MODIS-SEVIRI synergy

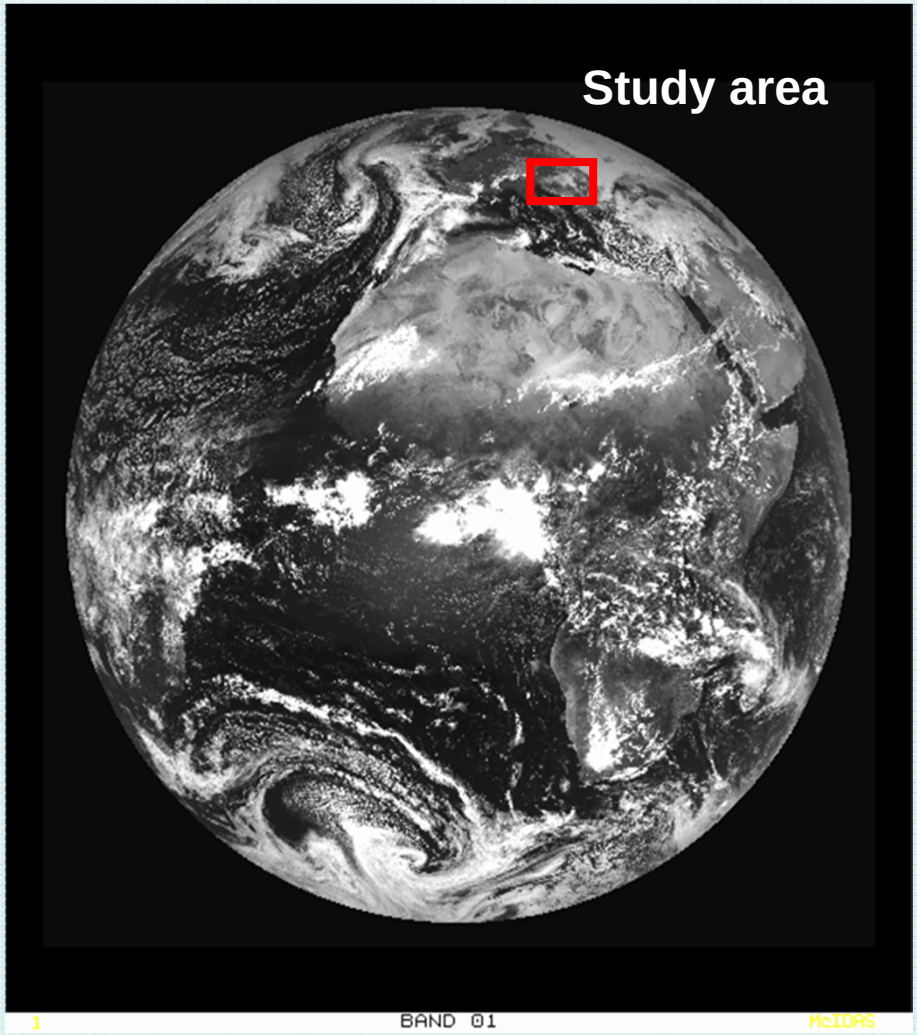
Quinten Vanhellemont

Griet Neukermans & Kevin Ruddick

IOCS Splinter Session 3

Geostationary Ocean Colour Radiometry

6 May 2013

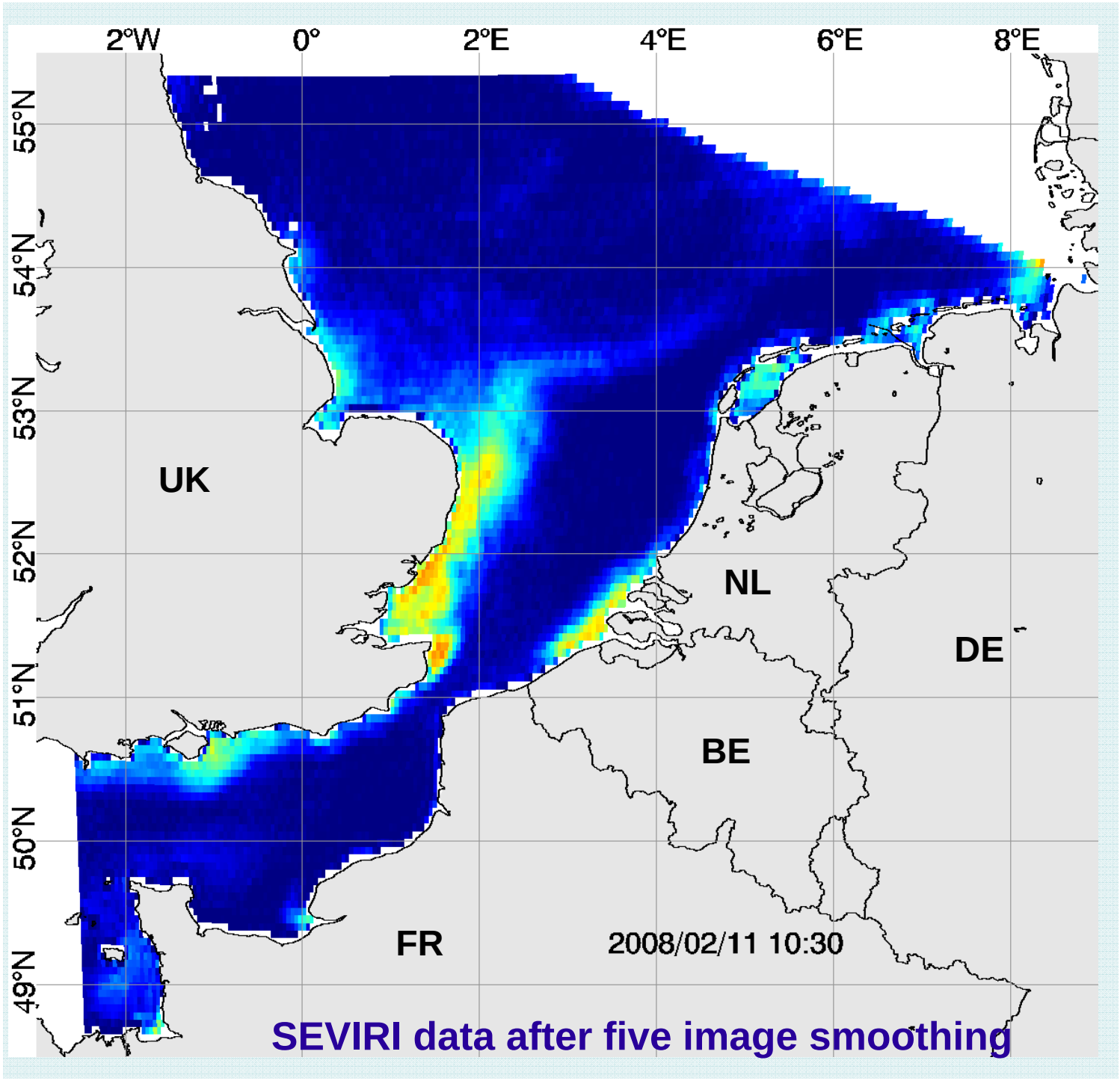


SEVIRI is a geostationary meteo sensor, gives a “full disk” image every 15’

Two broad ‘VIS’ bands: VIS06 = 570 – 710 nm, VIS08 = 740 – 880 nm

GSD 3x3 km at nadir, ~3x6km at 50°N

First used for OC by Neukermans et al., 2009, 2012 (SPM/T/Kpar)


2°W
0°
2°E
4°E
6°E
8°E
55°N
54°N
53°N
52°N
51°N
50°N
