PROGRAMME OF THE EUROPEAN UNION

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Downstream Service Water Quality Products Validation

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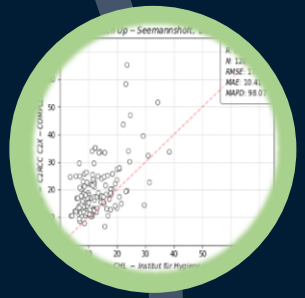
Table of Contents

1 – DOWNSTREAM SERVICES FOR WATER QUALITY

Provide value-added information



2- VALIDATION

Provide product quality validation

3 – USER INTERFACES

Adapt to user's needs

4 – CONCLUSION

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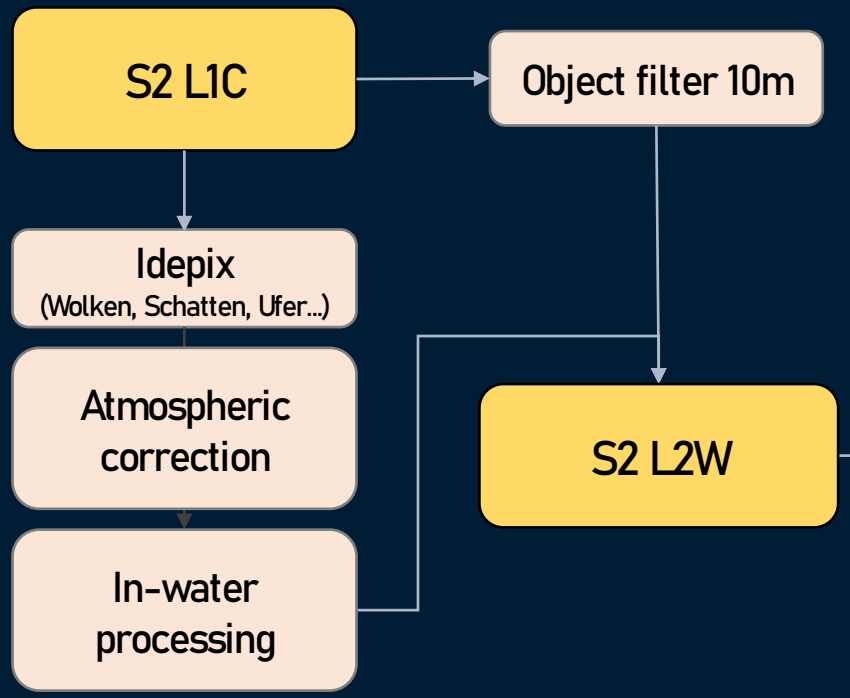
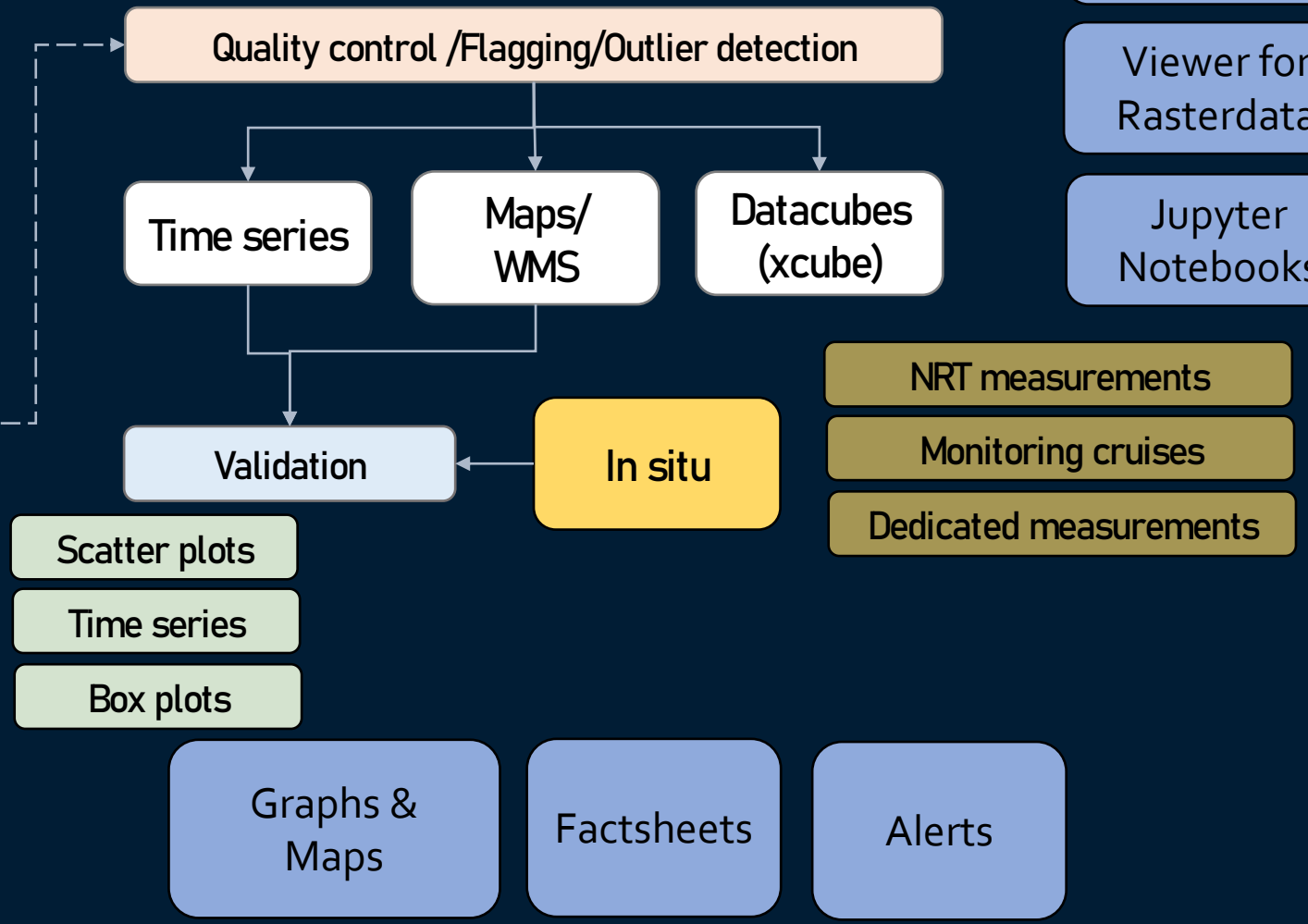
Downstream Service by BC

Basic Processing (Calvalus)



Higher Level Product generation



Interface Offer

- Mobile App
- Viewer for Rasterdata
- Jupyter Notebooks

- NRT: data driven processing
- On demand processing

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Validation of Downstream Service = Convincing the User

- Downstream CyanoAlert Services
  - Downstream services in Germany and Sweden provided by Brockmann Consult (Germany) and Brockmann Geomatics Sweden
  - Mostly WFD driven
- BIGFE
  - National support project for admins, fostering Copernicus uptake
  - Harmonisation for Bundesländer Germany (UFZ, HU HH, LUBW)
- DASIF
  - Contract by National Protection Agency in the framework of the national Climate Change Adaptation Strategy
  - Development and validation of national climate indicators

