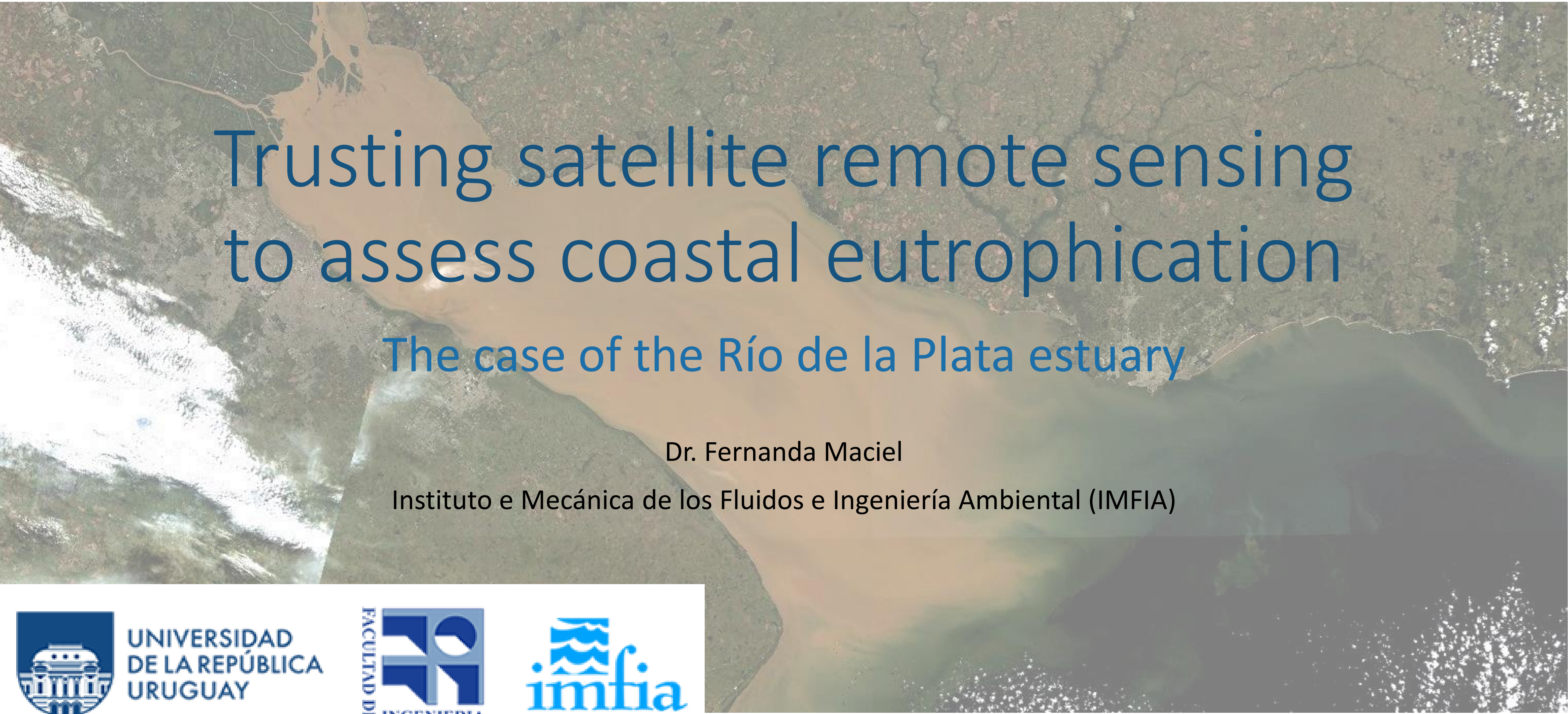
Geospatial and Other Data Sources for Environment Statistics: Assessing the Impact of the Economy on the Environment; 21-23 March, 2023



