Next Generation Hyperspectral Radiometric Validation Networks for Water and Land Surface Reflectance - the HYPERNETS project

RBINS (Kevin Ruddick et al), TARTU (J. Kuusk et al)

LOV (D. Doxaran et al), NPL (A. Bialek et al), CNR (Vittorio Brando et al)

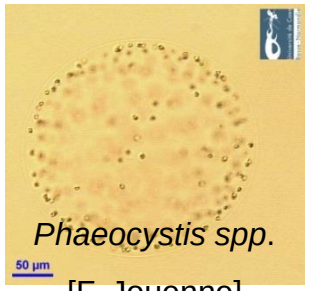
CONICET/IAFE (A. Dogliotti et al), GFZ (D. Spengler et al)

ATHENS 7-9 DECEMBER 2022

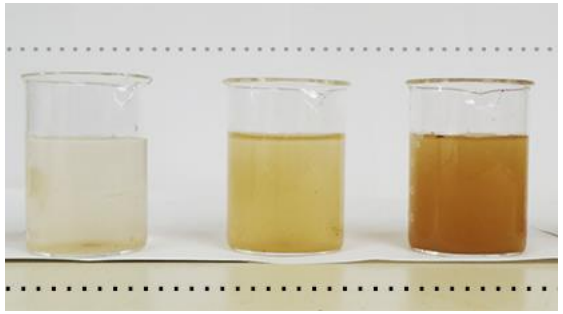
Intense near-shore algae bloom observed by Sentinel-2A/MSI in Belgian waters

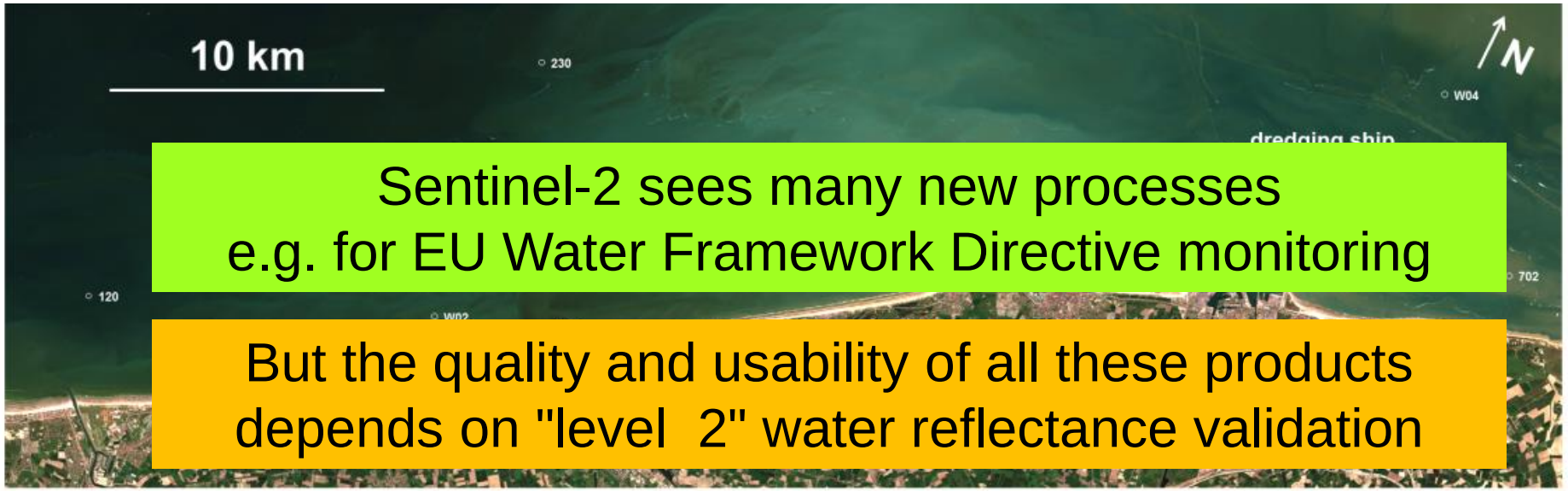
(red-edge Chl-a absorption – see Vanhellemont & Ruddick 2017)

[R. Mendes]



[F. Jouenne]





Sentinel-2 sees many new processes
e.g. for EU Water Framework Directive monitoring

But the quality and usability of all these products depends on "level 2" water reflectance validation

Figure 1 Sentinel-2A/MSI Rayleigh-corrected RGB composite of the Belgian coastal zone on 2016-05-01 (10:53 UTC). Common sampling stations are annotated.