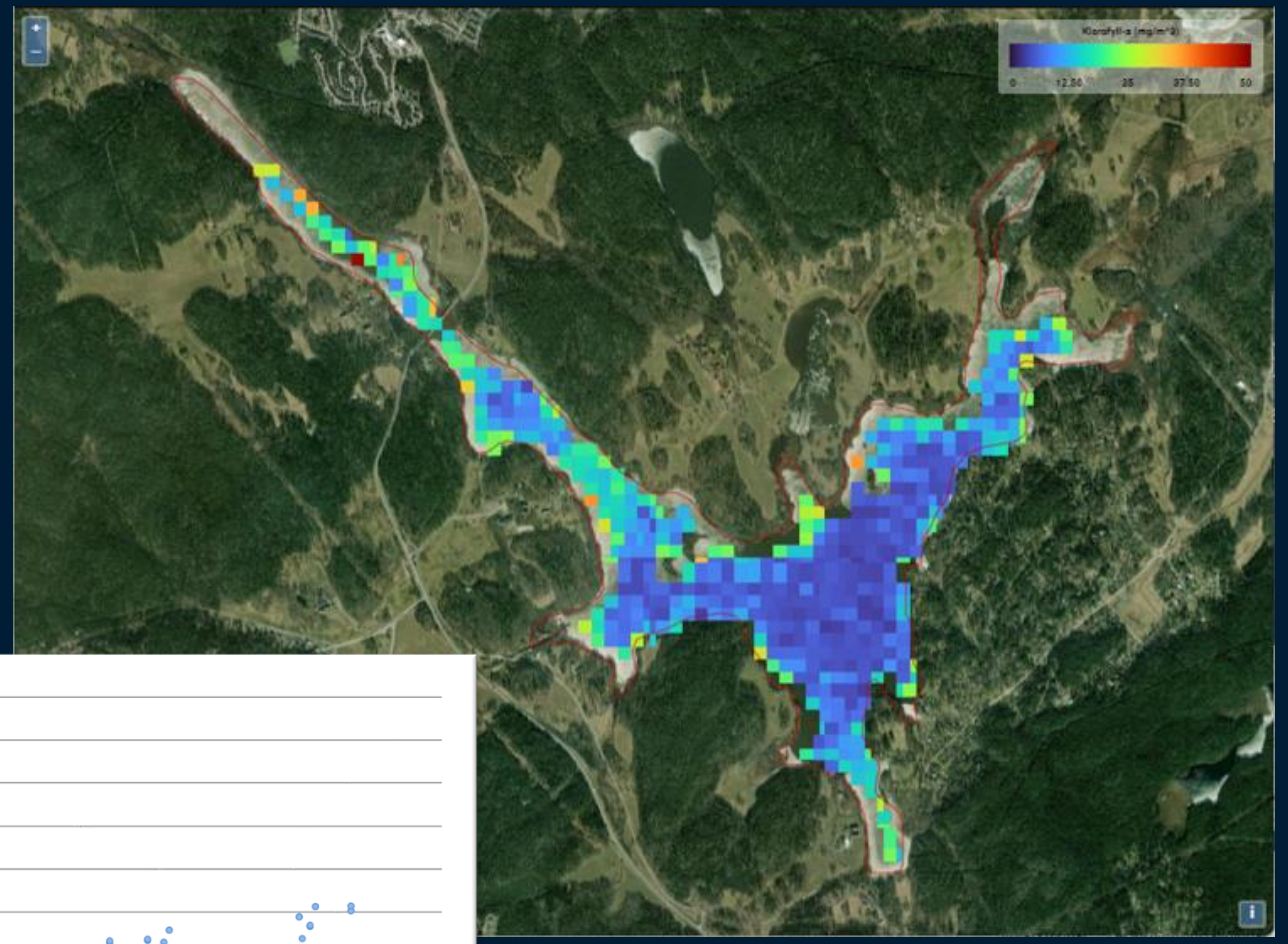
CyanoAlert Service - Sweden

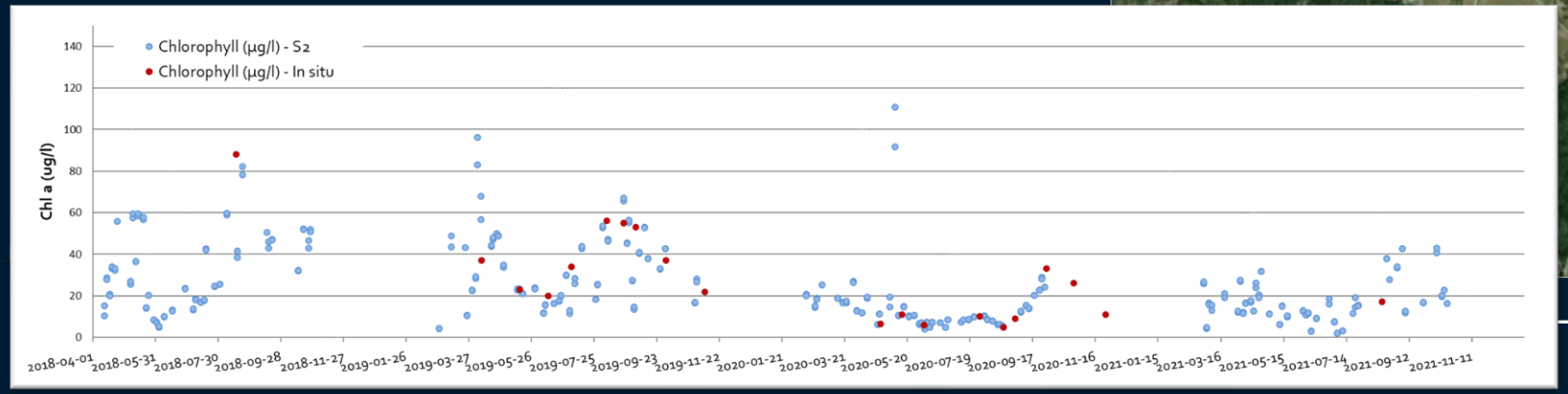
Supporting planning, monitoring and follow up on restoration activities.

Orlången, a severely eutrophicated lake due to impact of stormwater and a large number of private sewers.

During 2019, aluminum treatment was carried out to reduce the phosphorus levels in the sediment and the chlorophyll-a levels was significantly reduced during 2020.

Lake Orlången 2020-08-19





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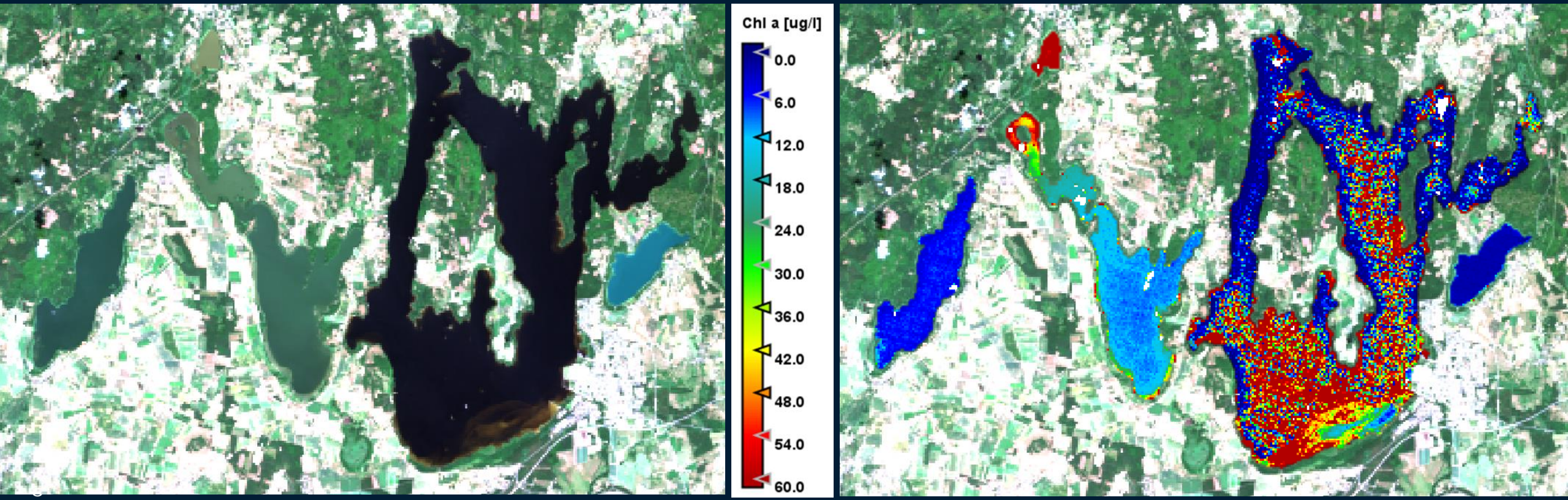
CyanoAlert Service - Sweden

Vattenriket - a UNESCO biosphere reserve area monitored with Sentinel-2. Reflectance and Chl a retrieval fails over dark humic waters.