Trusting satellite remote sensing to assess coastal eutrophication

The case of the Río de la Plata estuary

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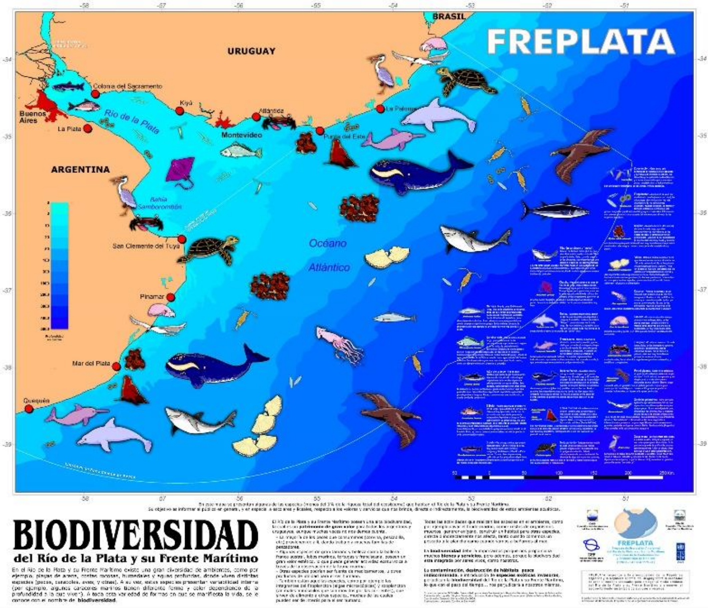
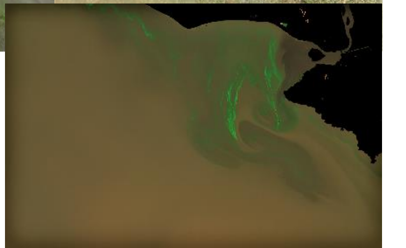
imfia

Economic and environmental relevance of the estuary

- Five countries, +100 million inhabitants, second largest flow in South America
- Biodiversity and water uses (transportation, commercial ports, fishing, water supply, recreation, tourism, etc.)
- Increase in eutrophication and coastal blooms (Nagy et al., 2002; Sathicq et al., 2014)
- Cyanobacteria from upstream reservoirs (Aubriot et al., 2020)

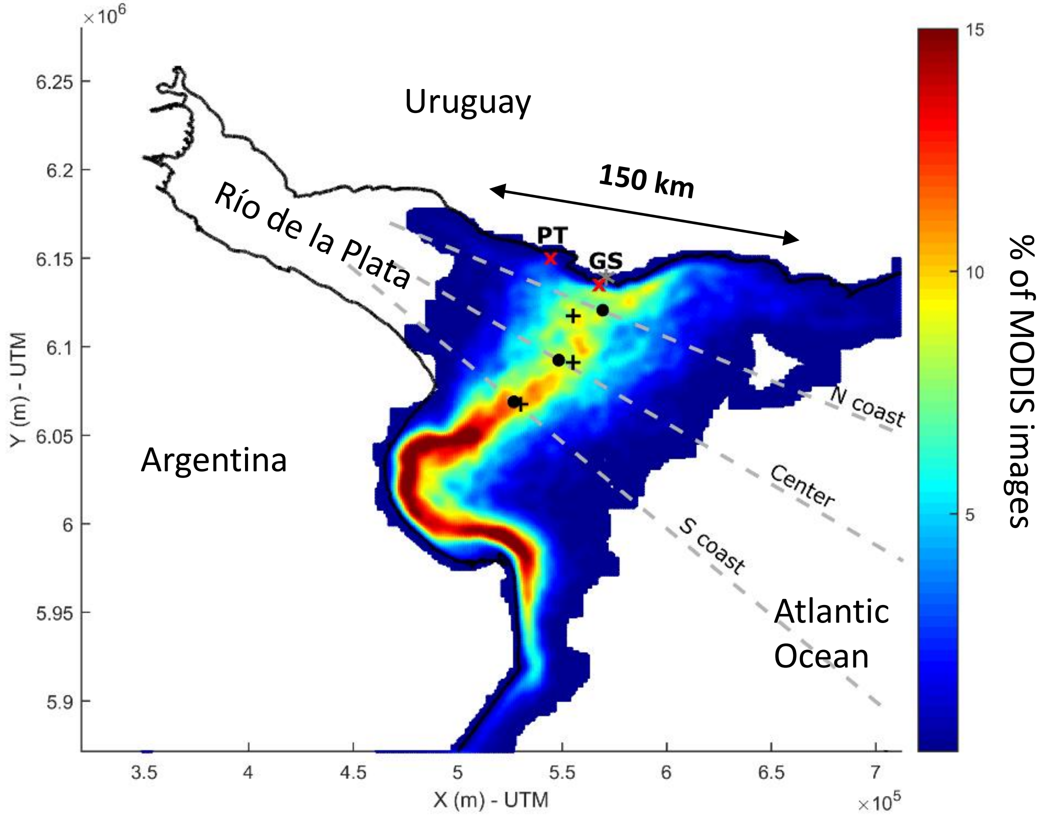




Considering the **environmental variability of the region**

- High variability of the turbidity and salinity fronts, dependency on discharge (El Niño cycles), winds, sea-level (Framiñan & Brown, 1996; Maciel et al., 2021)
- Affect transport of suspended sediments and dissolved substances
- Potential effect on remote sensing products (if not robust to the variability) and should be considered when performing statistics (e.g. definition ad comparison to baseline)

