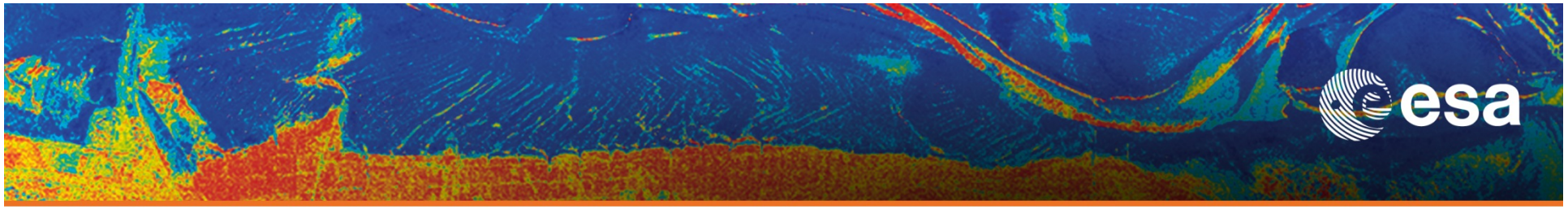

→ 3rd ADVANCED COURSE ON RADAR POLARIMETRY

PolSAR App Ocean

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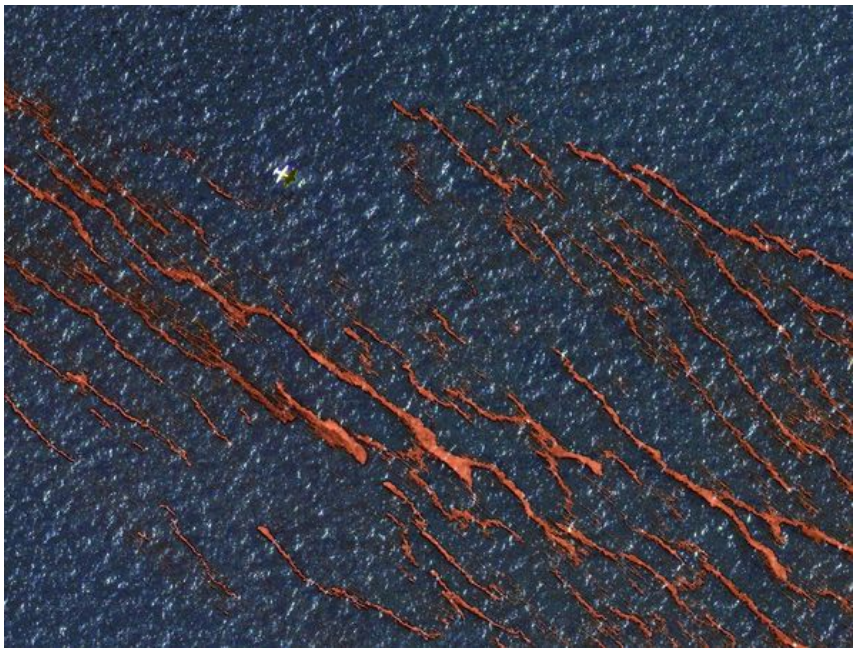
Motivations

- Oil observation (hazard)



Motivations

Motivations

- Target at sea observation

Motivations

Oil observation

SAR polarimetry data associated to appropriately tailored physical processing allows to:

- Detect oil at sea;
- Provide information on the kind of surfactant.

Oil observation

Physical processing is based on:

- Slick-free sea surface scattering calls for **Bragg** or **tilted-Bragg scattering**. It is a single-reflection scattering mechanism that, being quasi-deterministic, is expected to be characterized by a low polarimetric entropy, a high correlation between like-polarized channels and a low unpolarized backscattered energy.
- Therefore, a way to detect the presence of an oil slick is to use polarimetric indicators that indicate the departure of the cell under test from a Bragg scattering.

Oil observation

Pros:

- Unique detection capability robust with respect to weak damping look-alikes;
- No extra information requested;
- Better morphological oil slick detection;

Cons:

- Polarimetric SAR data availability.

Target at sea observation

SAR polarimetry data associated to appropriately tailored physical processing allows to:

- Detect metallic targets;

Target at sea observation

Physical processing is based on:

- non-Bragg scattering;
- intrinsic different scattering characteristics;

Target at sea observation

Pros:

- High detection and low false alarms;
- Robust in terms of incident angle;
- Threshold selection less critical.

