



Satellite-based water quality monitoring: exploring the potential for spatial and temporal mapping

WEDA Conference 2022

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EOMAP



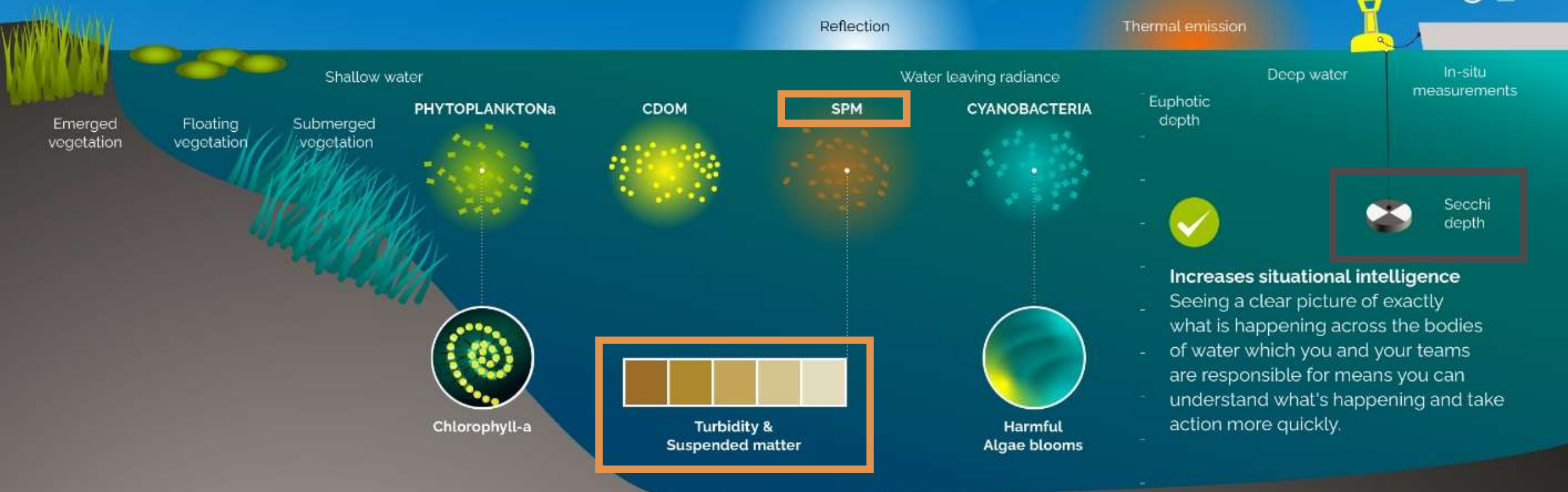
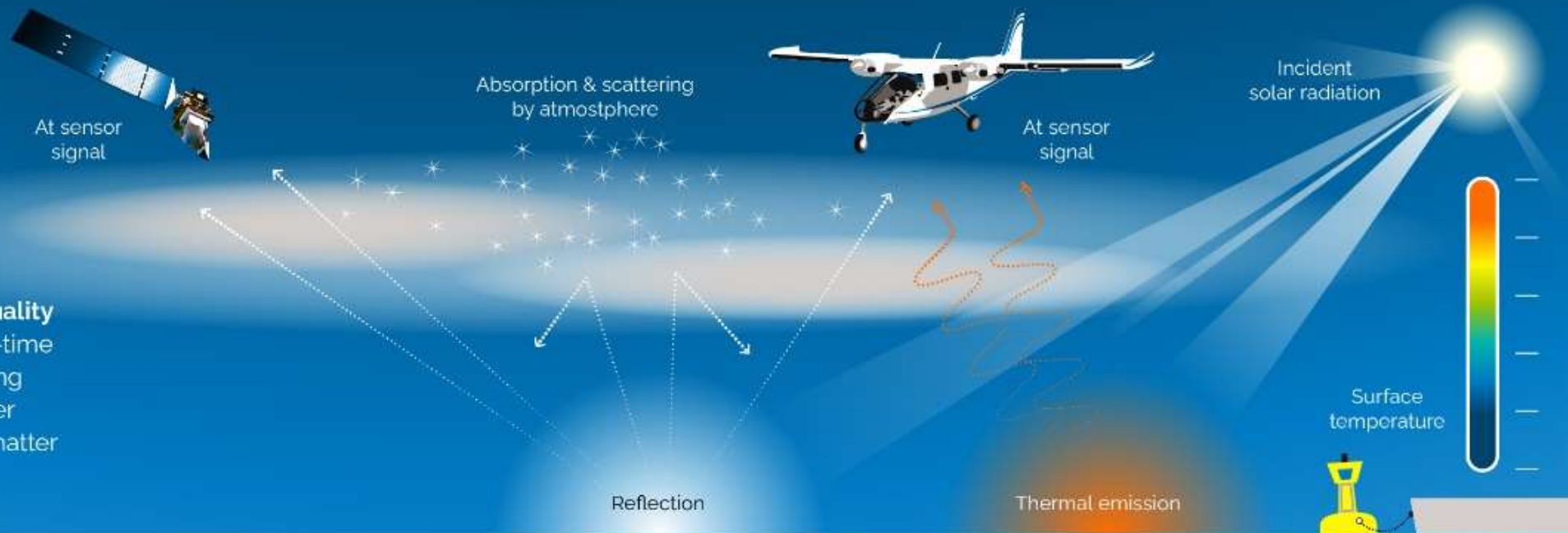
AGENDA

- 01** About aquatic remote sensing and satellites
- 02** Technical details and validation
- 03** Outlook

Aquatic Remote Sensing



Earth-observation-based water quality monitoring data provides near real-time information on water quality including turbidity, chlorophyll-a, surface water temperature and total suspended matter



Increases situational intelligence
 Seeing a clear picture of exactly what is happening across the bodies of water which you and your teams are responsible for means you can understand what's happening and take action more quickly.