Distribution frquency for the turbidity front (2014-2017)



Advantages of satellite remote sensing

- Combined spatial and temporal resolutions that cannot be obtained with conventional sampling
- Data from sites with difficult accessibility
- Cost-effective
- **Possibility to retrieve chlorophyll a** → Measure coastal eutrophication (indicator 14.1.1a)

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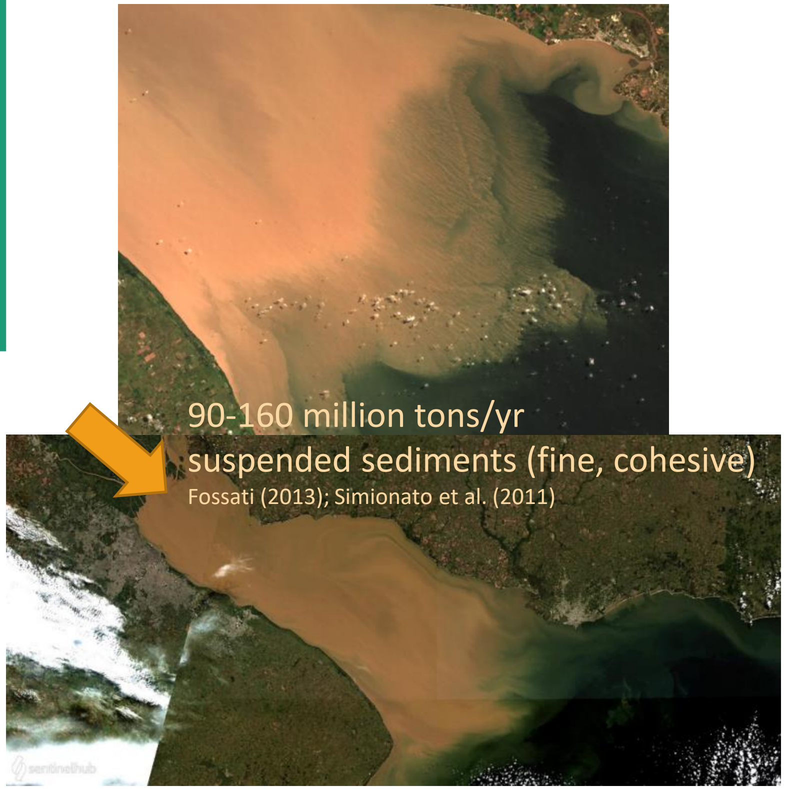

- Atmospheric correction for oceanic waters fail
- Difficulty to detect chl-a signal

Measure coastal eutrophication (indicator 14.1.1a)

Limitations
of satellite remote sensing

- Need for atmospheric correction to retrieve quantitative values
- Optical complexity of waters (case 2)
- Global satellite products may not be adequate (performance, resolution)

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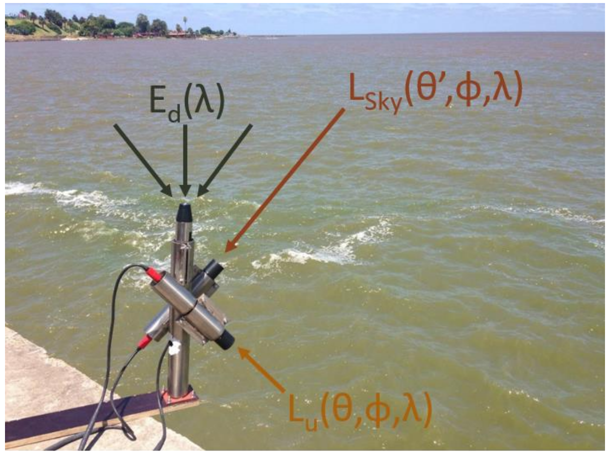