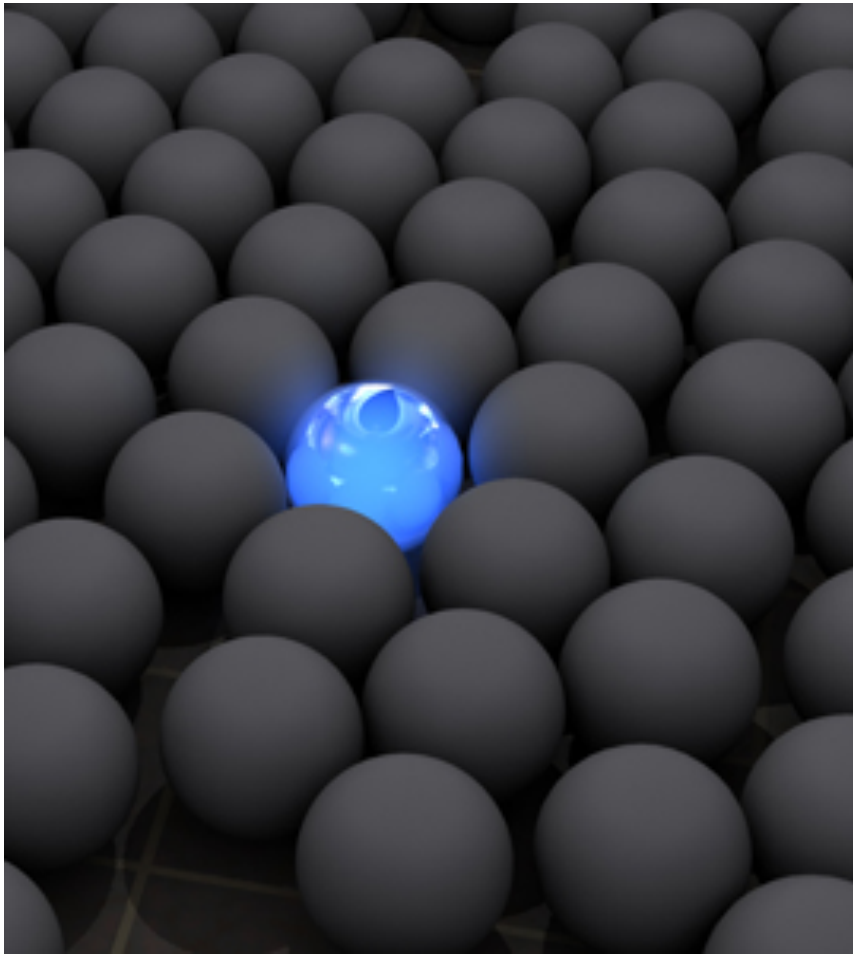
Cons:

- Polarimetric SAR data availability.

Physical vs image processing

- *'The important thing in science is not so much to obtain new facts as to discover new ways of thinking about them.'*