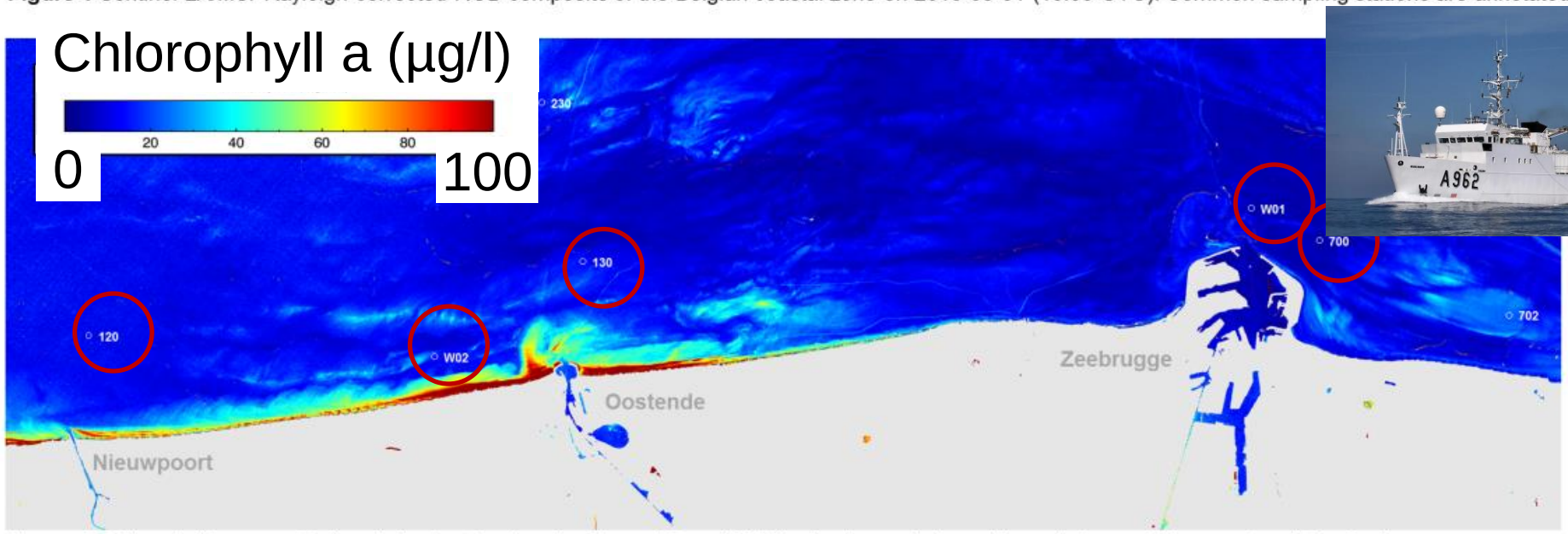
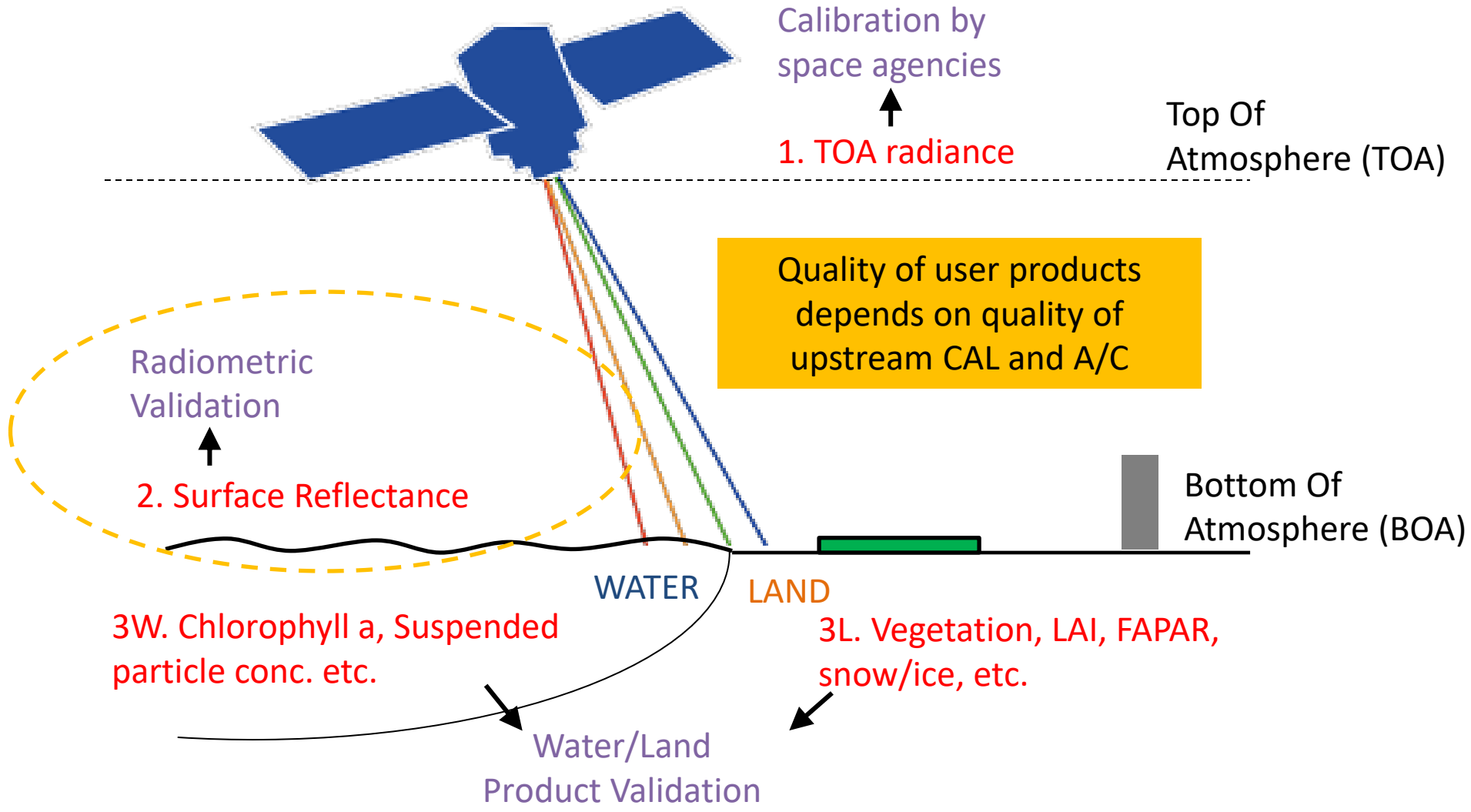