49°N
UK
NL
DE
BE
FR
2008/02/11 10:30
SEVIRI data after five image smoothing
ρ_w [sr^{-1}]
0.10
0.08
0.06
0.04
0.02
0.00

Potential for synergy!

Synergy: Combine the **high temporal signal** from SEVIRI with the **spatial resolution** from MODIS

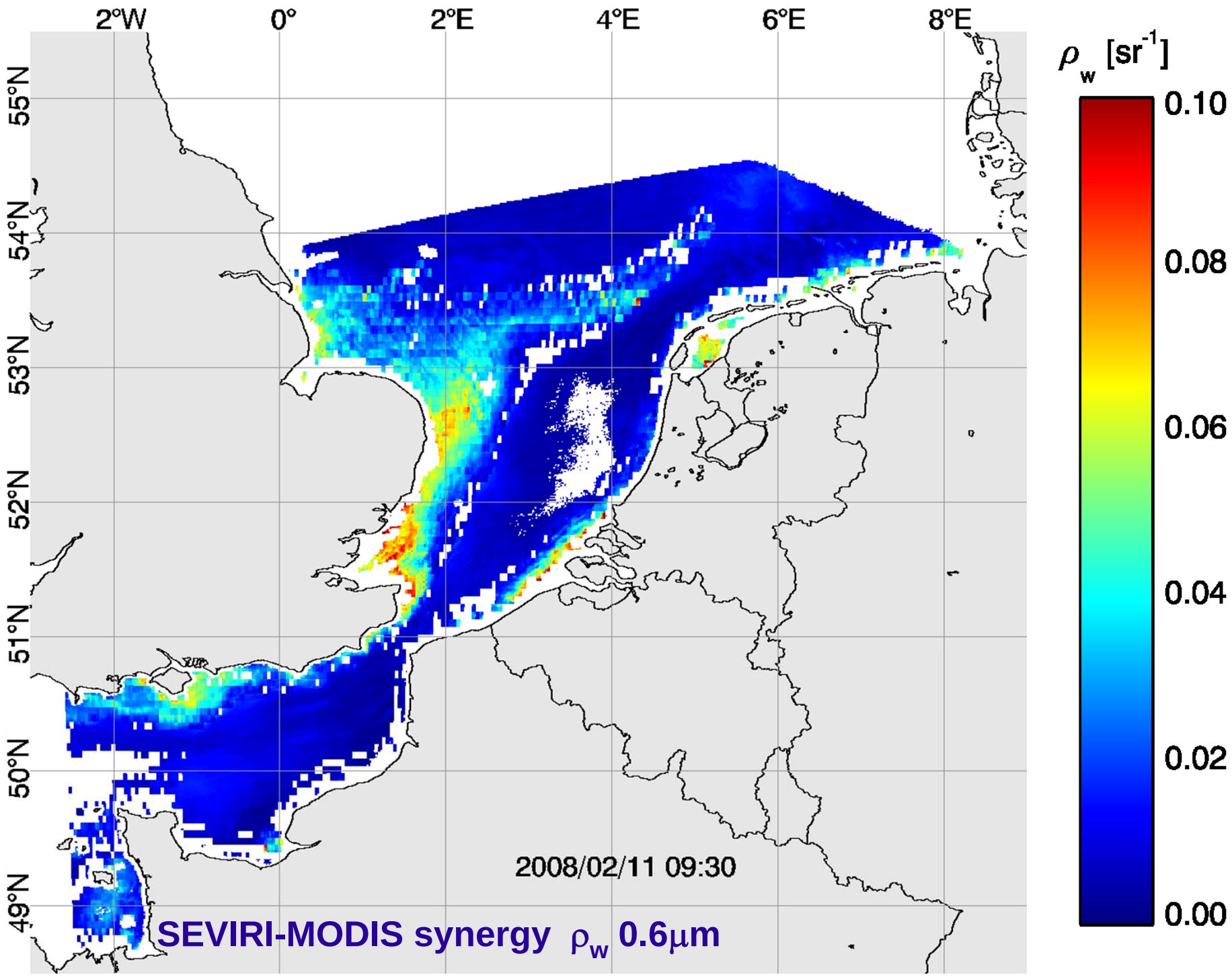
$$\rho_{w(SYN)}(t) = \rho_{w(MOD)}(t_0) \cdot F^{SEV}(t)$$

$$F^{SEV}(t) = \frac{\rho_{w(SEV)}(t)}{\rho_{w(SEV)}(t_0)}$$

ρ_w = marine reflectance MODIS/SEVIRI/Synergy

t = SEVIRI image times

t_0 = SEVIRI image time closest to MODIS overpass (noon)