  William Bragg

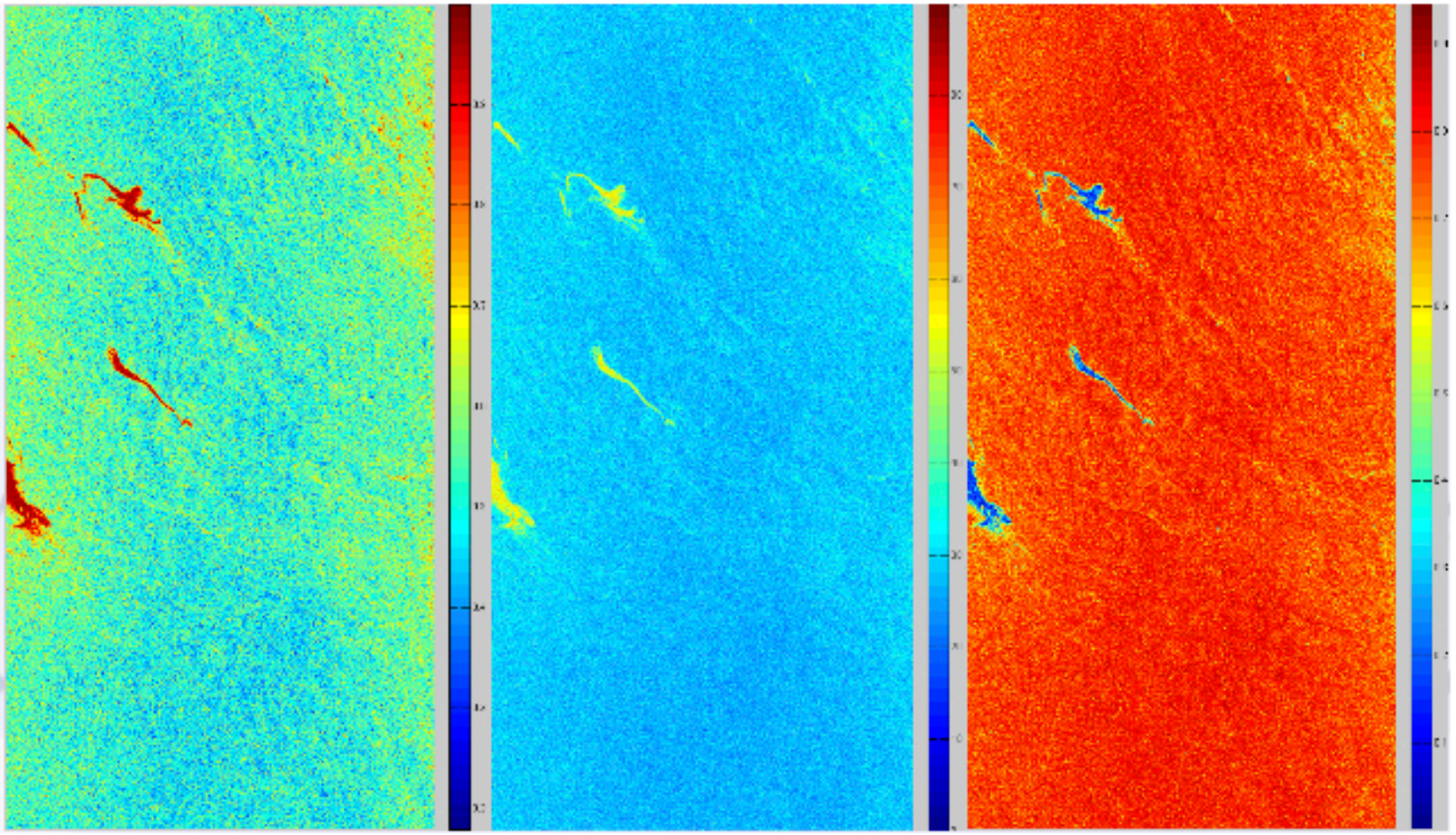


Polarimetric features

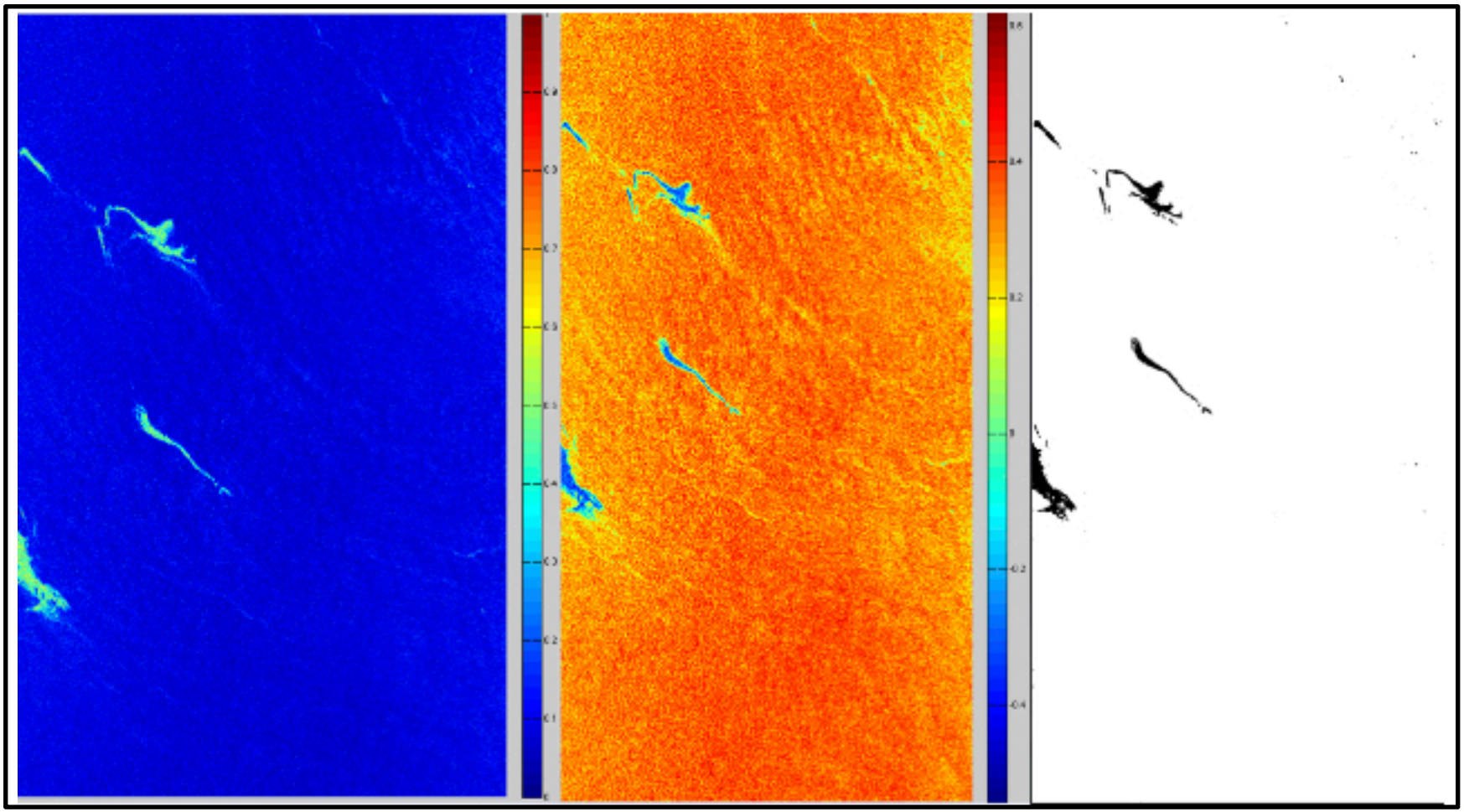
feature	sea	oil
$0<H<1$ entropy	low	high
$0<A_{12}<1$ modified anisotropy	high	low
$0°<\alpha<90°$ mean alpha	0°	≈45°
μ conformity	>0	<0
$0<NP<1$ normalized pedestal	low	high