Modular Inversion Processing System

Operational calculation of
water quality parameters

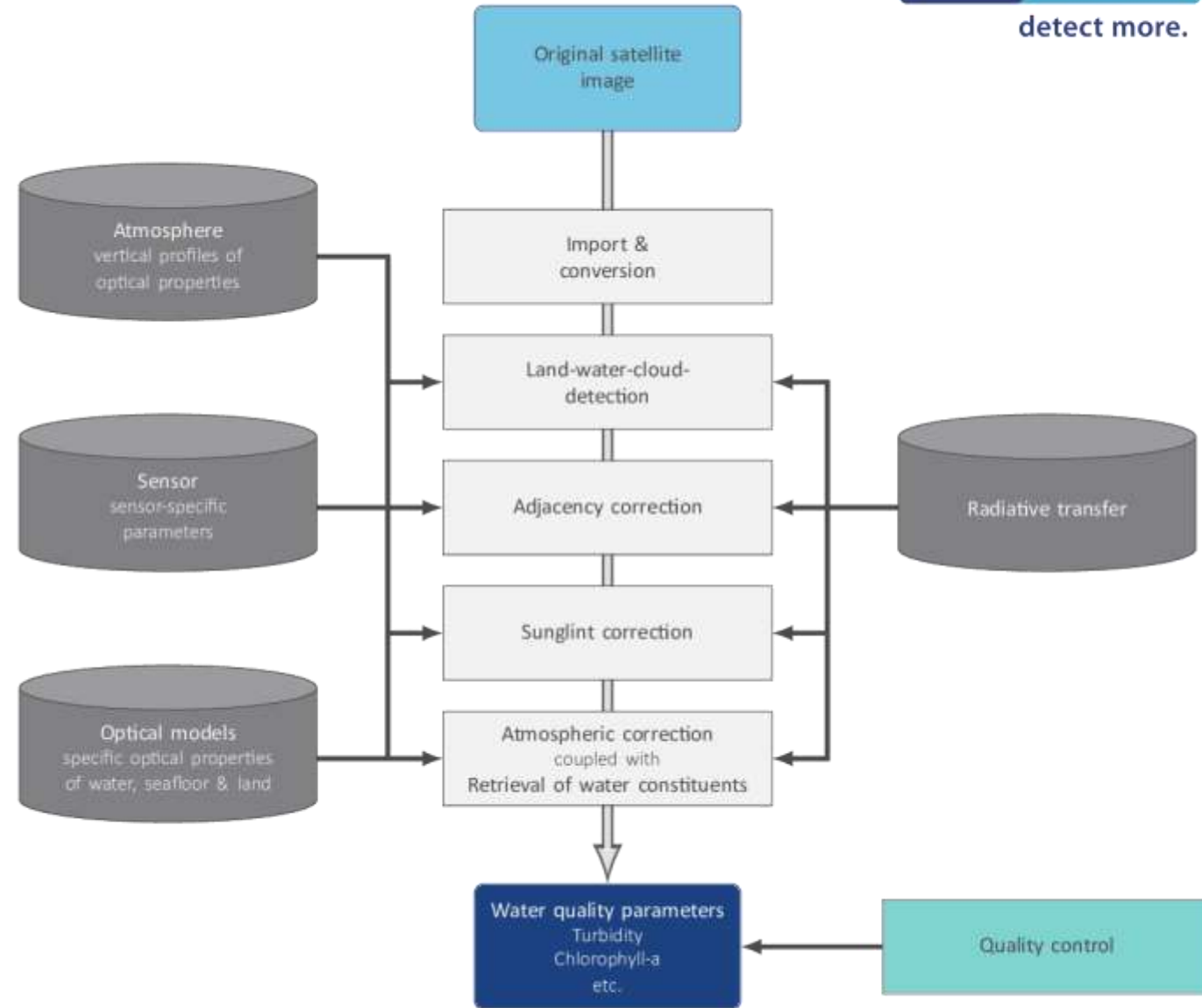
Sensoragnostic

Globally applicable

Physics-based

Independent of insitu data

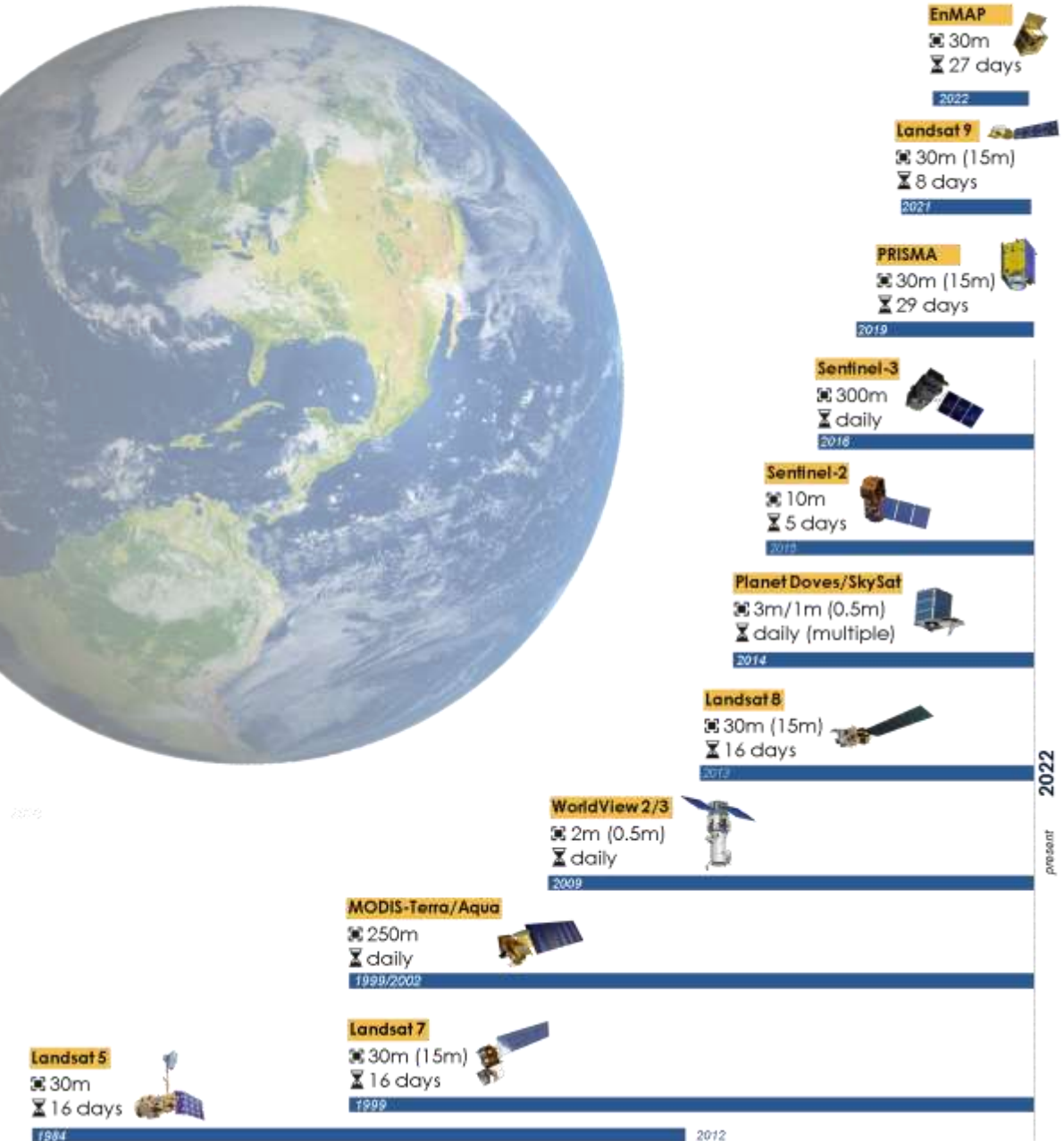
Processor-internal quality control



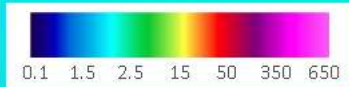
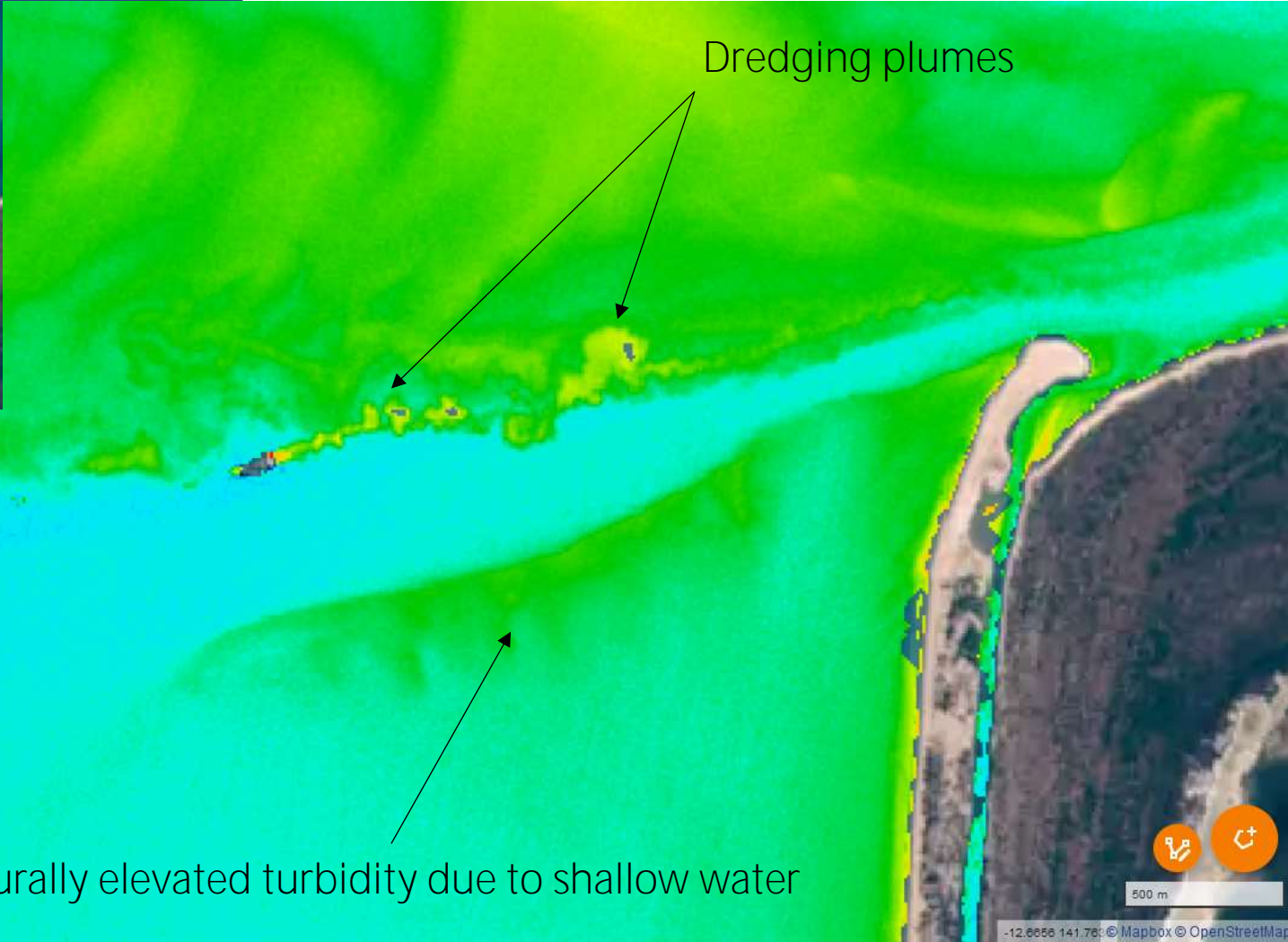
Era of Earth Observation

- 100+ high resolution satellites record the Earth **every day**