Need for in-situ measurements

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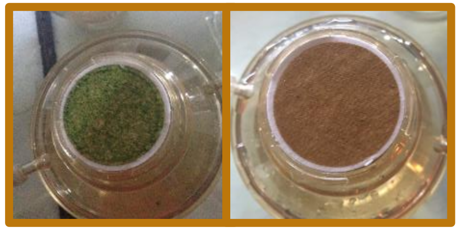
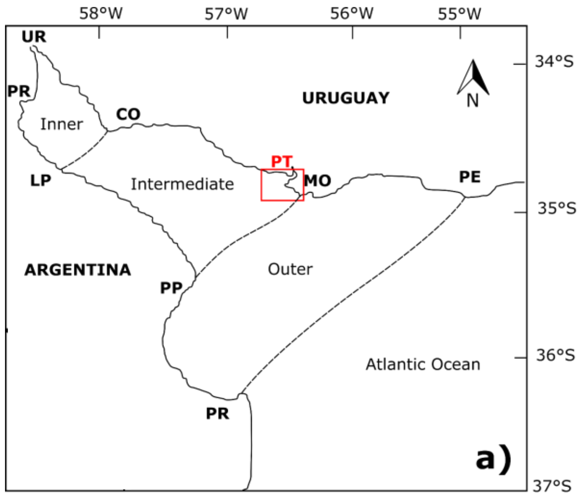
Need for regional testing and algorithm development

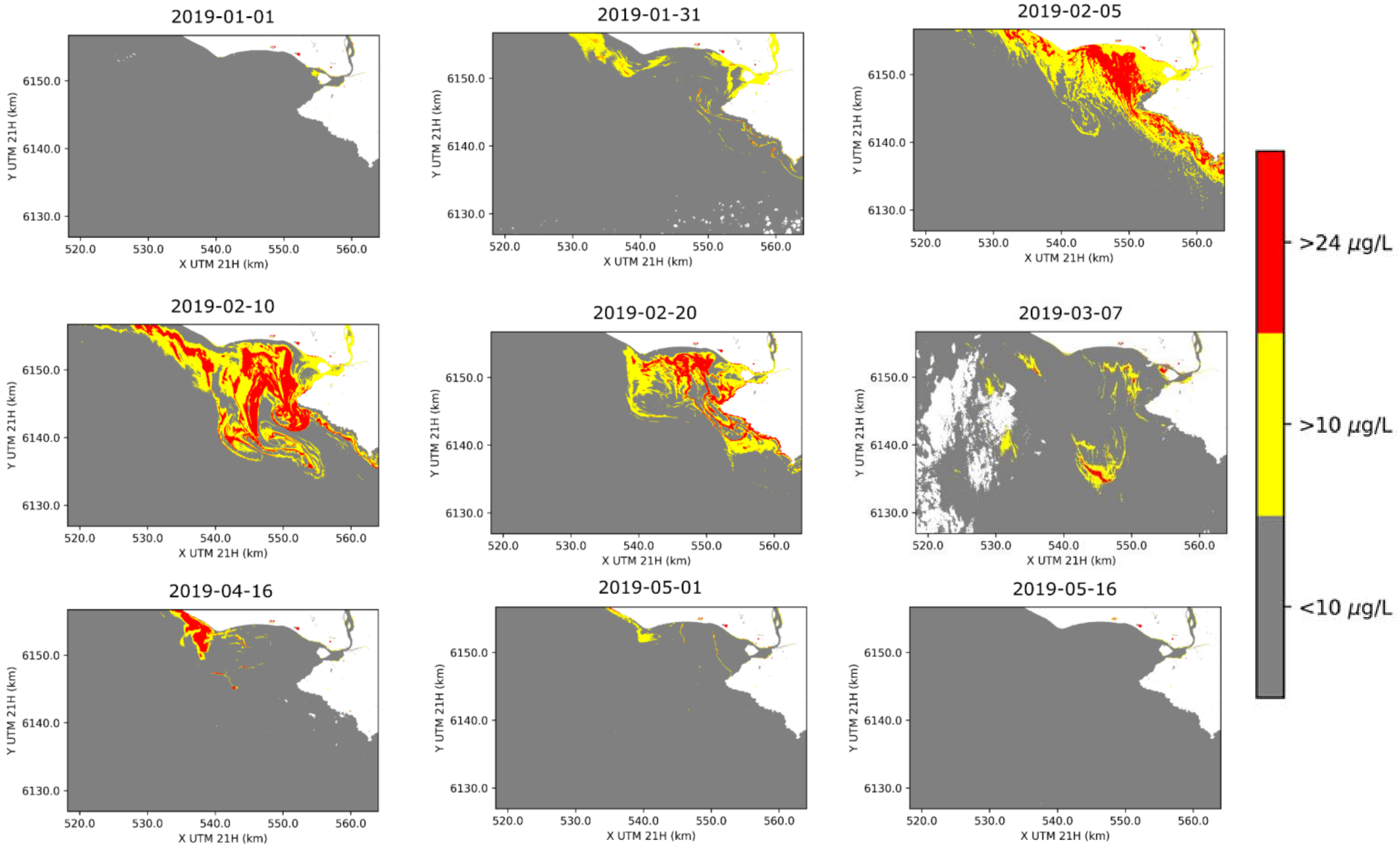
Chl-a algorithms: regional testing and developments



