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TAKING THE PULSE OF OUR PLANET FROM SPACE

Plastic Litter Project (PLP) 2021 – calibration and validation data for Sentinel-2 floating marine litter remote detection

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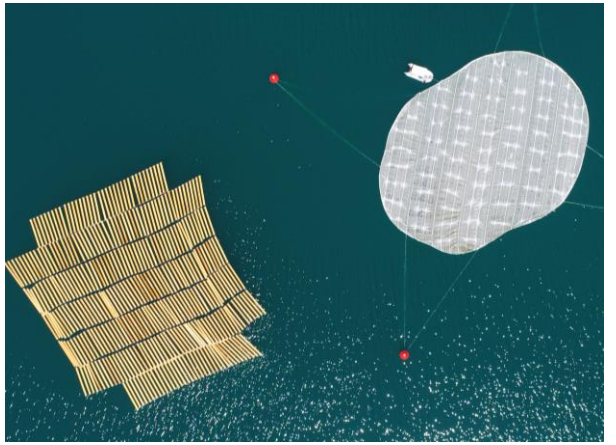
Plastic Litter Projects – Timeline

PLP 2018

PLP 2019

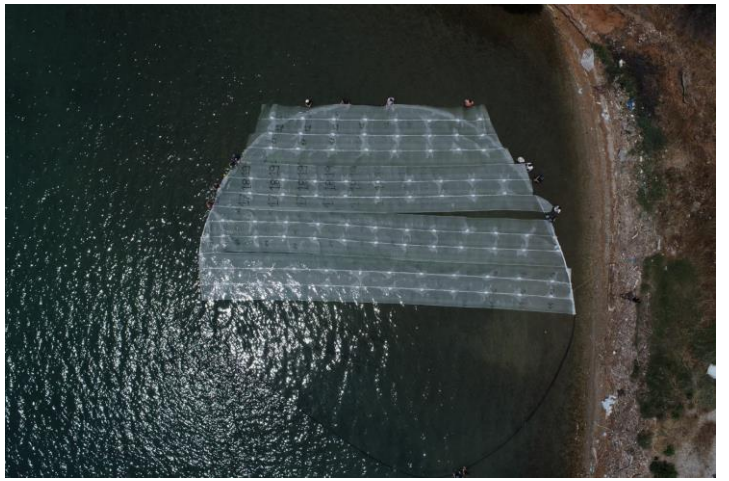
PLP 2020

PLP 2021



PLP2021 – target construction

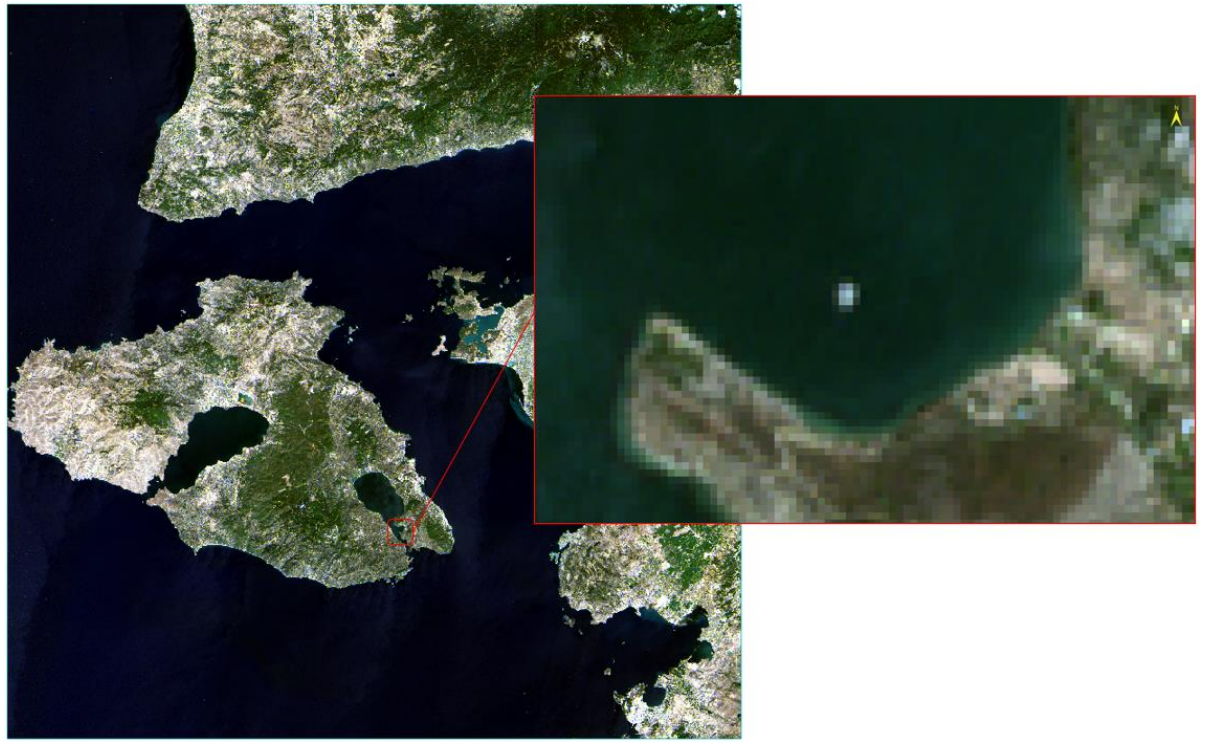
HDPE mesh target



Wooden planks target

PLP2021 – spectral analysis

- 10x10 m Sentinel-2 pixel fully covered by target materials
- Abundance fraction at 30-35% for HDPE mesh (adjacency effects)
- Effect of environmental variables on FML spectral response: biofouling, submersion depth