- Satellite **data archives** reach back to the early 1980s

→ A data treasure which can be used for **baseline** and **impact** studies



Project example:
Dredging near Weipa Port, AUS



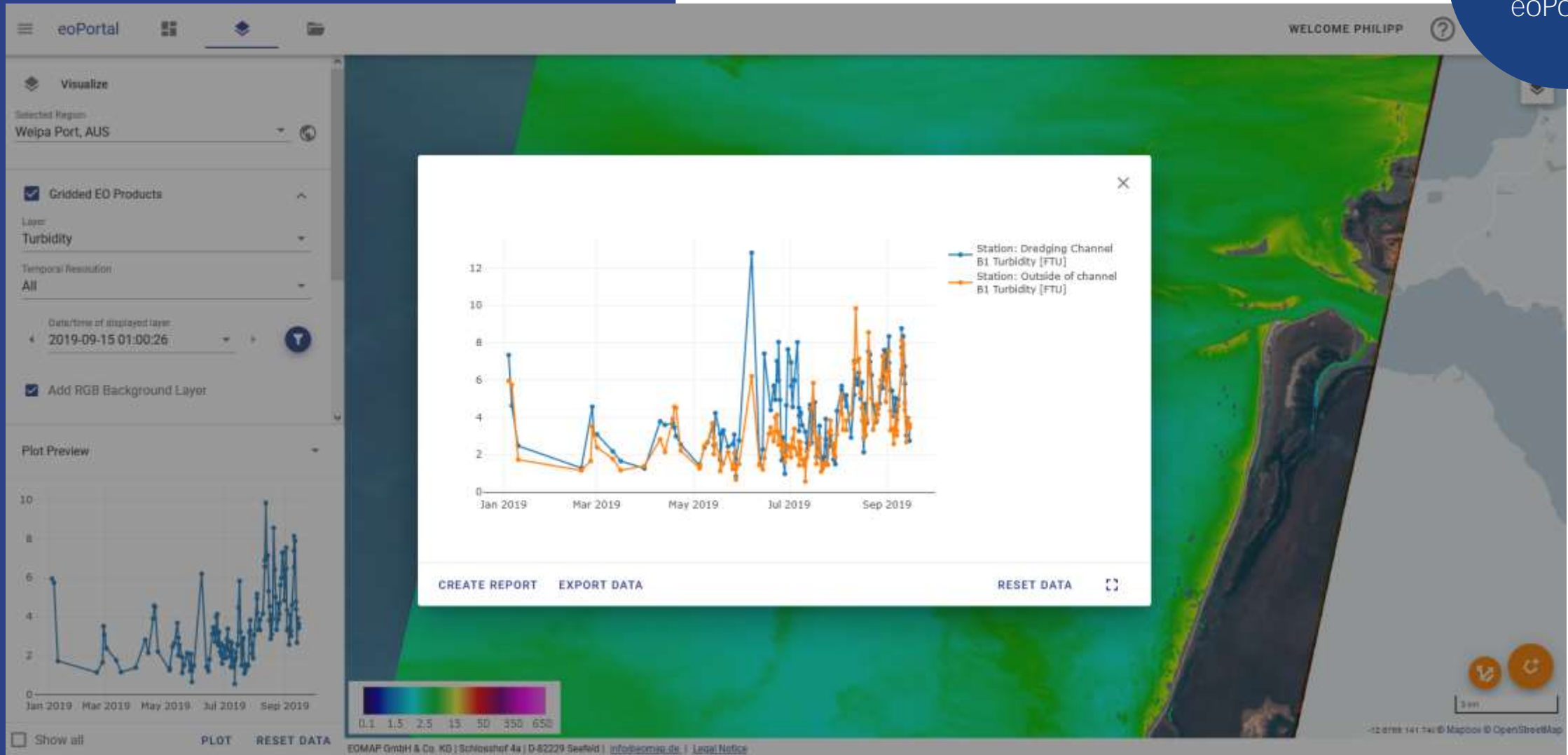
Naturally elevated turbidity due to shallow water

Dredging plumes

Sentinel-2 (2019-06-12)

Project example: Dredging near Weipa Port, AUS

Visit us for a
demo of the
eoPortal!