feature	sea	oil
$0<\sigma<\infty$ standard deviation CPD	low	high

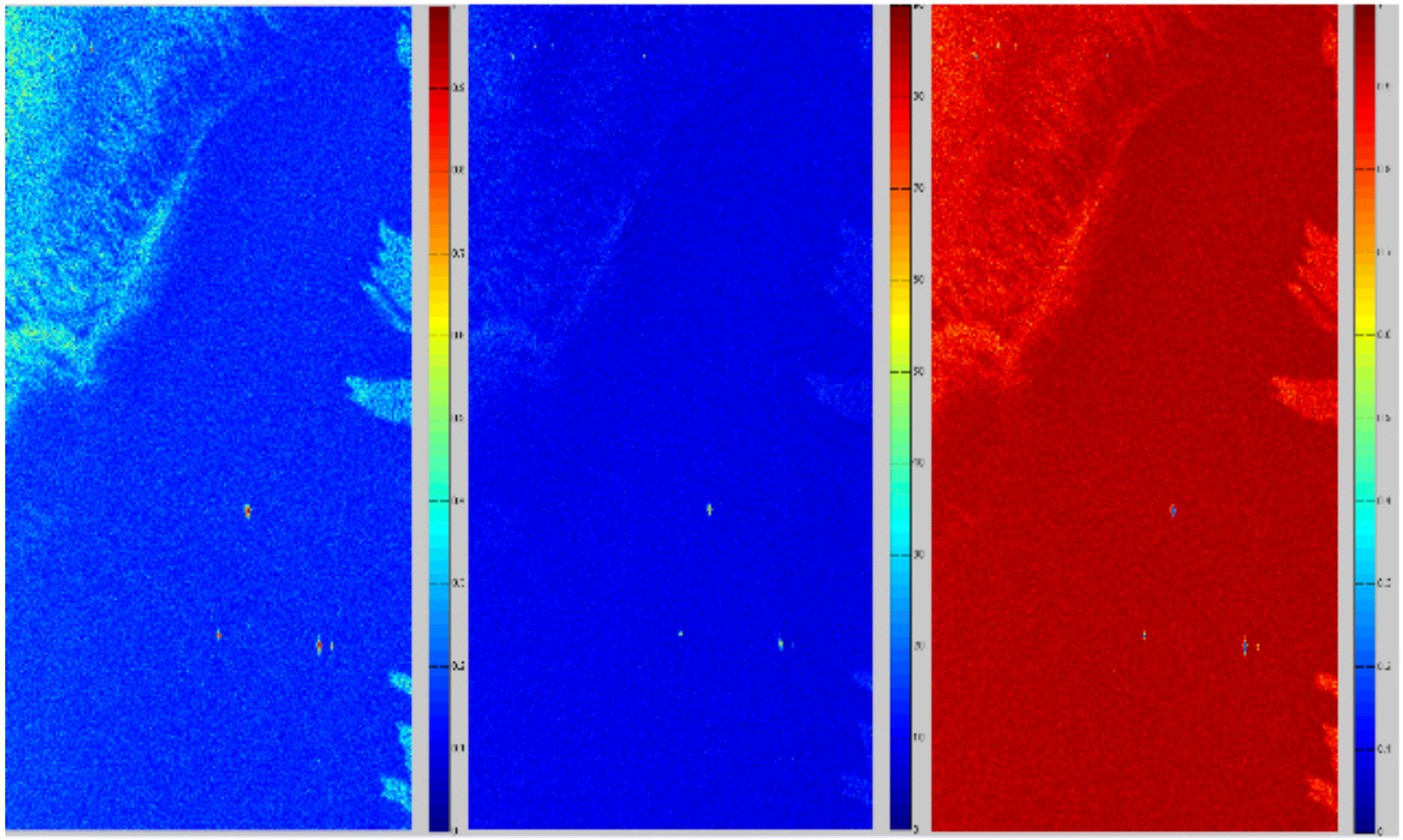
Oil seeps (H, α, A_{12})



