Ifremer

esa

→ 4th ESA ADVANCED TRAINING
ON OCEAN REMOTE SENSING

Application of the Ocean Colour methods in coastal seas: Experience at Ifremer Brest

Francis Gohin
Laboratoire d'Ecologie Pélagique

Francis.Gohin@ifremer.fr

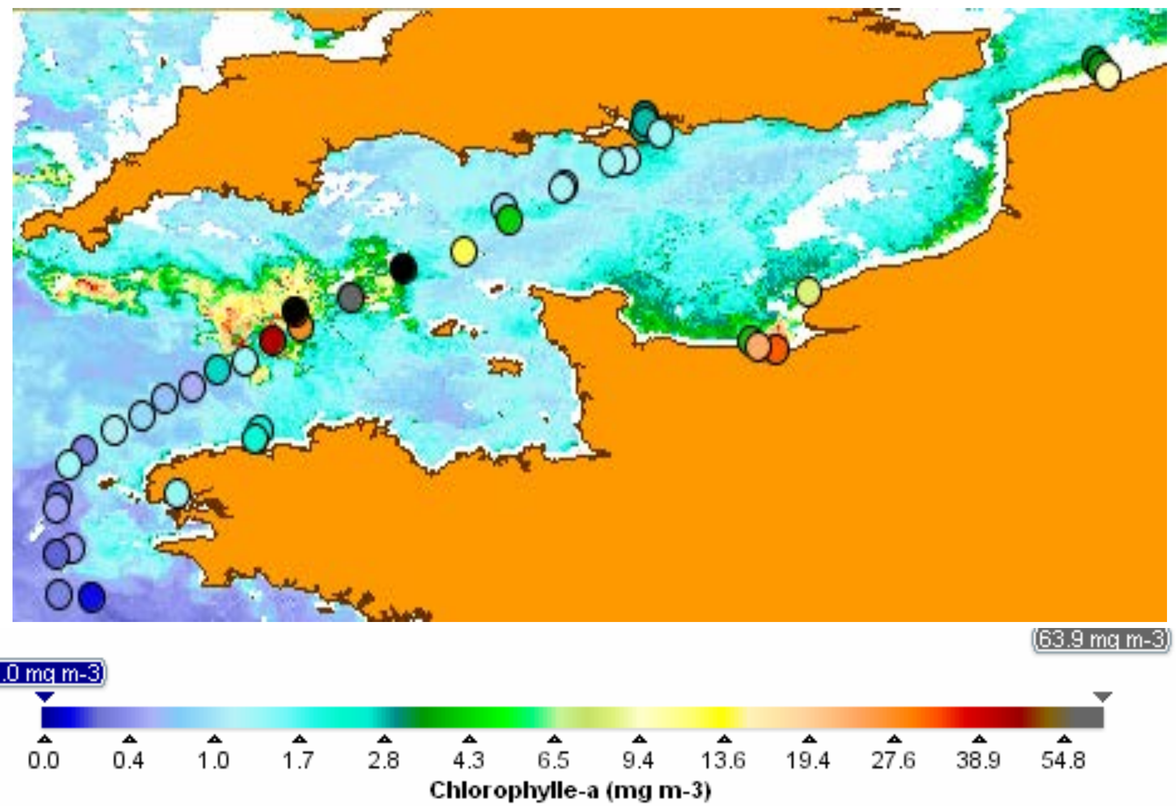
7–11 September 2015 | IFREMER | Brest, France

Complex but monitored waters

The coastal waters are optically complex but …

there are more sampled than the open sea

Example of a SeaWiFS/ MERIS composition on a Karenia mikimotoi bloom in July 2003



Note about the Karenia event in 2010, MarCoast report http://archimer.ifremer.fr/doc/00178/28883/27369.pdf

Procedures at Ifremer

The method for estimating Chlorophyll-a is derived of OC4:

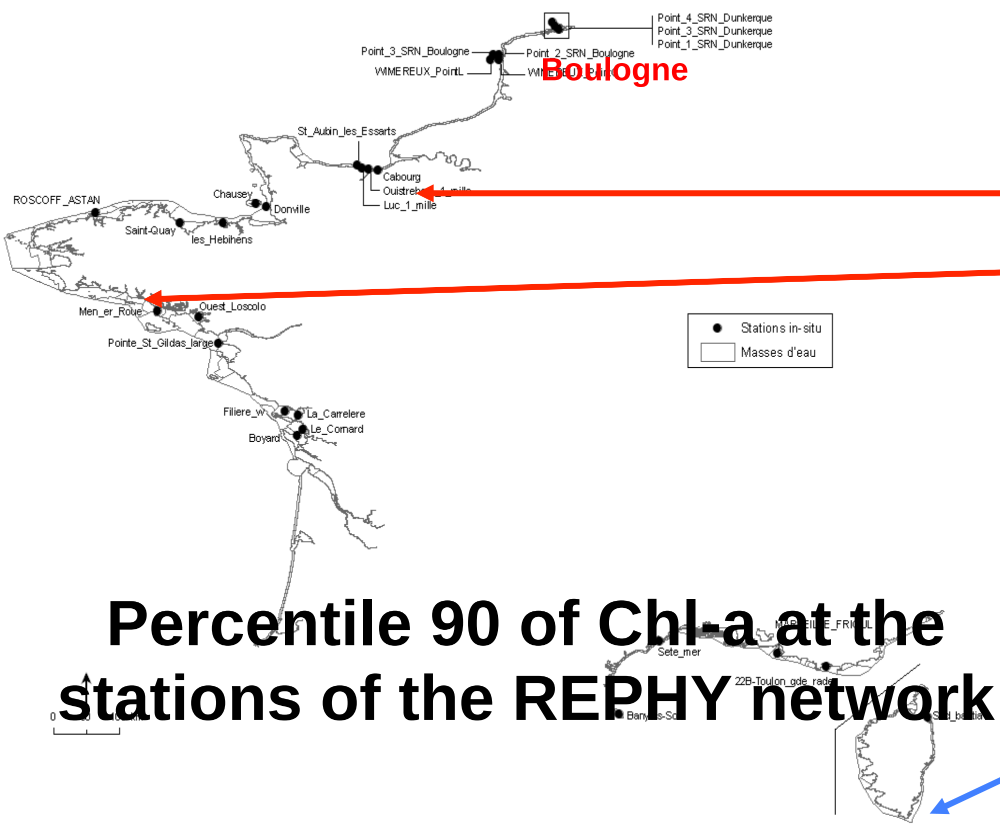
Results identical to OC4 for the Open Ocean, Lower for high reflectance in the green R550 (related to Suspended Particulate Matters) and low reflectance R412 (related to overestimation of the atmospheric content or yellow substances)

The error in remote-sensing is of two orders: Bias (overestimation of Chl-a by OC4 in case of high R550 due to non-algal SPM) and noise (variability of the atmospheric correction, algal population, yellow substances, ….)

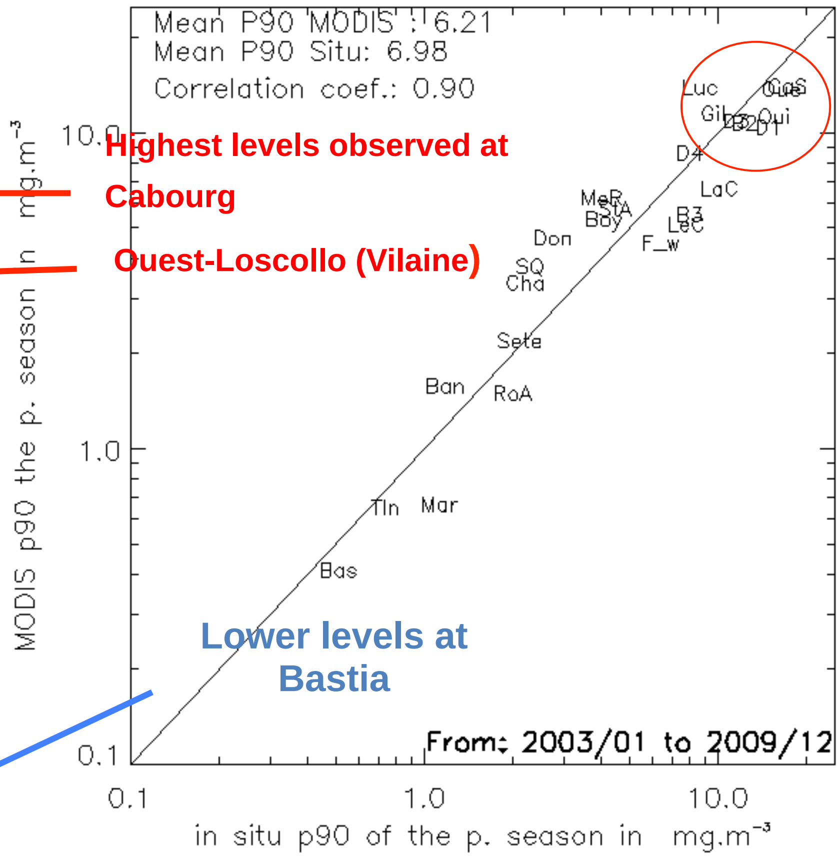
Methods shared with PML/UK and ACRI-ST within the Ocean Colour TAC of Copernicus

