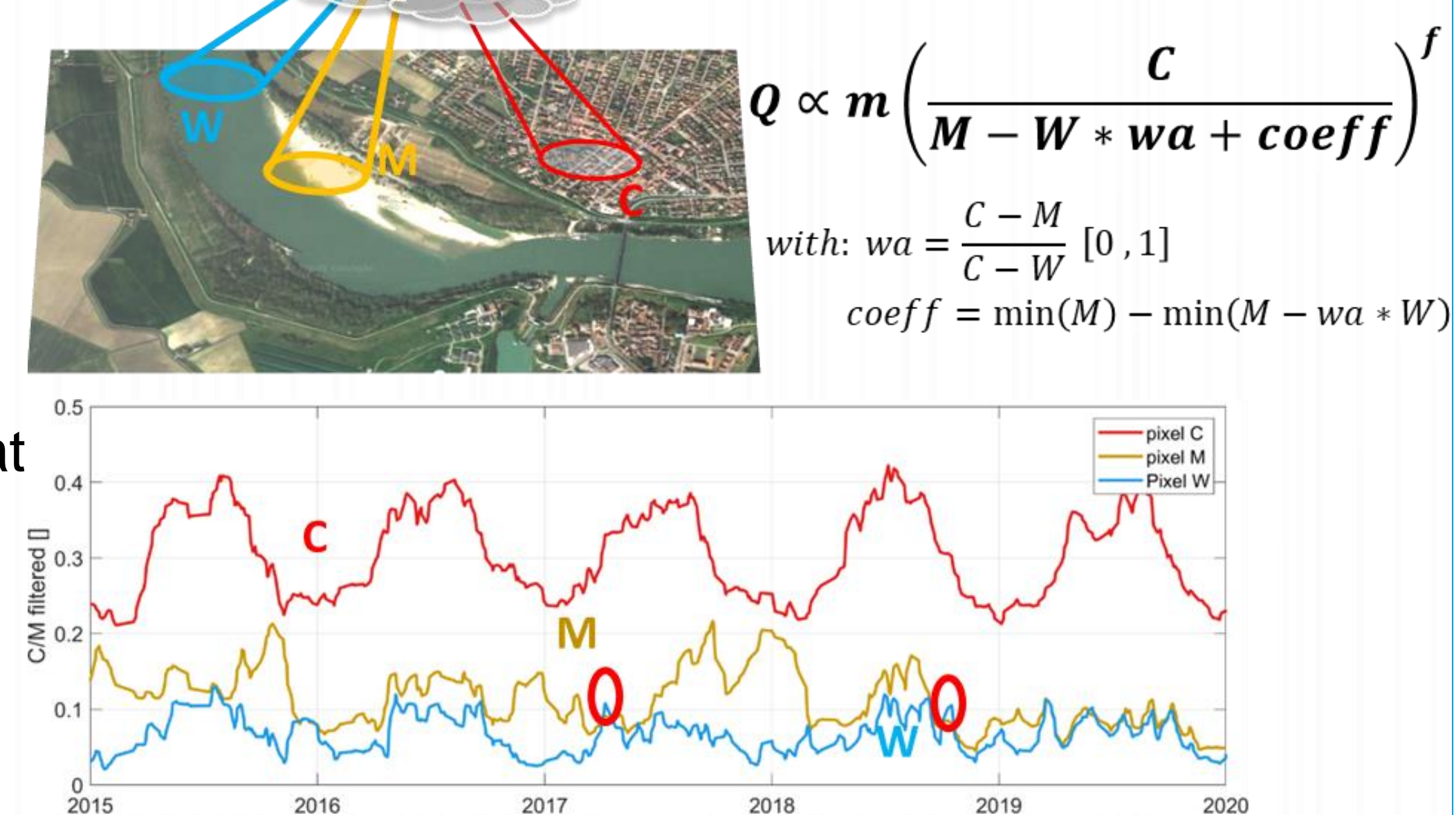
Example on the Po:



### Multispectral images

Spectrometers onboard: Landsat-7/8, Aqua/Terra, Sentinel-2/3, Envisat

Reflectance index btw dry and wet pixels → correlated with discharge (account for sediment, shown below at Pontelagoscuro, and vegetation)