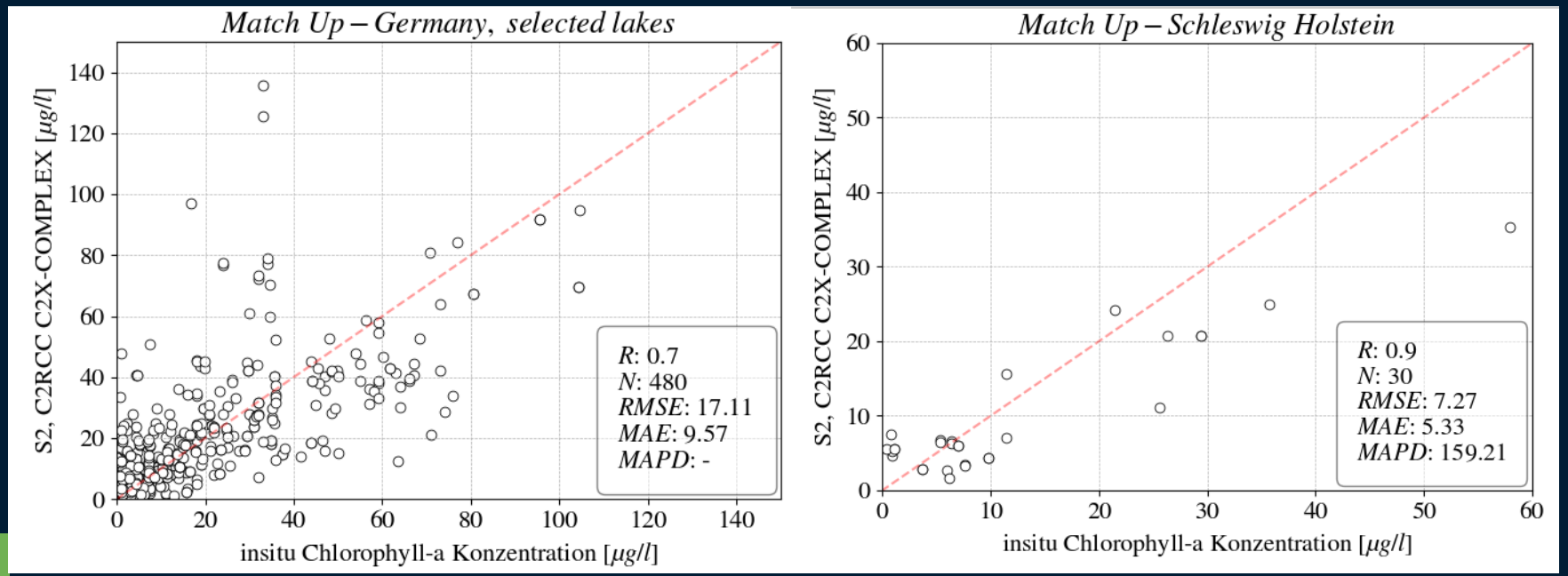


S2 2018-06-28 - C2X-Complex

Chlorophyll

Reservoirs and lakes, whole country of Germany

- Validation with in-situ measurements from national monitoring programme (Environmental Protection Agency UBA [left], Landesamt SH [right])
- Collection on national level for selected lakes
- Purpose: Climate Change Adaption monitoring [left], WFD [right]



Hamburg Service

- Customer: Hamburg City Admin (HU)
- Routine monitoring of water quality in Hamburg in charge of HU
- Permanent measurement stations equipped with BBE techniques (fluorometric with dark adaptation)
- Fully automated processes
- Valuable information for validation

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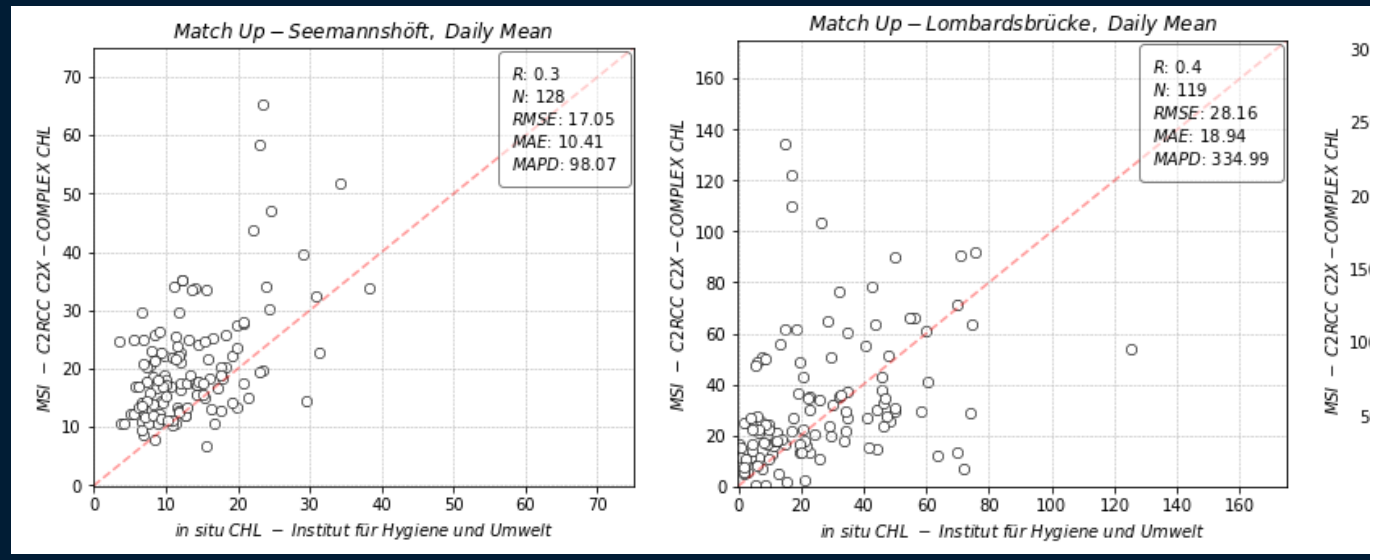
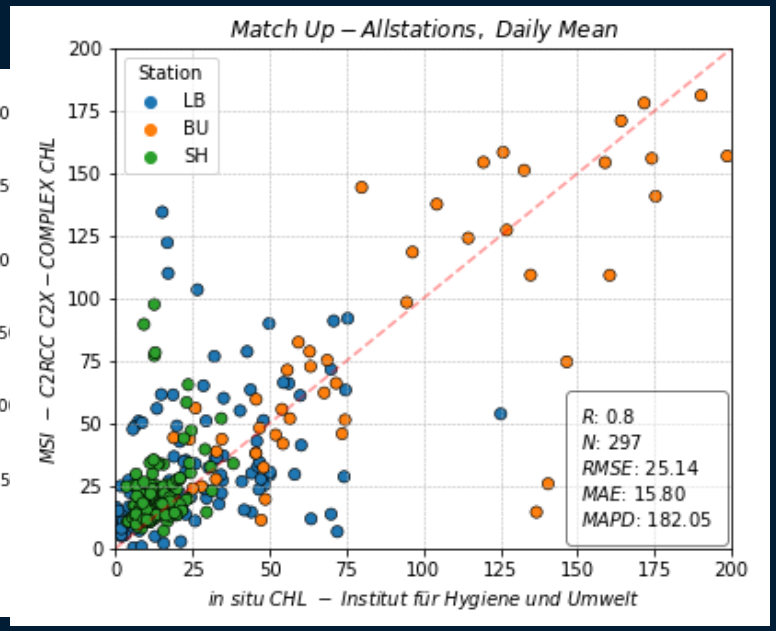
Chlorophyll

- Validation with in-situ measurements
  - Location of stations often close to shore
- Advantage of permanent measuring stations
  - many simultaneous measurements!

