



**GHENT
UNIVERSITY**

EVALUATION OF PLASTIC DETECTION ALGORITHMS OVER LAND AND WATER

Hyperspectral laboratory and airborne data



Remote Sensing
of Marine Litter
Workshop 2023

16 - 17 October 2023



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PUBLICATION

Remote Sensing of Environment 298 (2023) 113834



Contents lists available at [ScienceDirect](#)

Remote Sensing of Environment

journal homepage: www.elsevier.com/locate/rse



Evaluation of historic and new detection algorithms for different types of plastics over land and water from hyperspectral data and imagery

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BACKGROUND AND MOTIVATION

Marine Conservation Society

Published remote detection methods for macroplastics...

...however, further work needed on:

- Performance in different settings.
- Consistency across datasets.
- Performance over water.
- Performances over different plastics.



Daily Mail

- *Reflectance database of diverse materials.*
- *Airborne hyperspectral imagery over land and water.*

PUBLISHED INDEXES

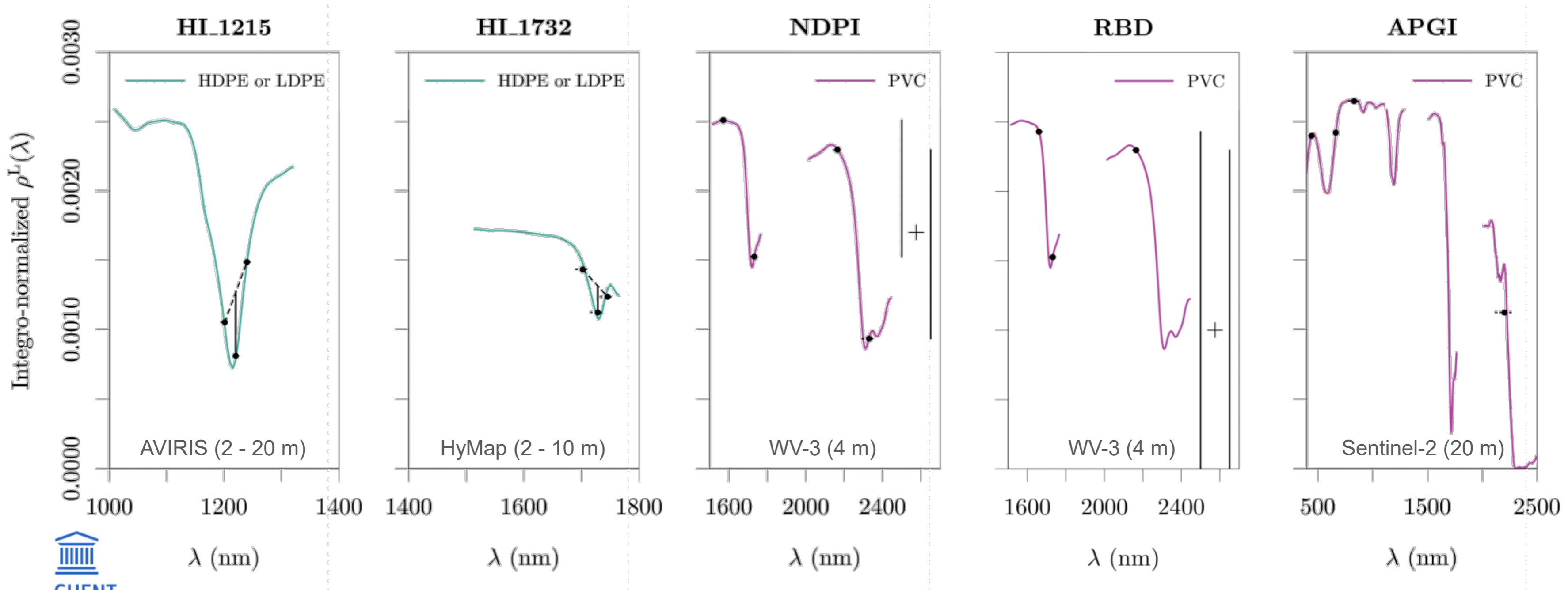
[Garaba & Dierssen \(2018\)](#)

[Kühn et al. \(2004\)](#)

[Guo & Li \(2020\)](#)

[Asadzadeh & Souza Filho \(2016\)](#)

[Zhang et al. \(2022\)](#)



COMPILED DATASET

[Knaeps et al. \(2020\)](#)

[Garaba & Dierssen \(2017\)](#)

PP
(1)



PVC
(6)



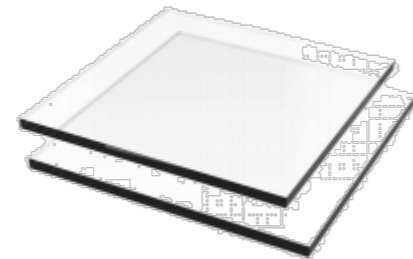
PTFE
(1)



PET
(6)



PMMA
(1)



Mixed
(7)

HDPE
(17)



ABS
(2)



PA
(2)



PS
(1)



LDPE
(6)



COMPILED DATASET



Metal



Concrete



Brick



Wood



Fabric



Fiberglass



Sargassum



Ulva



Artemia cysts



Ice



Whitecaps

[*Knaeps et al. \(2021\)*](#)

[*Kokaly et al. \(2017\)*](#)

[*Wang et al. \(2018\)*](#)

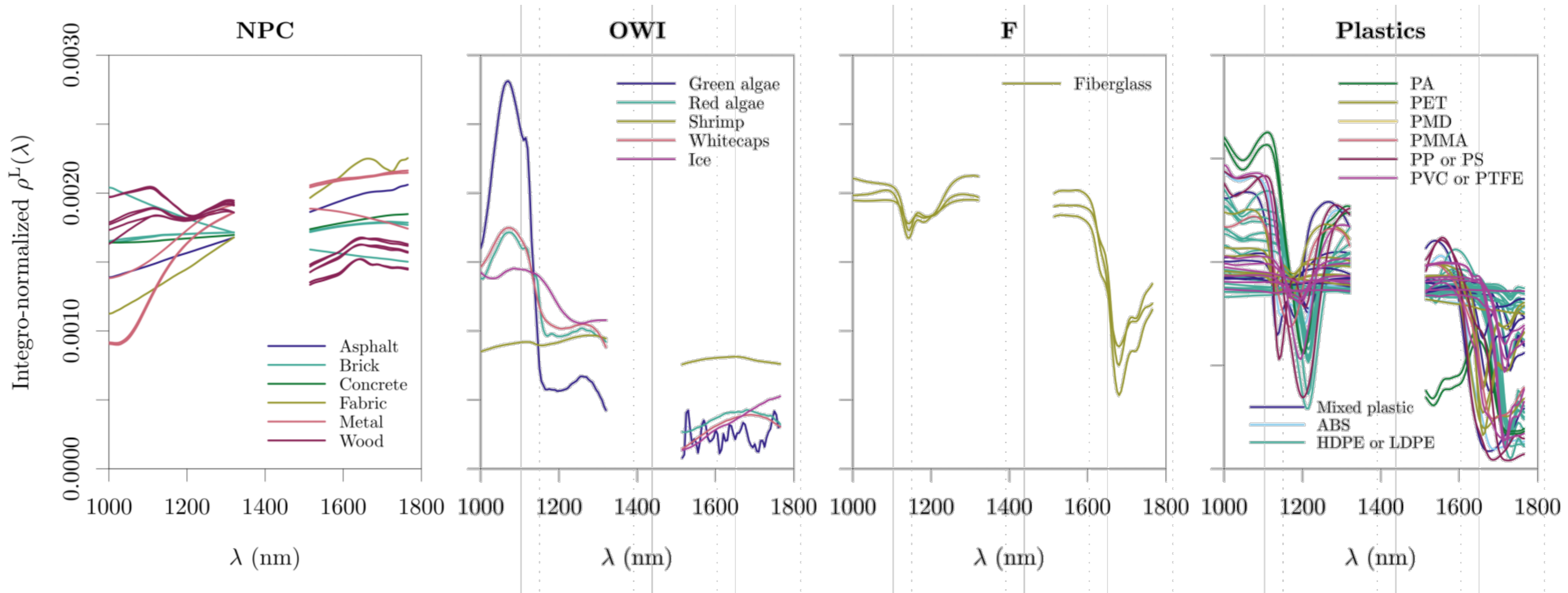
[*Khan et al. \(2017\)*](#)