Figure 2 Chlorophyll a concentration derived using the algorithm of Gons (2005), showing an intense bloom between Nieuwpoort and Oostende

Motivation for in situ validation of water and land surface reflectance



HYPERNETS in a single slide

Automated, hyperspectral every 20 mins

INSTRUMENTS

Automated hyperspectral measurements

PANTHYR system
[Vansteenwegen et al, 2019]
400-900nm, 10nm FWHM

HYPSTAR® system
[https://hypstar.eu/]
380-1700nm, 3-10nm FWHM

NETWORK

RBINS (BE, coordinator)
+ VLIZ (BE), CNR (IT), LOV (FR),
NPL (UK), GFZ (D), TARTU (ES),
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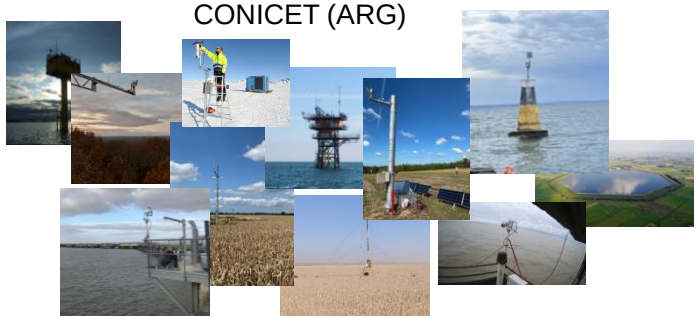
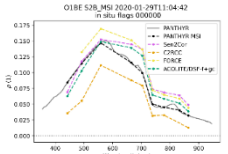
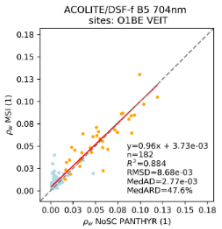


12 water and 12 land sites by Dec 2022
Many international requests to join in 2023 ...

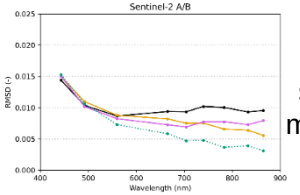
DATA PROCESSING and ANALYSIS



e.g. one matchup



one band (S2/704nm), many matchups



spectral stats, many matchups

Prototype network has provided validation data and information to:

Sentinel-2A&B, Sentinel-3A&B/OLCI, Landsat-8&9, Planetscope Doves, PRISMA, Pléiades, ENMAP, MODIS-A&T, VIIRS-1&2, Planetscope/Superdoves, ...

and preparing for:

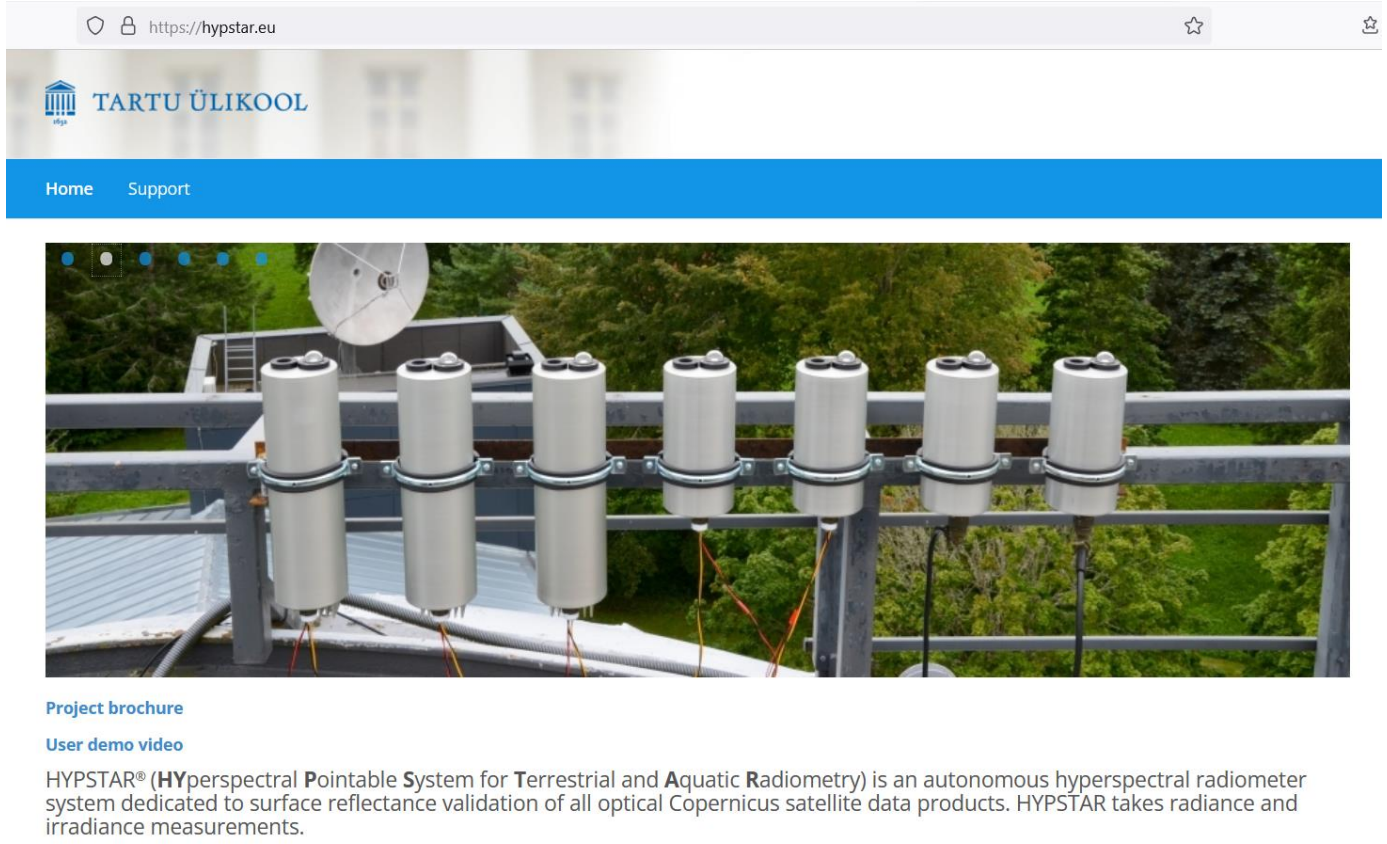
MTG, CHIME, PACE, GLIMR, SBG, PROBAV-CC, various Newspace, ..., AUS/Aquawatch

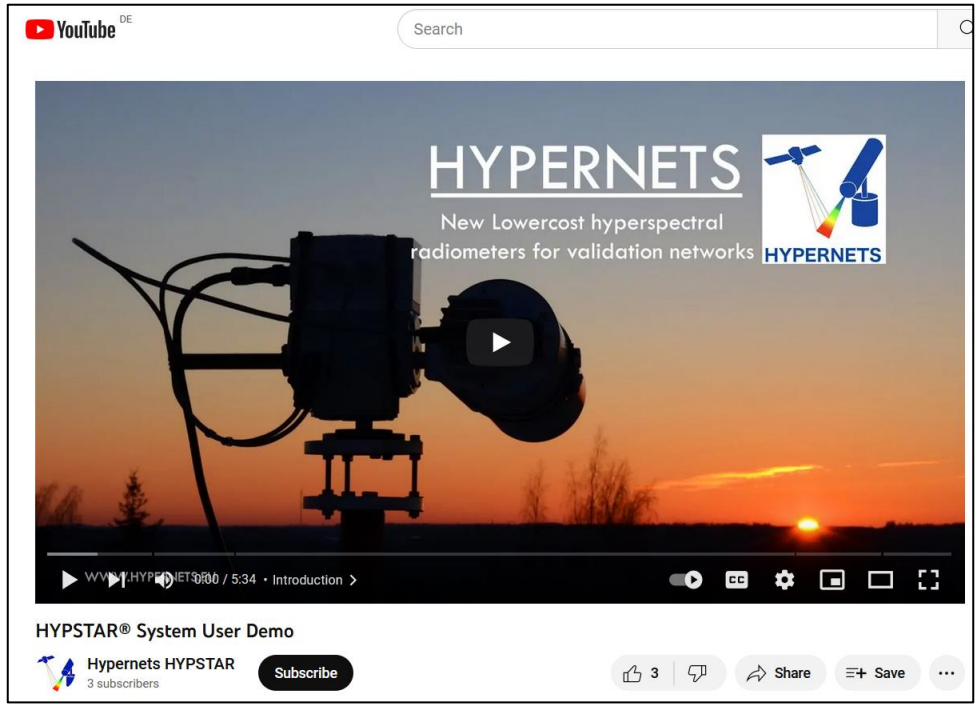
OBJECTIVE: To validate **all** VIS/NIR spectral bands (400-1700nm, @3nm FWHM) for **all** satellite missions measuring water or land surface reflectance