http://www.ocean-sci.net/7/705/2011/os-7-705-2011.pdf

Addressing the bias in Chl-a



Percentile 90 of Chl-a at the stations of the REPHY network

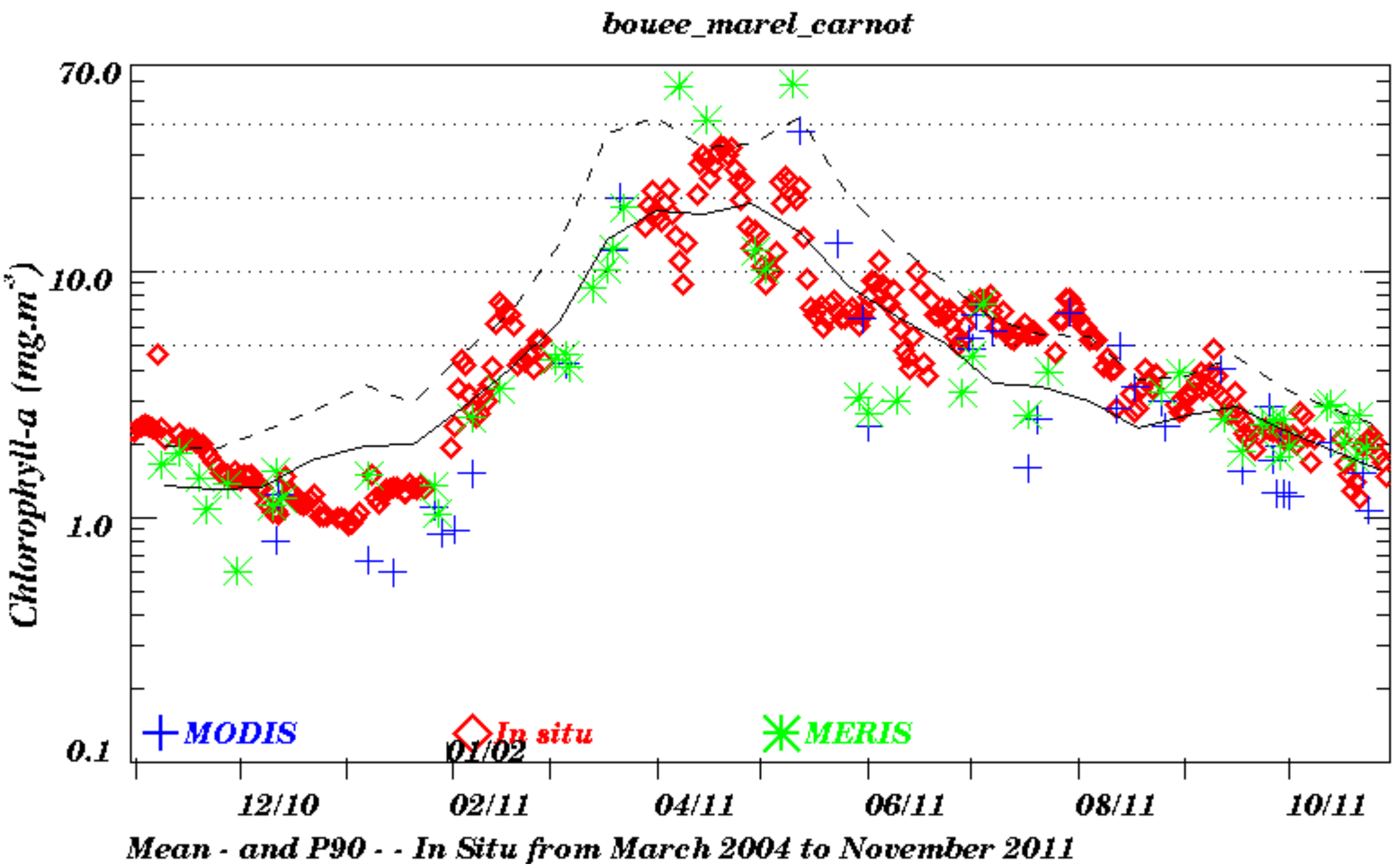


Highest levels observed at Cabourg

Ouest-Loscollo (Vilaine)

Lower levels at Bastia

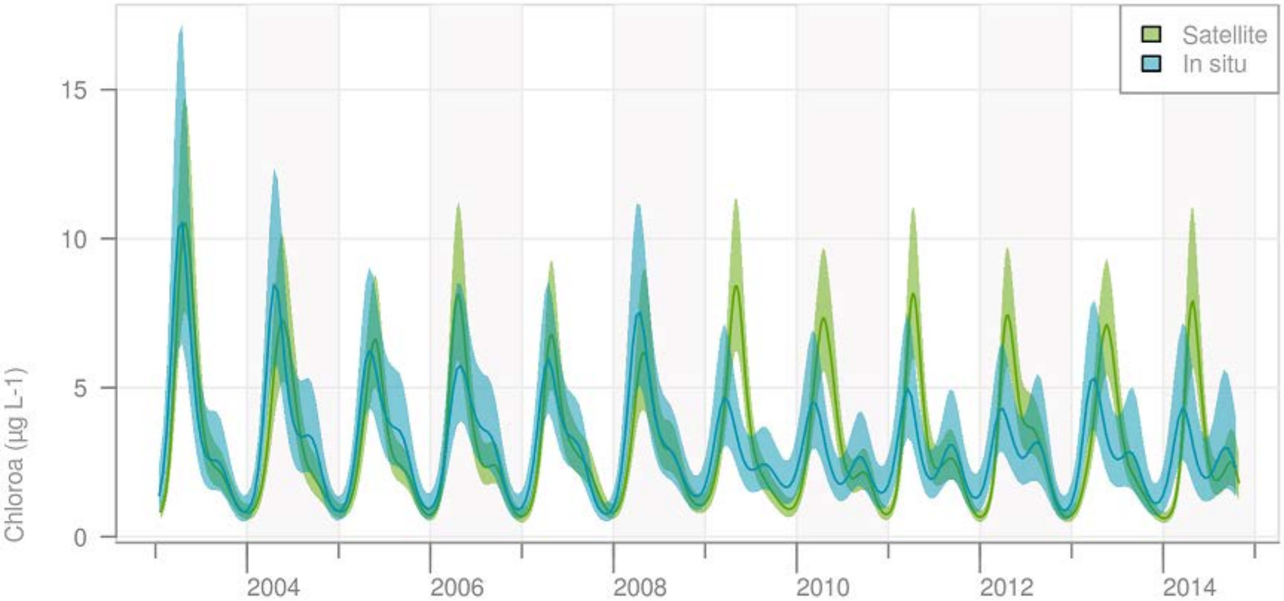
Comparison to fluorescence



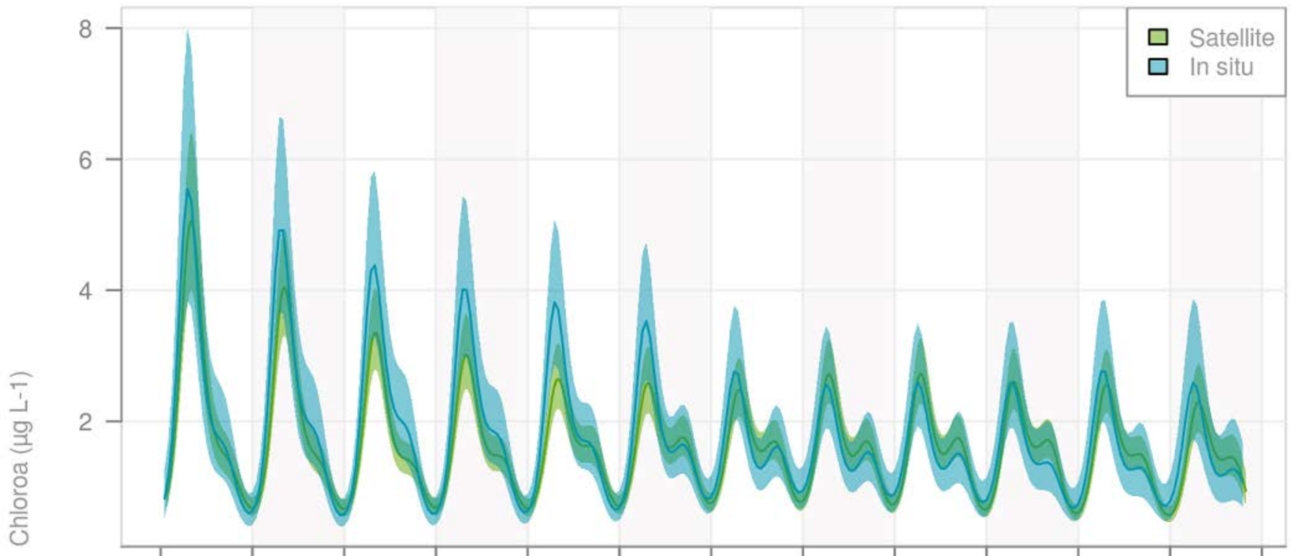
Different validation procedures : here a Generalized Linear Model is applied to the in situ (blue) and satellite data (green) independently at Boulogne Station 2 and Boulogne Station 3 (offshore)

Chl-a Boulogne transect

2003-2014



Point 2 (coastal)