Data from 2016 - current





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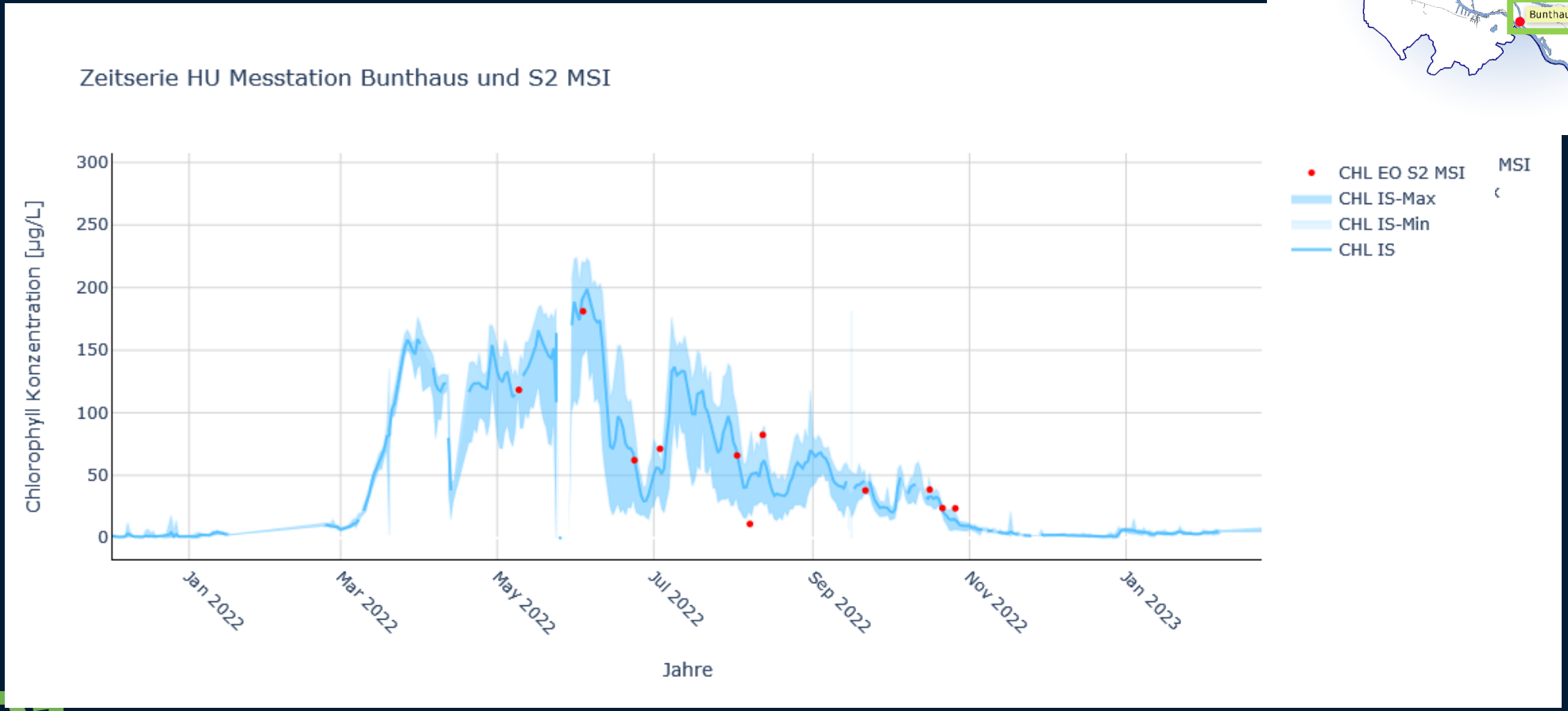
Permanent Measuring Station Bunthaus (River Elbe)

- Location of in.situ well place for EO observation



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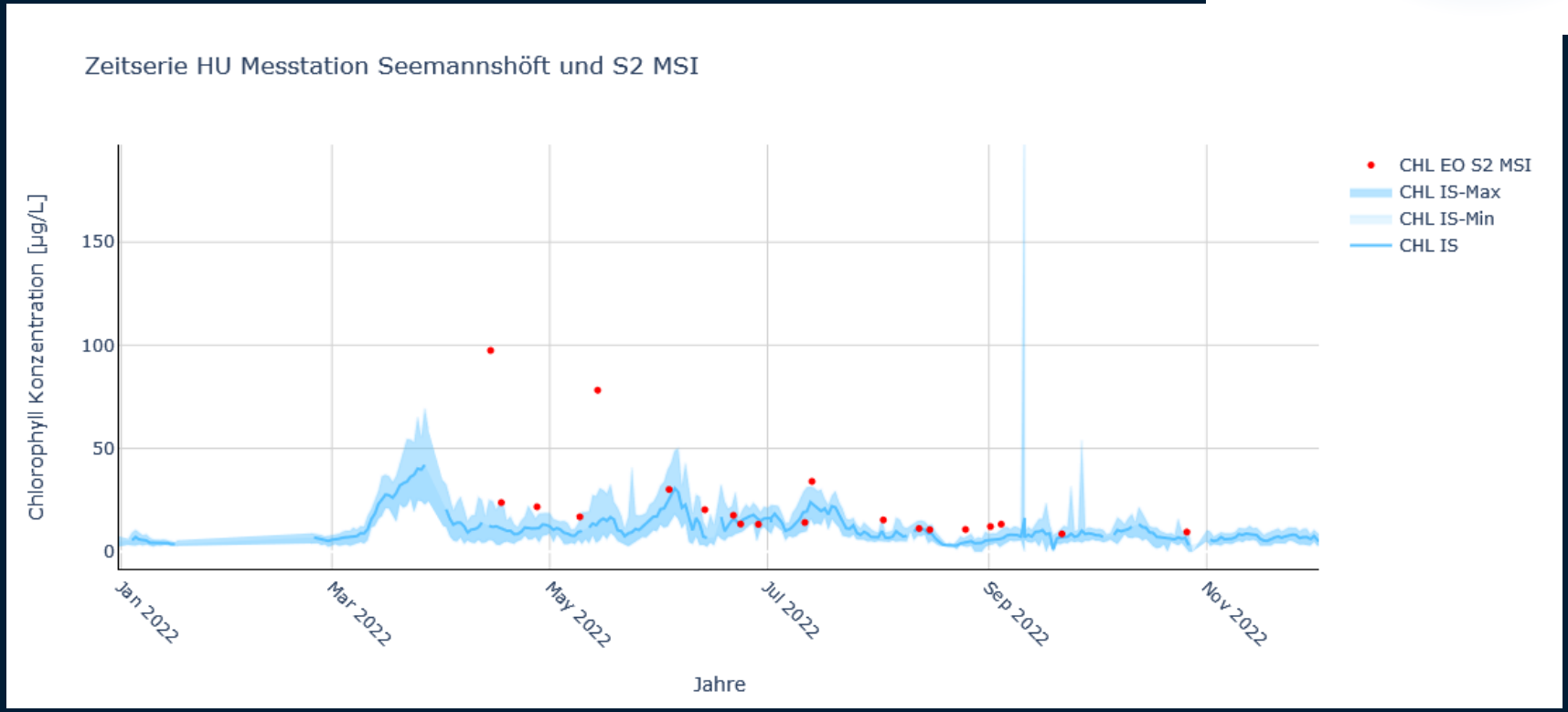
Permanent Measuring Station Seemannshöft (River Elbe)

- Location of in-situ close to shore



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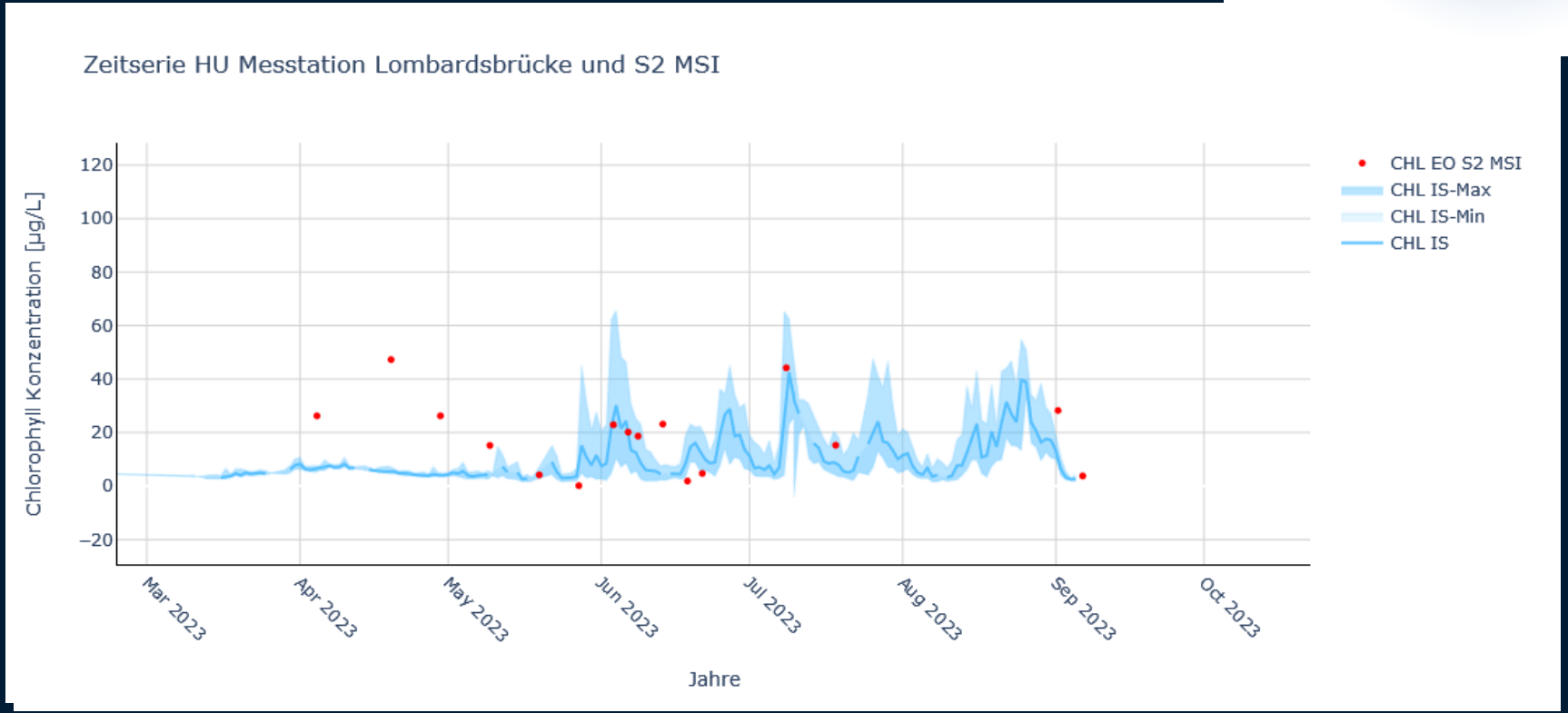
Permanent Measuring Station Lombardsbrücke (Lake Alster)