in-situ sampling of chl-a, matching satellite acquisition

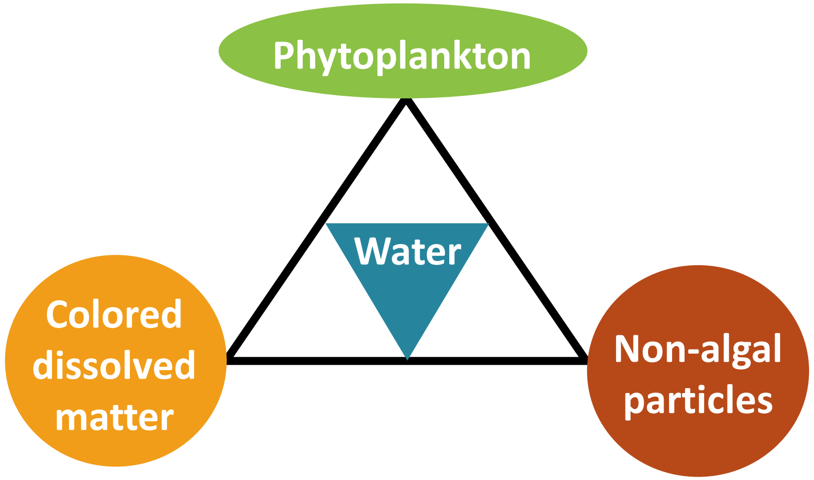


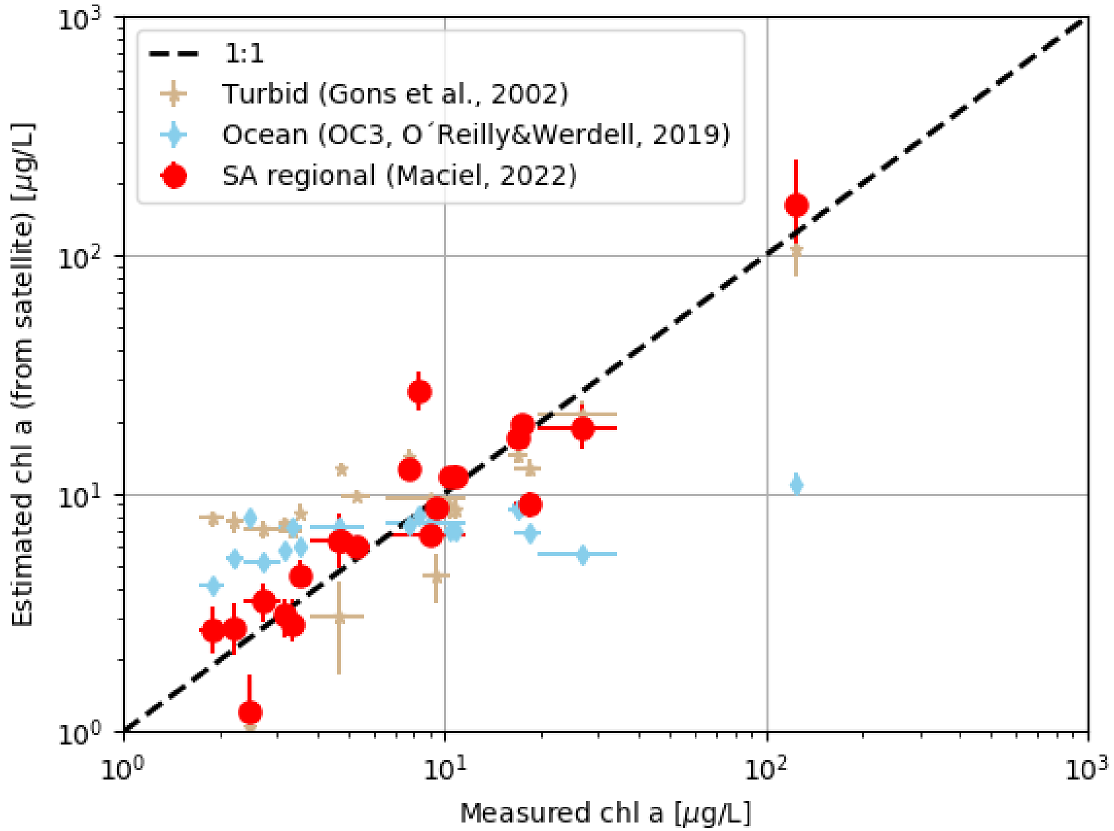
- Testing of existing algorithms, poor performance in turbid waters (30-100 FNU) (Dogliotti et al., 2021)
- Re-calibration of existing indices for variable turbidity (3-100 FNU) (Maciel et al., 2023):
  - Limitations of individual indices, affected by signal from suspended sediments
  - Combined used of two indices to detect chl-a thresholds (for algal blooms)