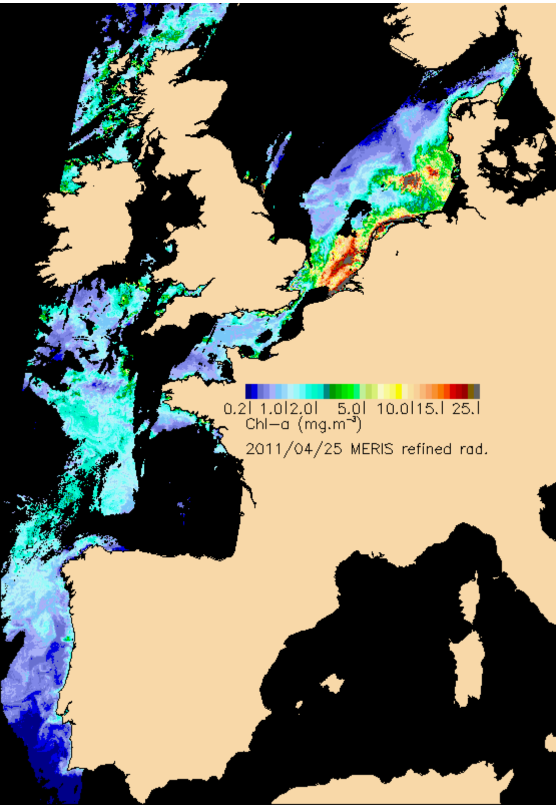


Point 3 (offshore)

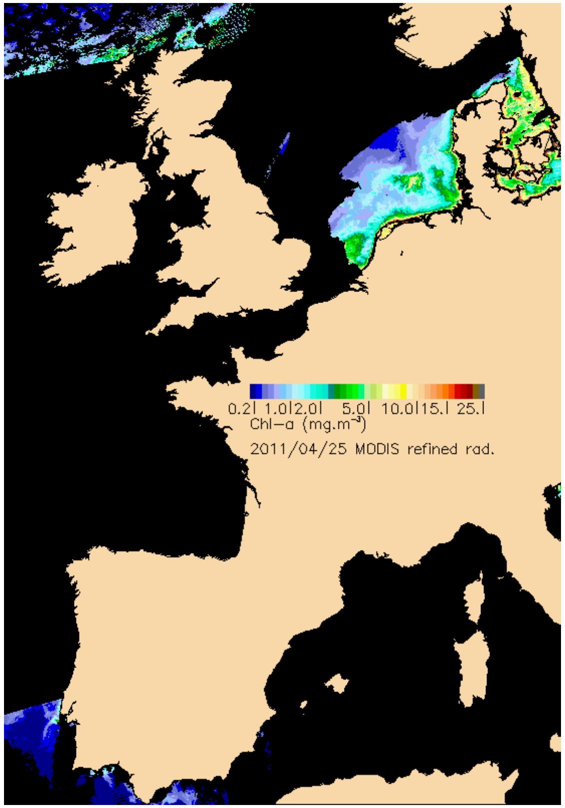
Merging

The method initially applied to SeaWiFS and extended to MODIS, MERIS, VIIRS making easier the merging by kriging example **2011/04/2**

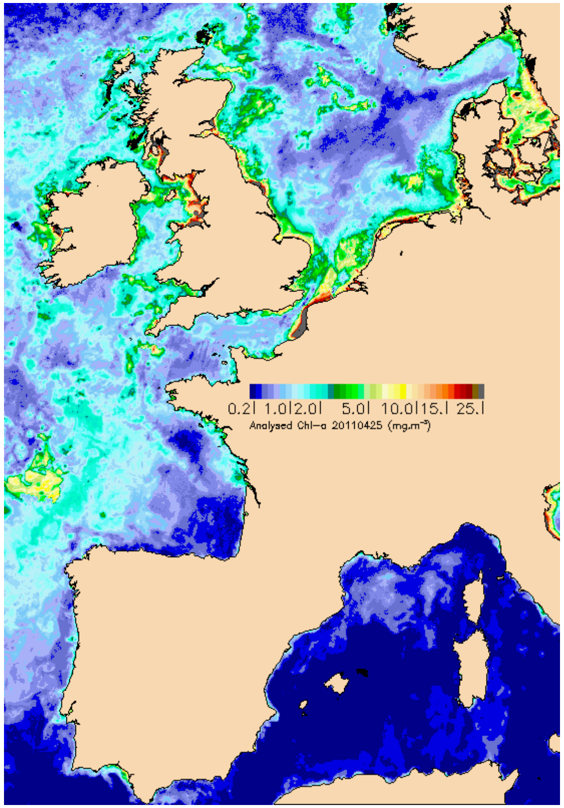
MERIS



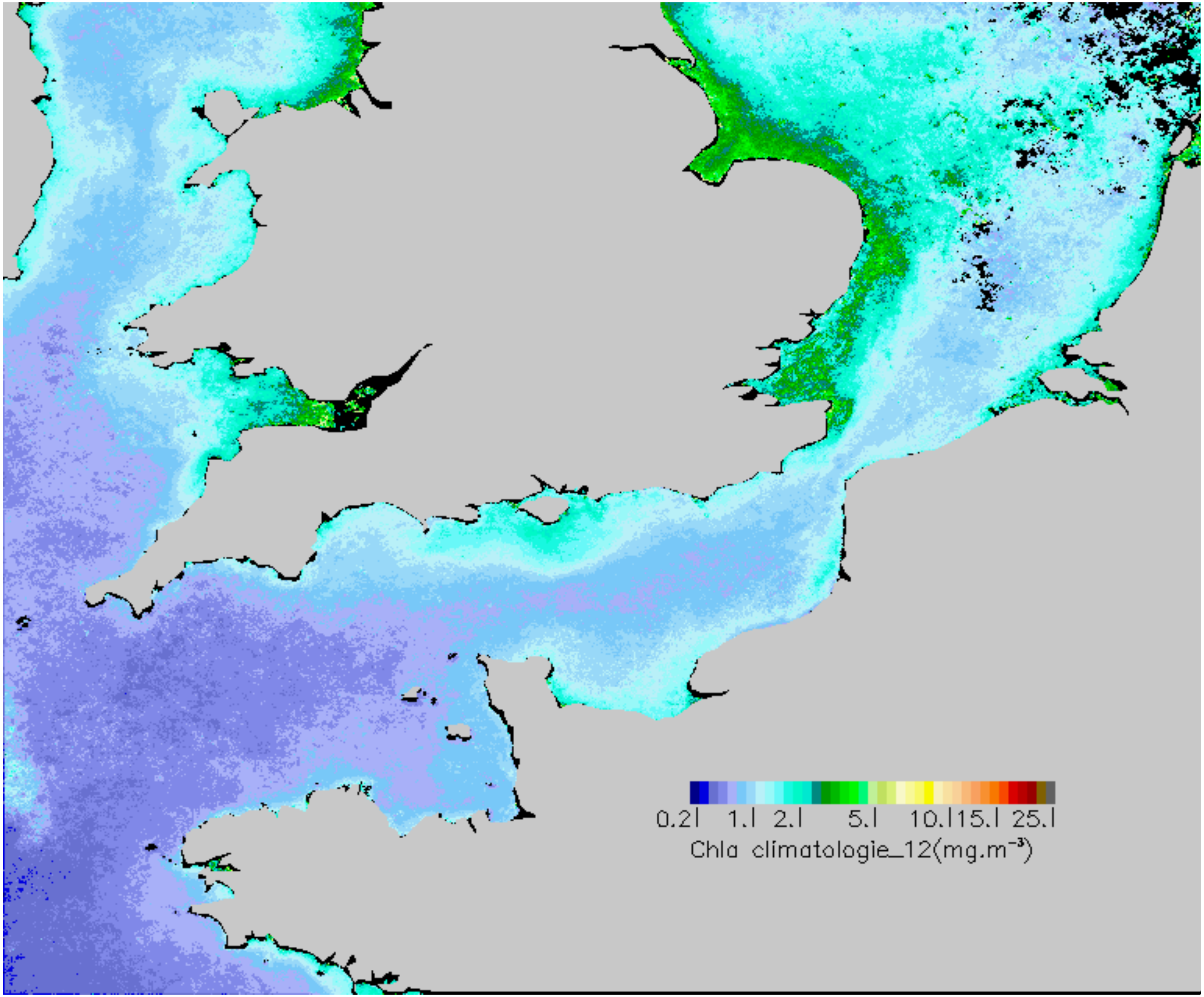
MODIS



Merged Chl-a



Annual cycle of the chlorophyll concentration (from SeaWiFS/MODIS/MERIS 1998-2008)



Non-algal SPM

For forcing light in the coastal biogeochemical models it has been necessary to provide