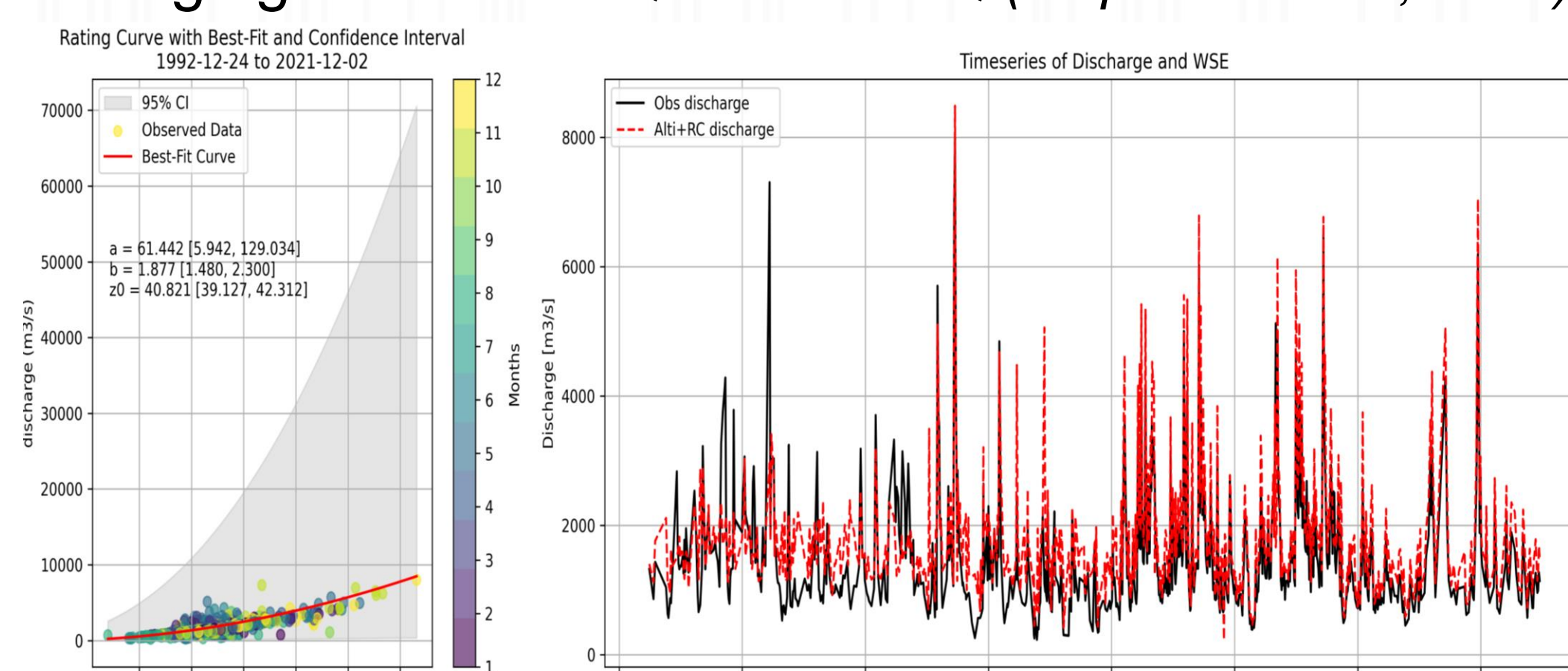
## First river discharge time series

### Discharge estimation methodology:

- Need ancillary discharge (Q) data (from in situ database, e.g. GRDC)
- Compute rating curve:  $Q=f(\text{sat})$  with  $\text{sat}=WSE$  or  $C/m$ ;  $f$  a power law or polynomial relationship (Koureaev et al., 2004; Paris et al., 2016; Tarpanelli et al., 2020)
- If no common time period between Q and sat → quantiles matching method (Tourian et al., 2013) but potentially important errors
- For basins with long in situ Q time series → test errors from quantiles matching methods, few/many years overlap with satellite data
- Q derived from WSE only, C/M only and merging both WSE Q and C/M Q (Tarpanelli et al., 2019)