- Location of in.situ under a bridge



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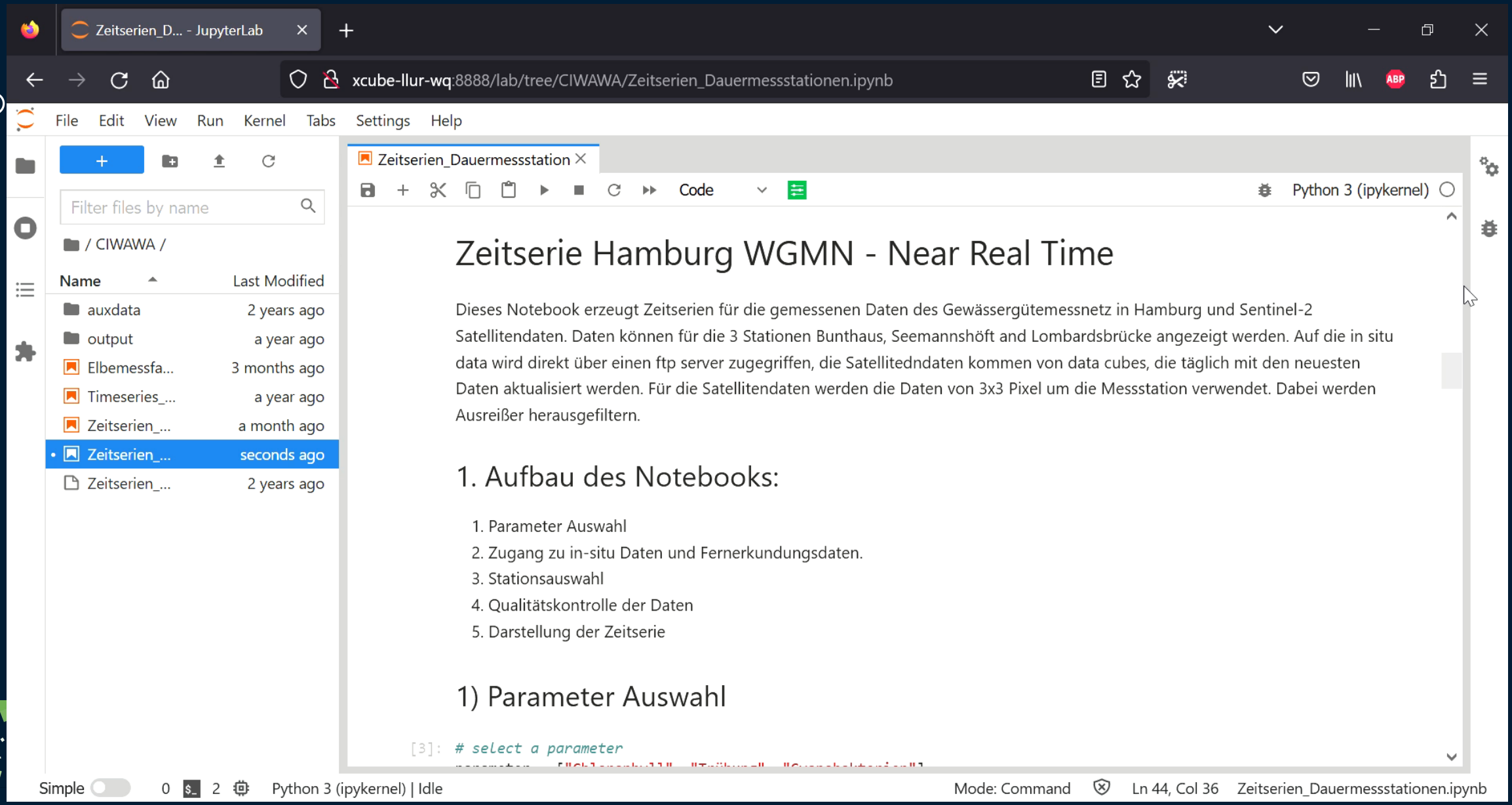
Automatization of Validation

- Using permanent measuring stations to automize validation of EO products
- API or interface for ground truth data needed
- Combine with NRT-data cubes run for downstream services
- Interactive and NRT validation
  - Timeseries
  - Scatterplots