[*Dierssen \(2019\)*](#)

[*Hu et al. \(2017\)*](#)

[*Qi et al. \(2021\)*](#)

COMPILED DATASET



COMPILED DATASET

Type I:

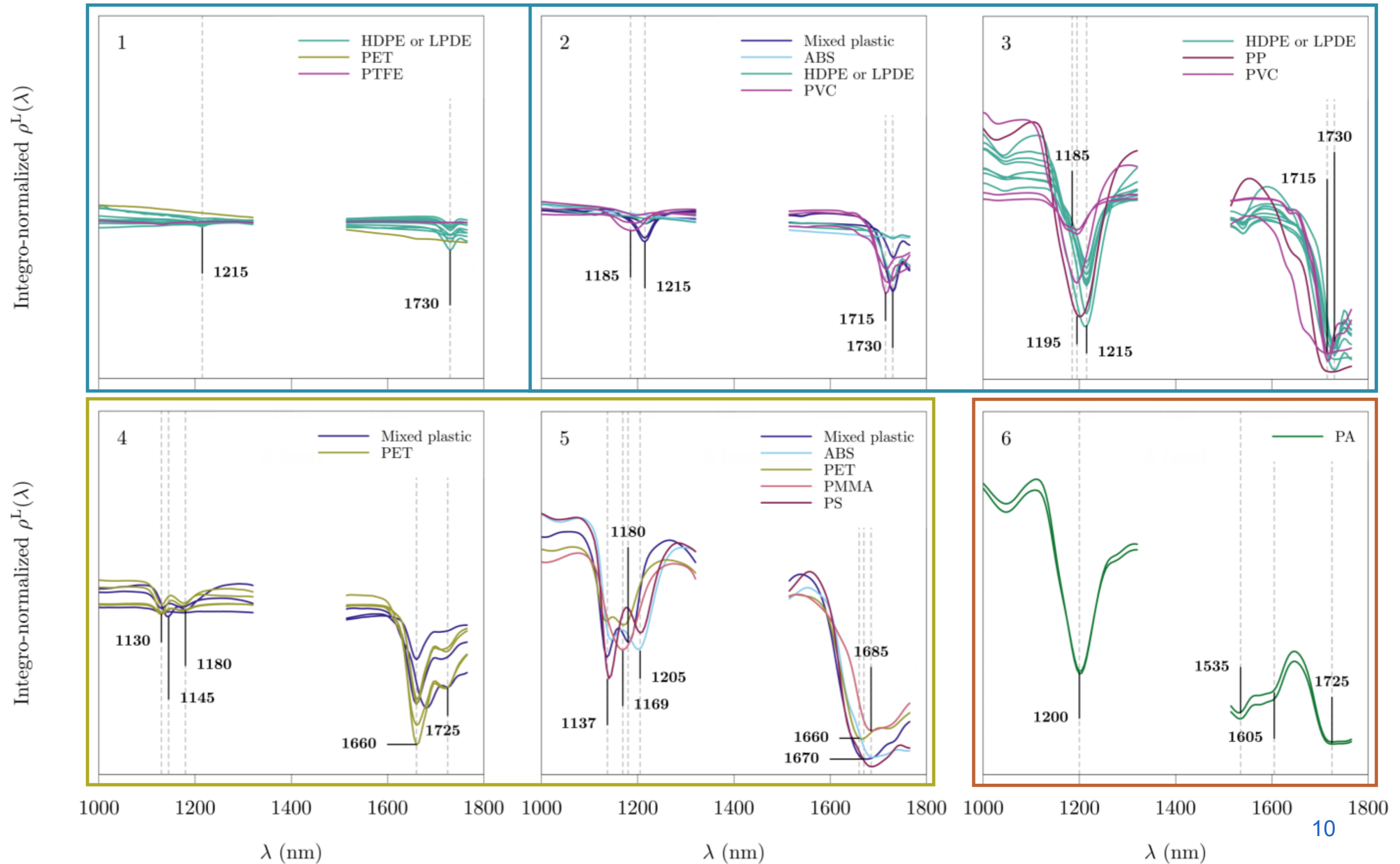
- LDPE
- HDPE
- PVC
- *PA*

Type II:

- PET

Type III:

- PA



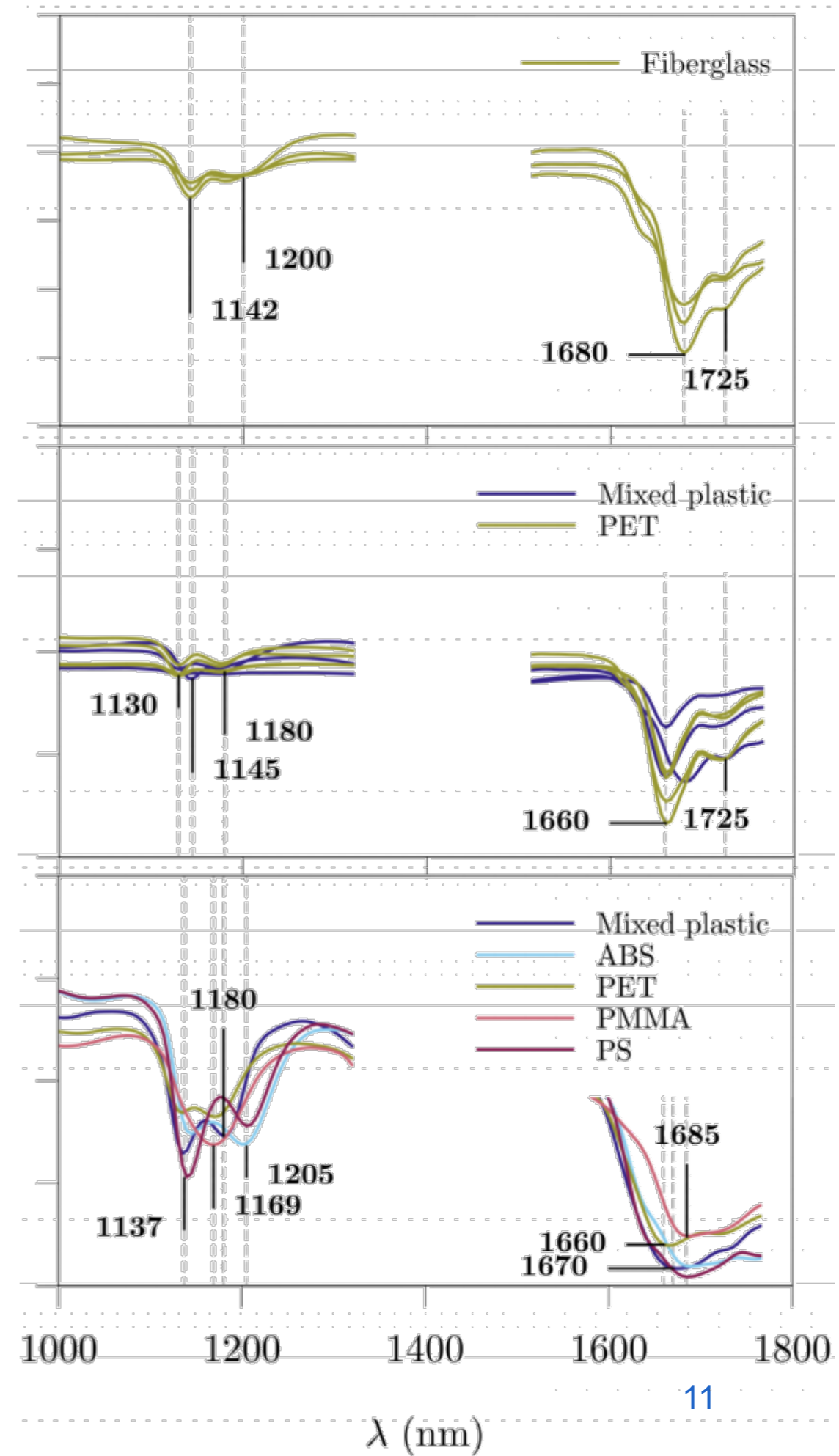
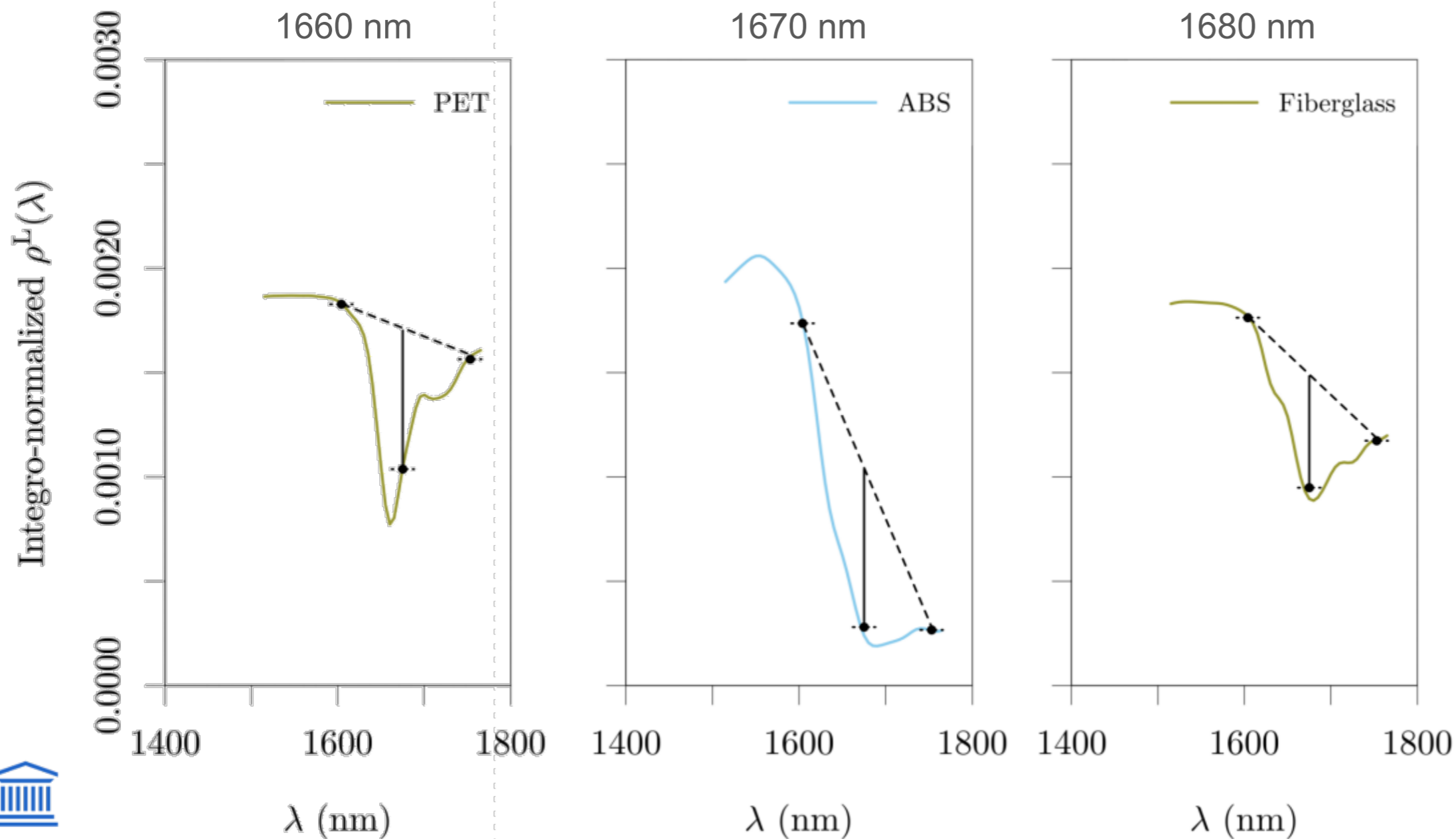
NEW INDEX: HI 1675

1604 (20)

1675 (20)

1753 (20)

$$(1675 - 1604) \frac{\rho^L(1753) - \rho^L(1604)}{1753 - 1604} + \rho^L(1604) - \rho^L(1675)$$