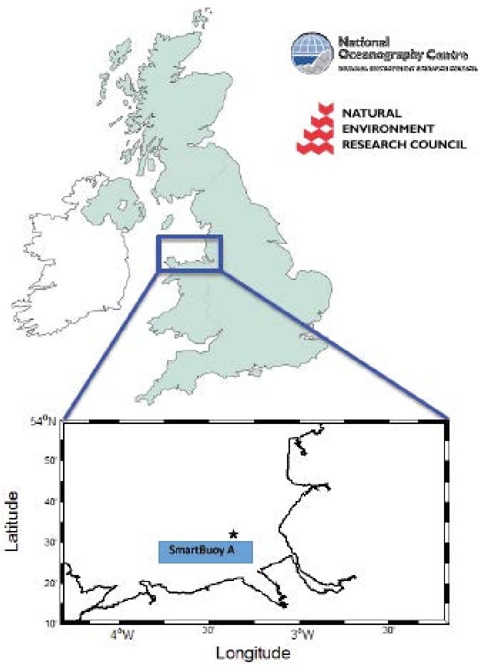
non-algal SPM from OC data

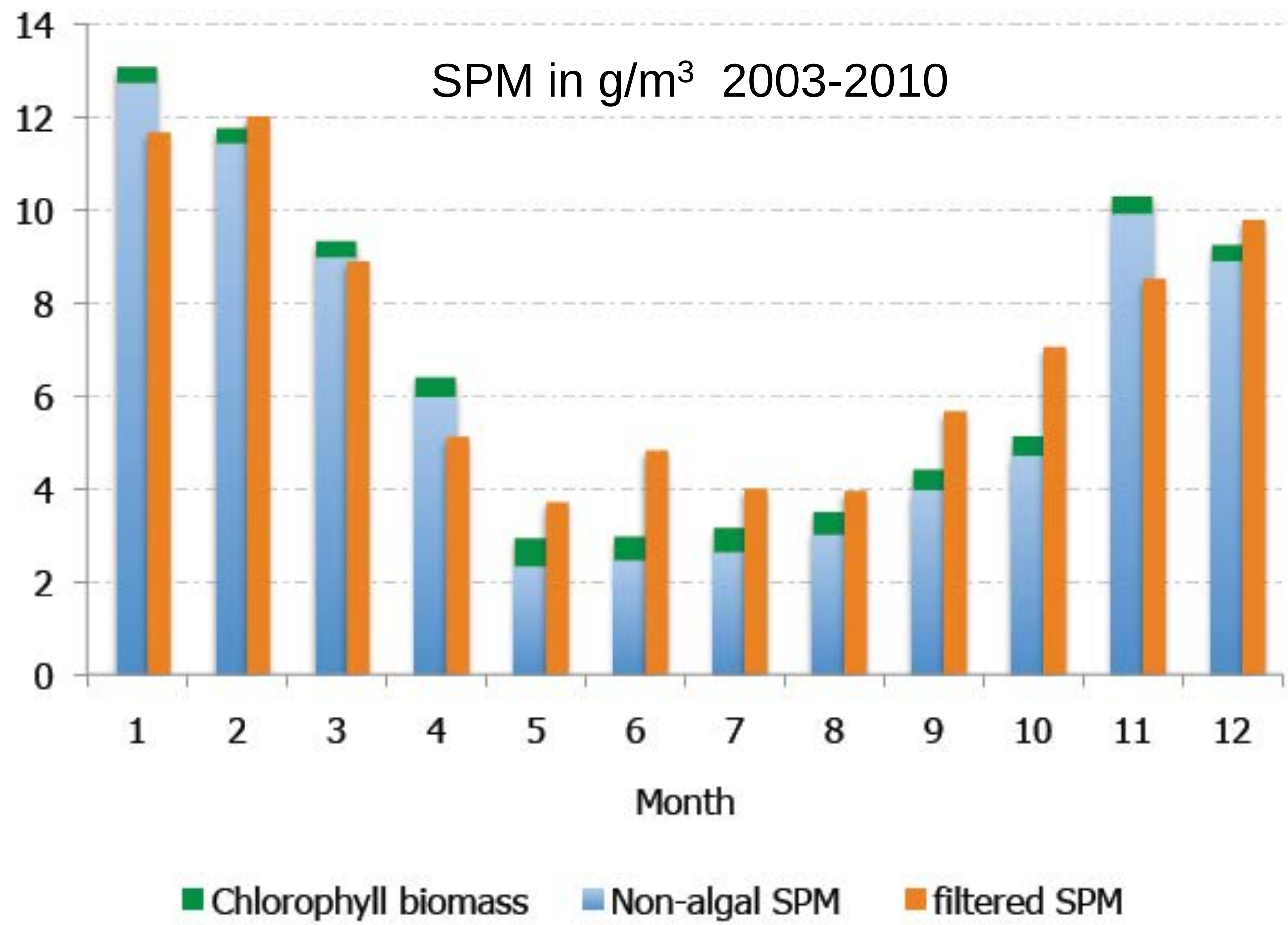
This is obtained from inversion of a semi-analytical model of the reflectance in the green (low turbidity) and the red (moderate to high turbidity)

Gohin, F., Loyer, S., Lunven, M., Labry, C., Froidefond, J. M., Delmas, D., Huret, M., and Herbland, A.: Satellite-derived parameters for biological modelling in coastal waters: Illustration over the eastern continental shelf of the bay of biscay, Remote Sensing of Environment, 95, 29-46, 10.1016/j.rse.2004.11.007, 2005.

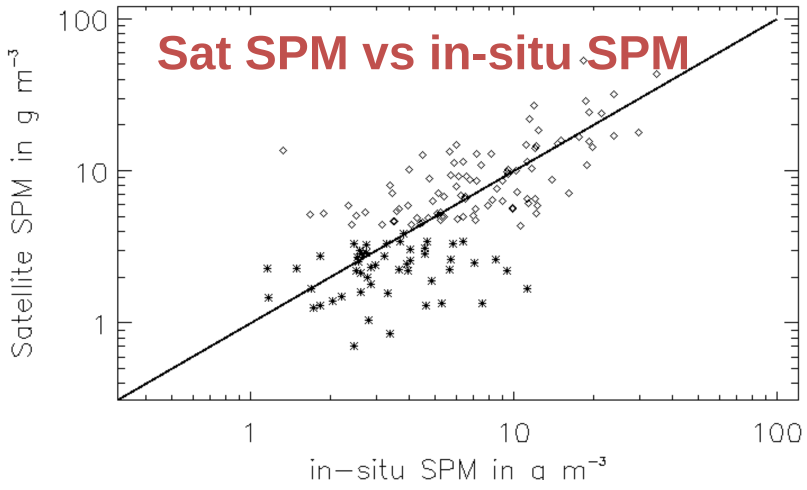
SPM validation

SPM at the Liverpool Mooring (SmartBuoy)





SPM & Turbidity

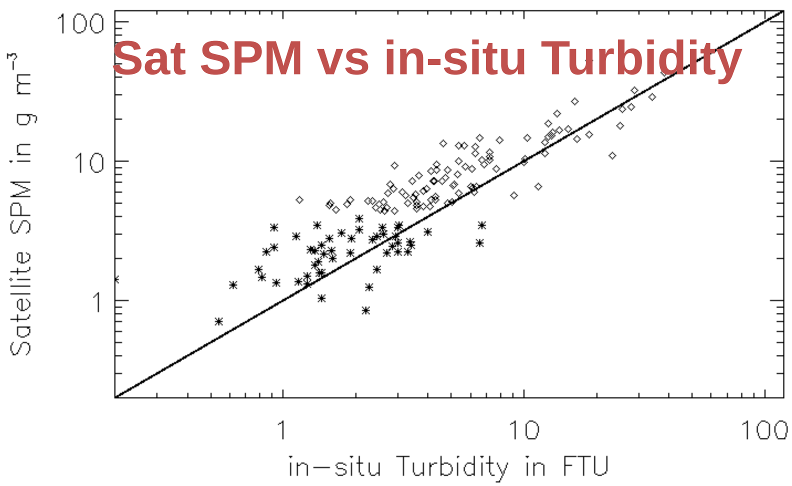


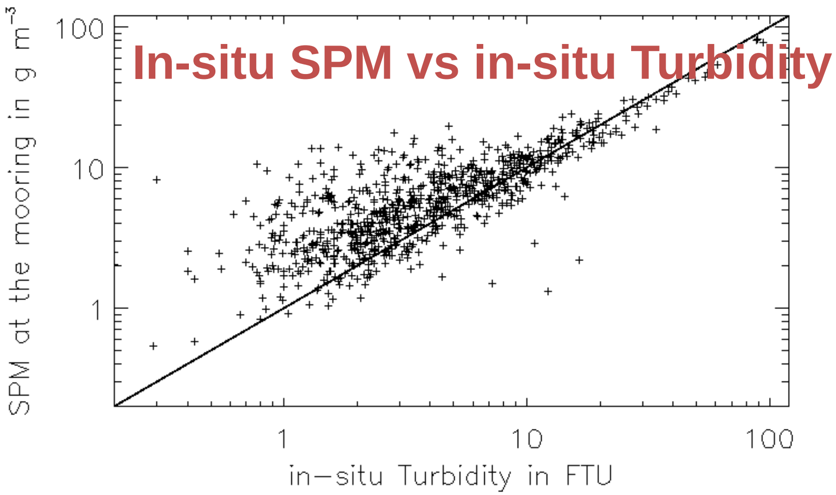
Validation from matchups at the Liverpool mooring