2°W
0°
2°E
4°E
6°E
8°E
55°N
54°N
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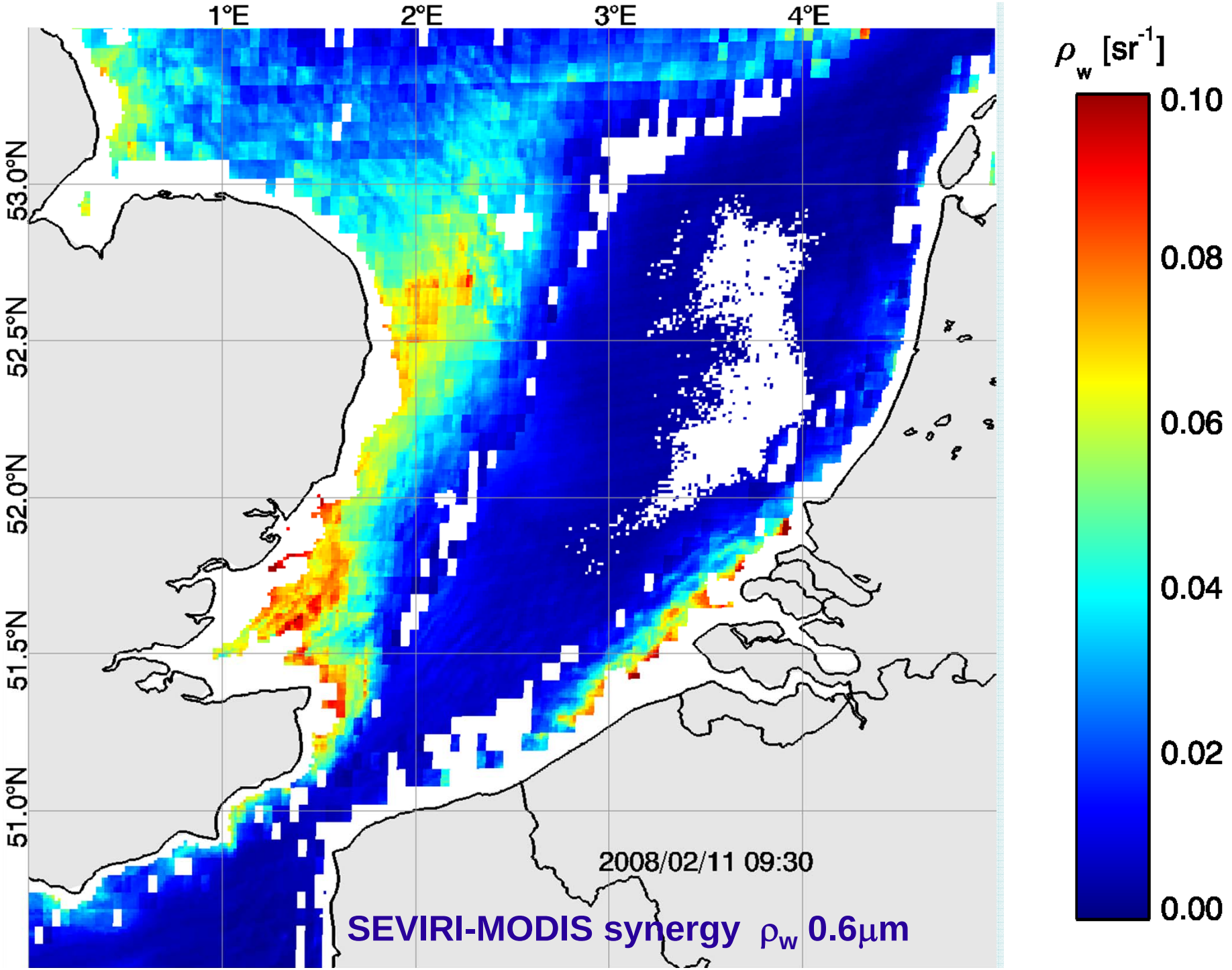
52°N
51°N
50°N
49°N
2008/02/11 09:30
SEVIRI-MODIS synergy ρw 0.6µm
ρw [sr-1]
0.10
0.08
0.06
0.04
0.02
0.00


1°E
2°E
3°E
4°E
53.0°N
52.5°N
52.0°N
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51.0°N
2008/02/11 09:30
SEVIRI-MODIS synergy ρw 0.6μm
ρw [sr-1]
0.10
0.08
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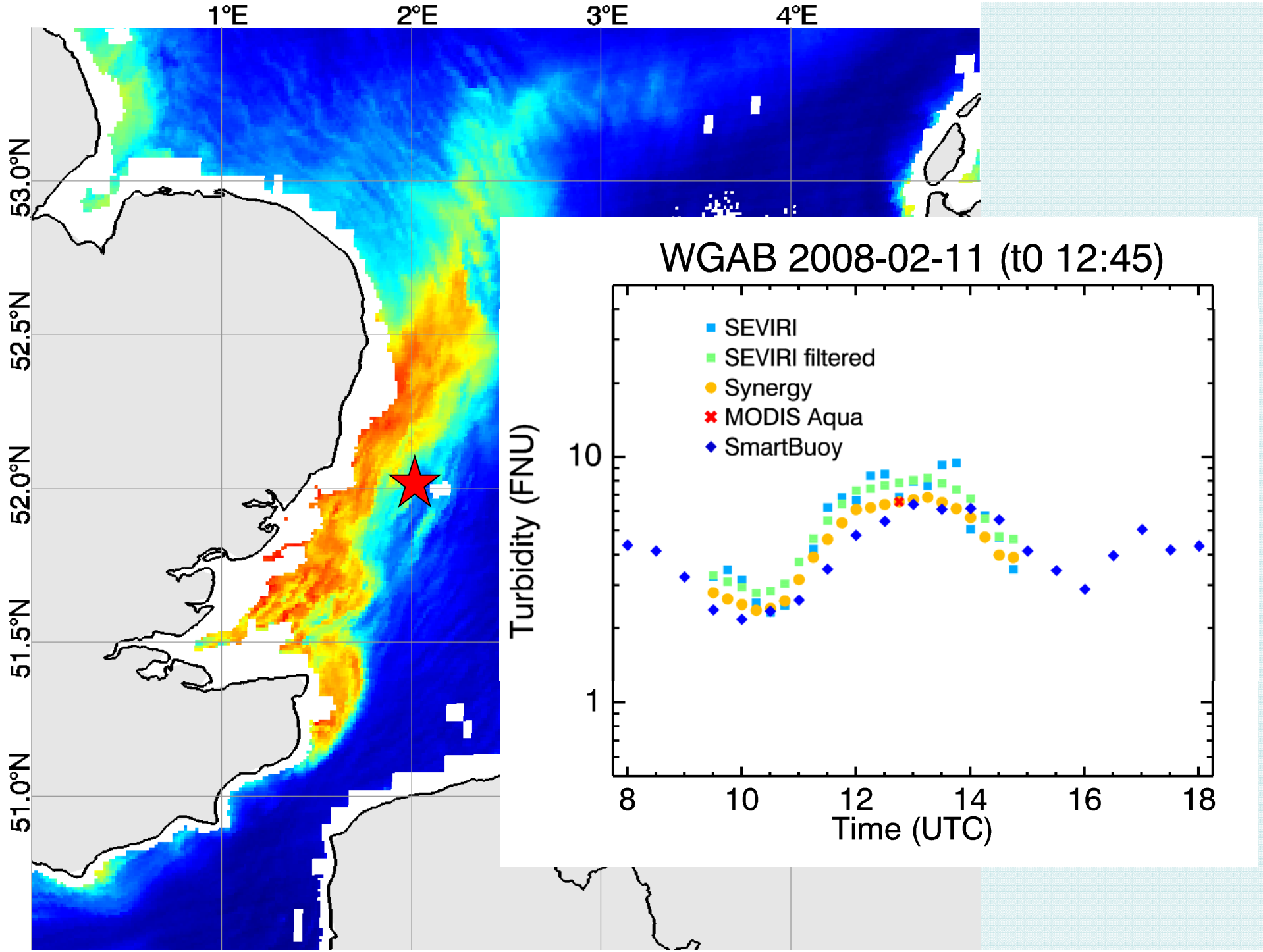
0.04
0.02
0.00