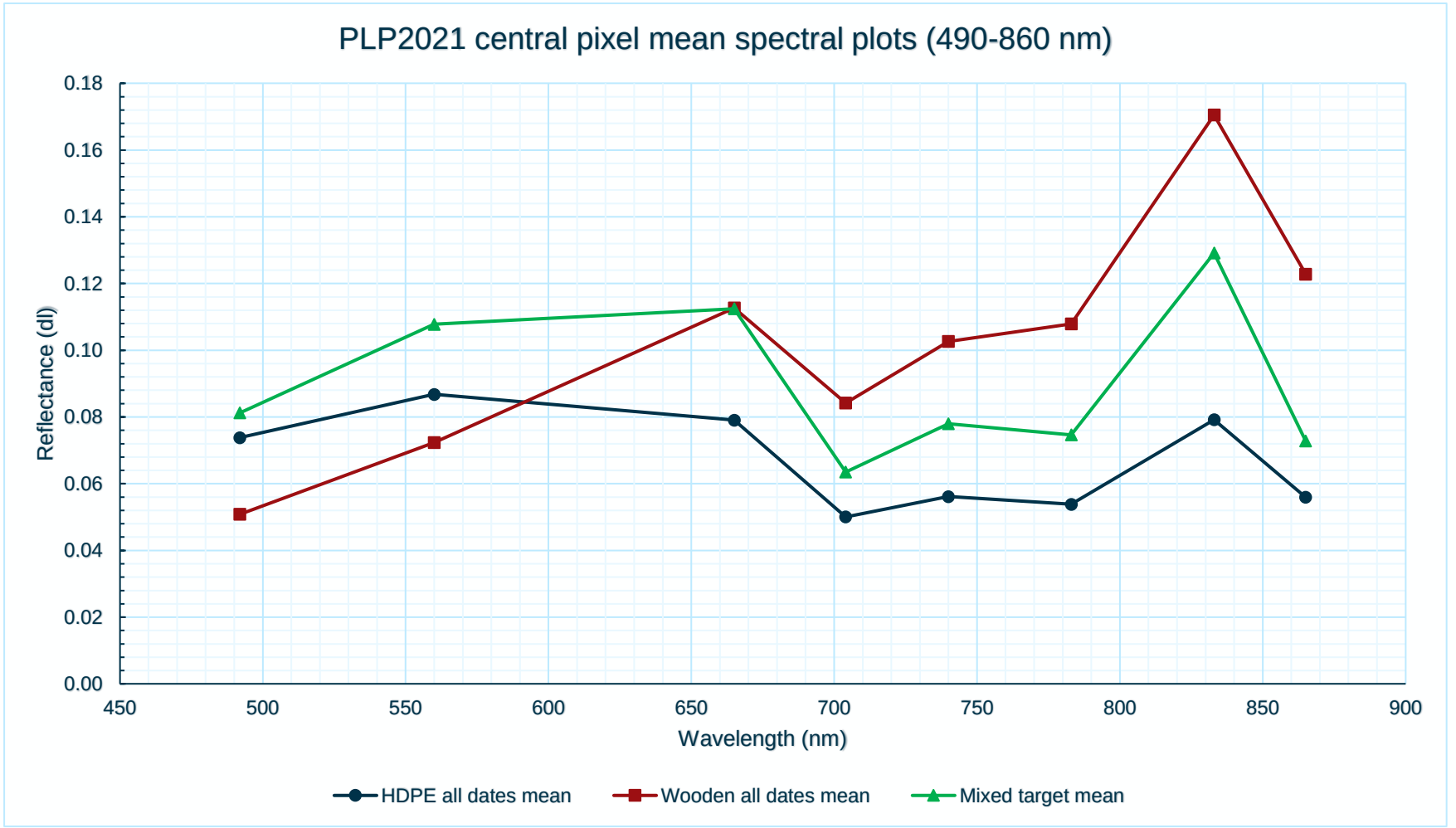
PLP2021 – data overview

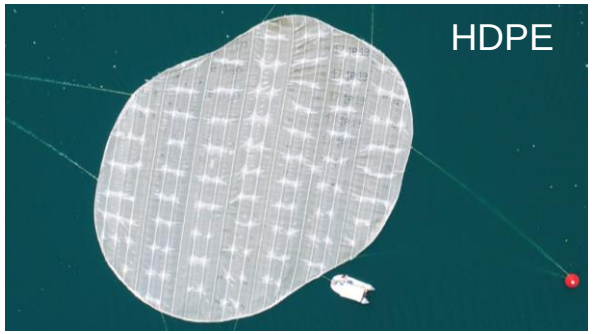
- 4-month data acquisition campaign
- 22 cloud free Sentinel-2 images – about 500 validated 10x10 m pixels
- 3 VHR hyper-spectral images (400-1000 nm)
- *In situ* spectrometer measurements (400-900 nm)
- VHR RGB images
- Ancillary data – turbidity, wind speed, light intensity