HYPSTAR® instrument

HYPSTAR® spin-off company will commercialise instrument from May 2023

User demo video
https://www.youtube.com/watch?v=dfUAPYxg5Cc





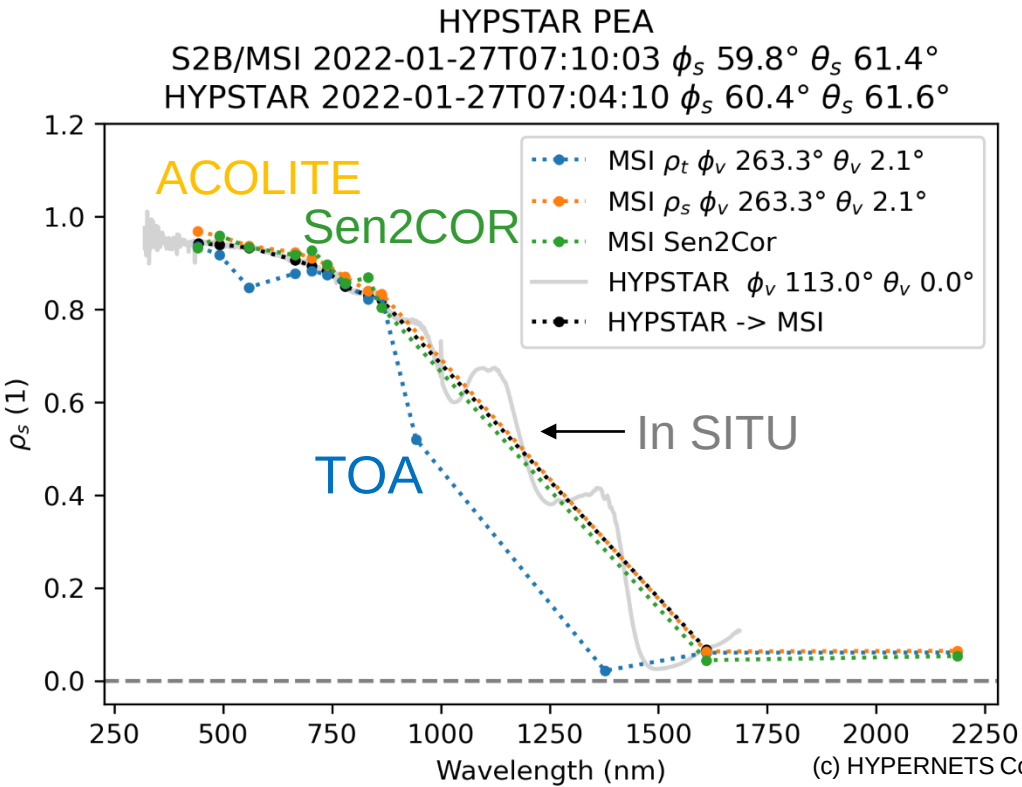
[www.hypstar.eu]

FOLLOW US on https://twitter.com/Hypernets_H2020 !

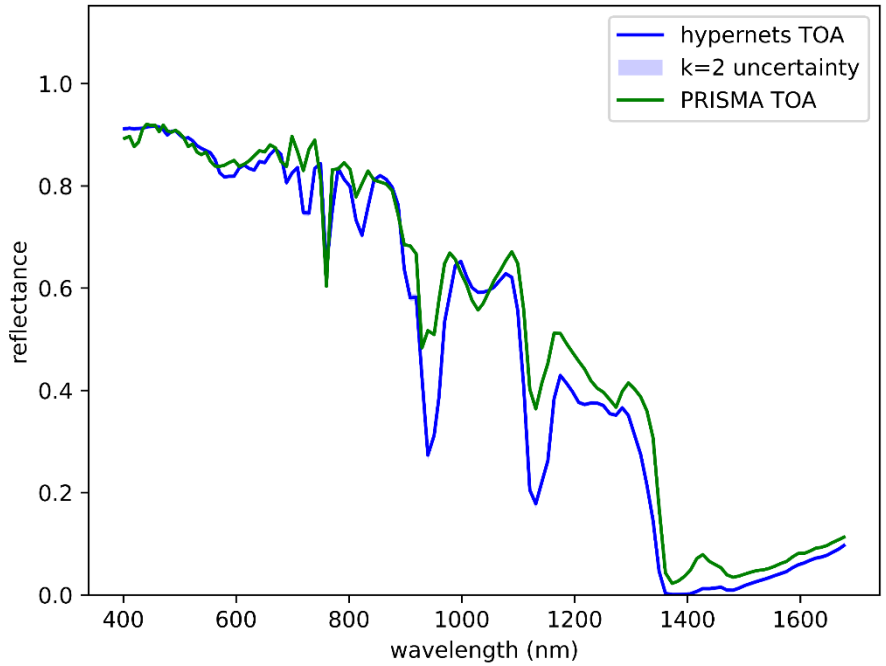
BE Antarctica base (IPF) - example matchup, HYPSTAR® prototype