Satellite SPM is better related to in-situ Turbidity than to in-situ SPM

Turbidity is an optical parameter

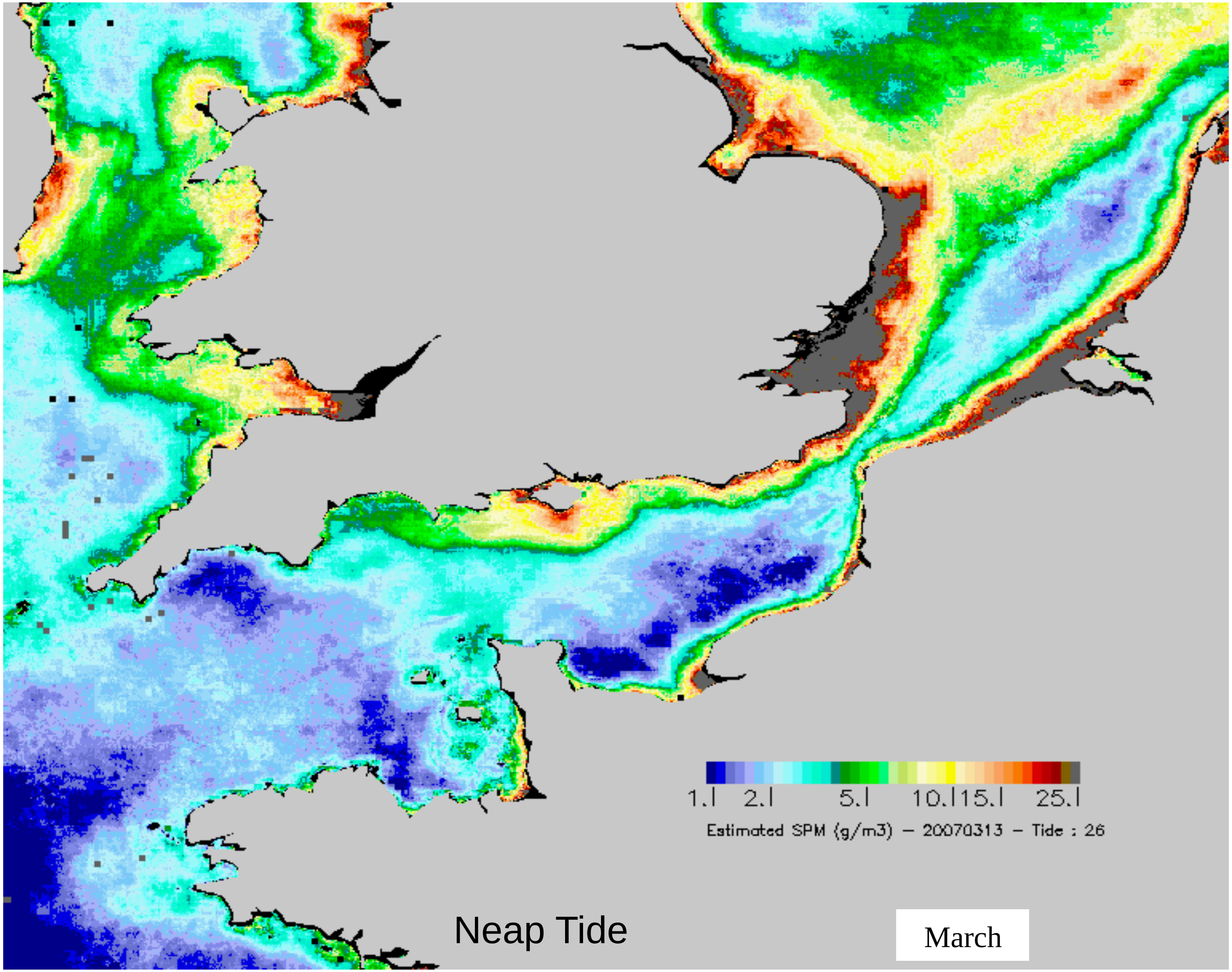
The ratio SPM:Turbidity depends on the nature and size of particles



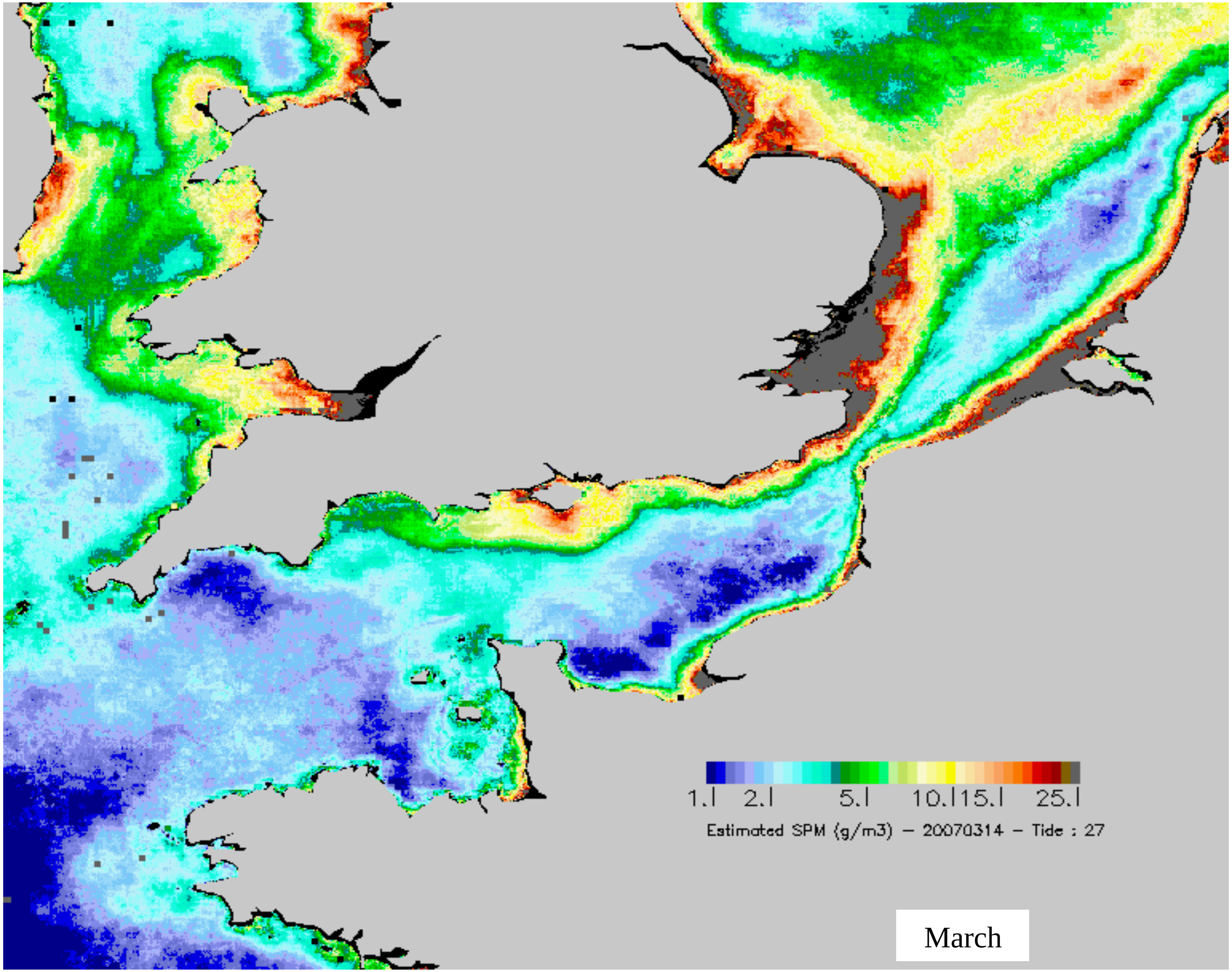


Reconstruction of a Neap/Spring cycle of surface SPM from Ocean Colour data

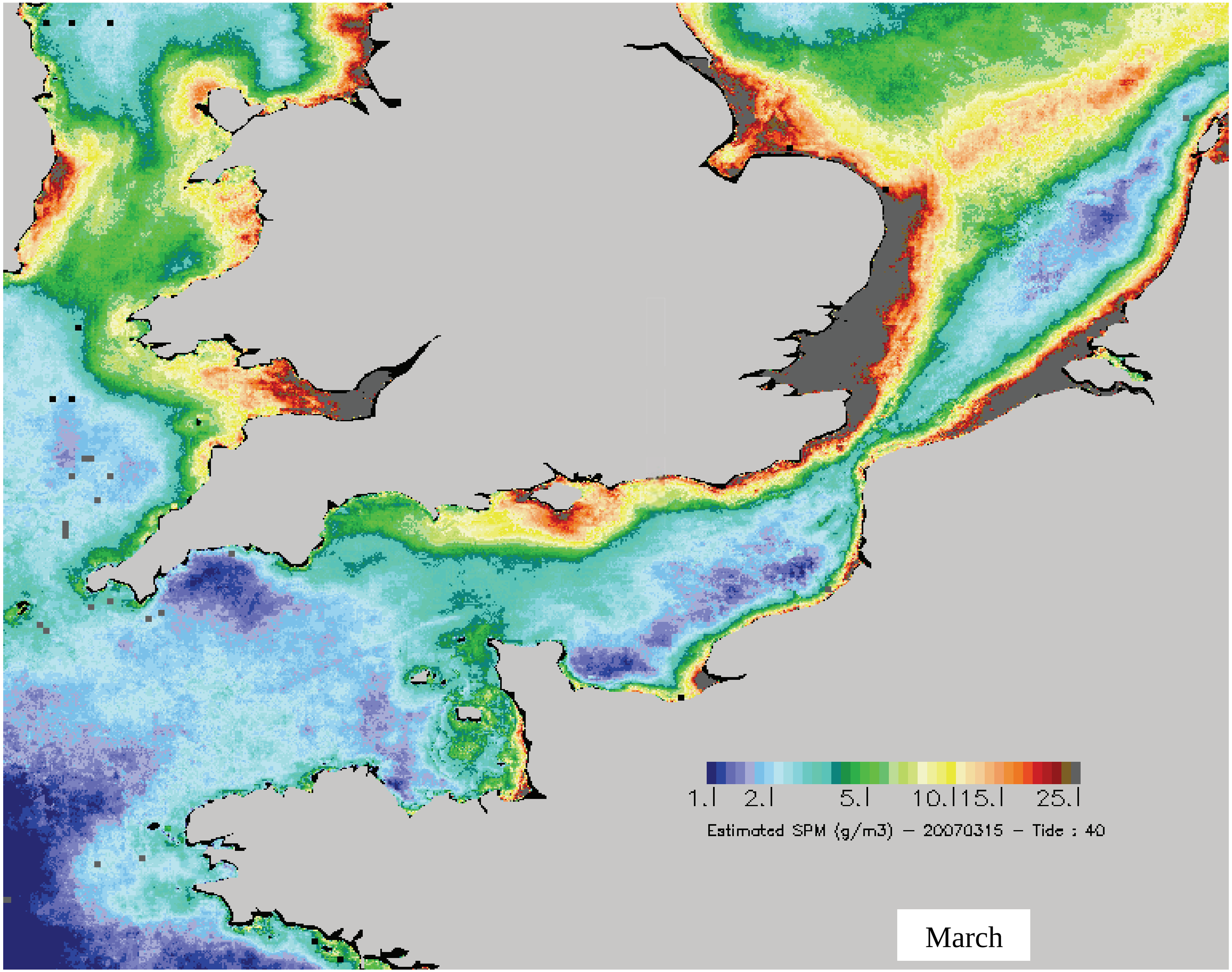
SPM Variability during a spring-neap tidal cycle