PLP2021 ancillary data log

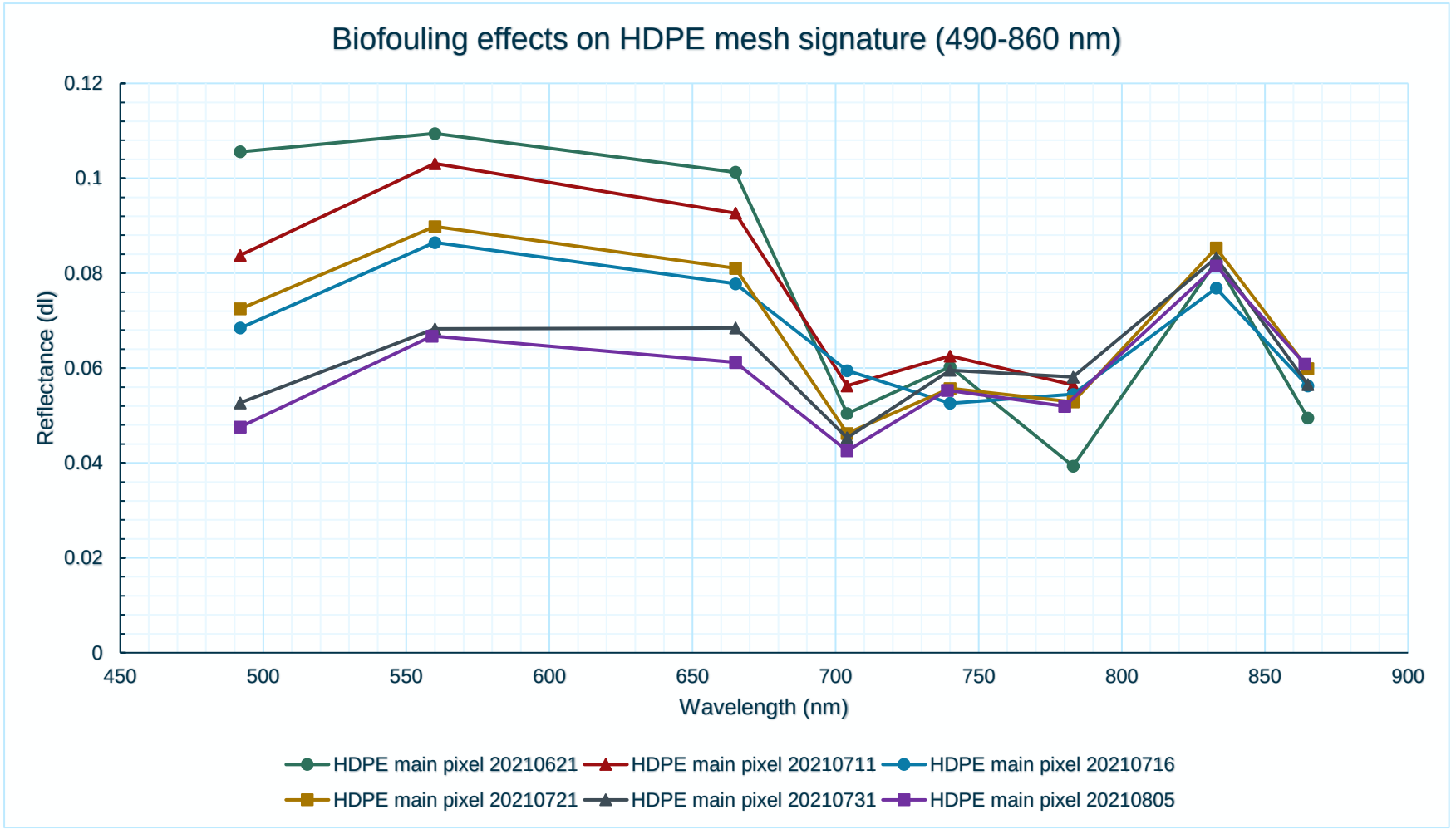
Date	State	Biofouling	Wind	Turbidity
20210611	floating	no	low	-
20210621	floating	no	no	8m
20210626	floating	no	no	-
20210701	floating	no	low	8.5m
20210706	floating	low	no	8m
20210711	floating	mid	high	6.8m
20210716	floating	mid	no	8m
20210721	floating	mid/high	low	8m
20210726	floating	mid/high	high	6.8m
20210731	floating	high	no	8m
20210805	floating	high	no	8m
20210810	floating	high	low	8m
20210815	submerged	high	-	-
20210820	submerged	high	mid	4m d.o.
20210825	part sub	high	no	4.7m d.o.
20210830	part sub	low	low	4.8m d.o.
20210904	mix floating	low	mid	-
20210909	mix part sub	mid	mid	-
20210914	mix mostly sub	mid	high	5m
20210919	mix mostly sub	mid	mid	7m
20210924	mostly submerged	mid/high		-
20211004	mostly submerged	high	high	-