1°E
2°E
3°E
4°E
53.0°N
52.5°N
52.0°N
51.5°N
51.0°N
WGAB 2008-02-11 (t0 12:45)
SEVIRI
SEVIRI filtered
Synergy
MODIS Aqua
SmartBuoy
Turbidity (FNU)
10
1
8
10
12
14
16
18
Time (UTC)

Validation with in situ data

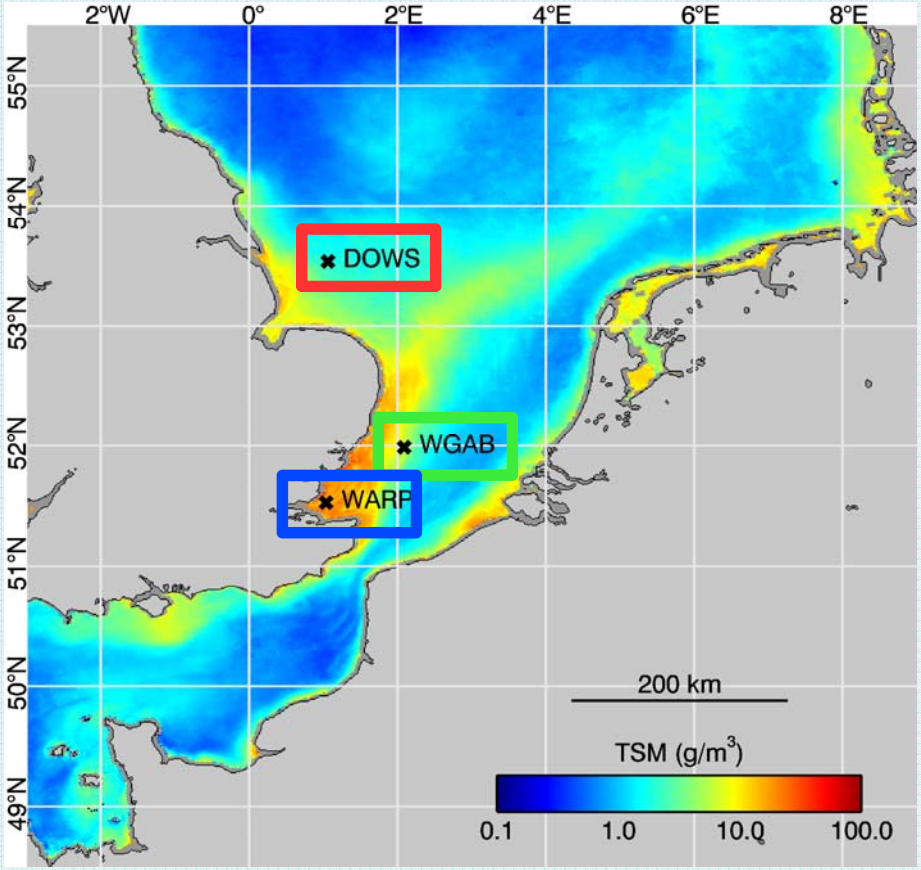
CEFAS Smartbuoys record turbidity several times per hour (increasing T):

Dowsing

West Gabbard

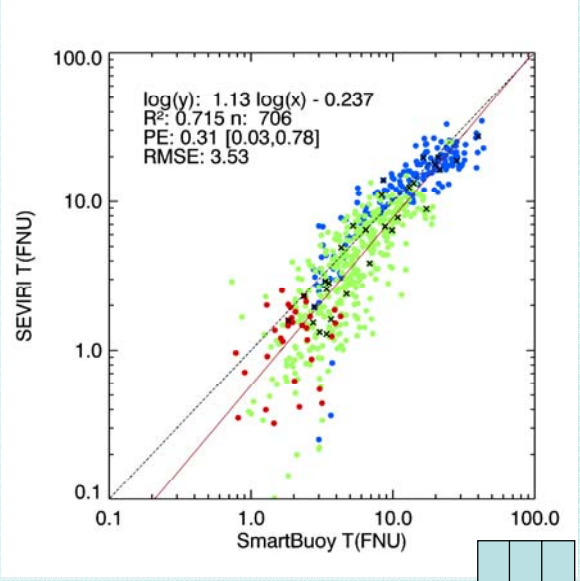
Warp

Remote sensing TU using Nechad et al. (2009)