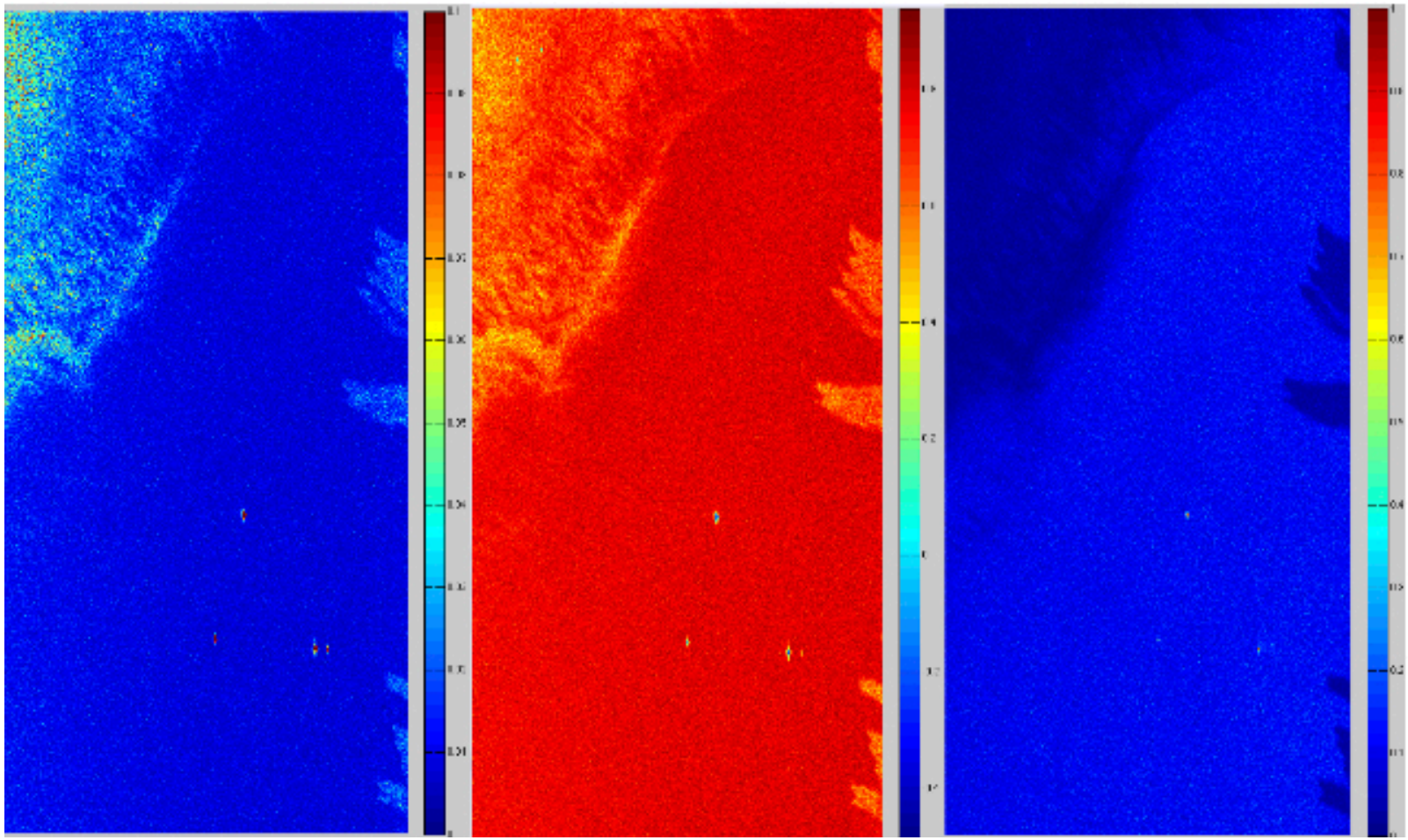
Oil seeps (H, μ, μ>0)



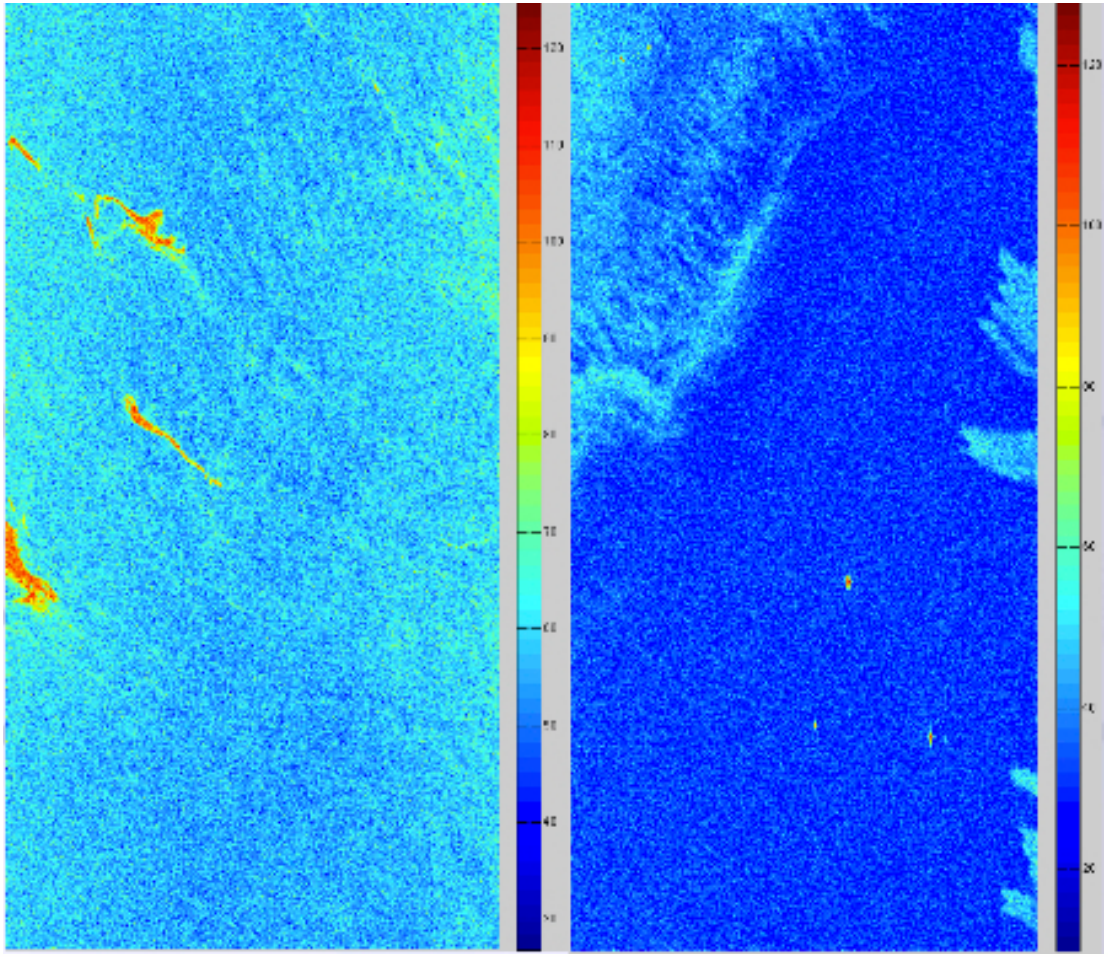
DWH (H, α, A_{12})