Good site for snow properties, HDRF, cloud detection over snow, vcal, user interest ...

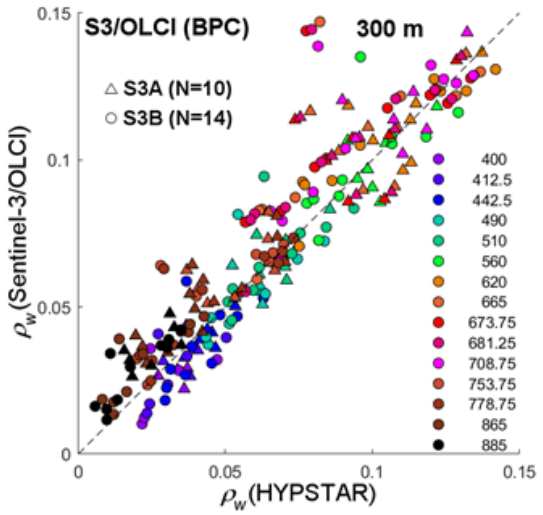
Sentinel-2 validation



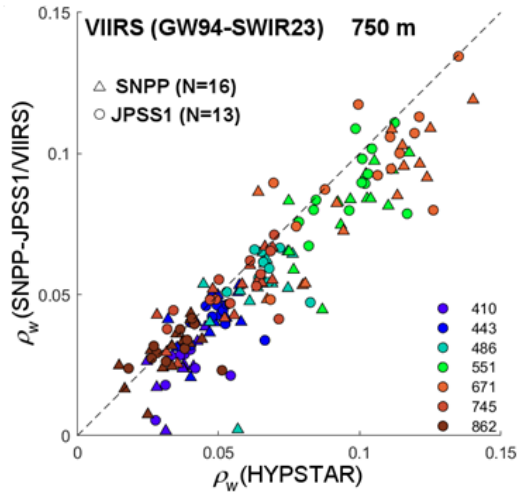
PRISMA TOA calibration

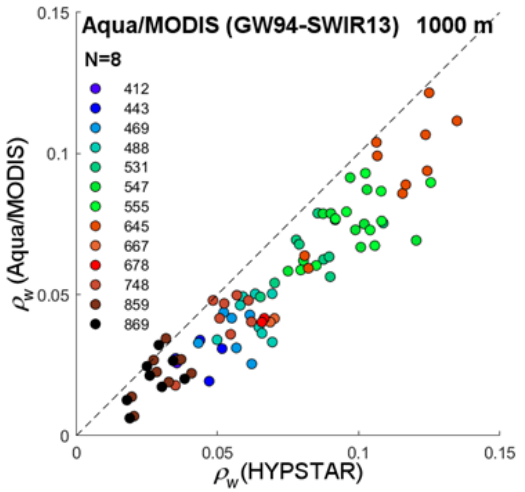


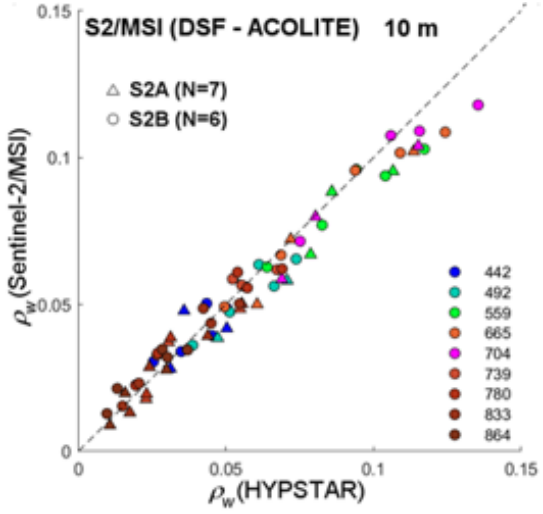
One site validating 9 missions (S2VT/Mar 2022) ...