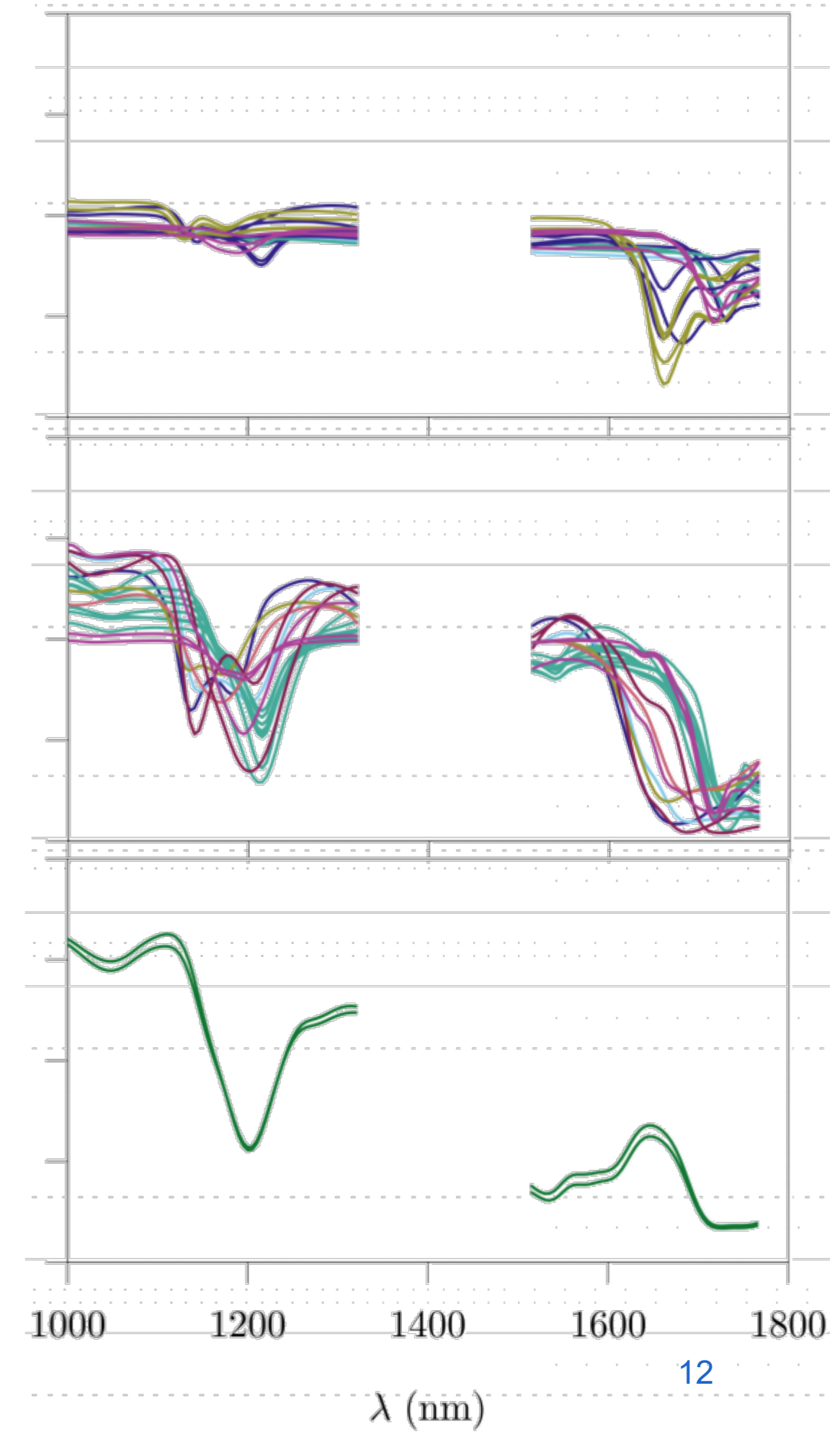
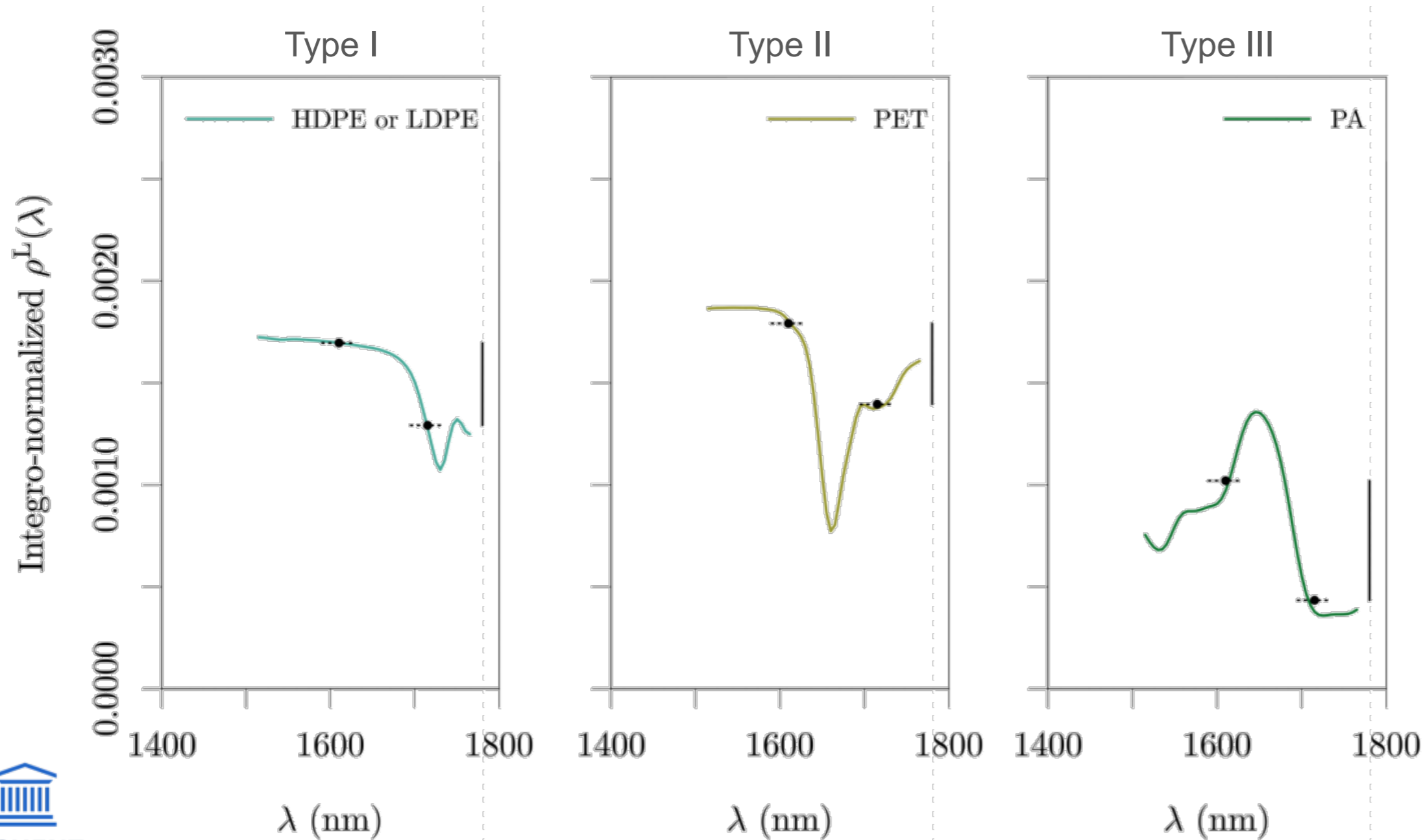