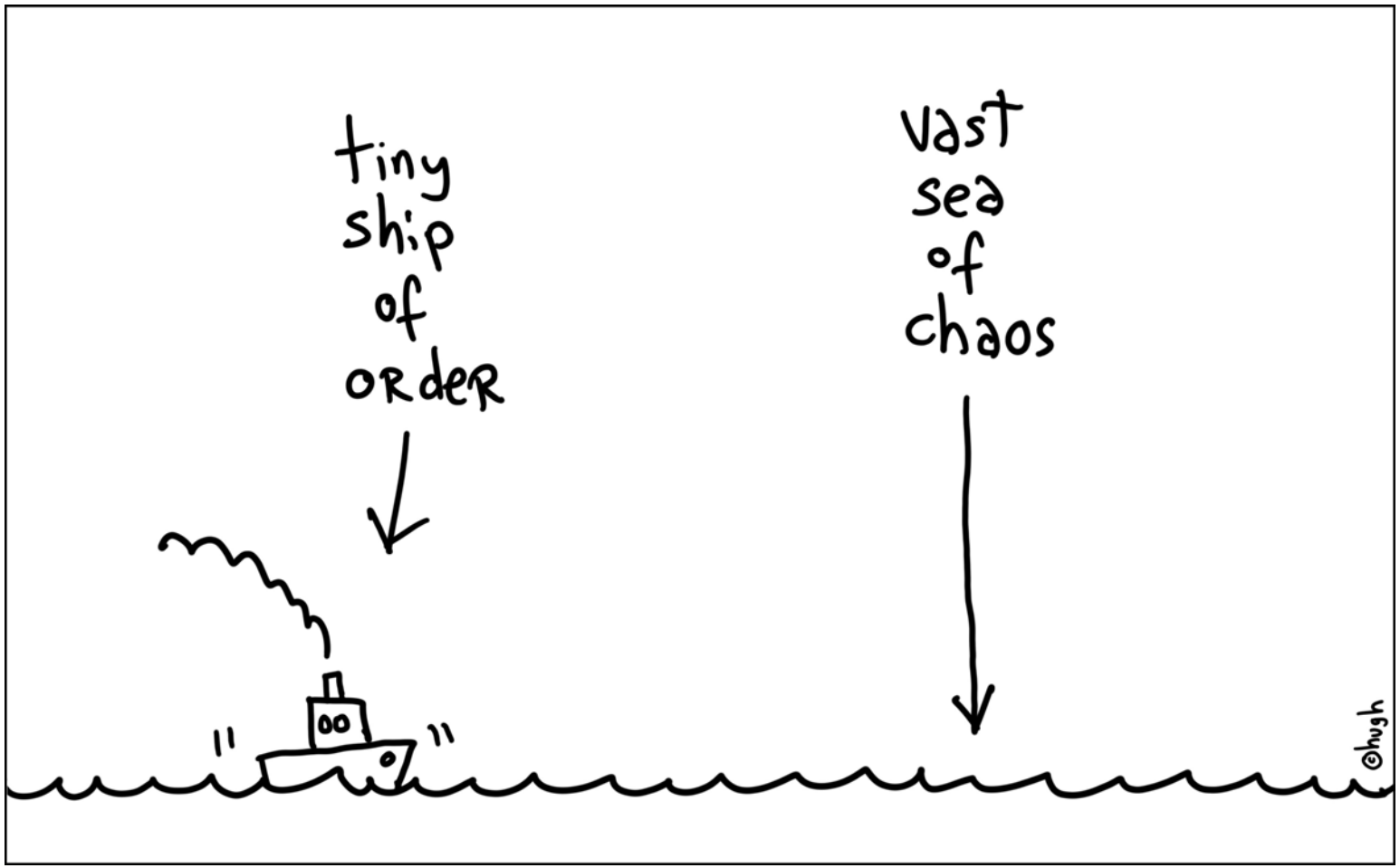
DWH (H, μ, λ_1)