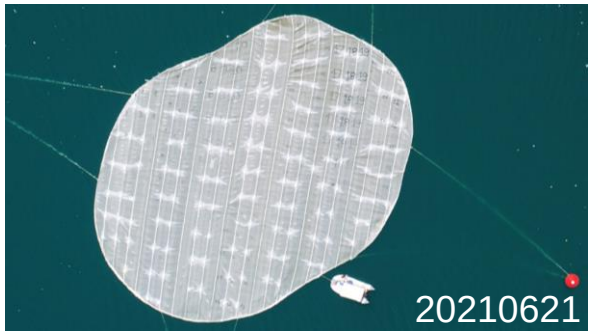
PLP2021 – spectral analysis

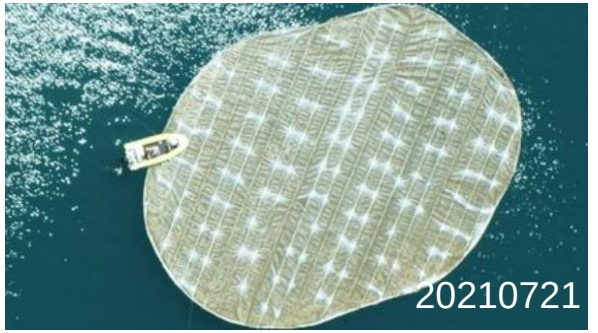


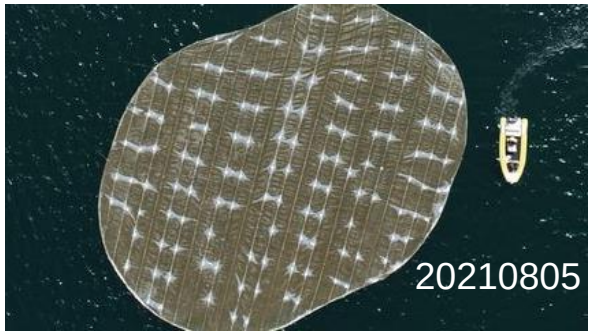


PLP2021 – spectral analysis: biofouling