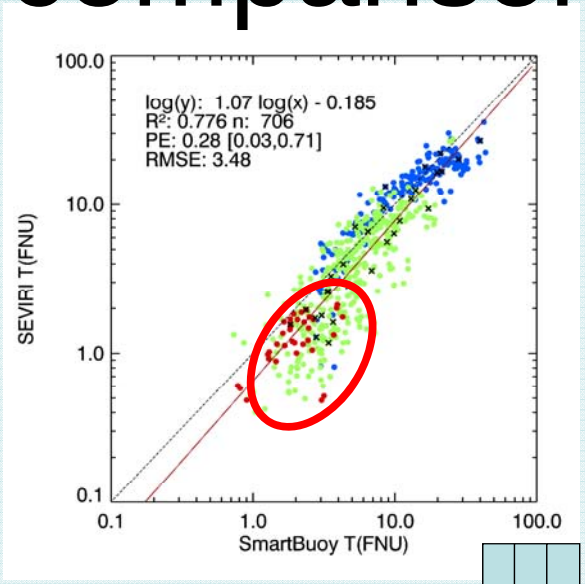


MODIS Aqua 2008-2009 SPM

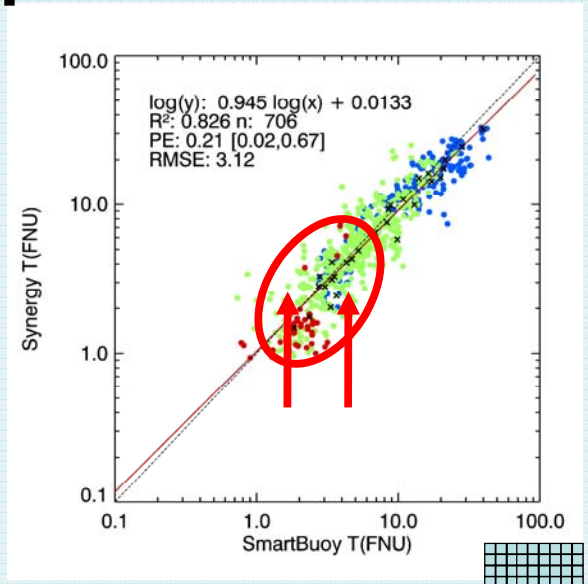
SEVIRI/Synergy– in situ comparison



SEVIRI



SEVIRI (s)



Synergy

	slope	offset	R^2	RMSE	PE50 (5-95)
SEVIRI	1.13	-0.24	0.72	3.53	31% (3%-78%)
SEVIRI (s)	1.07	-0.19	0.78	3.48	28% (3%-71%)
Synergy	0.95	0.01	0.83	3.12	21% (2%-67%)

Conclusions

- High frequency dynamics detected with SEVIRI can be used to modulate higher spatial resolution MODIS data
- The resulting synergy product, resolves temporal dynamics at high spatial resolution, and has lower errors when compared with in situ measurements.
- Is limited to cloud position at MODIS overpass. The approach is only valid for vertical processes.