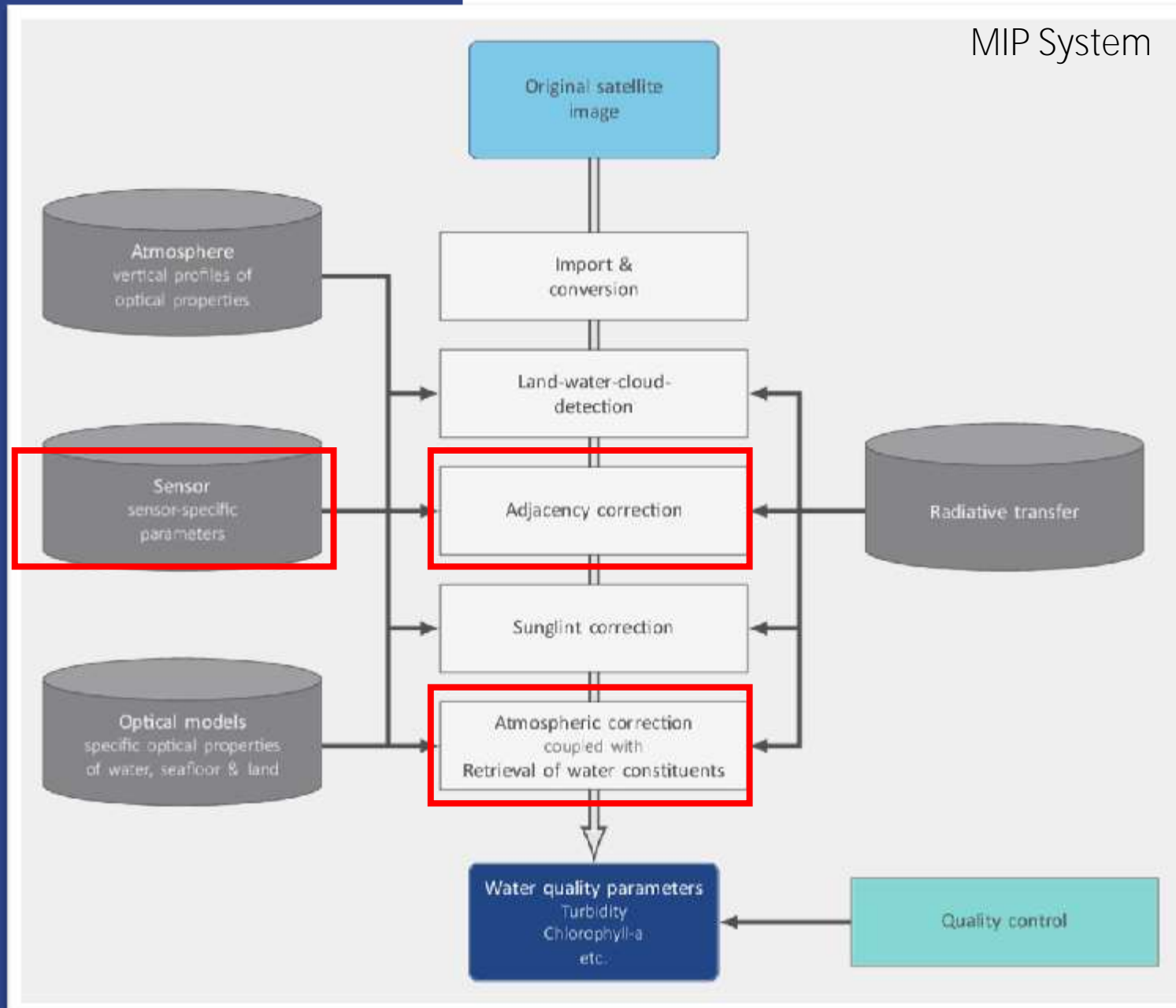


02.1

Technical details



Technical Details



New Sensor Systems

Planet Labs SuperDoves

- 3-meter spatial resolution, daily multispectral coverage



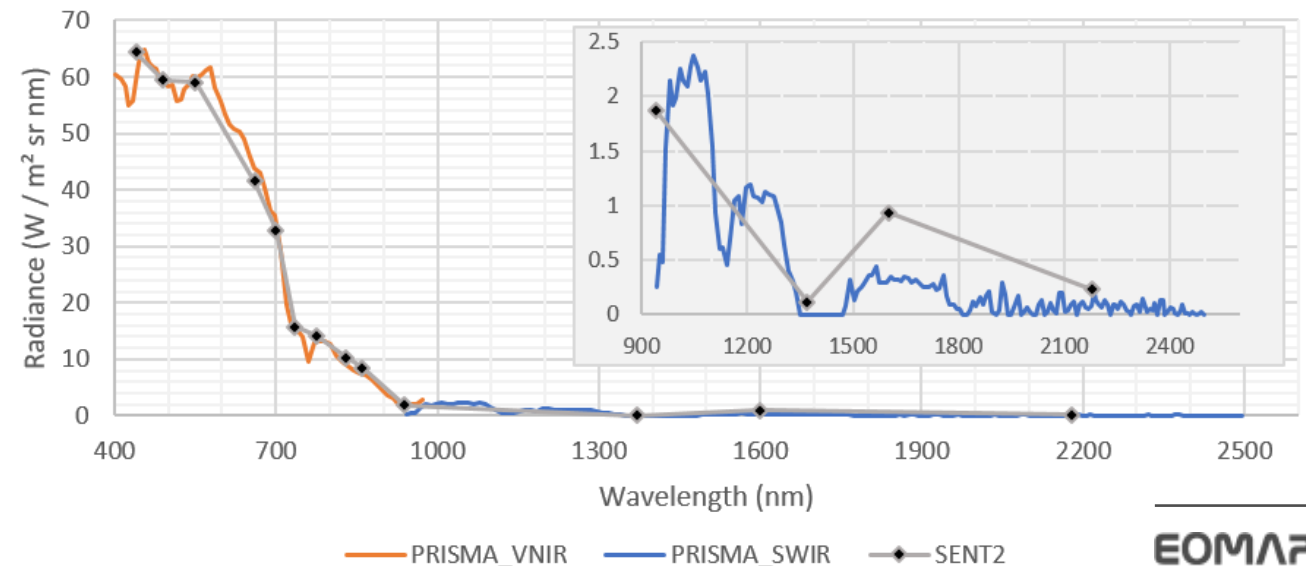
Landsat 9

- Improving Landsat revisit time from 16 to 8 days

Hyperspectral Imagery

- Italian PRISMA satellite
~240 spectral bands

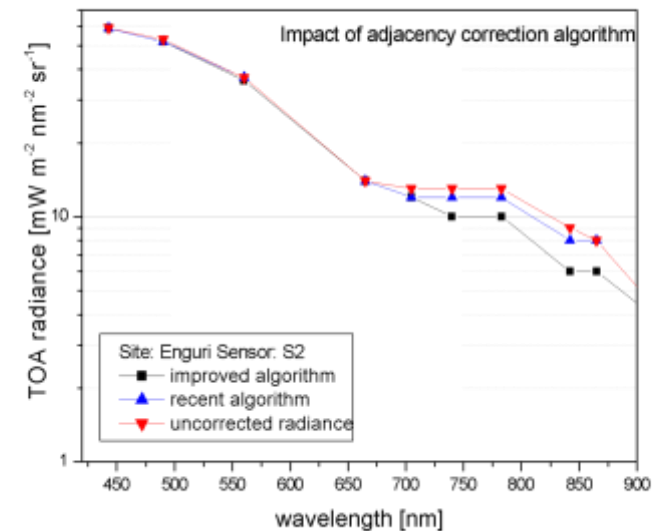
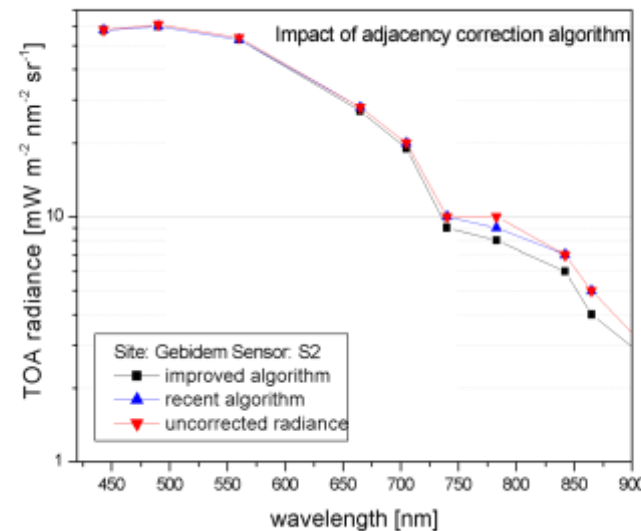
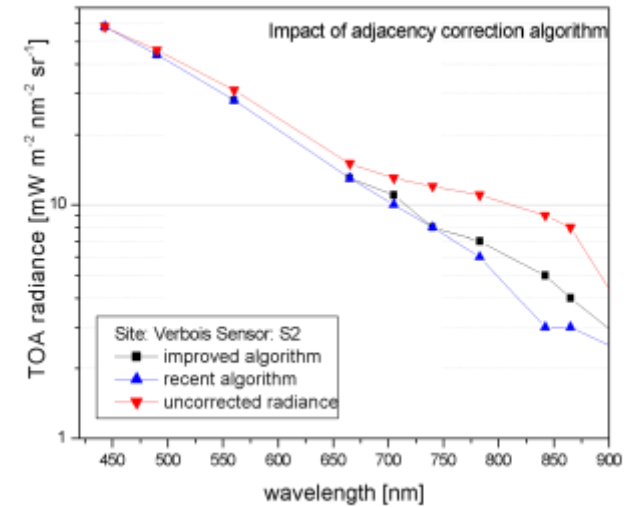
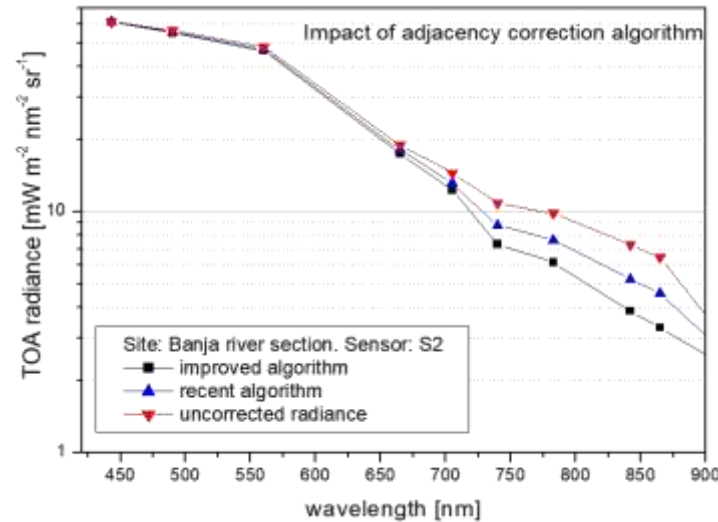
Algal water spectrum comparison, Azud de Ojós