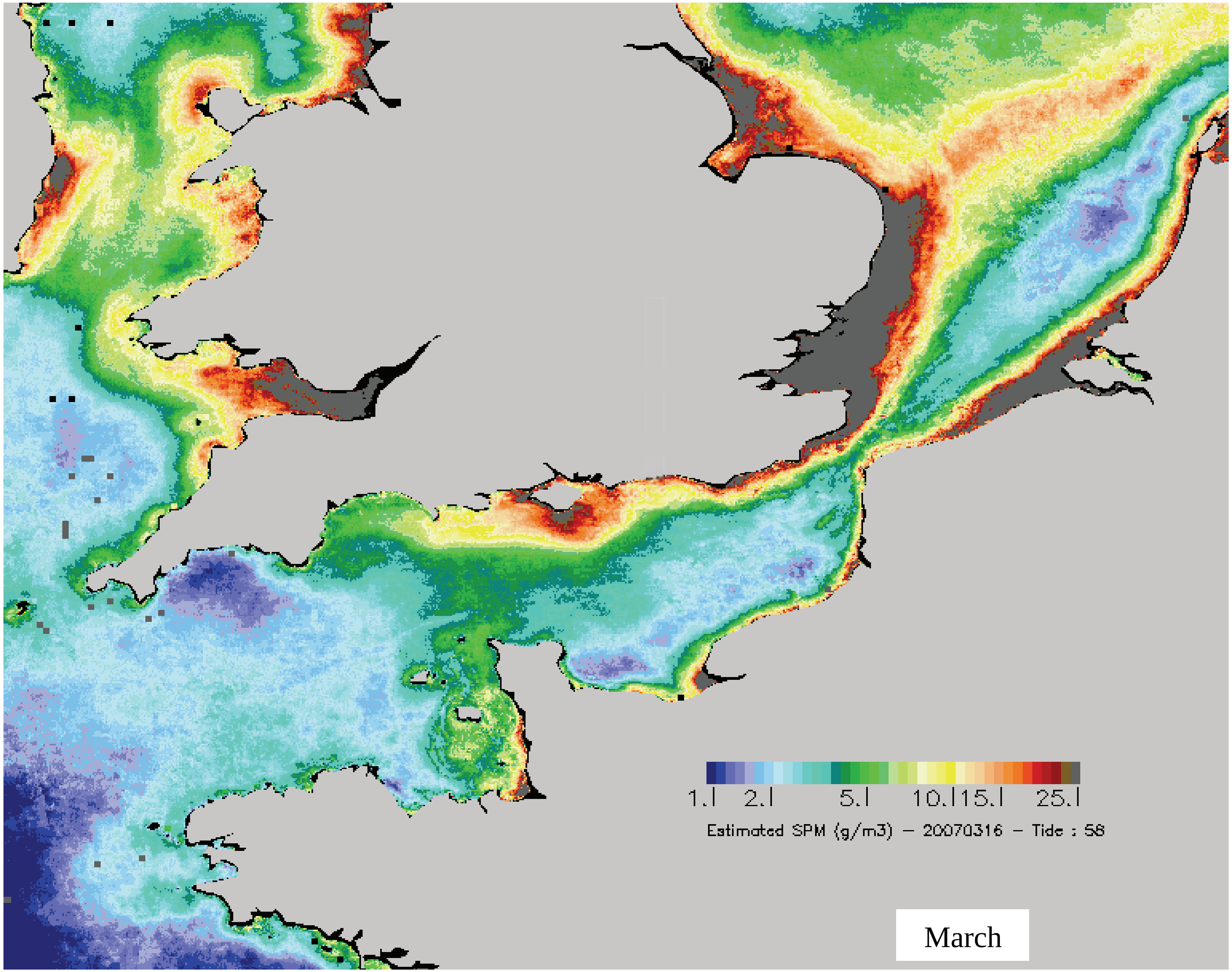
SPM Variability during a spring-neap tidal cycle



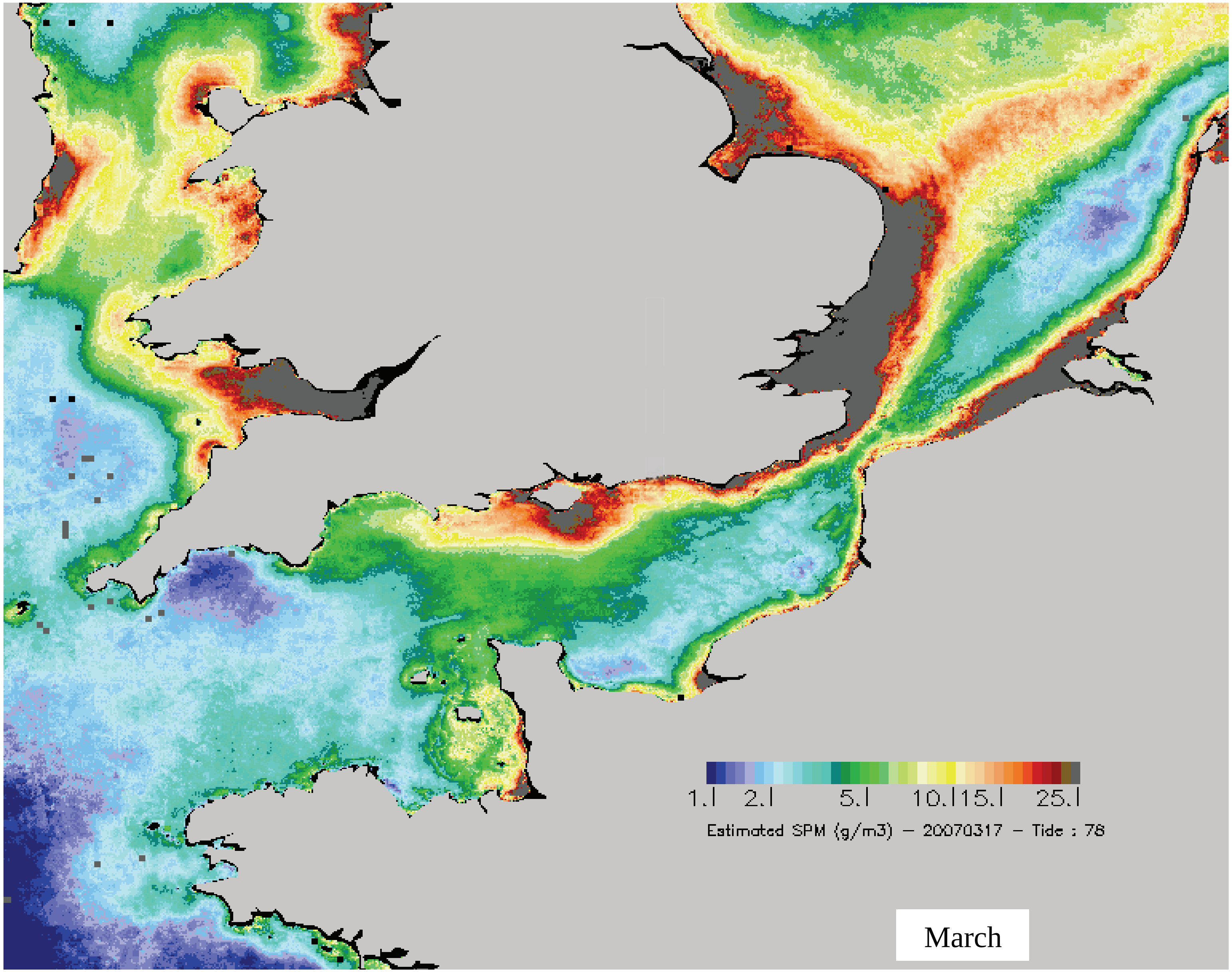
SPM Variability during a spring-neap tidal cycle