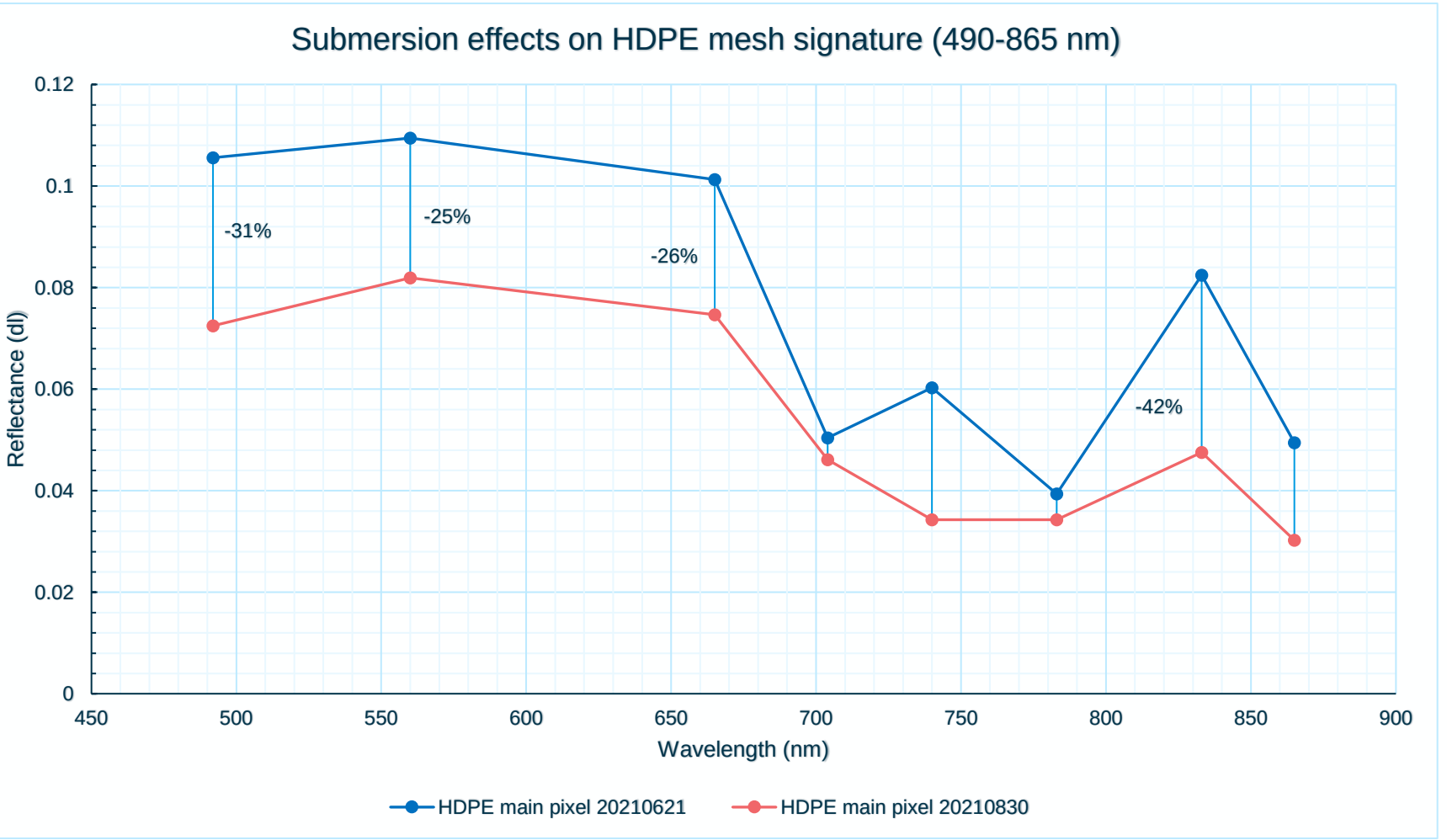




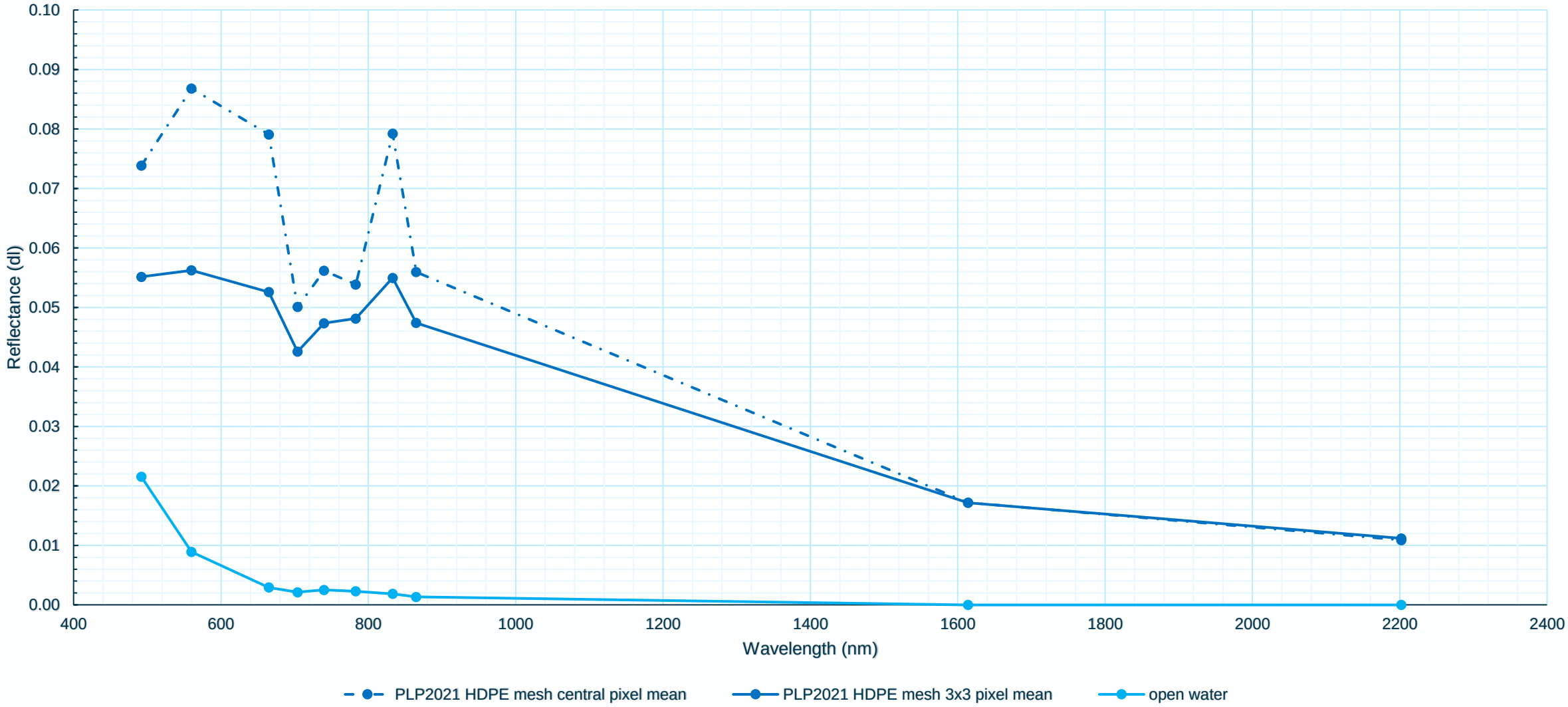




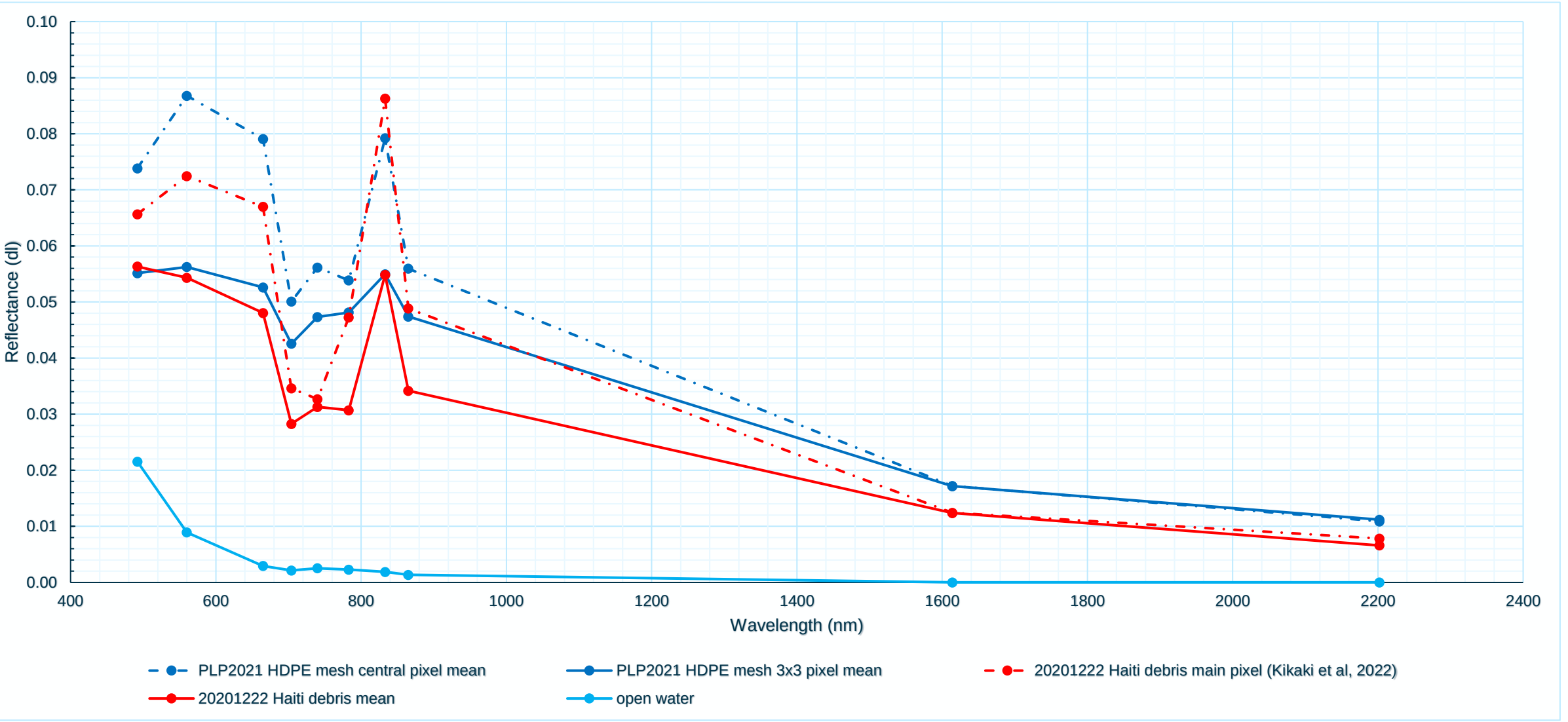
PLP2021 – spectral analysis: submersion effects