Adjacency Correction

Iterative retrieval of atmospheric optical properties used for more accurate adjacency correction

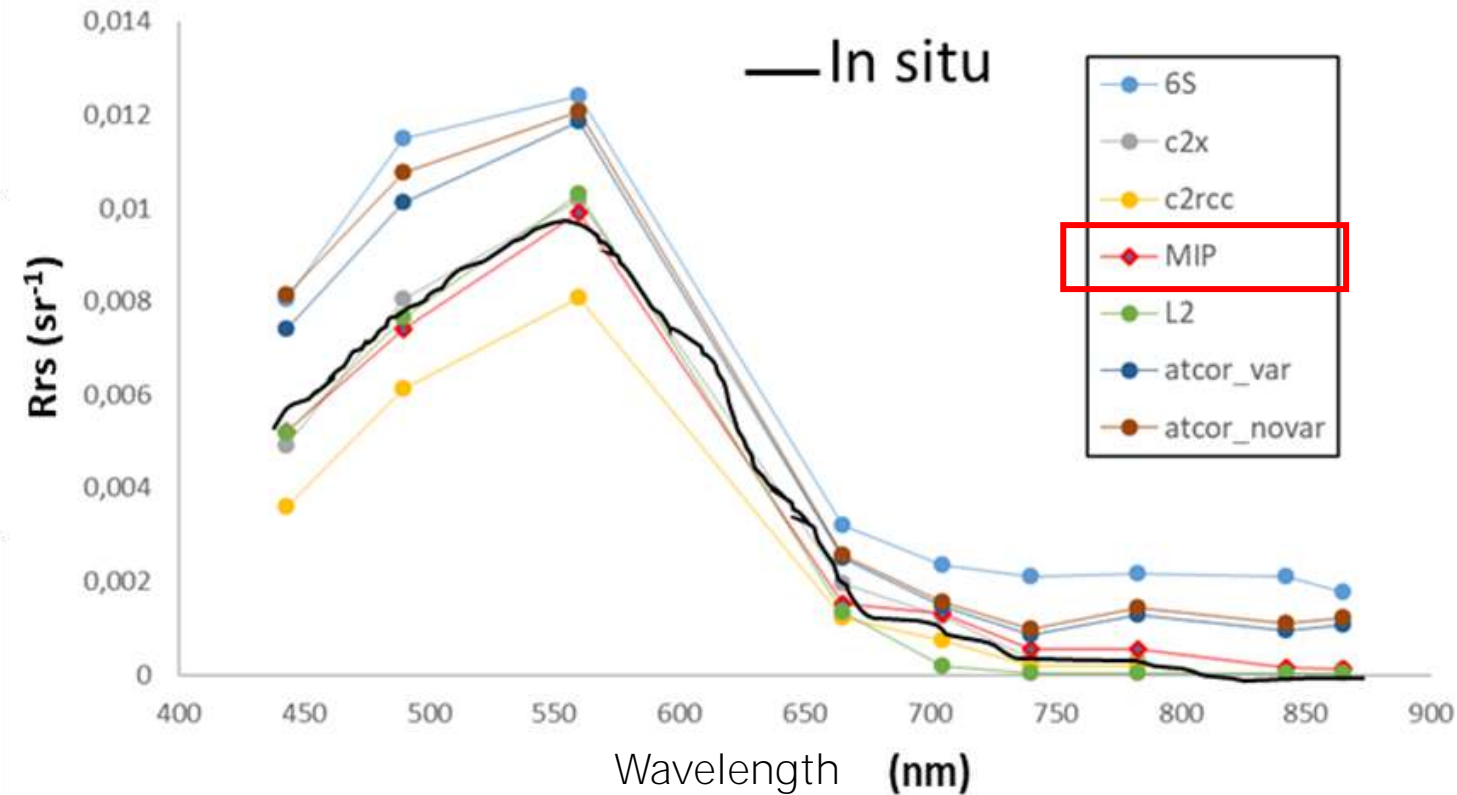
High importance in areas near land (relevant for dredging projects in coastal areas)