Chl-a algorithms: regional testing and developments

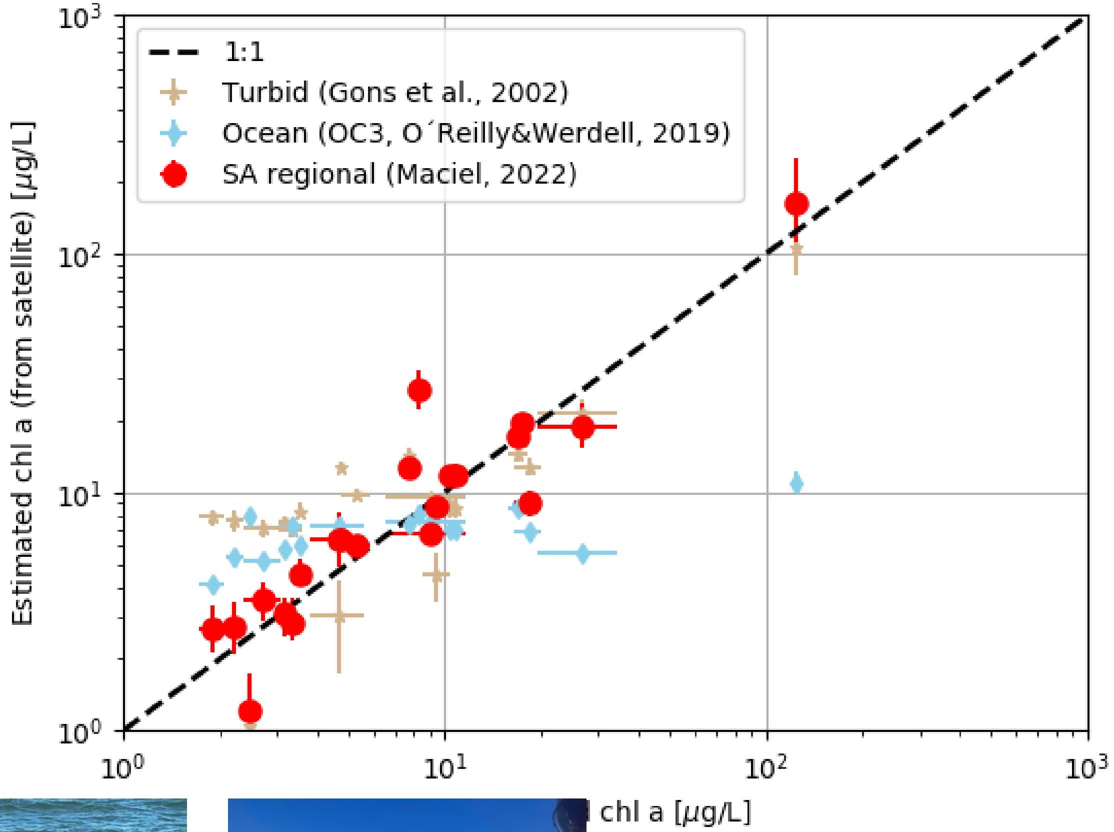
- Regional development of semi-analytic (SA) chl-a algorithm, accounting for variability of optically active water constituents (Maciel, 2022)