CPD σ



Physical vs image processing



Polarimetric features

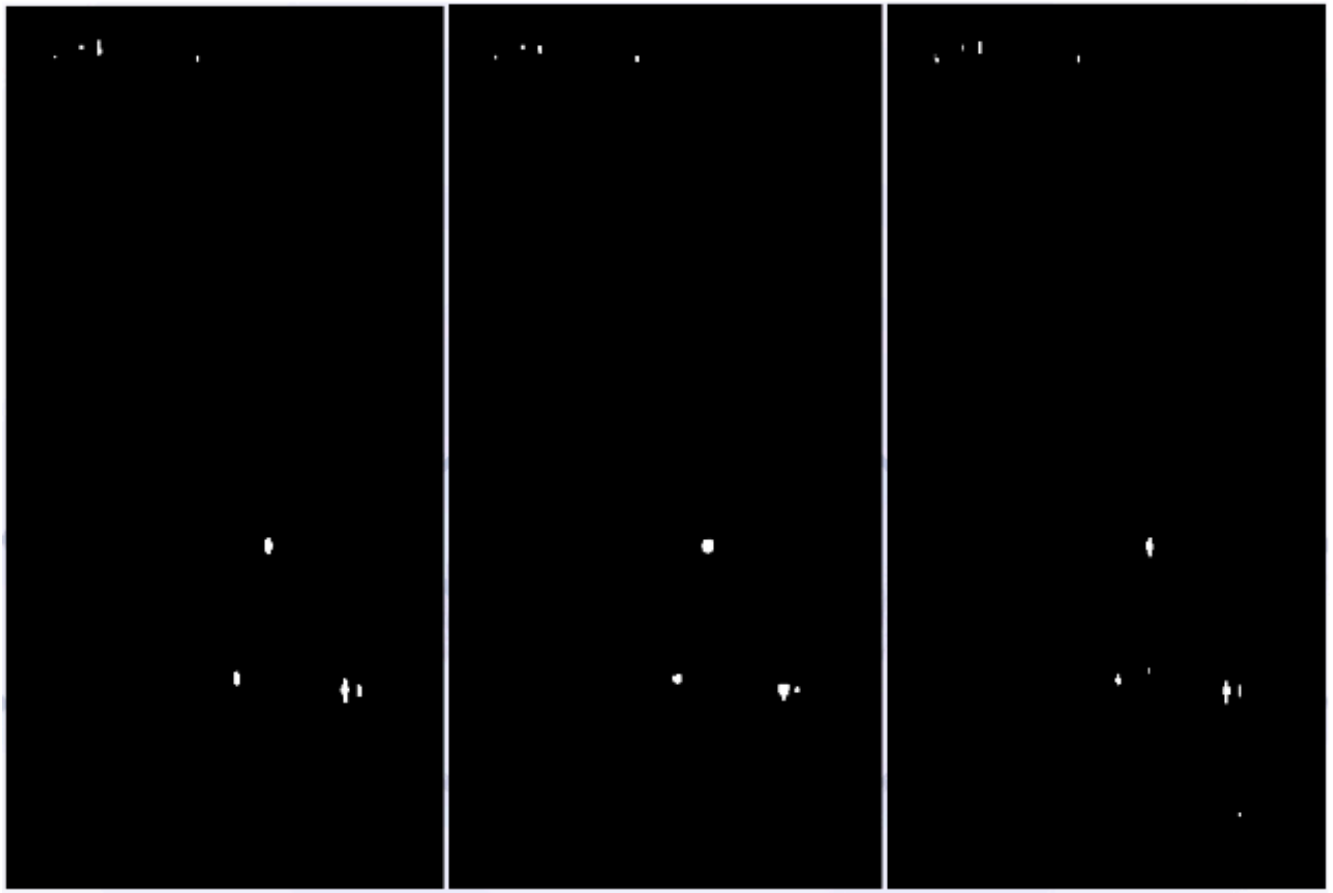
Quad-pol:

- Polarimetric Matched Filter (PMF);
- Liu et al. detector;
- Polarimetric Notch Filter (GP-PNF).