NEW INDEX: ND 1715

1610 (40)

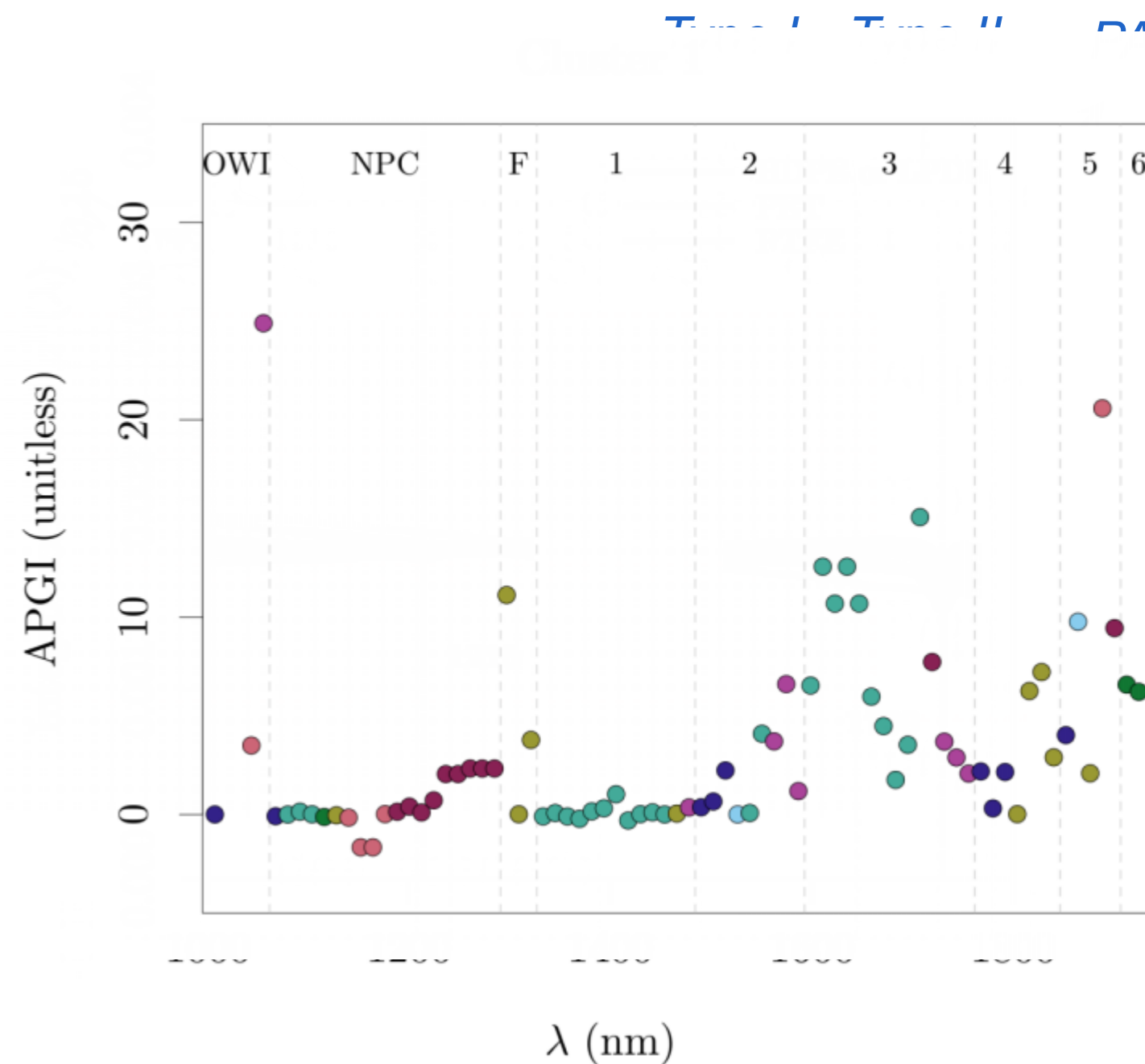
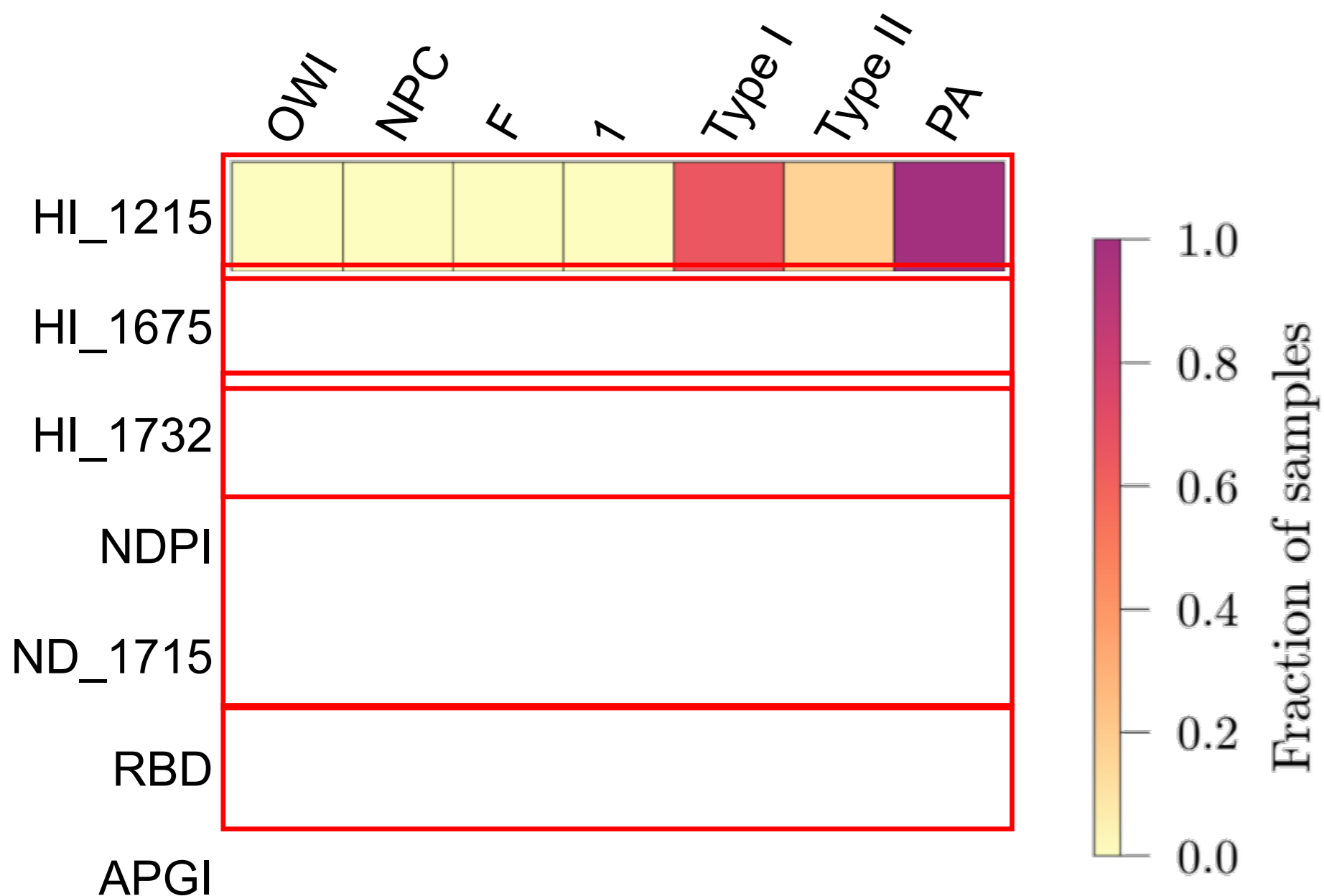
1715 (40)