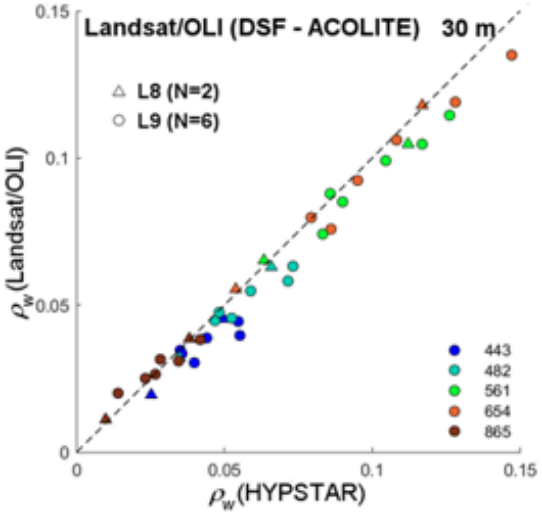


La Plata
[CONICET/A.Dogliotti]





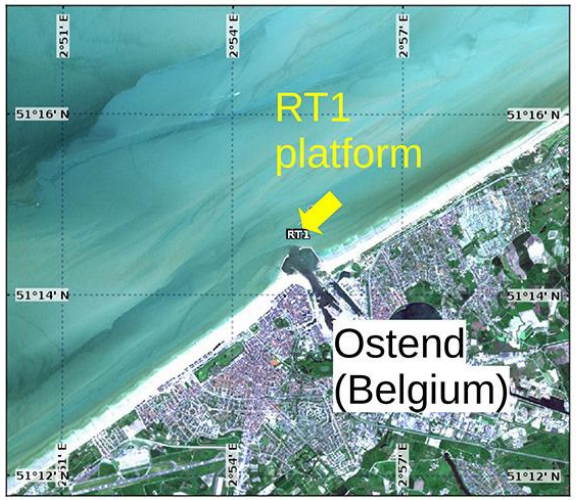




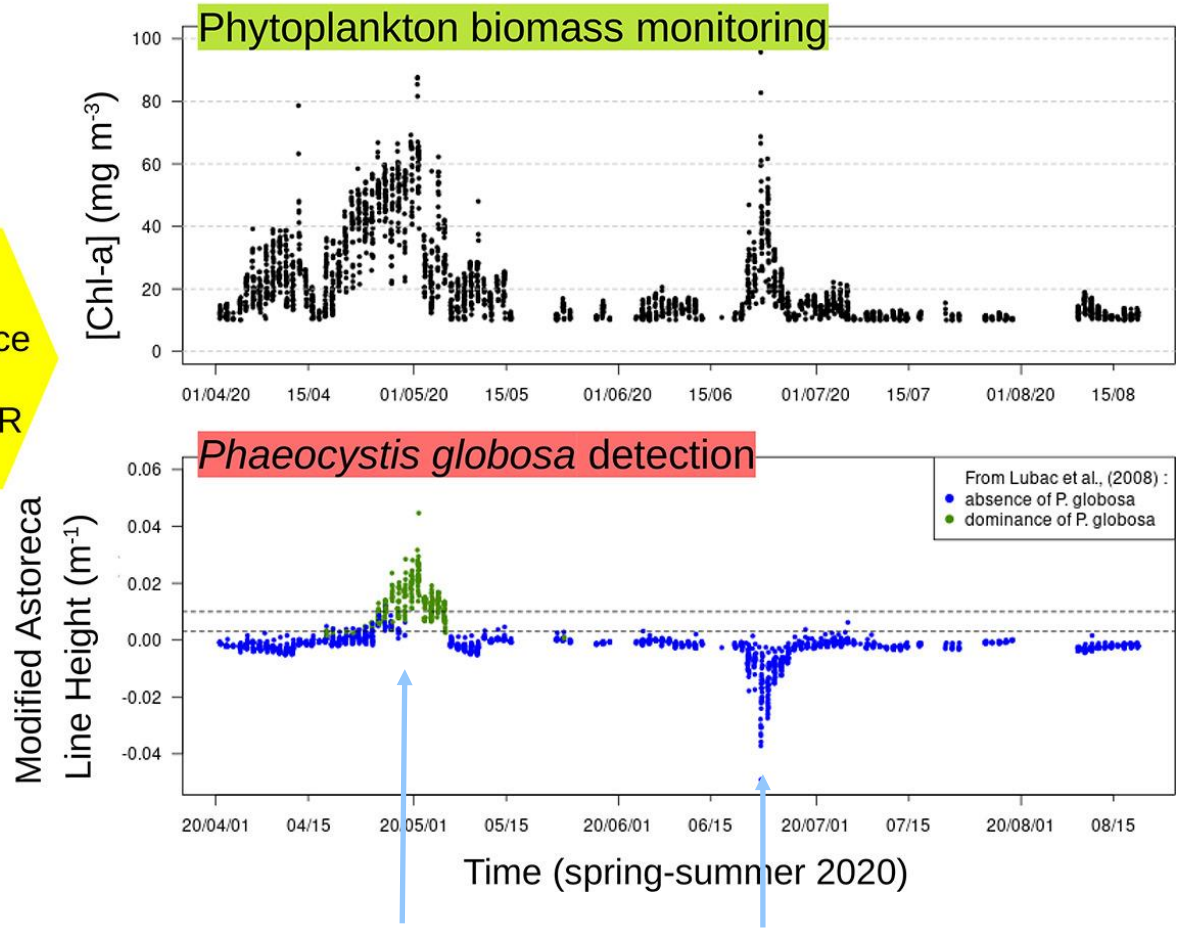
"One month of automated HYPSTAR® = 5 years of shipborne matchups"