Acknowledgments

NASA: MODIS Aqua data

EUMETSAT and KMI: SEVIRI data

CEFAS: in situ Smartbuoy data

BELSPO: funding of the GEOCOLOUR project

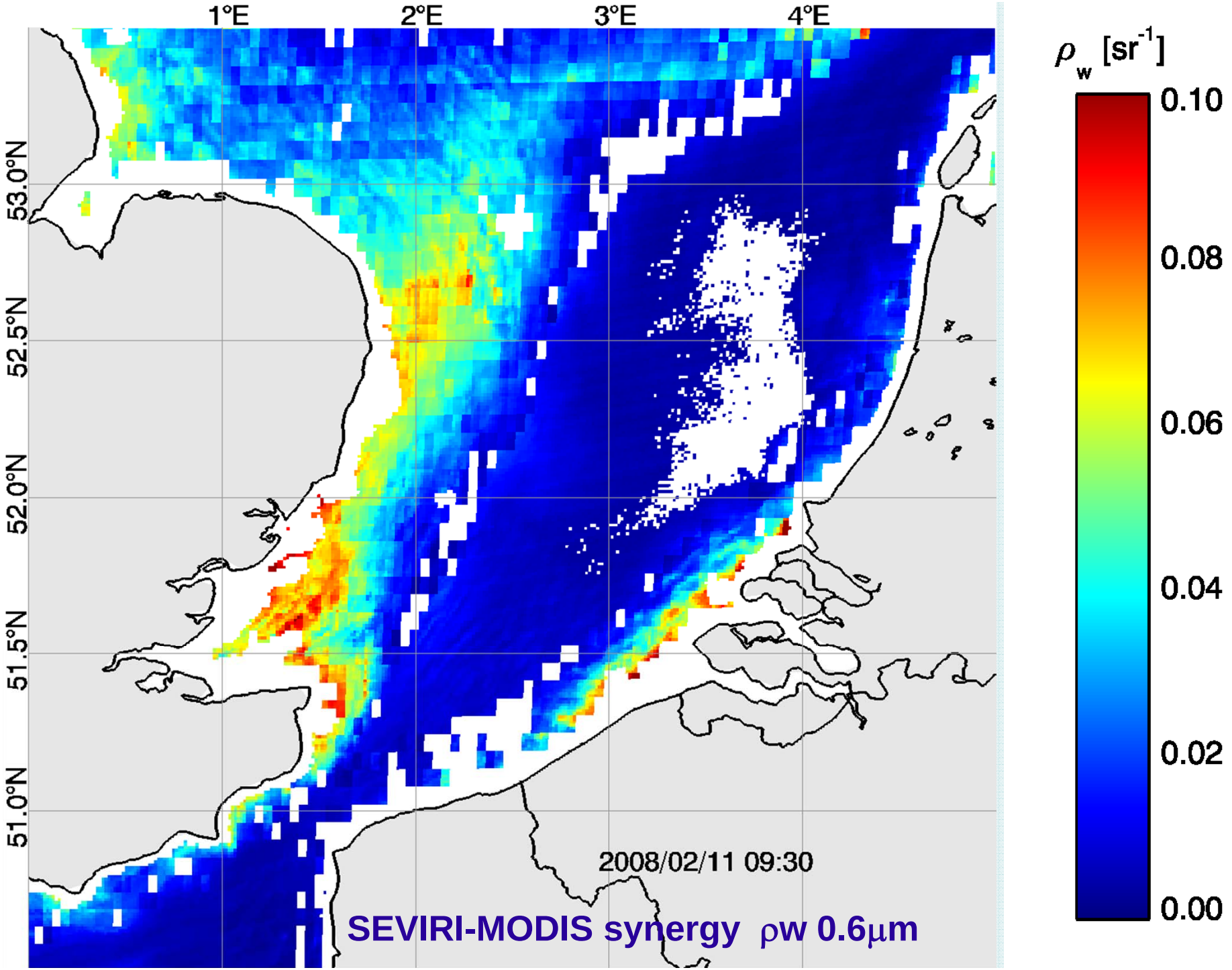
References

Neukermans G., Ruddick K., Bernard E., Ramon D., Nechad B. & Deschamps P.-Y. (2009). **Mapping total suspended matter from geostationary satellites: a feasibility study with SEVIRI in the Southern North Sea**. *Optics Express*, Vol. 17(16), pp. 14029–14052

Neukermans, G. (2012). **Optical in-situ and geostationary satellite-borne observations of suspended particles in coastal waters**, PhD Thesis, Université du Littoral Côte d'Opal. Academic and Scientific Publishers, Brussels, Belgium (ISBN 978 90 7028 949 2).

Neukermans, G., K. Ruddick and N. Greenwood (2012). **Diurnal variability and light attenuation in the southern North Sea from the SEVIRI geostationary sensor**. Remote Sensing of Environment 124, 564–580. doi:10.1016/j.rse.2012.06.003

Vanhellemont, Q., G. Neukermans, and K. Ruddick (accepted). **Synergy between polar-orbiting and geostationary sensors: Remote sensing of the ocean at high spatial and high temporal resolution.** Rem Sens Env (special issue Liège colloquium 2012)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SEVIRI-MODIS synergy ρw 0.6μm
ρ_w [sr^{-1}]
0.10
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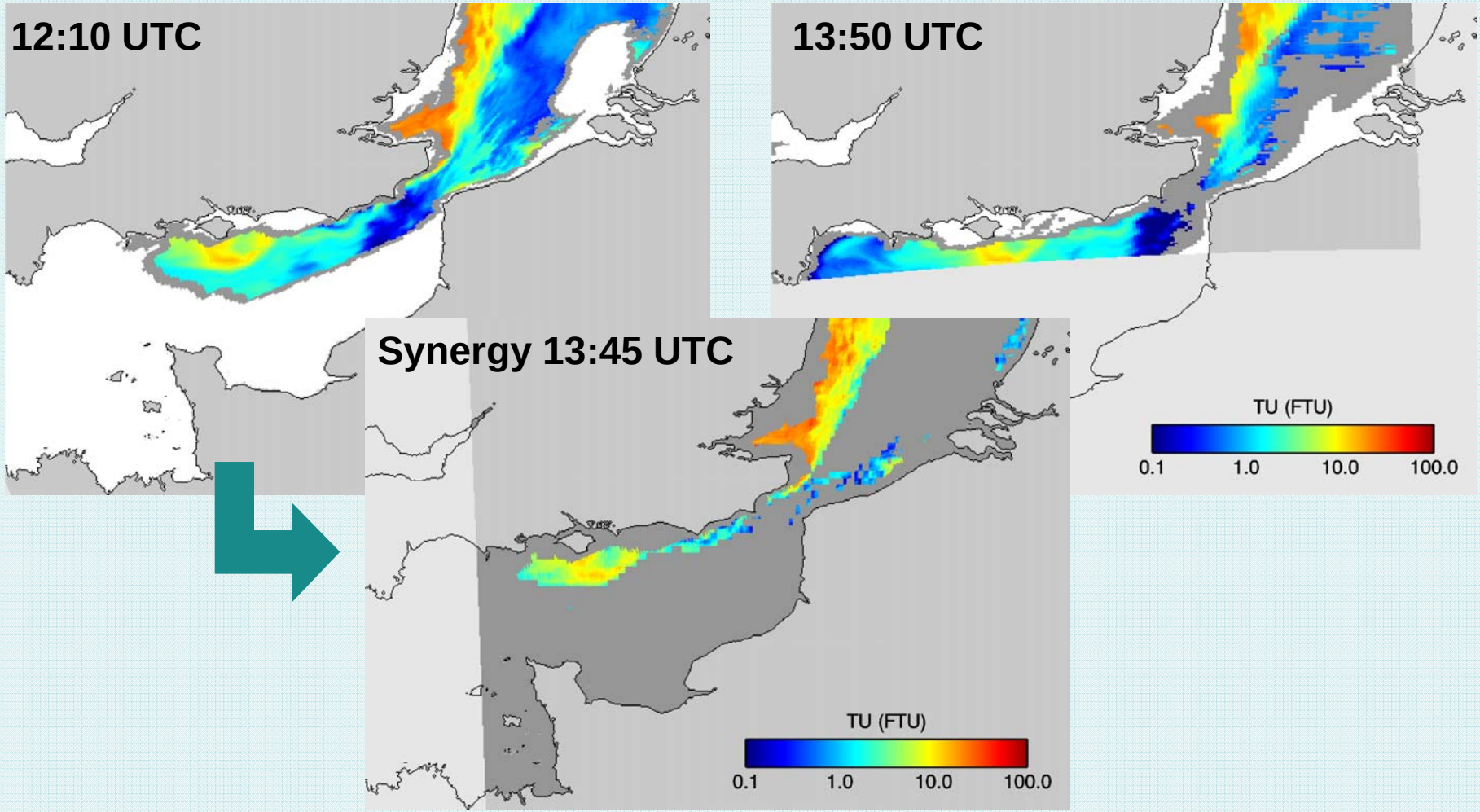
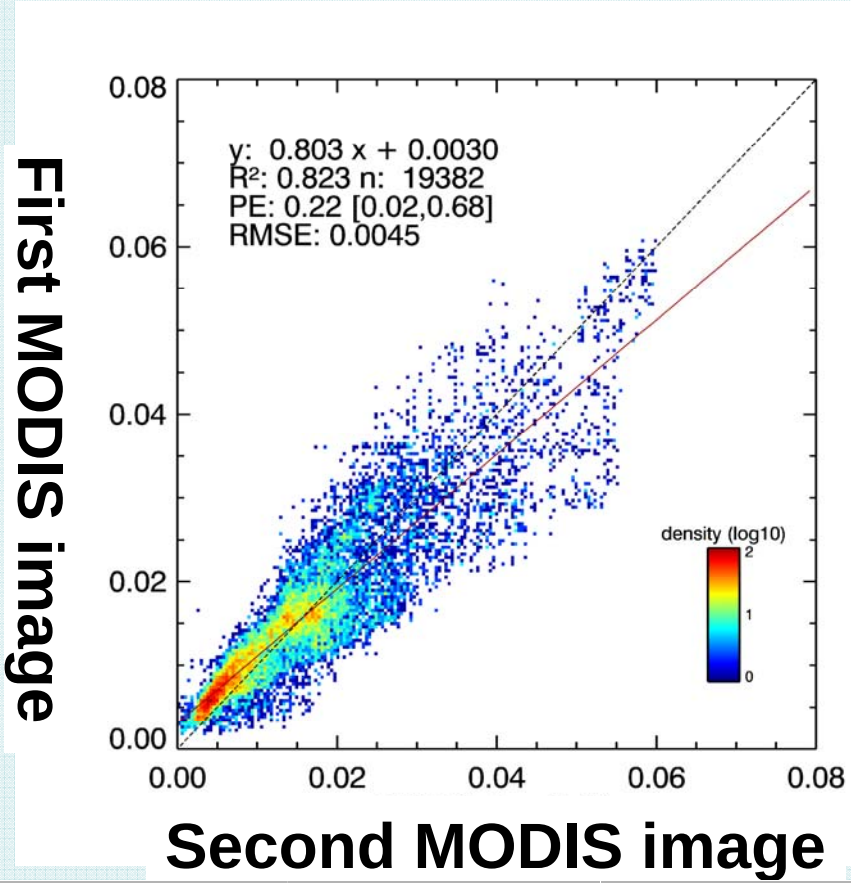
0.00