$$\frac{\bar{\rho}^L(1590 \text{ to } 1630) - \bar{\rho}^L(1695 \text{ to } 1735)}{\bar{\rho}^L(1590 \text{ to } 1630) + \bar{\rho}^L(1695 \text{ to } 1735)}$$



SPECIFICITY OF ALGORITHMS

- Threshold: lowest discriminating value from OWI and NPC.



APPLICATION TO IMAGERY

– APEX: June 27, 2019, 10:00 to 10:30 UTC



APPLICATION TO IMAGERY

Type II (PET)
3.0 m × 2.5 m



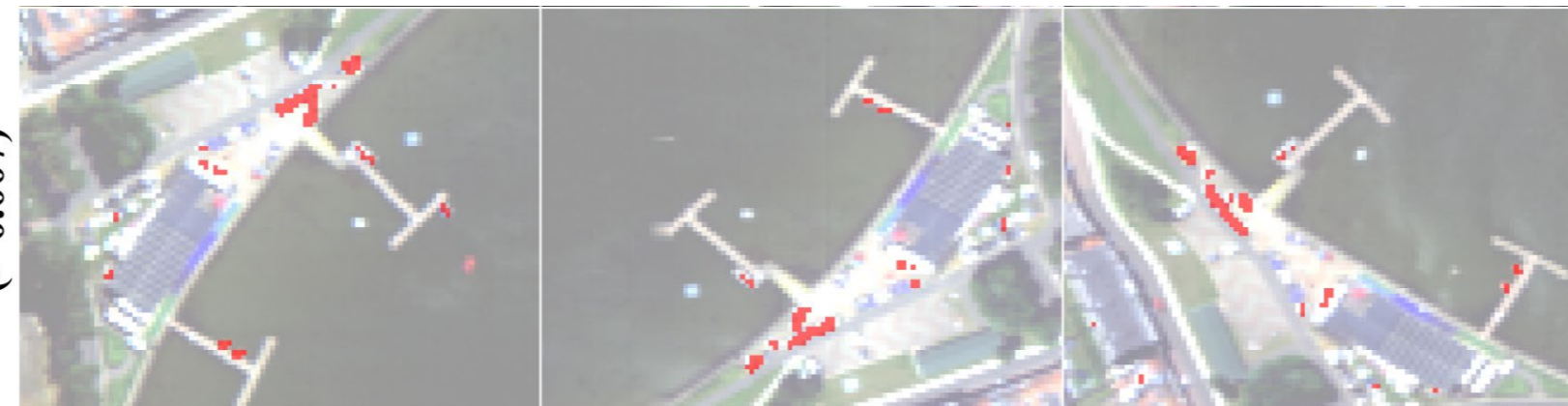
Type I (PE)
4.0 m × 4.0 m



Type I (PE)
3.60 m × 3.20 m

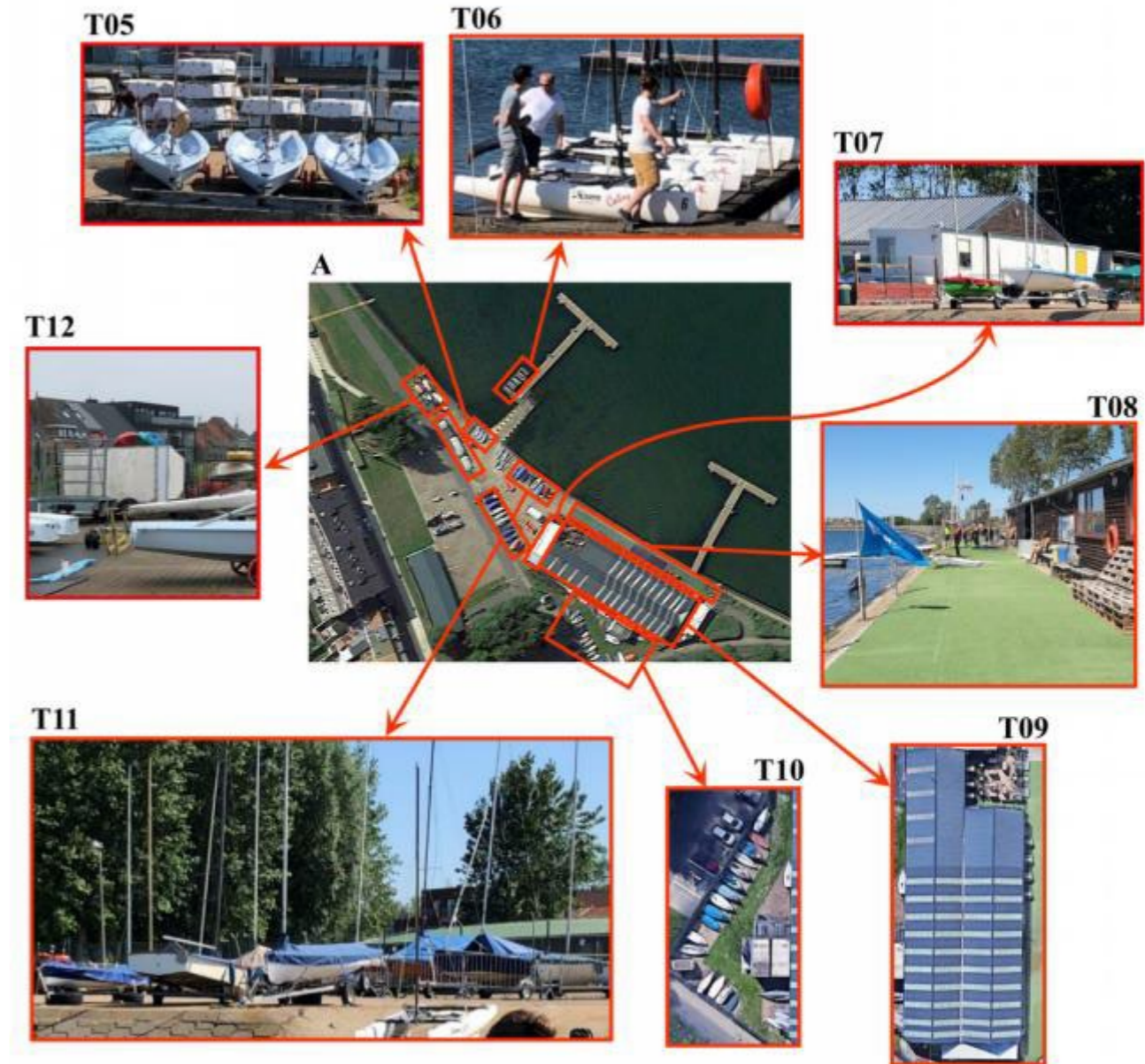
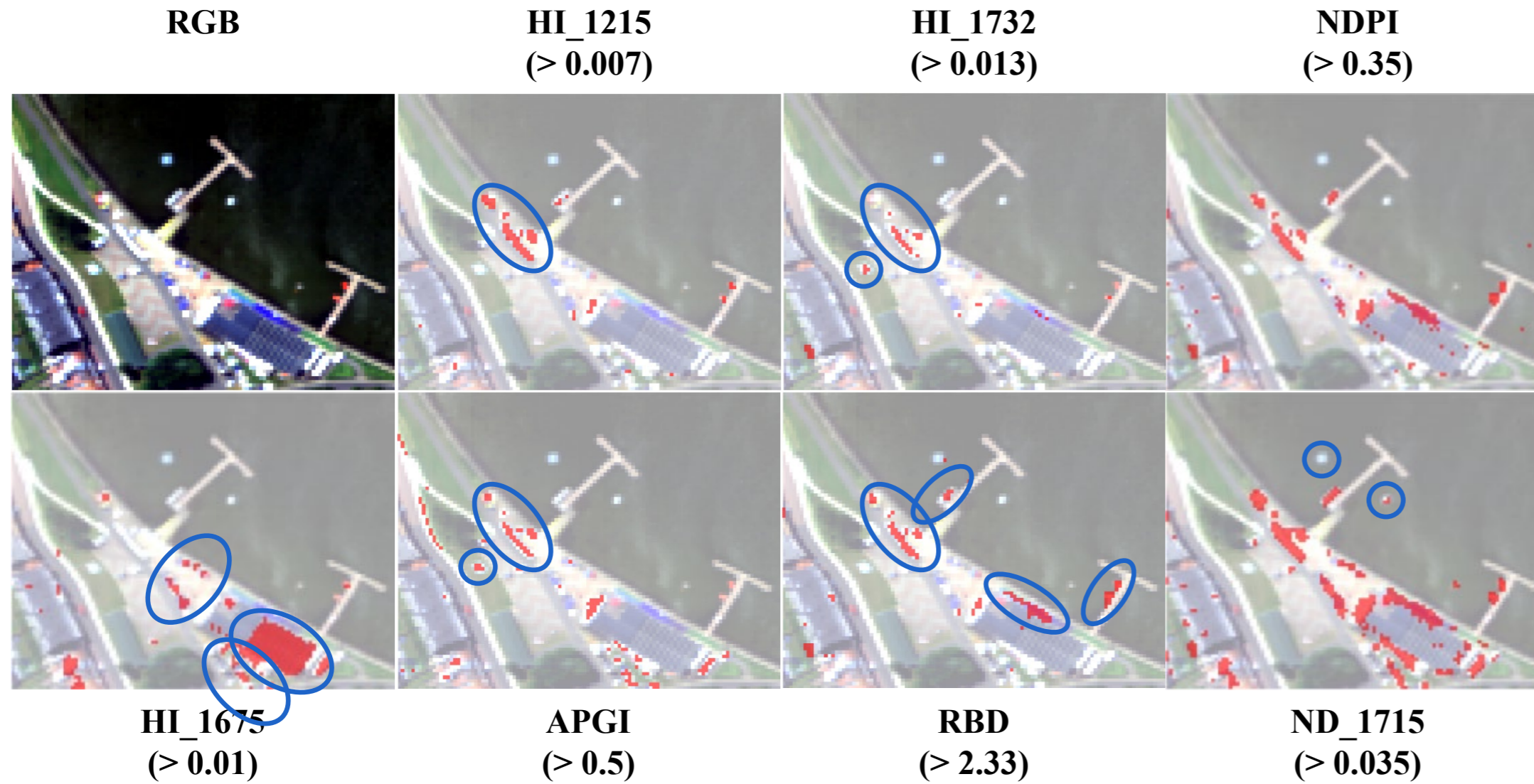