Automatization of Validation



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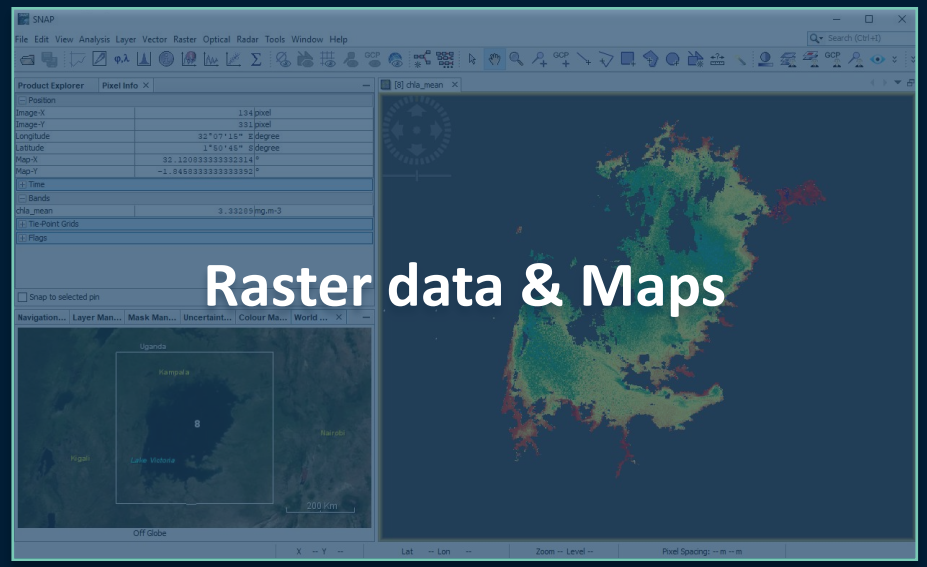
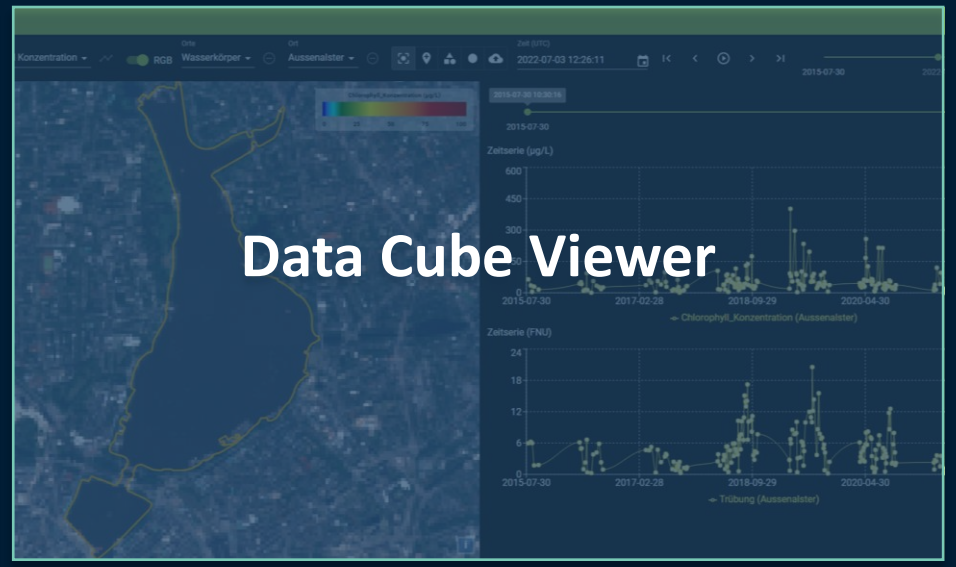
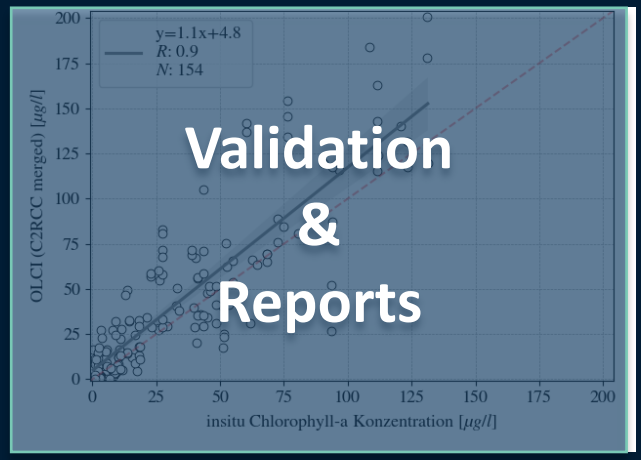
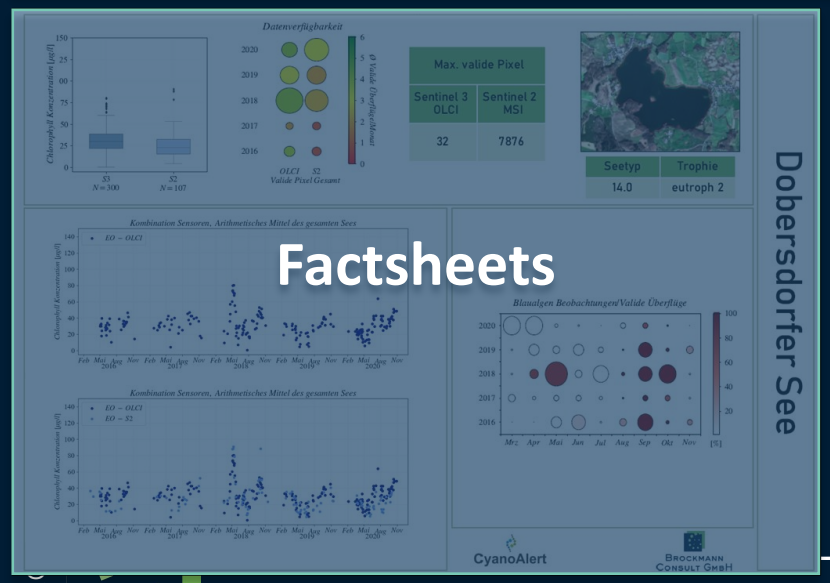
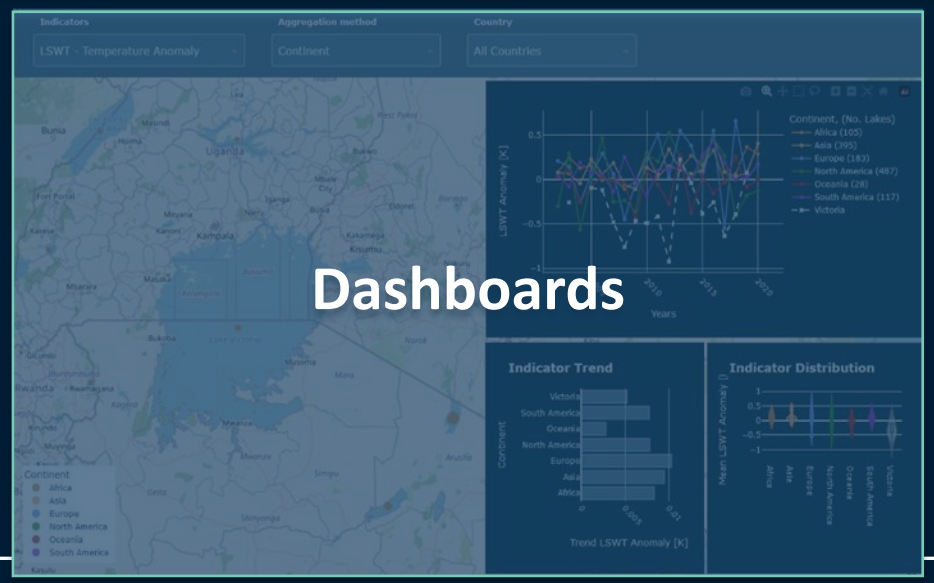
User Interfaces