BONUS: hyperspectral radiometry is not just sat val

Hyperspectral autonomous radiometer system (PANTHYR) on RT1 platform



Water reflectance from PANTHYR



Spring bloom (*Phaeocystis globosa*)

Summer bloom (not *Phaeocystsis*)

+ instrument can also be useful for photovoltaic industry ...

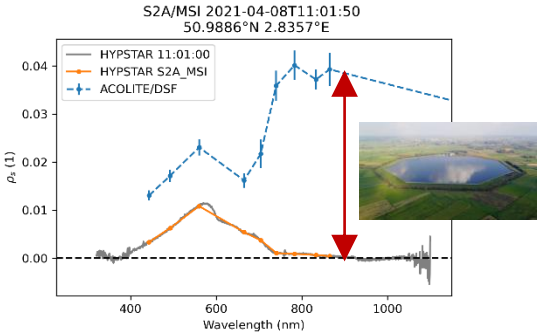
[Lavigne et al, 2022; https://doi.org/10.1016/j.rse.2022.113270]

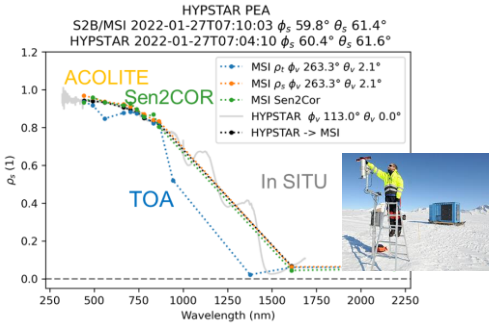
Conclusions

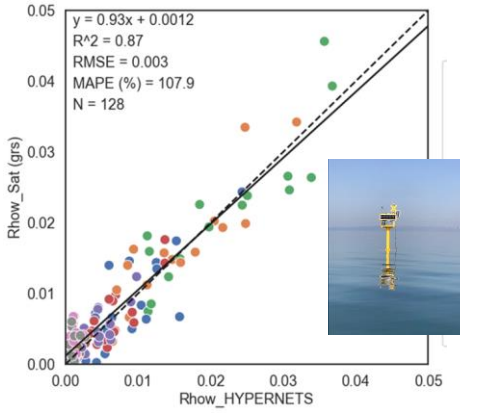
- Surface reflectance data is essential for water and land product validation
- Autonomous hyperspectral network is most cost-effective (multi-mission context)
- Zenith- and azimuth-pointing advantageous
- Useful for other applications (not just sat val) ...
- **Early prototype HYPSTAR® data looks very useful ...**

- Diverse water and land HYPERNETS validation sites should provide good basis for validation of S2A&B (and L8&9 and S3A&B and CHIME and PRISMA and ENMAP and NewSpace and ...)

- Integration within GEO: already well-integrated in many sat mission validations plans (inc NASA/PACE, DLR/ENMAP, ESA/CHIME, AUS/Aquawatch?)
- HYPSTAR® instrument and networks sustainable post-project...







Any questions?

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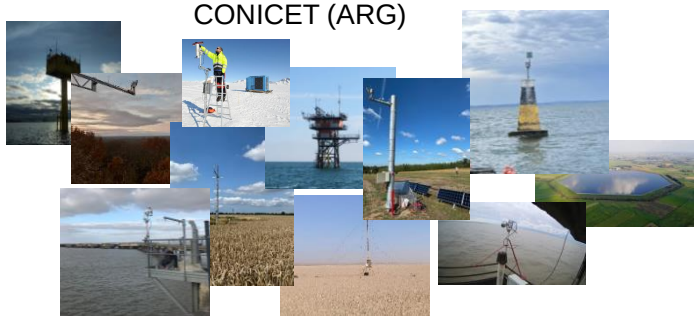

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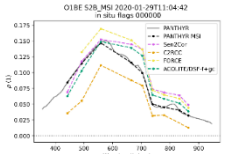

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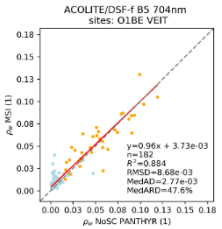

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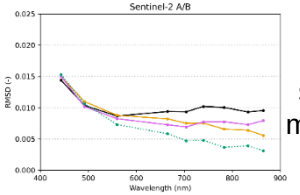

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