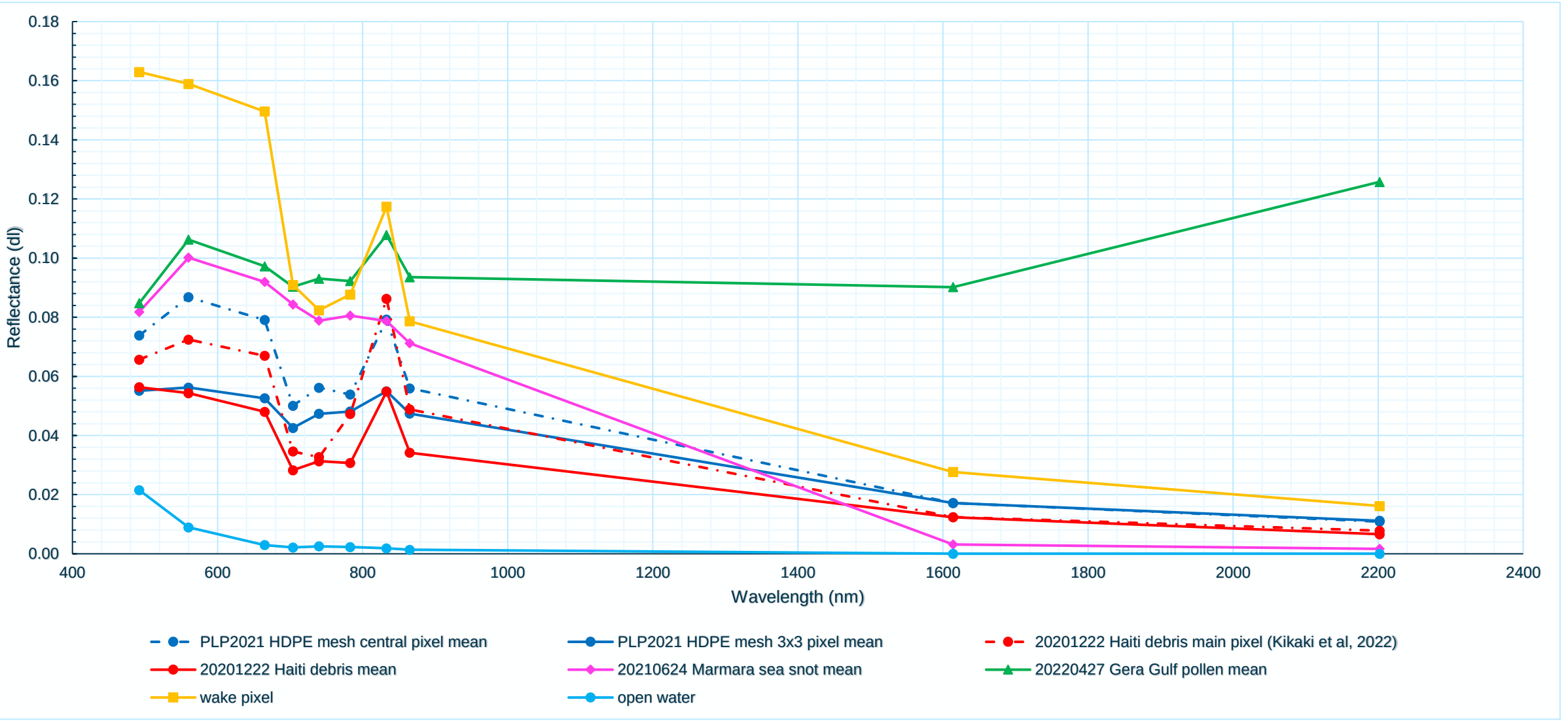
PLP2021 – spectral analysis



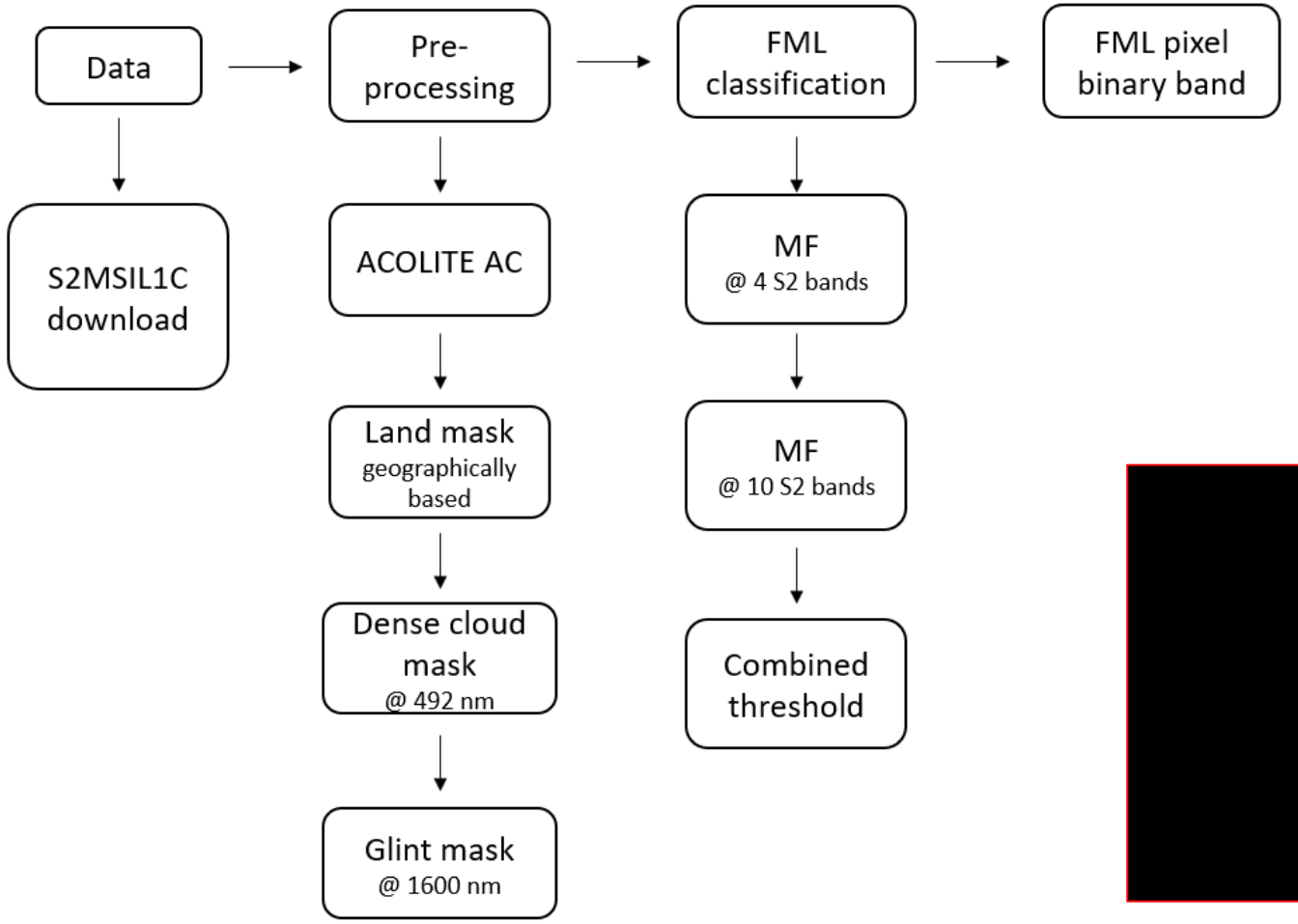
PLP2021 – spectral analysis

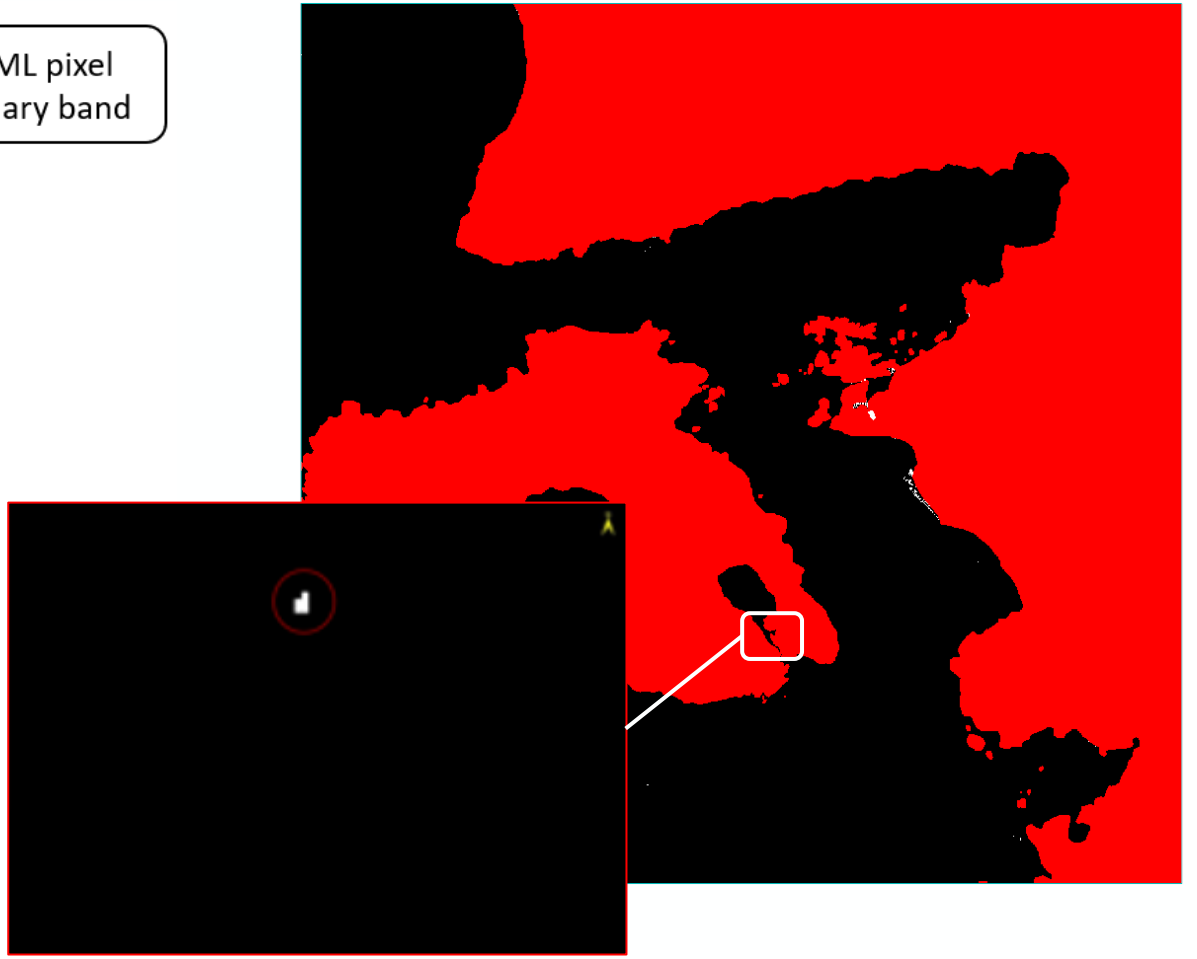


PLP2021 – spectral analysis

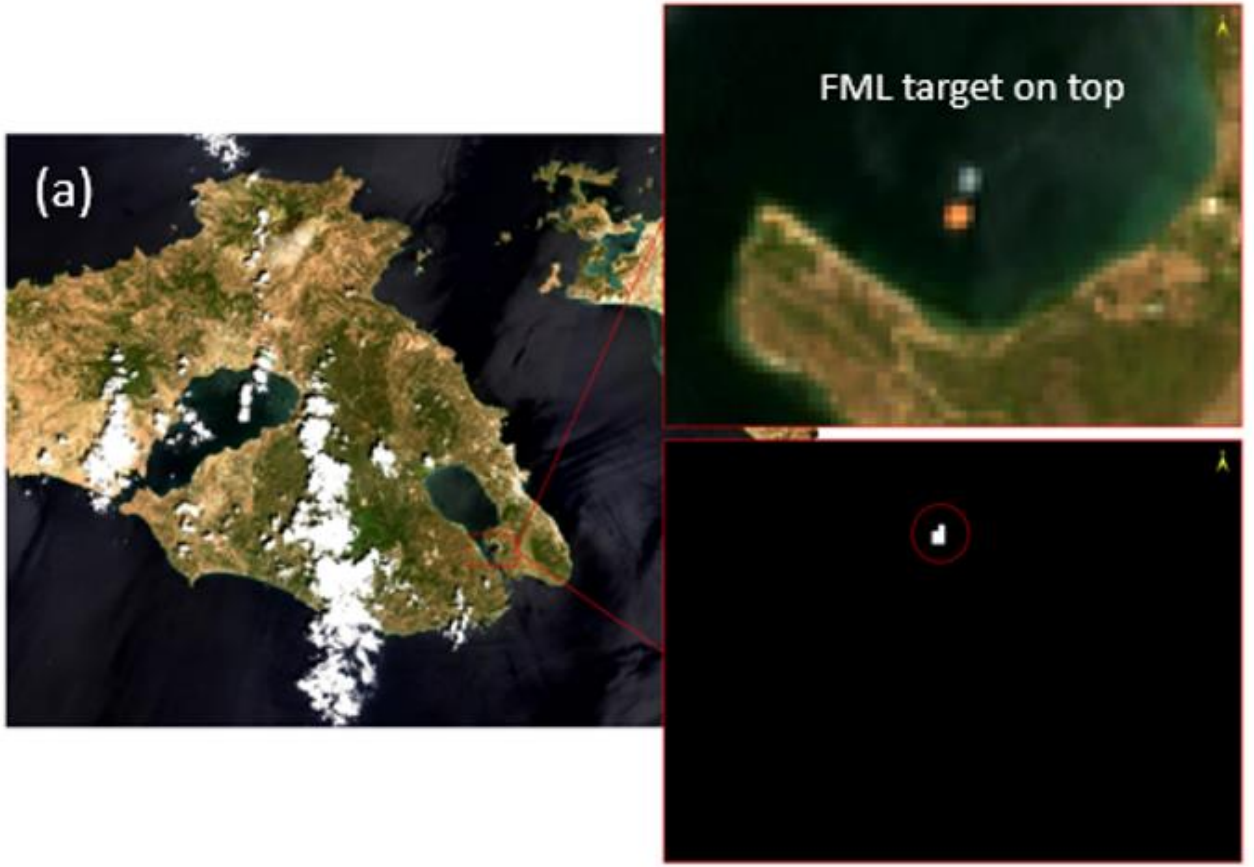


FML detection

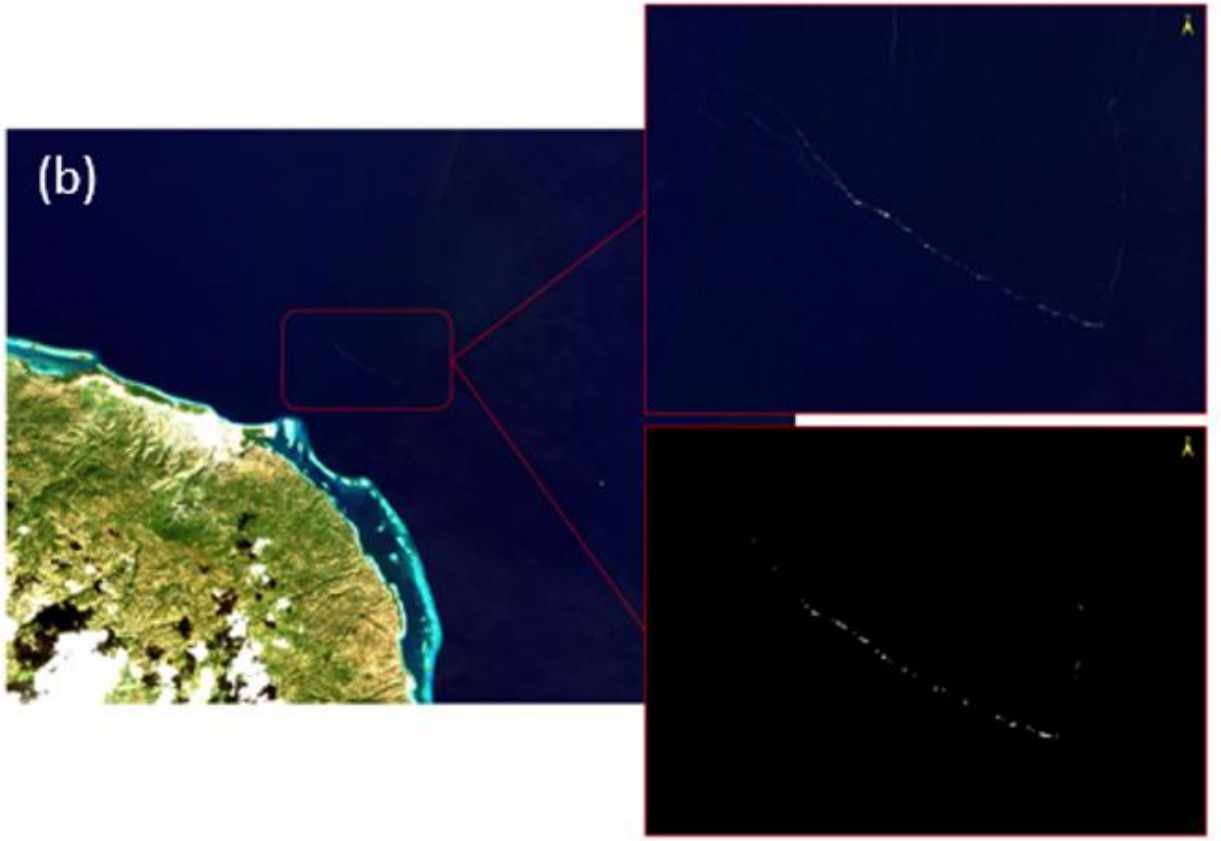




FML detection



PLP2021 targets, Gulf of Gera, Lesvos, 26/06/2021