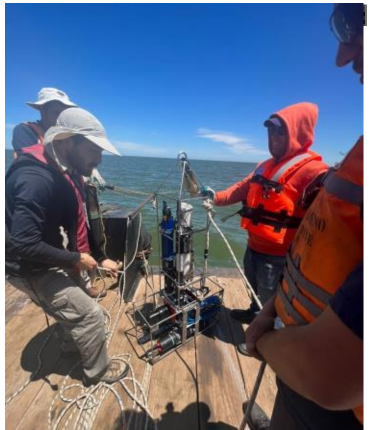




Chl-a algorithms: regional testing and developments

- Regional development of semi-analytic (SA) chl-a algorithm, accounting for variability of optically active water constituents (Maciel, 2022)
- Current work: testing the algorithm with more in-situ data and for other satellites (entire estuary)





Field campaigns last November, further from the coast
Funded by UNEP

General remarks

- Satellite data is extremely useful to extend geospatial information, but always complementary to in-situ data
- In-situ data is critical to validate existing satellite products, and to develop robust regional algorithms
- To study a water body using satellite data, several considerations are useful:
  - optical water type,
  - selection of adequate satellite products and know their performance,
  - influence of physiscal drivers and climatic phenomena to stablish a baseline and interpret longer term results.

Thank you!

Questions?

Further questions: fmaciel@fing.edu.uy

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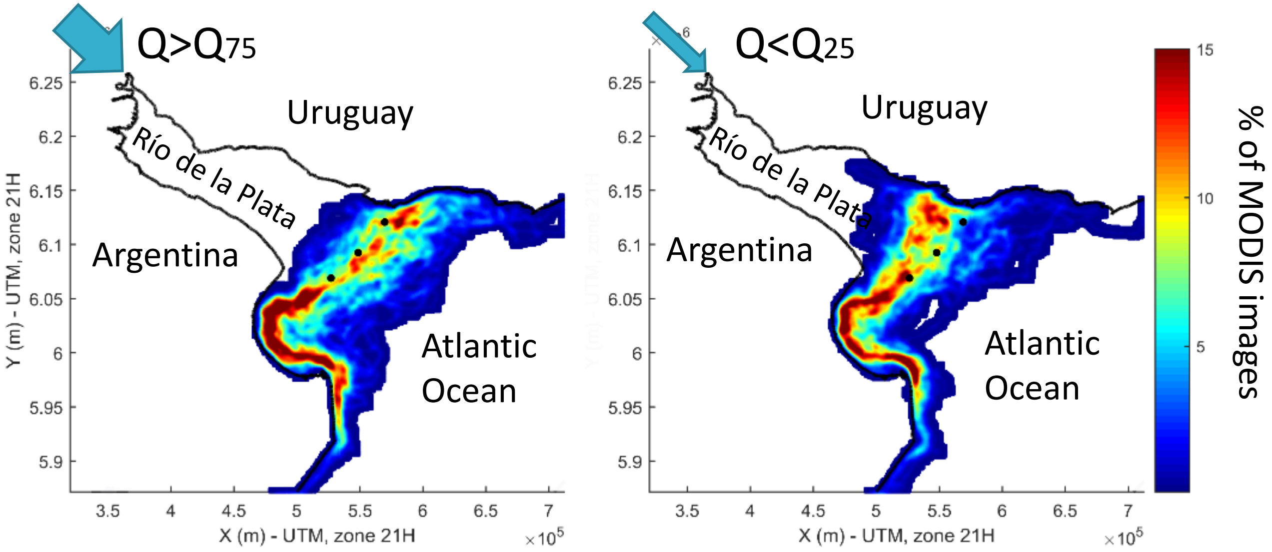
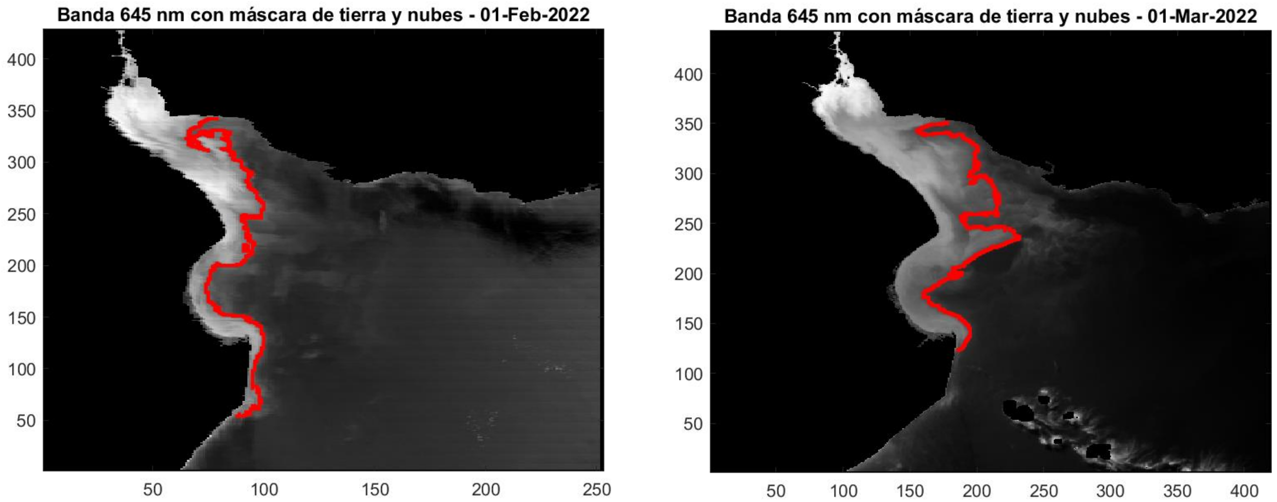
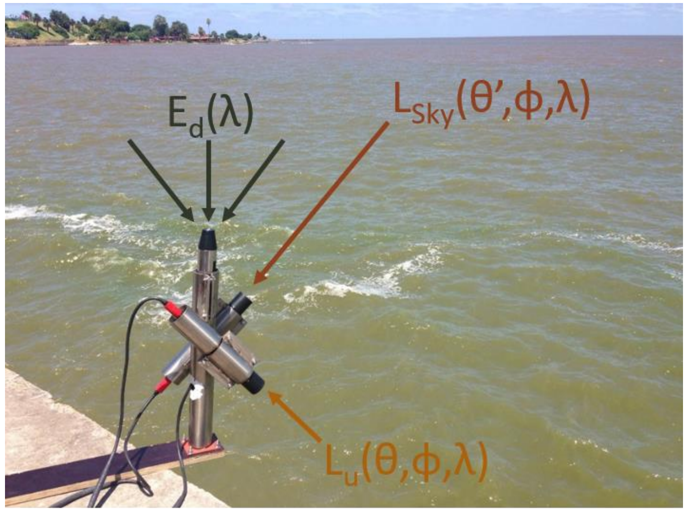