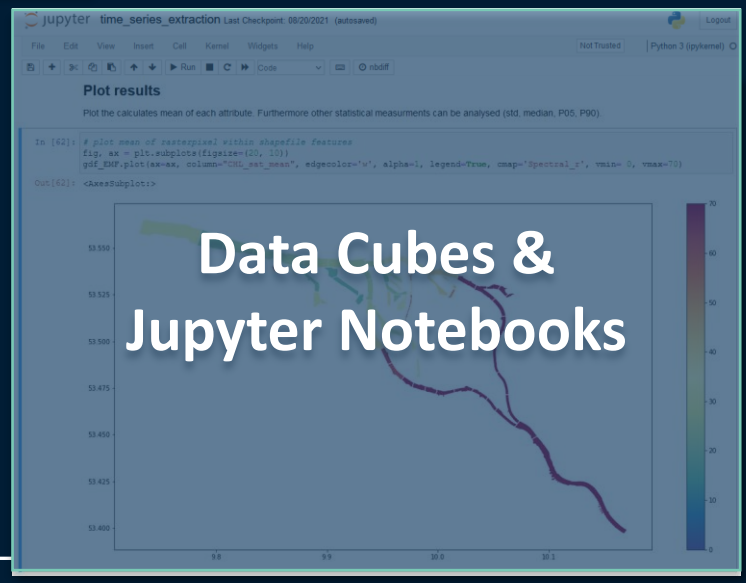






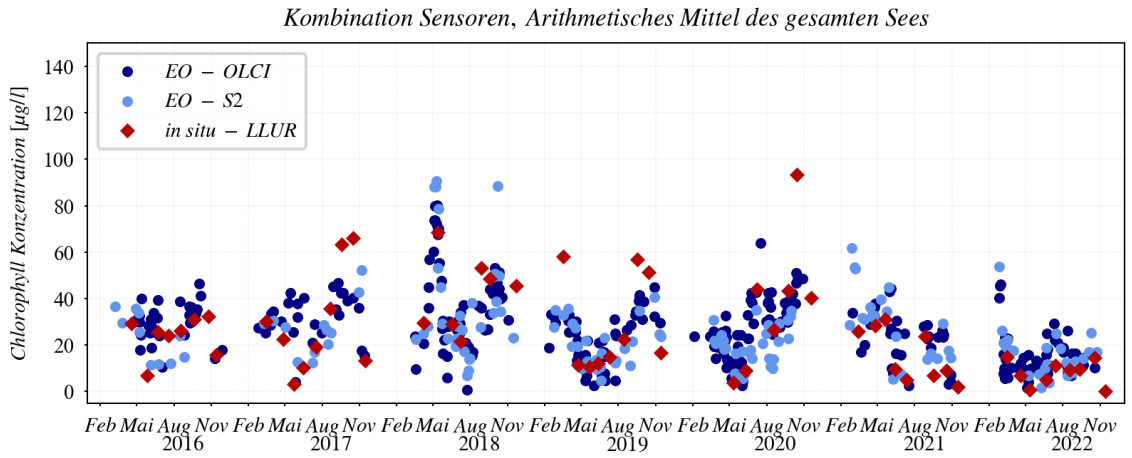


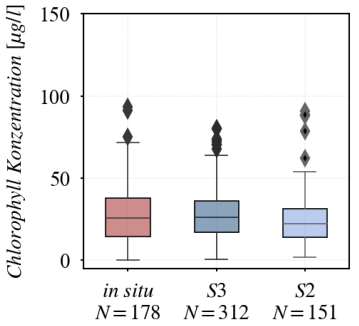


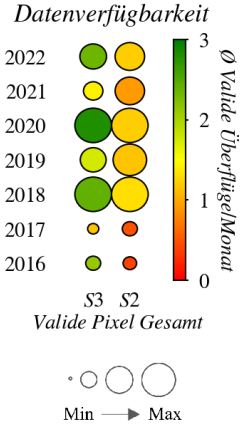


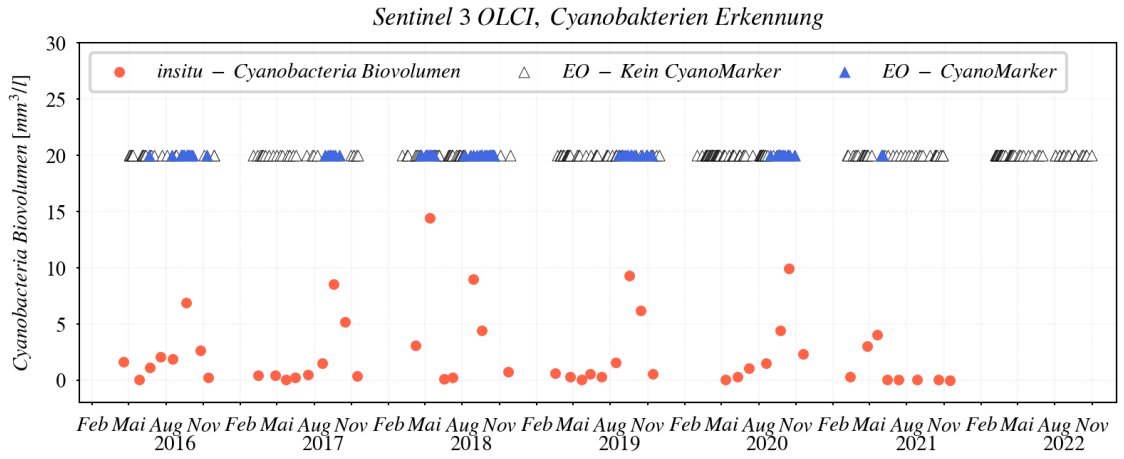
Dobersdorfer See

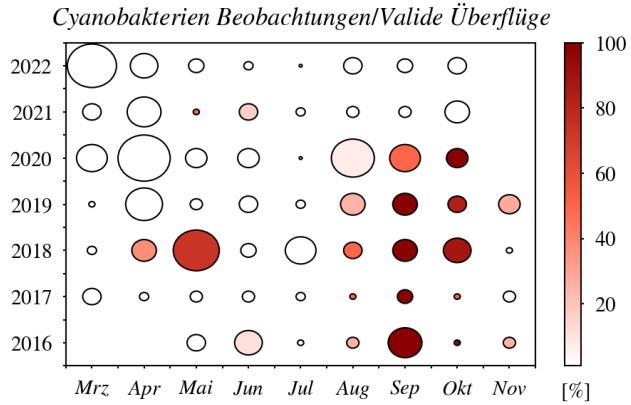
Max. valide Pixel	
Sentinel 3 OLCI	Sentinel 2 MSI
32	7413











Summary validation results (“it depends”)

- Time series plots provide insight into quality of EO (temporal pattern, agreement with in-situ) beyond classical match-up analysis
- Users appreciate and value the information included in spatial view as well as the temporal resolution and consistency
- Chlorophyll
  - Match-up (scatter plots & statistics; problematic space – time differences) MAE between 5 and 20mg/m³ for values between up to 200 mg/m³
- Secchi disc depth (reservoirs)
  - Match-up (scatter plots & statistics; problematic space – time differences) MAE between 0.1 and 4m for values up to 12m
- Limitations of S2
  - Very clear lakes in clear atmospheric conditions (AC): S2 MSI sensitivity and SNR are too low for such conditions
  - Detector striping are an issue in coastal areas but have not been recognised as a big issue for lakes because of large spatial in-water variability

Conclusions

- Downstream services important for various end-user
- Validation of national lakes
  - High ranges of CHL are covered by EO
  - Permanent measuring stations have many advantages
    - temporal pattern ananylsis
    - Automatization of validation with NRT EO data cubes
  - Challenges for very clear lakes in clear atmospheric conditions (AC)
- Custom user interfaces are needed for user interactions
  - Including validation tools

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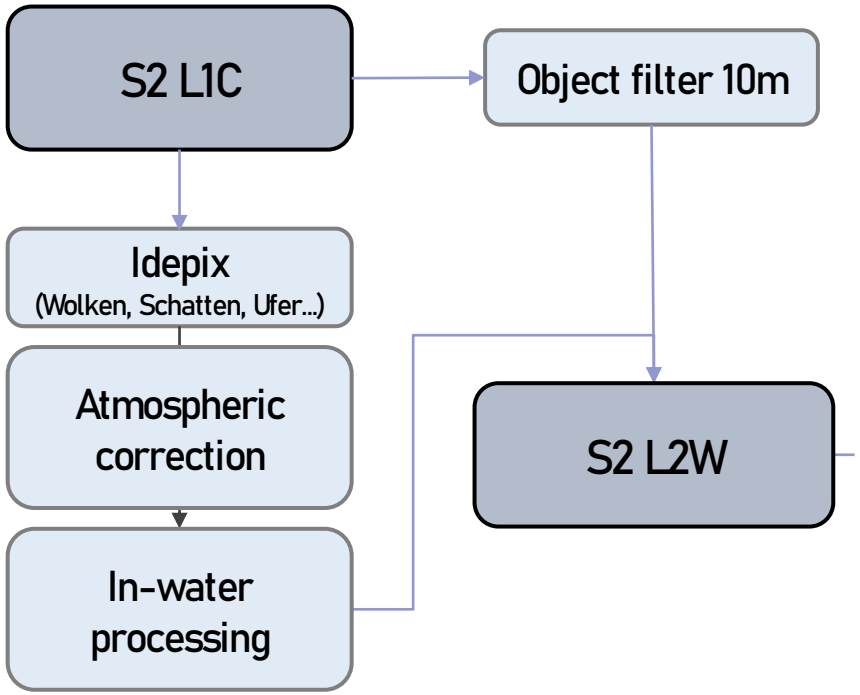
SPARE