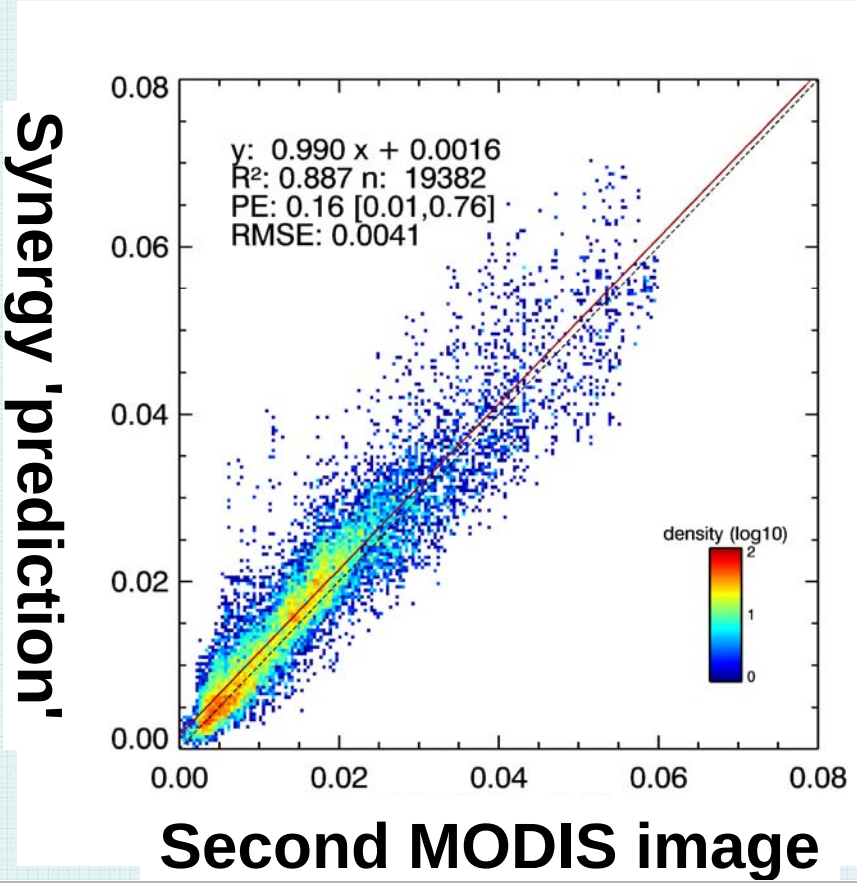
Validation with independent satellite data