Atmospheric Correction

Atmospheric correction is the most important factor in aquatic remote sensing

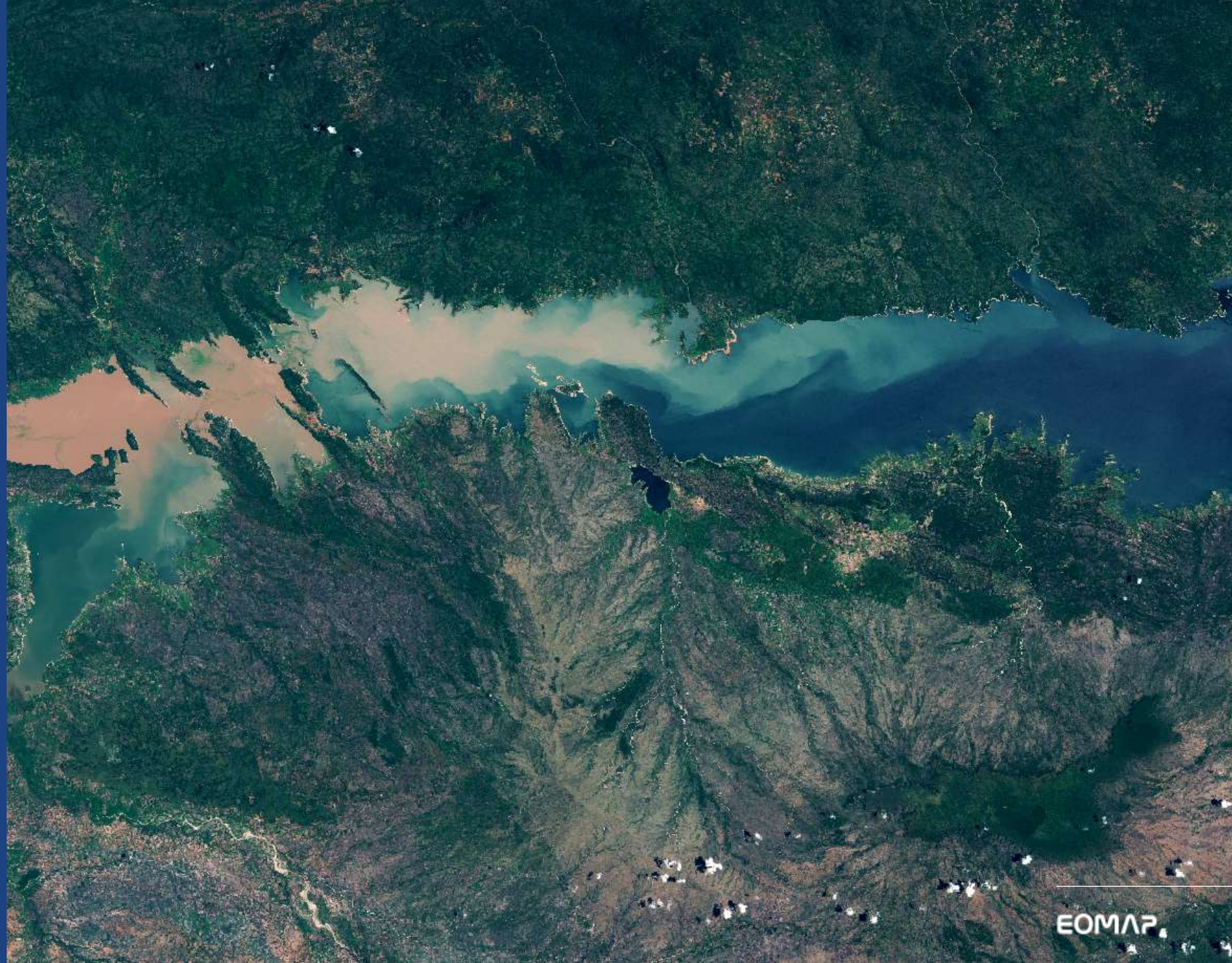
MIP algorithm in great agreement with in situ measurements



Comparison of in situ R_{rs} collected near to the coastal zone of Banja reservoir and R_{rs} retrieved from different atmospheric code applied to Sentinel-2 MSI on 23 September 2021.