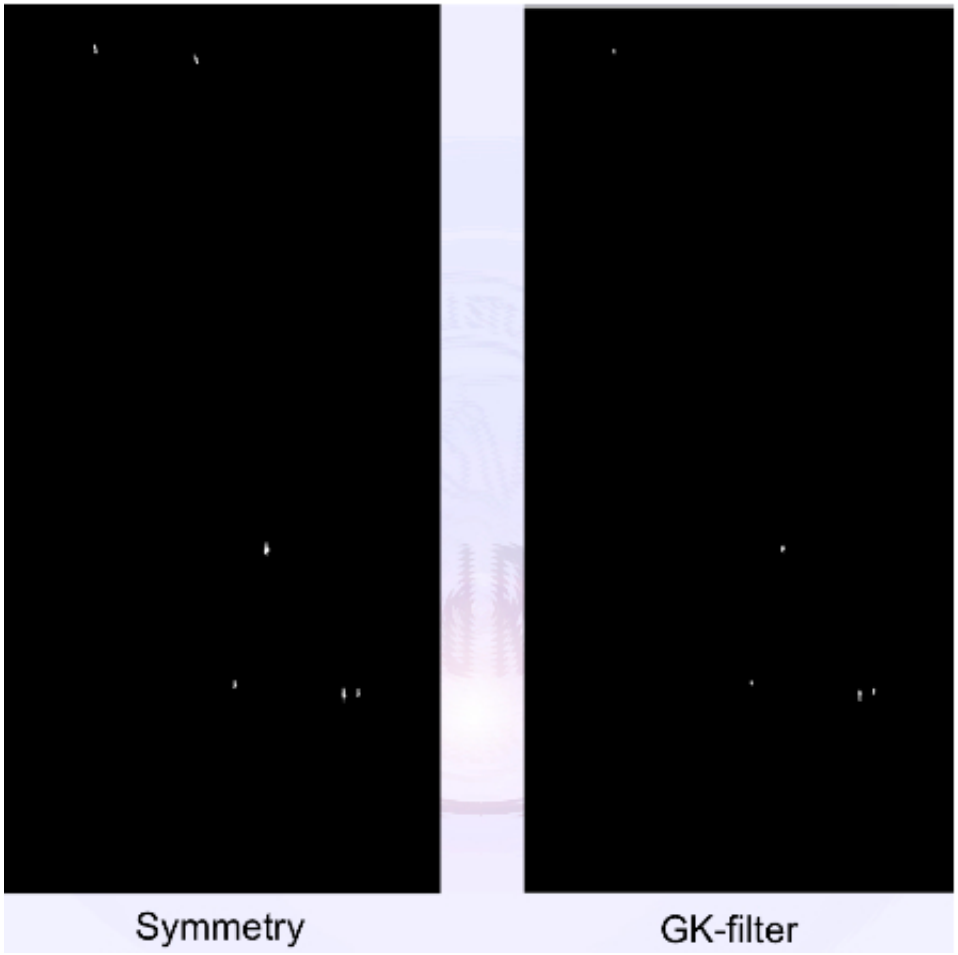
Dual-pol:

- Symmetry.

Gulf of Mexico

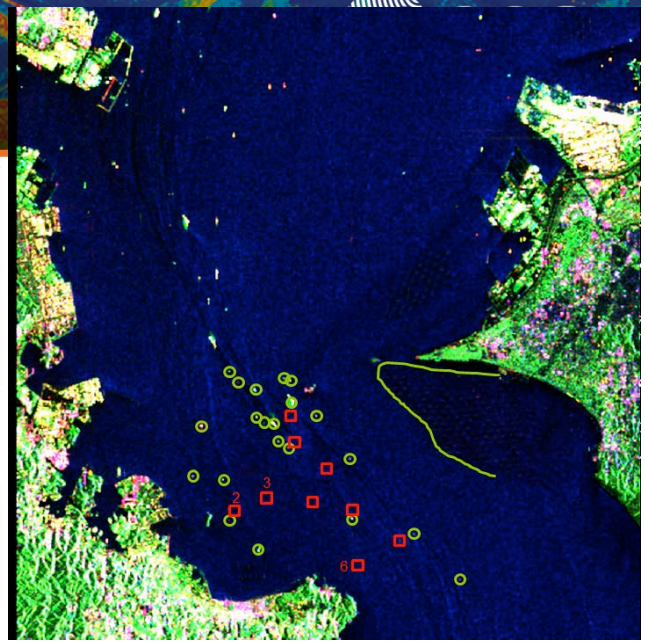


Gulf of Mexico

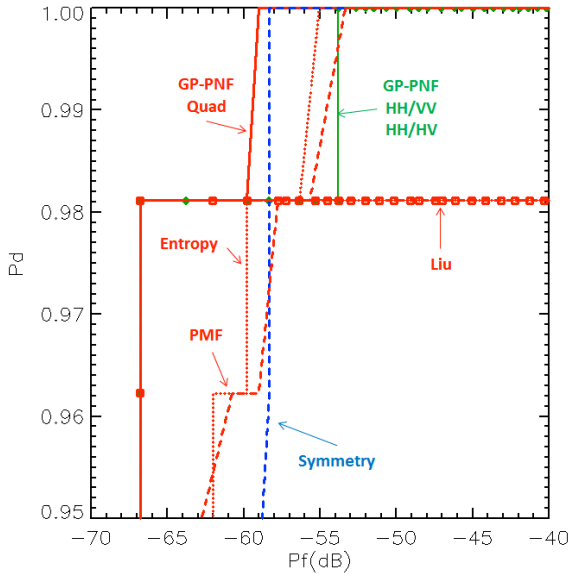


Tokyo bay

Algorithms	Visual RGB	GP-PNF	PMF	Liu et al.	Entropy	Symmetry	HV
Detected	21	22	22	22	21	14	18
Missed	9(17)	8(16)	8(16)	8(16)	9(17)	16(24)	12(20)
False Alarms	0	0	1	1	several	0	0



1) The best detectors seem to be the quad-polarimetric ones (red curves), followed by the dual-polarimetric ones (blue and green curves).
2) The symmetry detector presents a very good ROC curve (not largely inferior to quad-pol detectors), but its P_d from the previous analysis was quite low.



Conclusions

- SAR polarimetry measurements associated to appropriately tailored physical scattering models allow to take full benefit of SAR spatial resolution and to generate reliable ocean added-value products.
- Many thanks are due to the PolSAR App team.