MODIS Aqua 2009/04/01

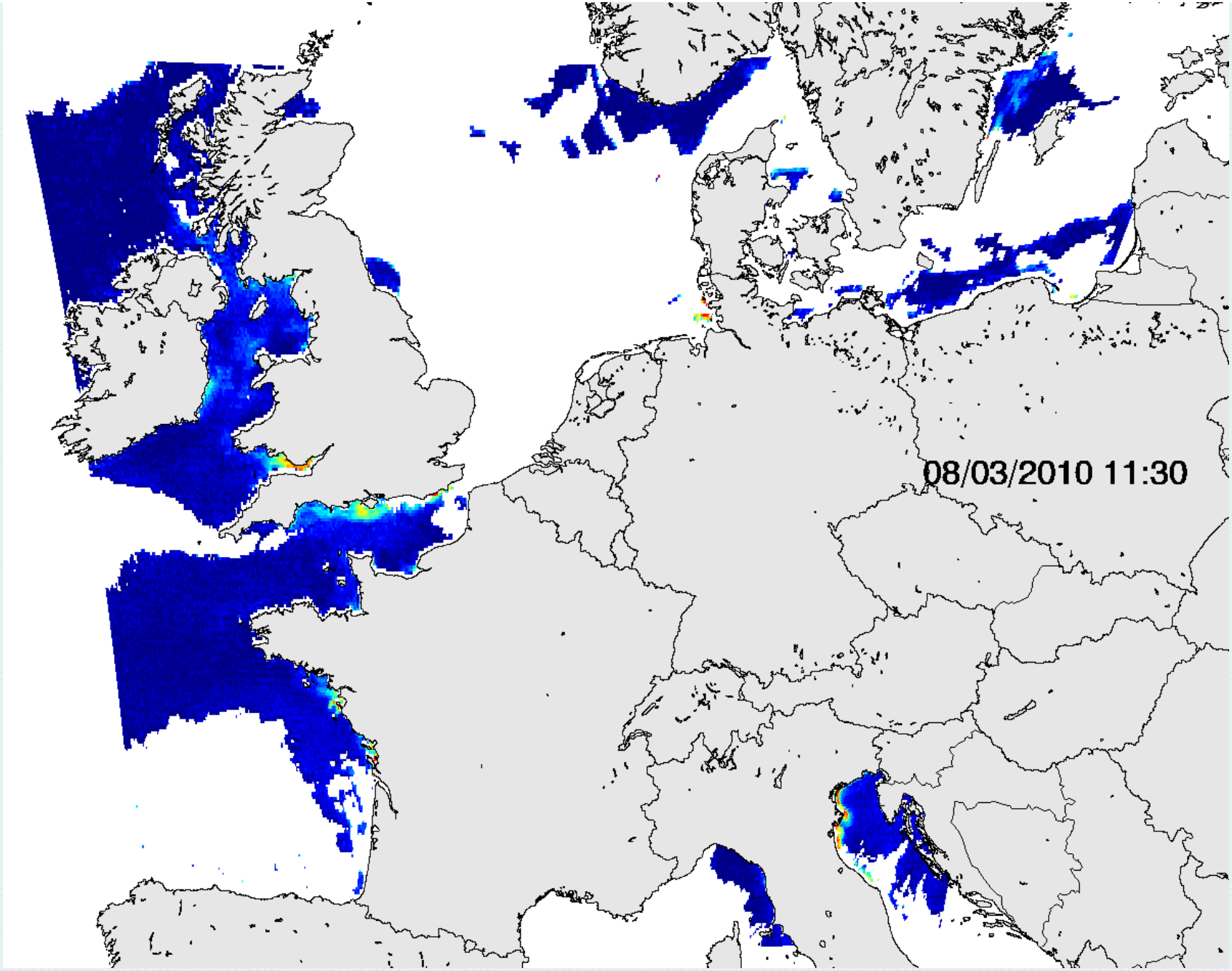


Validation with independent satellite data

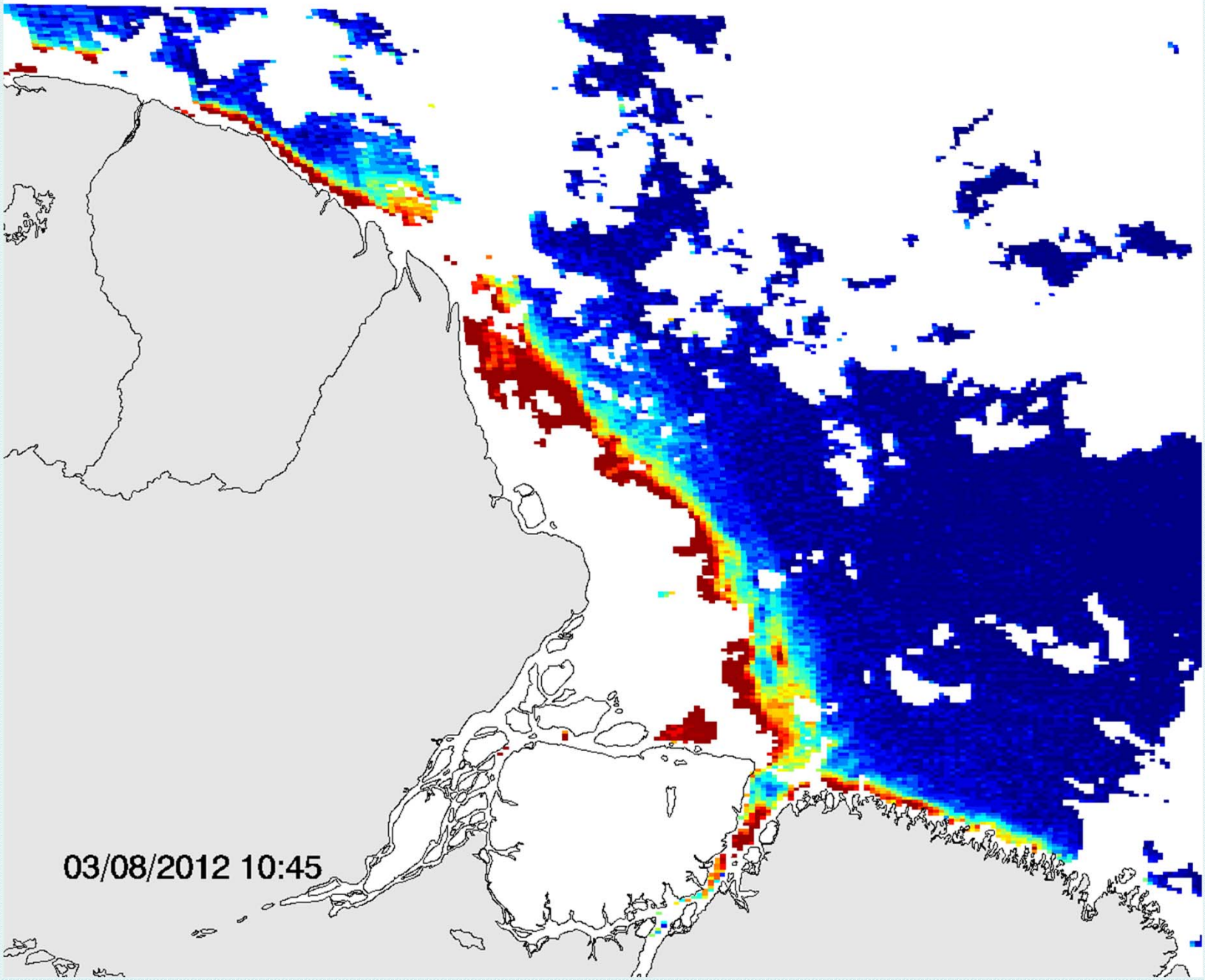




	slope	offset	R2	RMSE	PE50 (5-95)
MODIS	0.83	-0.003	0.82	0.0045	22% (2%-63%)
Synergy	0.99	-0.002	0.89	0.0041	16% (1%-76%)



Other regions in “BEL” crop



Other regions in FULL disk