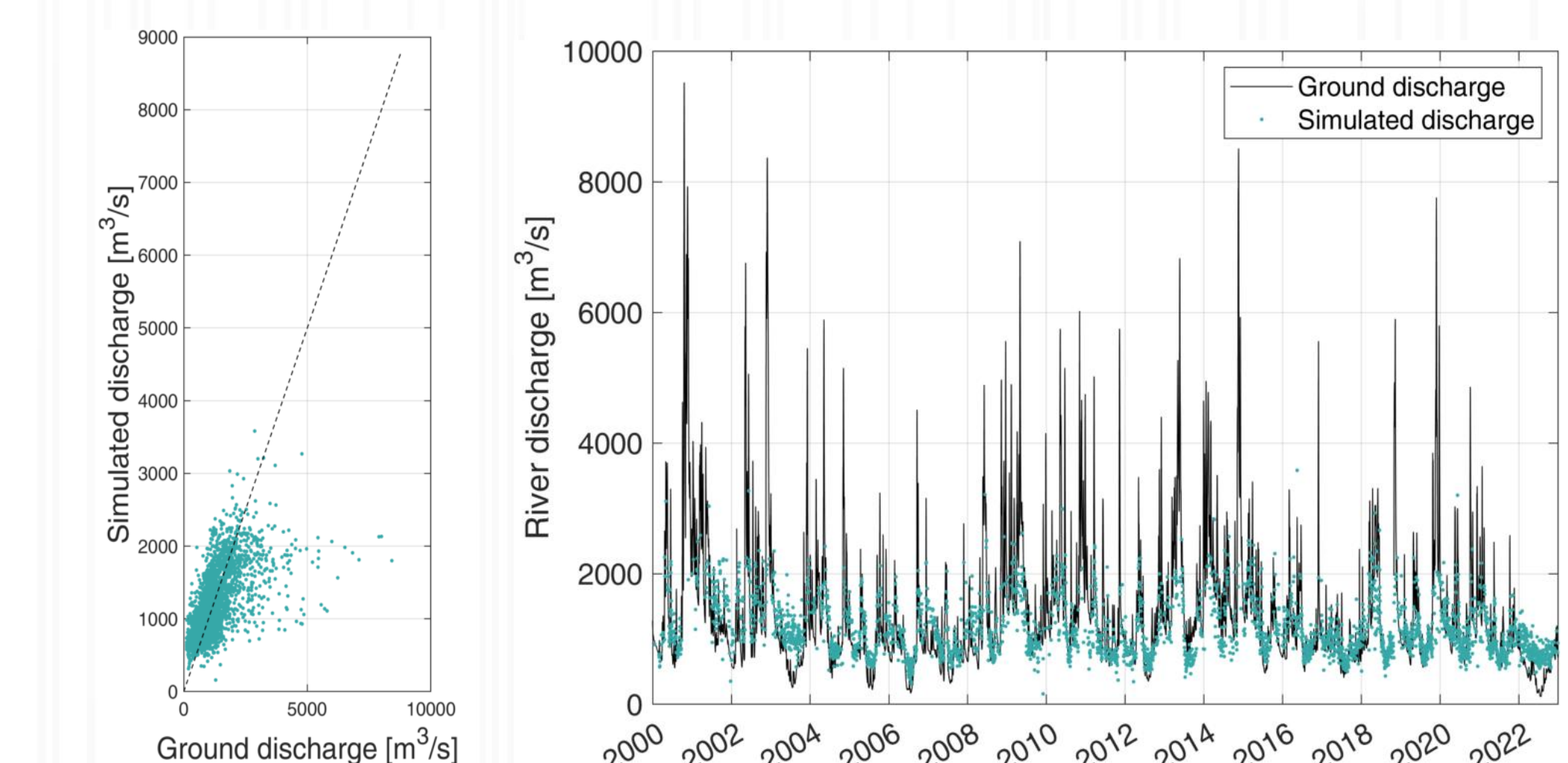
### Discharge from WSE

Example at Pontelagoscuro on Po river (29 years common period btw in situ and WSE)



### Discharge from Multispectral images

Example at Pontelagoscuro on Po river (20 years common period btw in situ and sat missions)



## Preliminary conclusions and next steps:

- WSE dataset processed. On-going work to fit with the CCI Data Standards
- Deriving long time series of Discharge from satellite data over 20 years is feasible at some sites
- There are sites where there are data gaps or no data because of: nadir looking/ instrument design/complex signal post-processing for altimetry; clouds & atmospheric effects/different space resolution for multispectral images
- The river discharge time series over the 18 sites will be available in February 2024. Validation and round robin of the different methodologies to retrieve river discharge will begin soon on few already processed basins
- The main output of this precursor project is to provide a roadmap for future global project
- Users workshop ~June 2024

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 -Tarpanelli A. et al.(2020). River flow monitoring by Sentinel-3 OLCI and MODIS: comparison and combination. Remote Sensing, 12(23), 3867  
 -Tourian M. et al.(2013). A quantile function approach to discharge estimation from satellite altimetry (ENVISAT). WRR, 49, 1-13

We thank CNES, ESA, ISRO, NASA, USGS for providing freely their satellite data and AIPO, Environment and Climate Change Canada, GRDC, Schapi, USGS for providing open access Q data.

ESA contract: 4000139952/22/I-NB



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