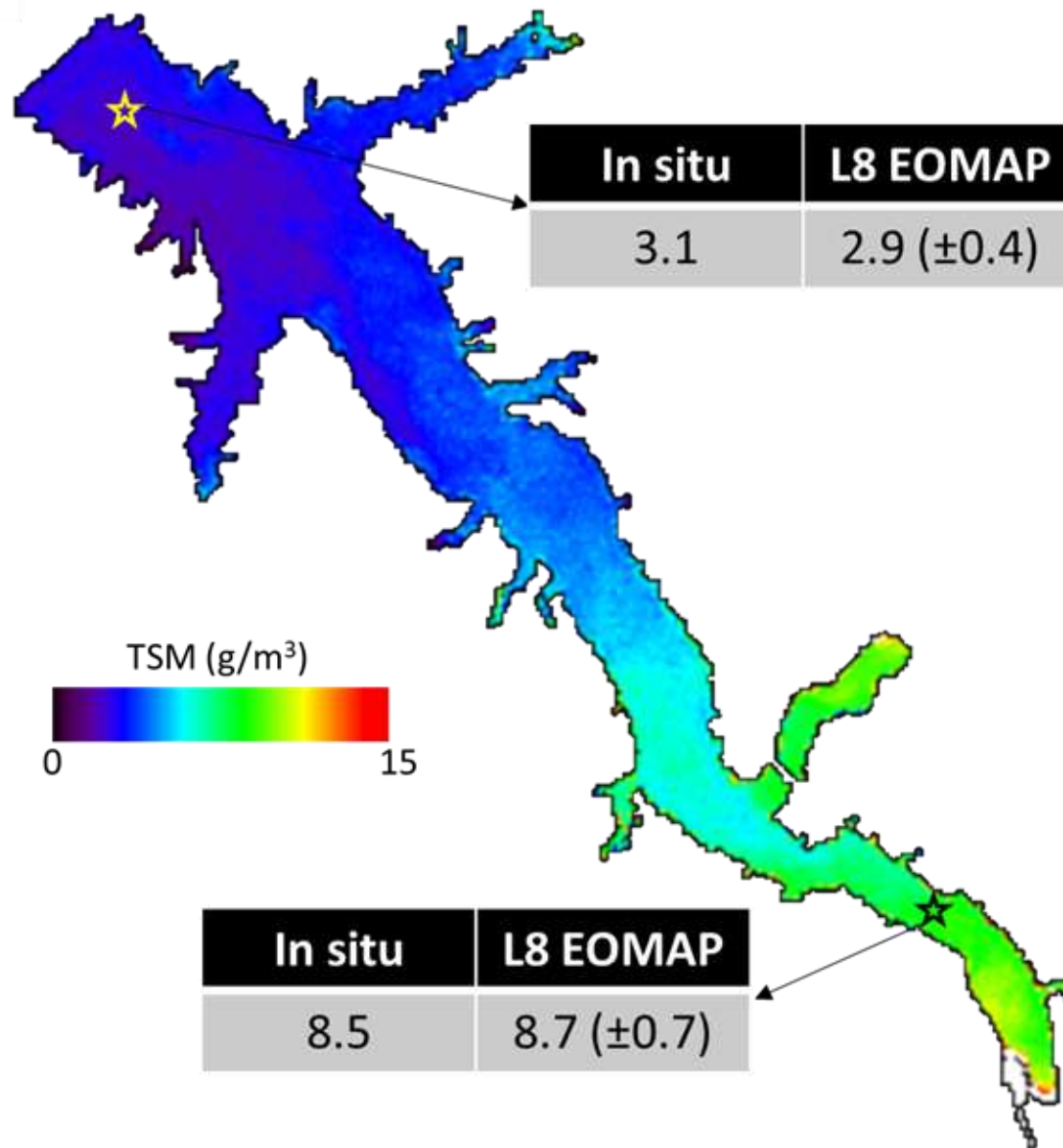
02.2

Validation

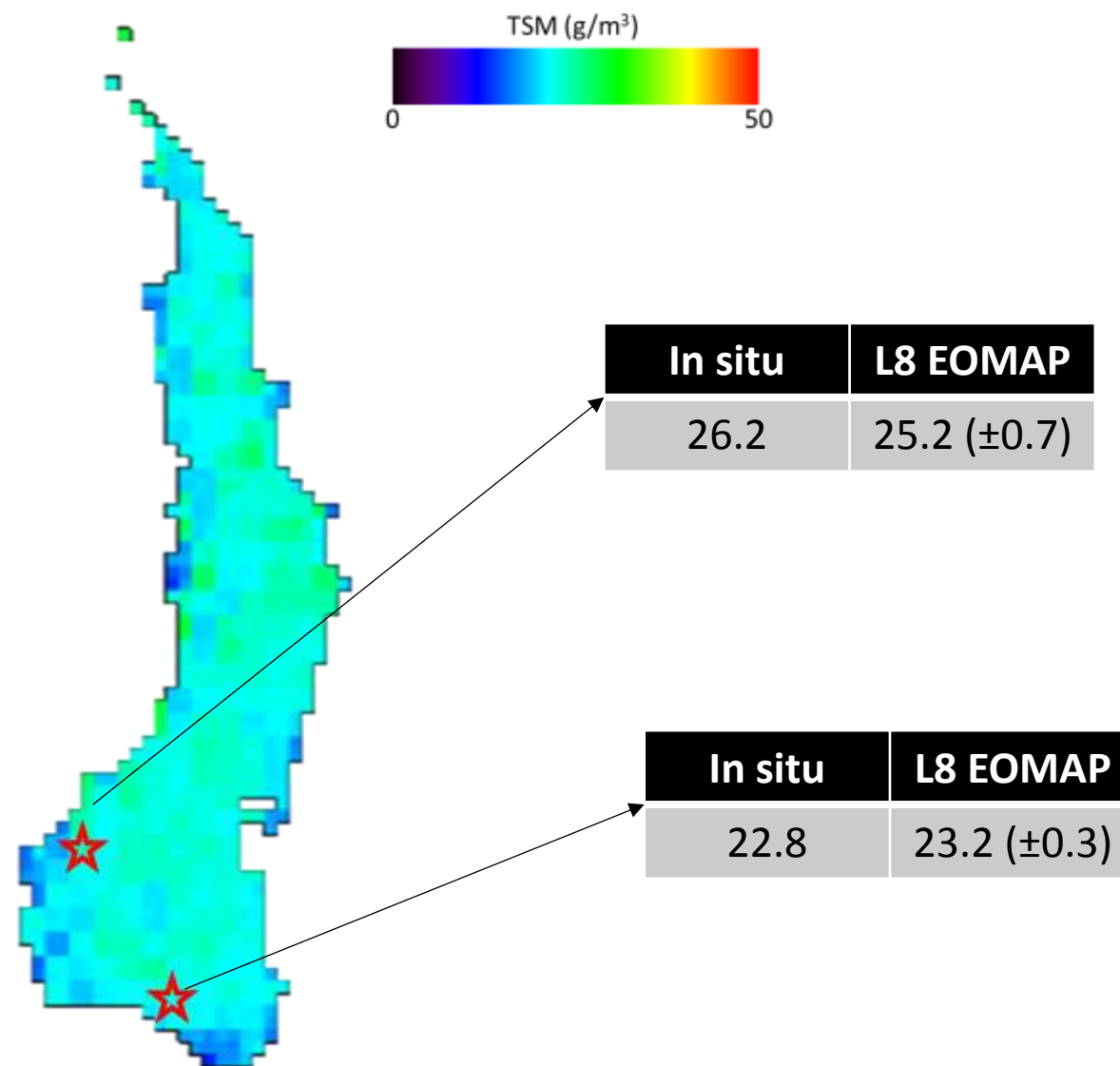


Validation of satellite derived water quality products

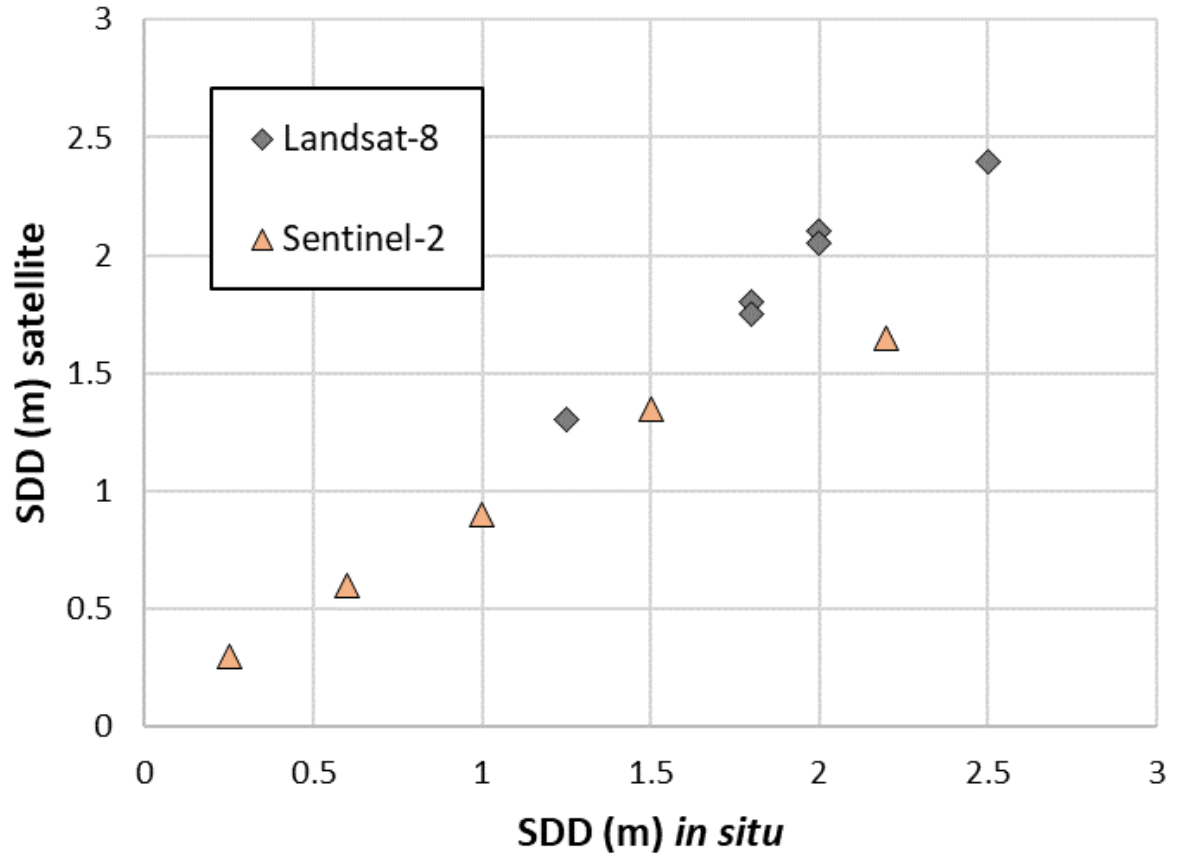
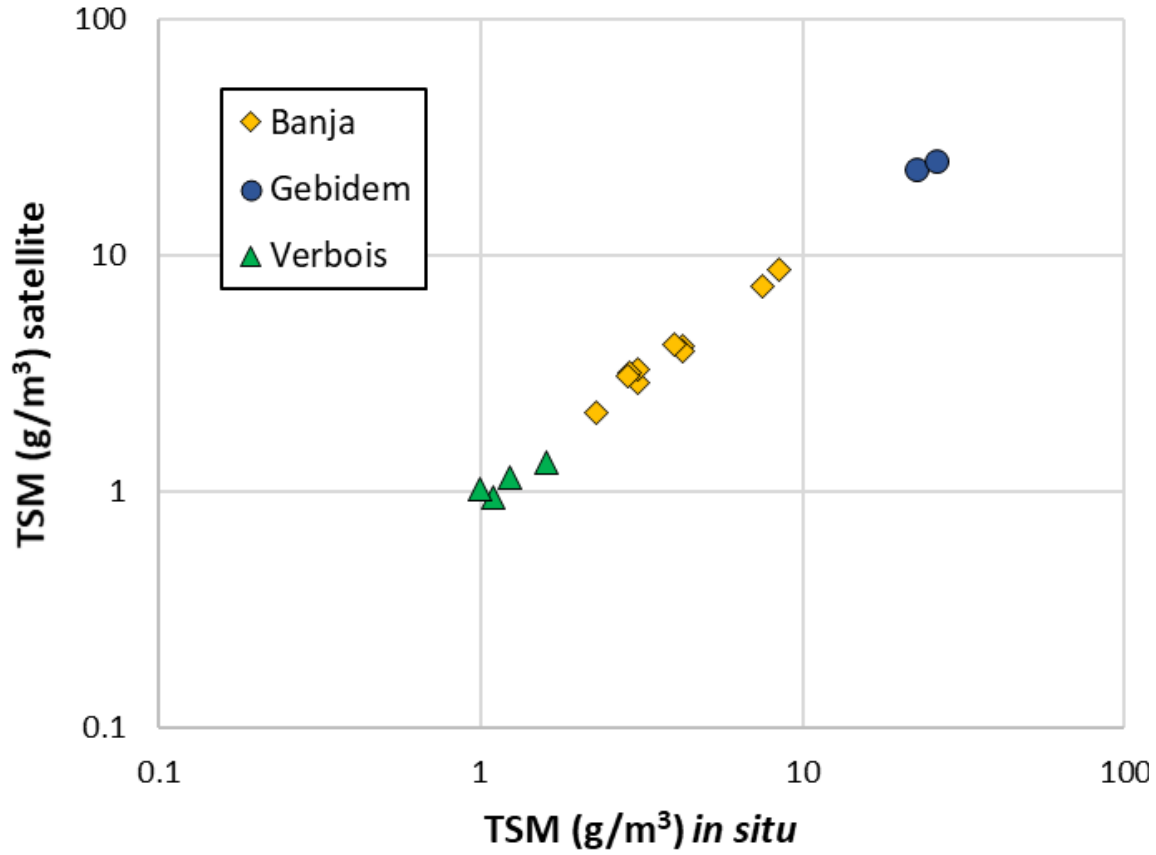
Banja Reservoir