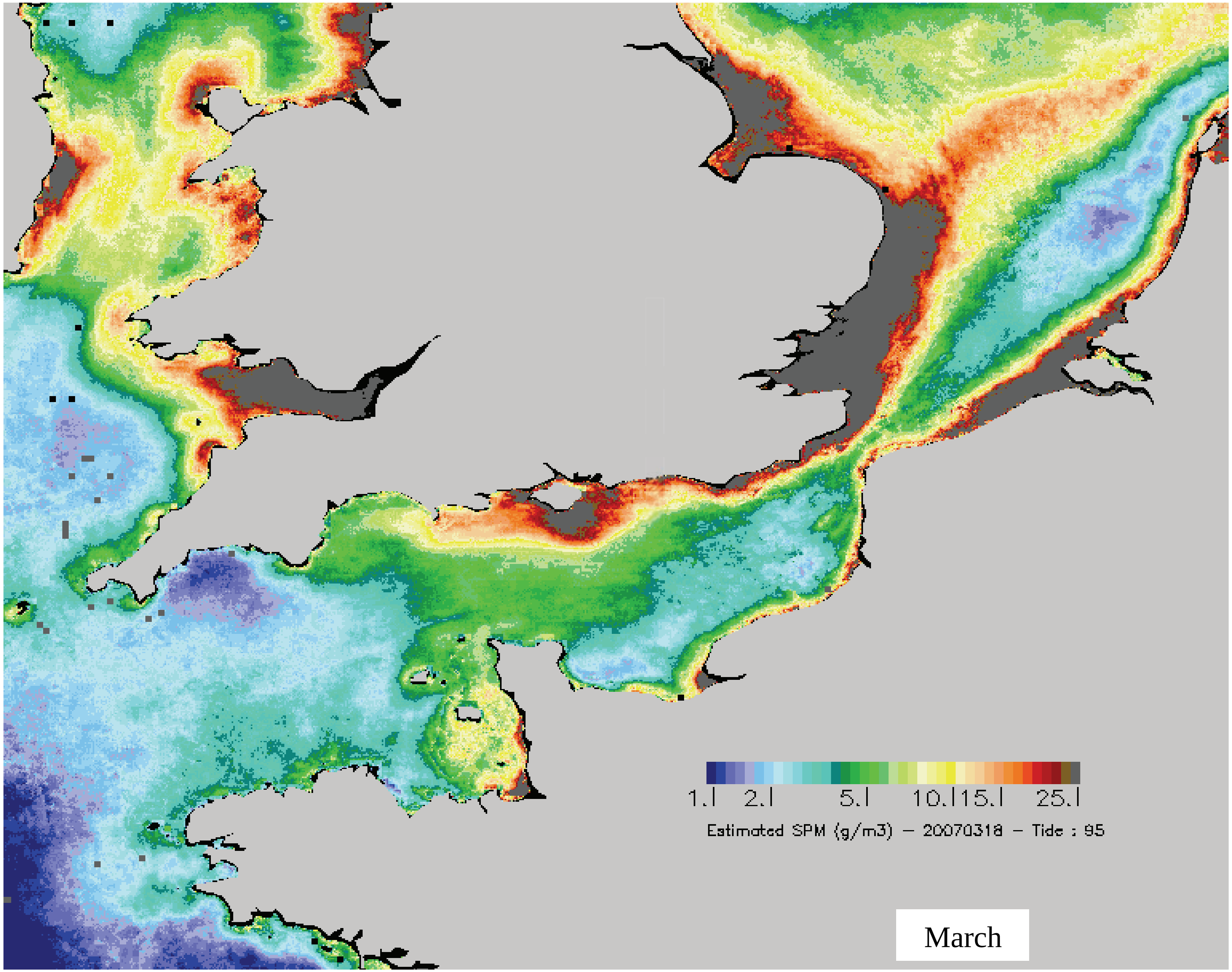
SPM Variability during a spring-neap tidal cycle

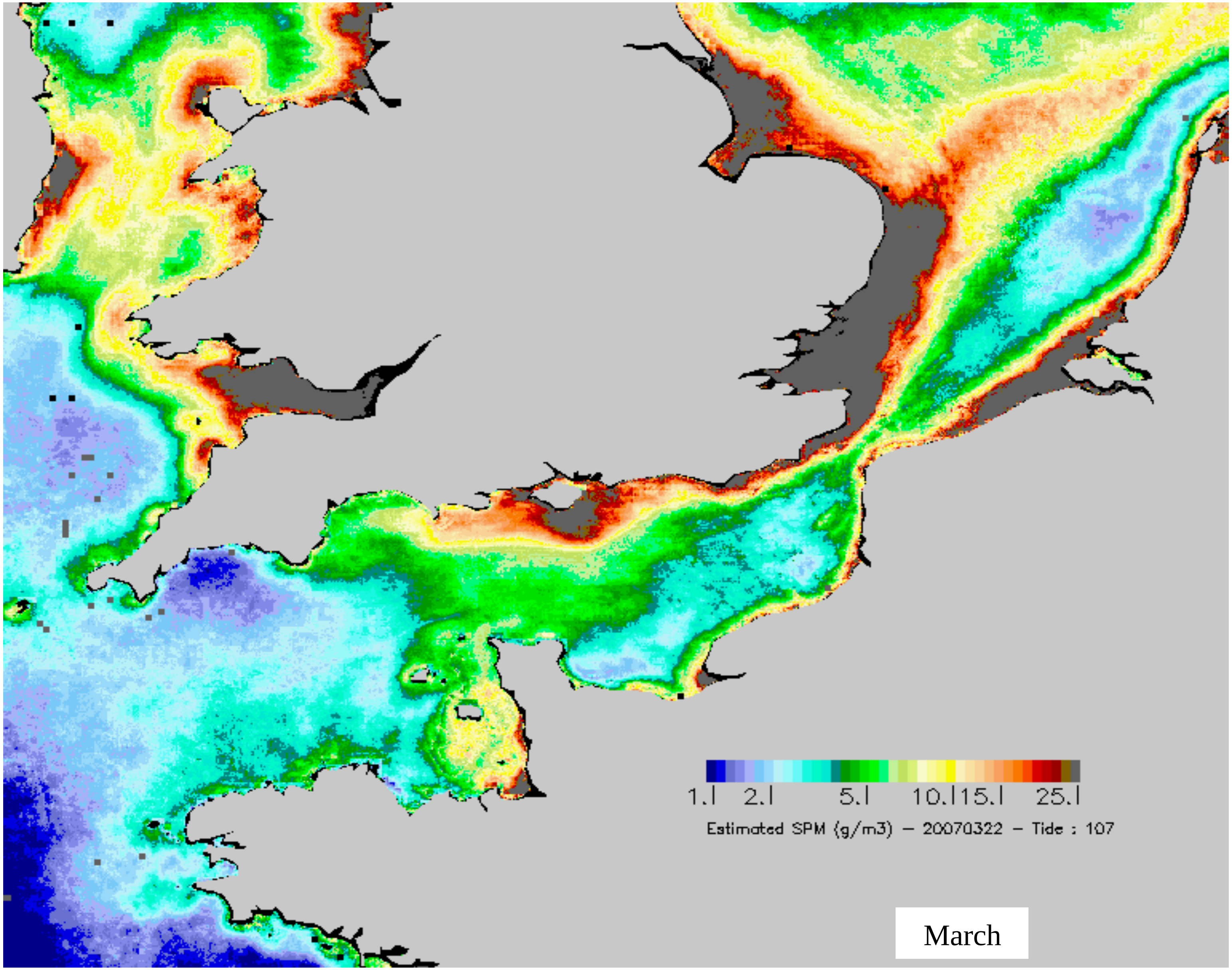


SPM Variability during a spring-neap tidal cycle



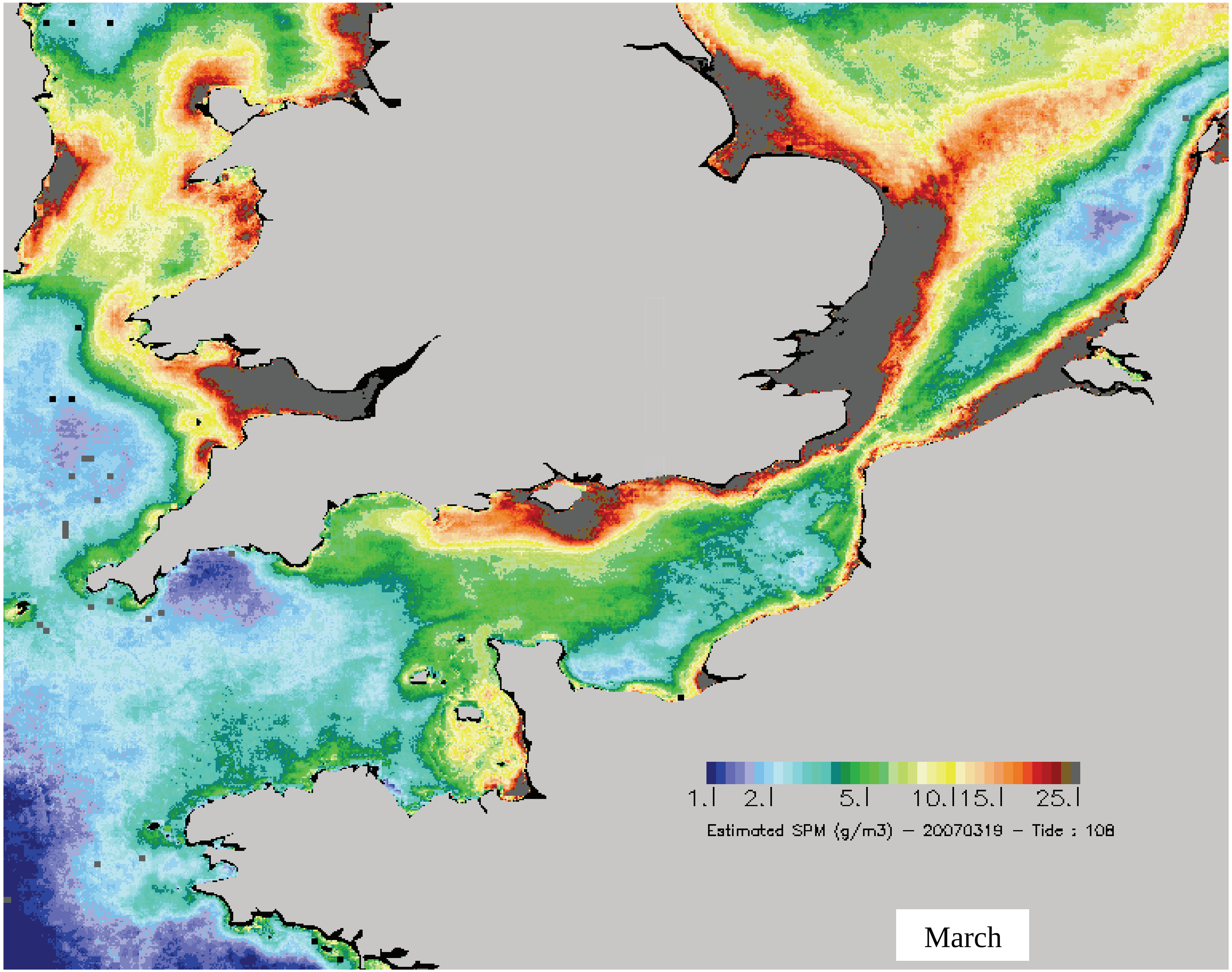
SPM Variability during a spring-neap tidal cycle