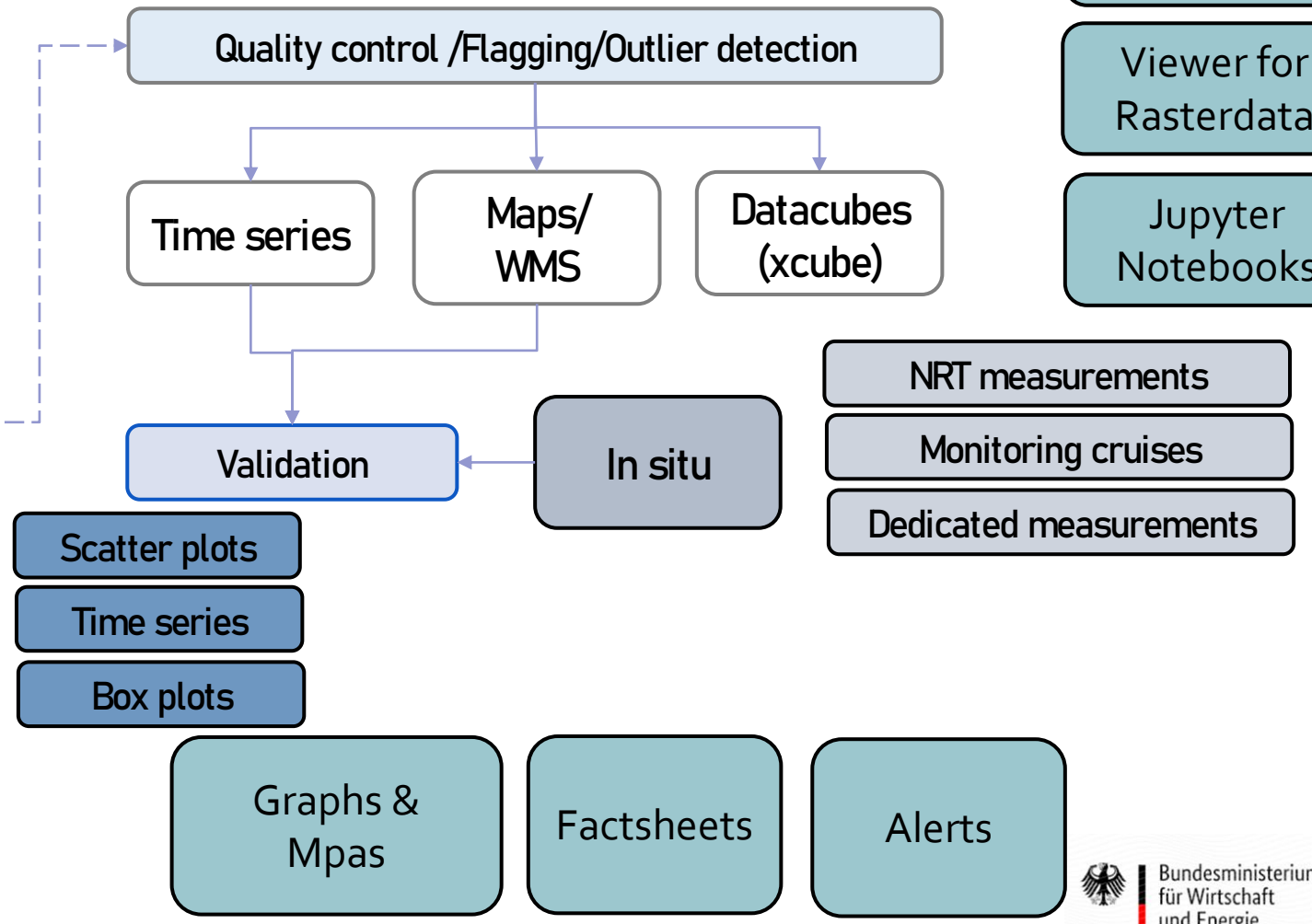
From single images to user products

Processing Calvalus

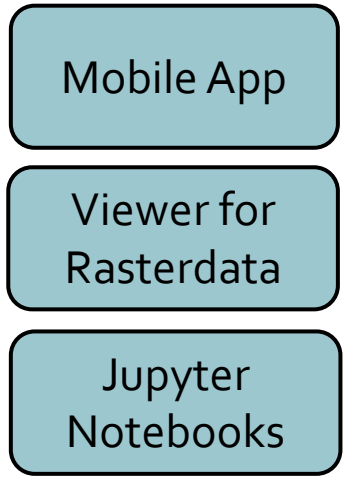


- NRT: data driven processing
- On demand processing

Product generation



Interfaces

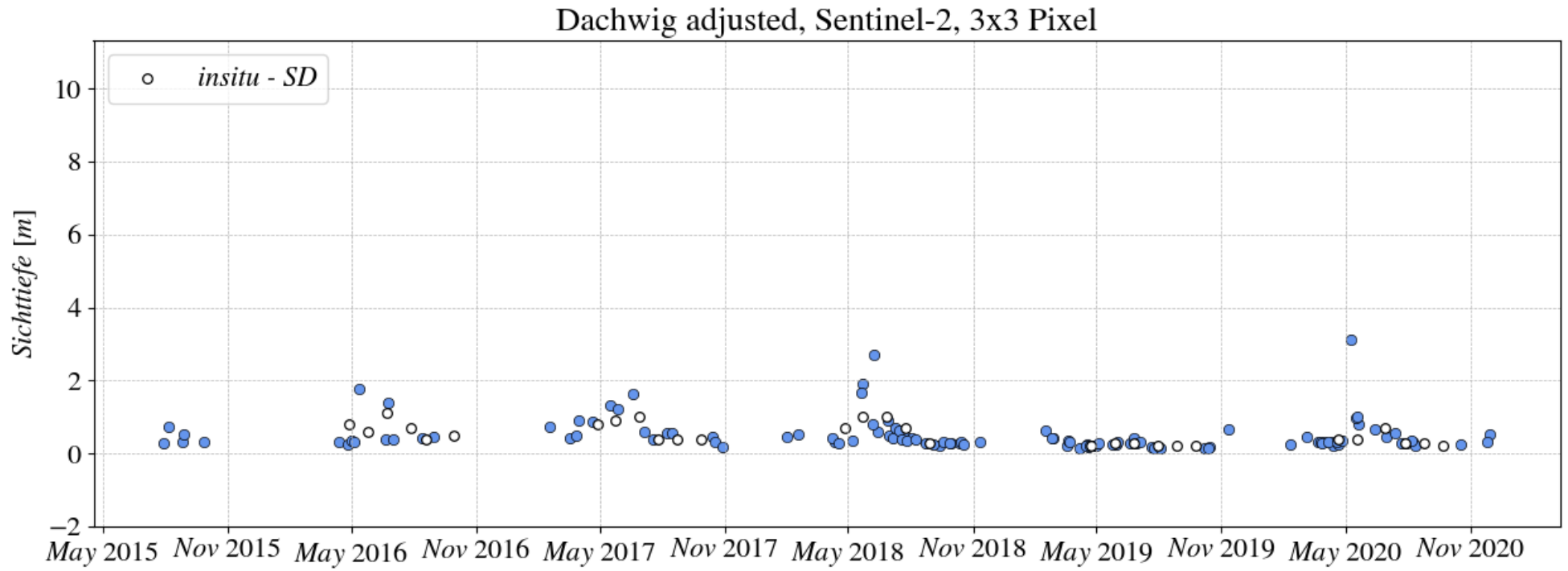


Brockmann Consult
bbe moldaenke
Bundesministerium für Wirtschaft und Energie

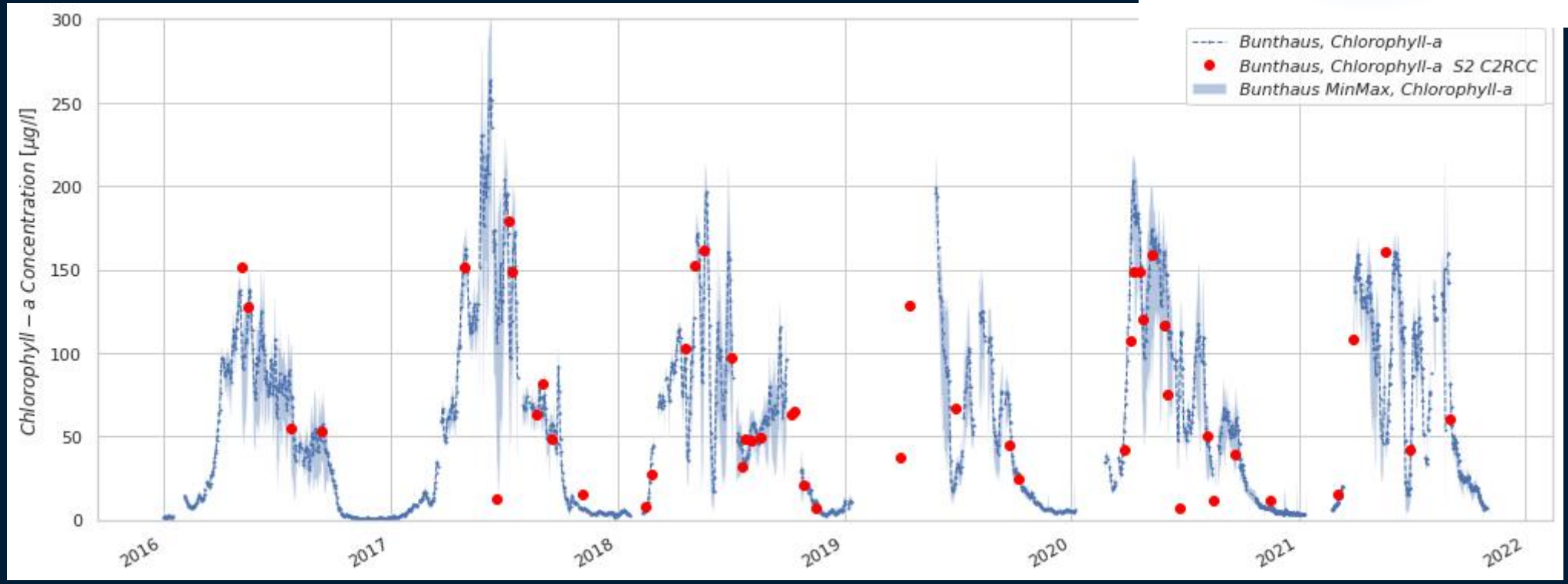
CyanoAlert Service

- Content
- Users
  - Germany, Sweden

Sichttiefe Thüringen



Time series Chlorophyll Concentration in Bunthaus (Elbe River)



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Bogen vom Scatterplot zu anderen Darstellungsformen

- Level 1 – statistics agree
- Level 2 – temporal trends agree
- Level 3 – match-ups agree

Harmonisation ?

- Consistent filtering and plotting methods
- Quality of in-situ data
  - Different sources of data
  - Diff measurement techniques
  - 15 Bundesländer = 15 different organisations, formats, metadata, depths, sampling and analysis methods