Validation of satellite derived water quality products



Statistical analyses



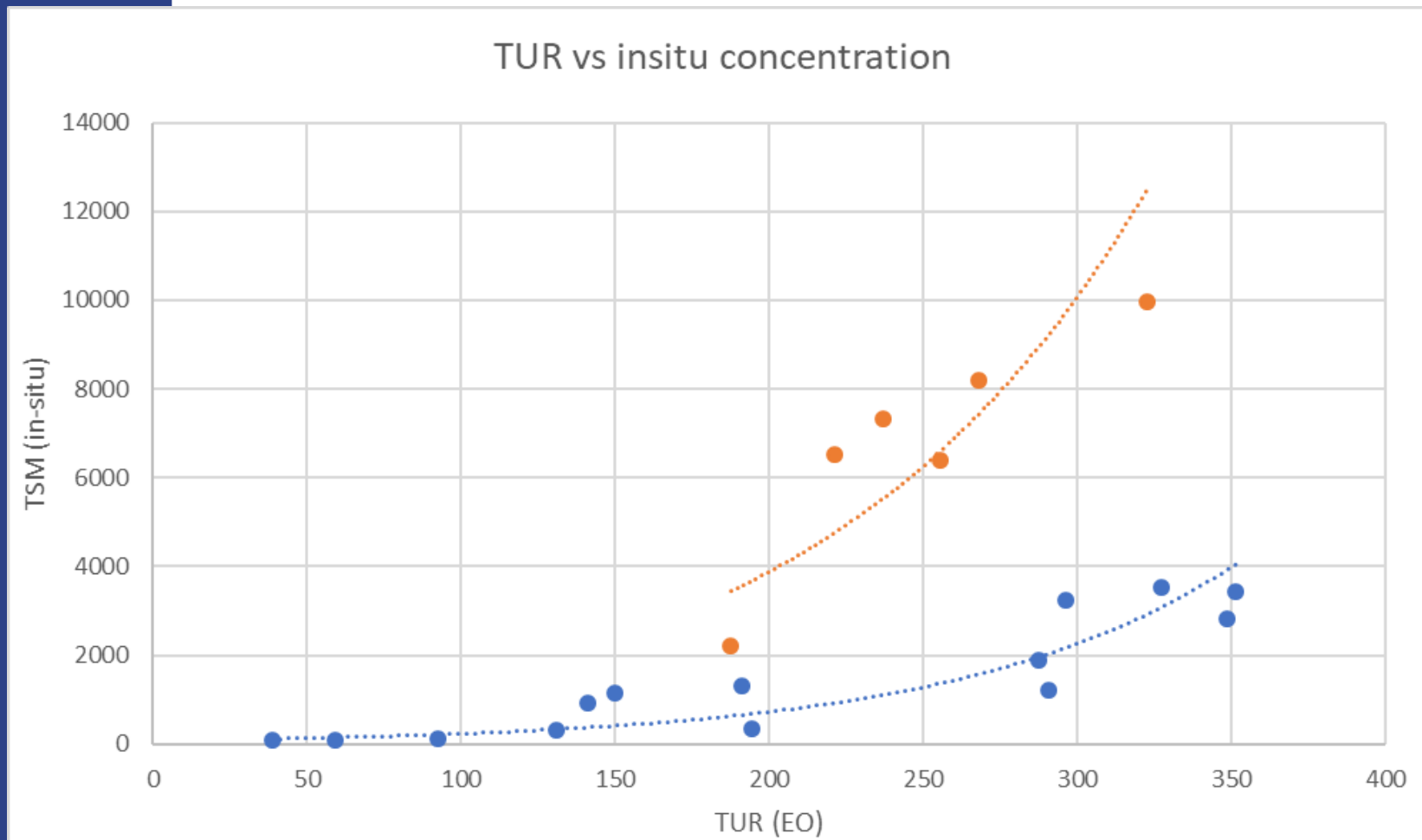
MAE	RMSE (%)	R2	Average satellite (g/m ³)	Average in situ (g/m ³)
0.25	5.41	0.98	6.04	5.99

MAE	RMSE (%)	R2	Average satellite (m)	Average in situ (m)
0.11	11.06	0.93	1.47	1.54

Seasonality effects TUR vs. TSM

Vakhsh river, Tajikistan

Strong seasonality of
relation between turbidity
and total suspended matter



Orange: April – June

Blue: September - March

03

Outlook

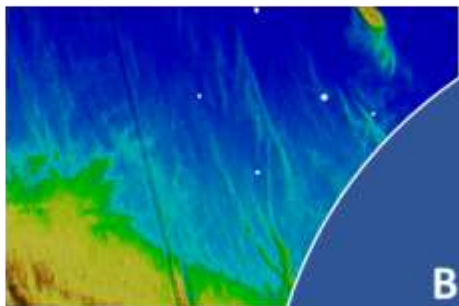




OUTLOOK

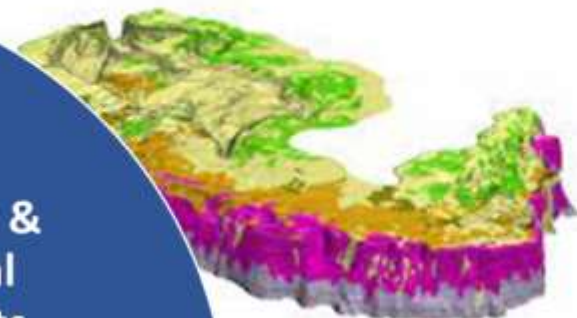
- 01 ...**operational** monitoring projects using multispectral satellite imagery in very high spatial and temporal resolution
- 02 ...use of new satellite missions such as PRISMA or Pelicans for improved water constituents detection and temporal coverage
- 03 ...further algorithm developments, e.g. new atmospheric model for improved atmospheric correction using AERONET stations

- Pre-assessment
- Cost estimation
- Change detection



Bathymetry

- Critical habitat detection and monitoring
- Survey & dredge planning

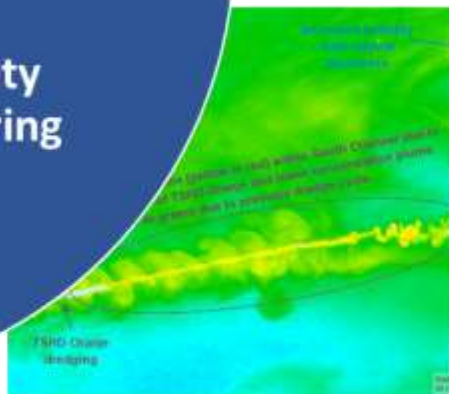


Benthic & coastal habitats



Coastal topography and change

- Beach nourishment monitoring
- Erosion analysis



Turbidity monitoring

- Baseline and impact analysis
- Integration to sediment models



Thank you!

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