Regional validation of **atmospheric corrections (AC)**

- Aim to remove the signal of the atmosphere from satellite measurements (up to 90%)
- Advance in AC for case 2 waters in recent years
- In-situ data →



Radiometric measurements, matching satellite acquisition

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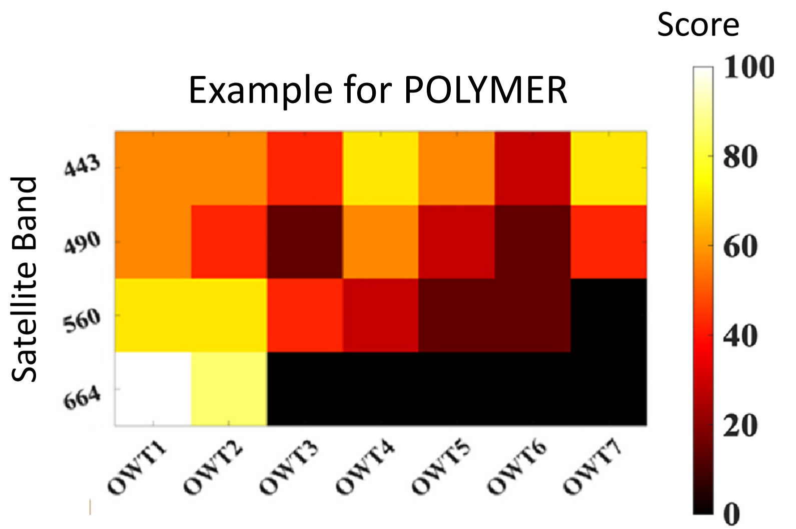
Global initiative ACIX-Aqua (Pahlevan et al., 2021):

- Evaluation of eight AC processors
- Classification according to **water optical type (OWT)**



Río de la Plata:

- North coast (Punta Tigre), ACOLITE processor (Maciel & Pedocchi, 2022)
- South coast (Bs. As.), ESA (last respocessing) (Dogliotti et al., 2022)