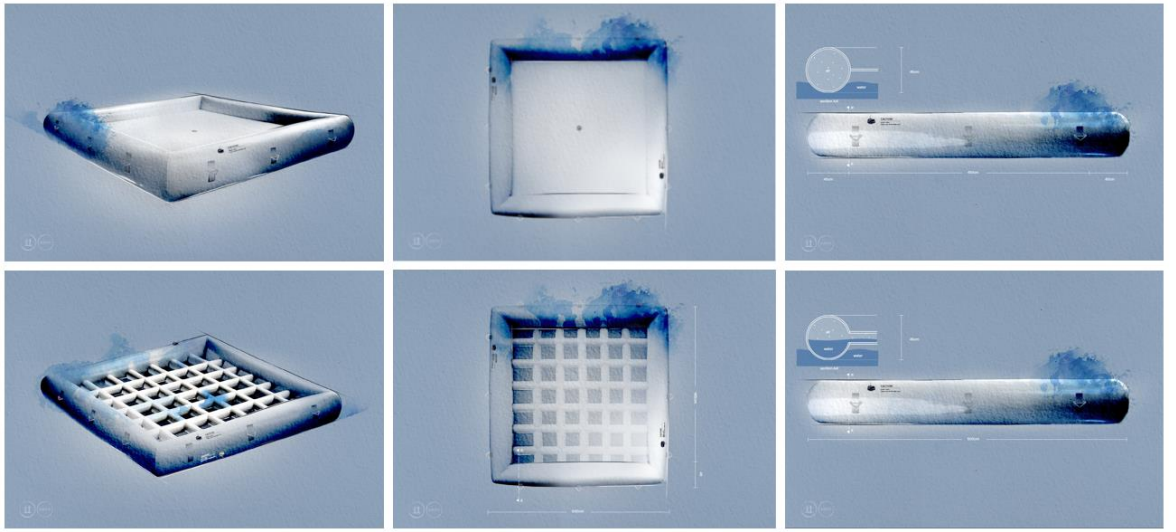
La Gonave Island, Haiti, 22/12/2020 (Source: Kikaki et al, 2022)

Main conclusions and PLP2022

- Biofouling mainly affects RGB part of signal in terms of magnitude but not shape
- Submersion affects magnitude but not shape of FML response throughout the electromagnetic spectrum
- SWIR useful for the exclusion of certain surface features e.g. pollen
- FML detection through MF feasible for accumulations lower than 20% in a 10x10 m pixel under reasonable conditions

PLP2022:

- Investigation of theoretical minimum detectable FML abundance fraction for the S2 MSI (Hu, 2021)
- Same tile, same date simultaneous acquisitions for turbid vs. open water comparison
- Inflatable, reusable targets deployment



Thank you for you attention!

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