APPLICATION TO IMAGERY

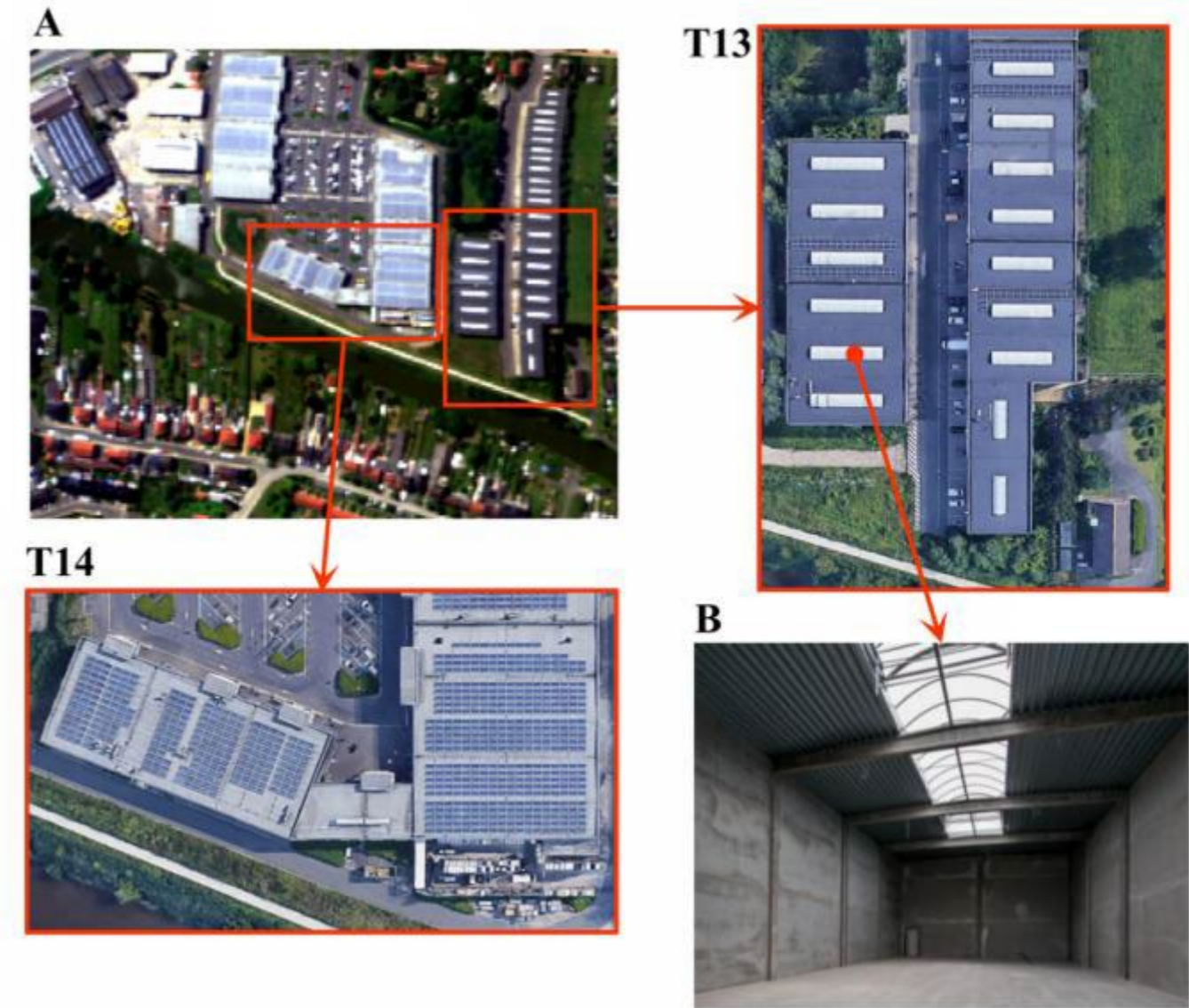
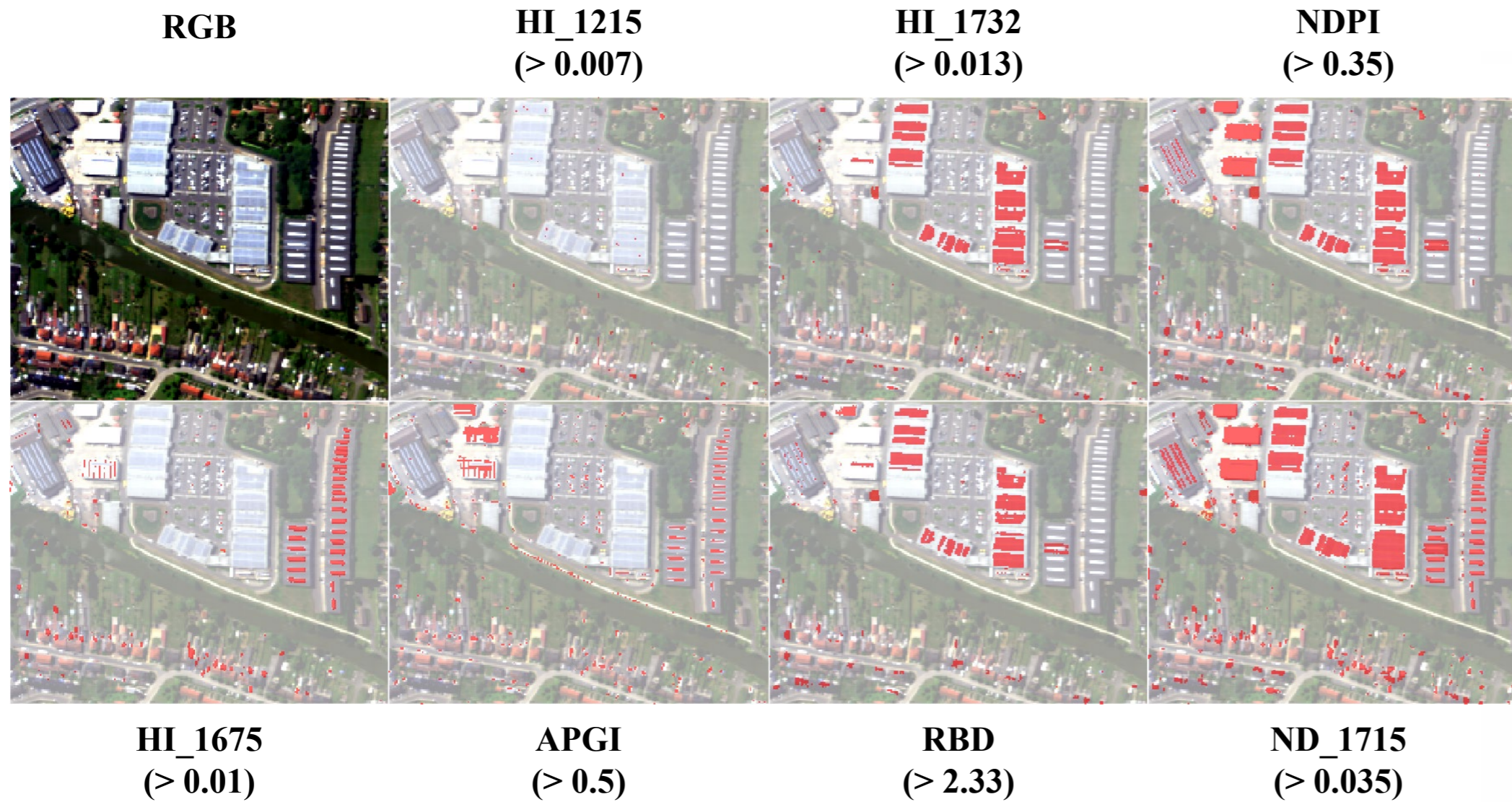


HI_1215
(> 0.007)

APPLICATION TO IMAGERY



APPLICATION TO IMAGERY



CONSISTENCY

Index	Dataset	Imagery
HI_1215	> 0.010	> 0.007
HI_1675	> 0.010	> 0.010
HI_1732	> 0.007	> 0.013
NDPI	> 0.050	> 0.350
ND_1715	> 0.030	> 0.035
RBD	> 2.200	> 2.330
APGI	-	> 0.500

CONCLUSIONS

Access the publication:

1. Multispectral wavebands might be sufficient and desirable.
2. Optical plastic type discrimination seems possible, but likely less relevant.
3. RBD, HI_1675, and ND_1715 showed consistent thresholds between datasets.
4. ND_1715 showed improved coverage compared to NDPI.



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ATMOSPHERIC CORRECTION