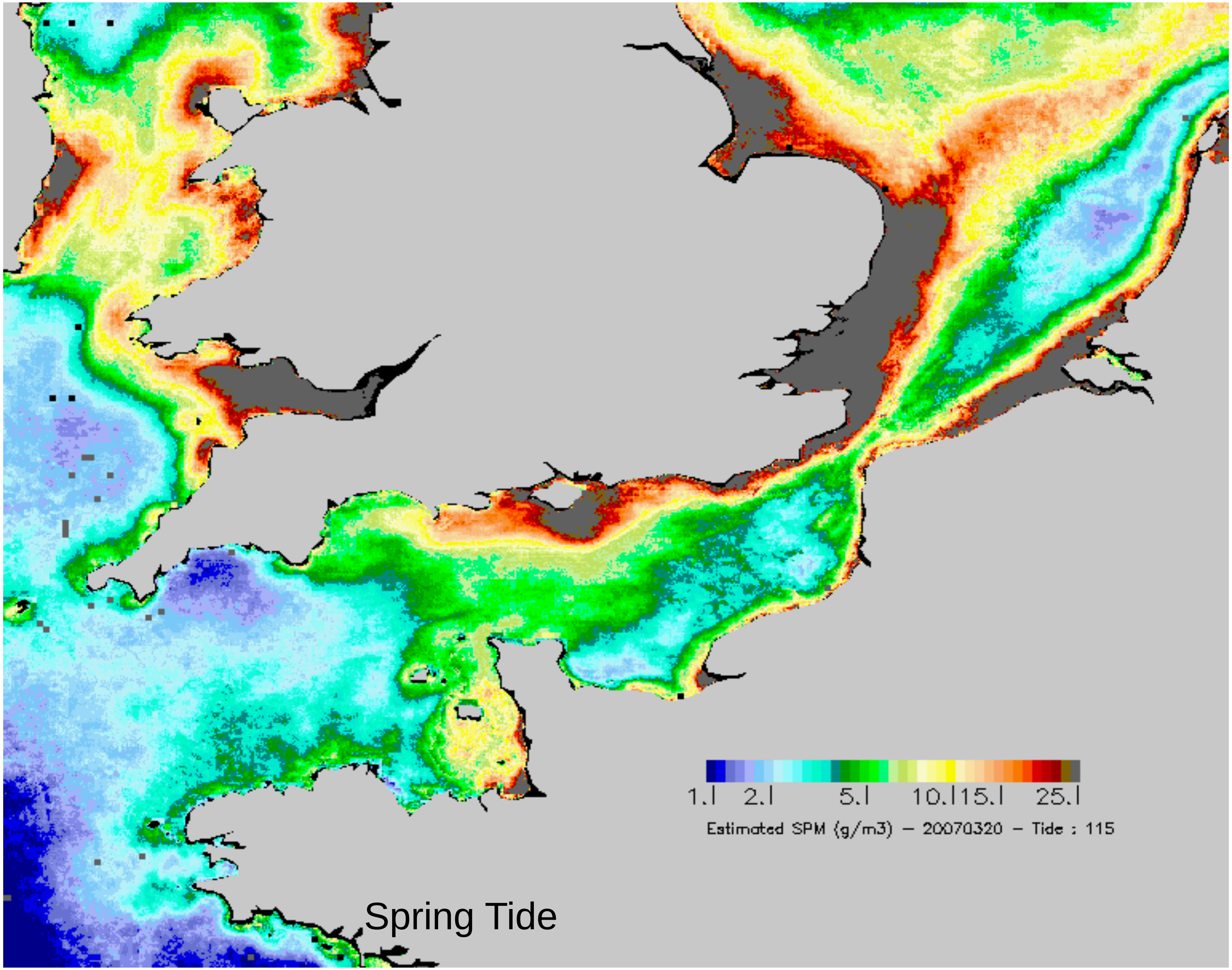




March

SPM Variability during a spring-neap tidal cycle





Spring Tide

Ifremer

The Water Framework Directive

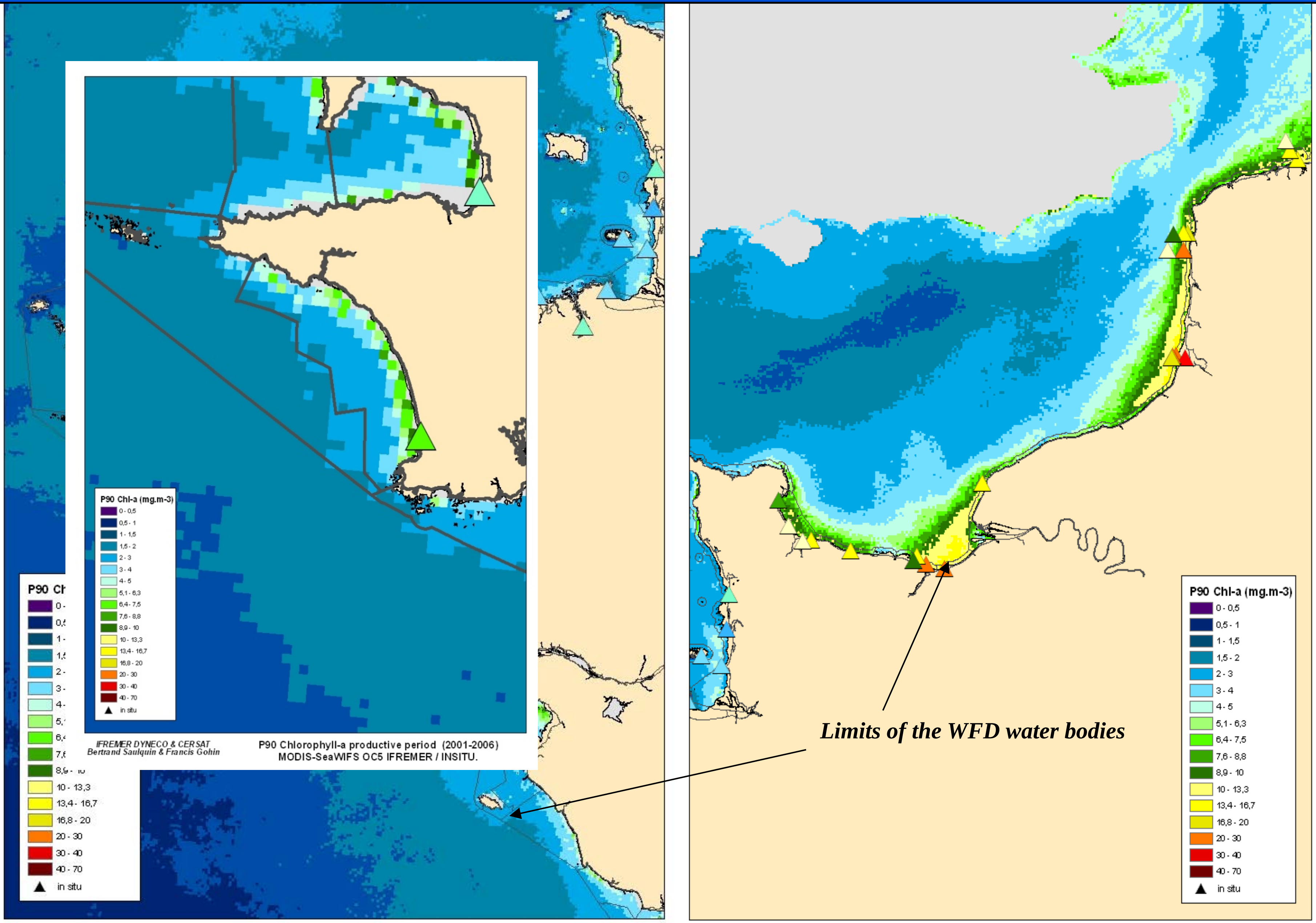
esa

The quality indicator for the phytoplankton biomass in France is the percentile 90 of the Chl-a during the productive period (March to October)

Ecological Status	**High**	**Good**	**Moderate**	**Poor**	**Bad**
Level of the P90 chl-*a* (mg.m^{-3})	**0 – 5**	**5 – 10**	**10 – 20**	**20 – 40**	**> 40**

Limits of the P90 classes applied to the coastal water bodies for the Atlantic Coast

But the best contribution of the satellite is clearly the spatial coverage



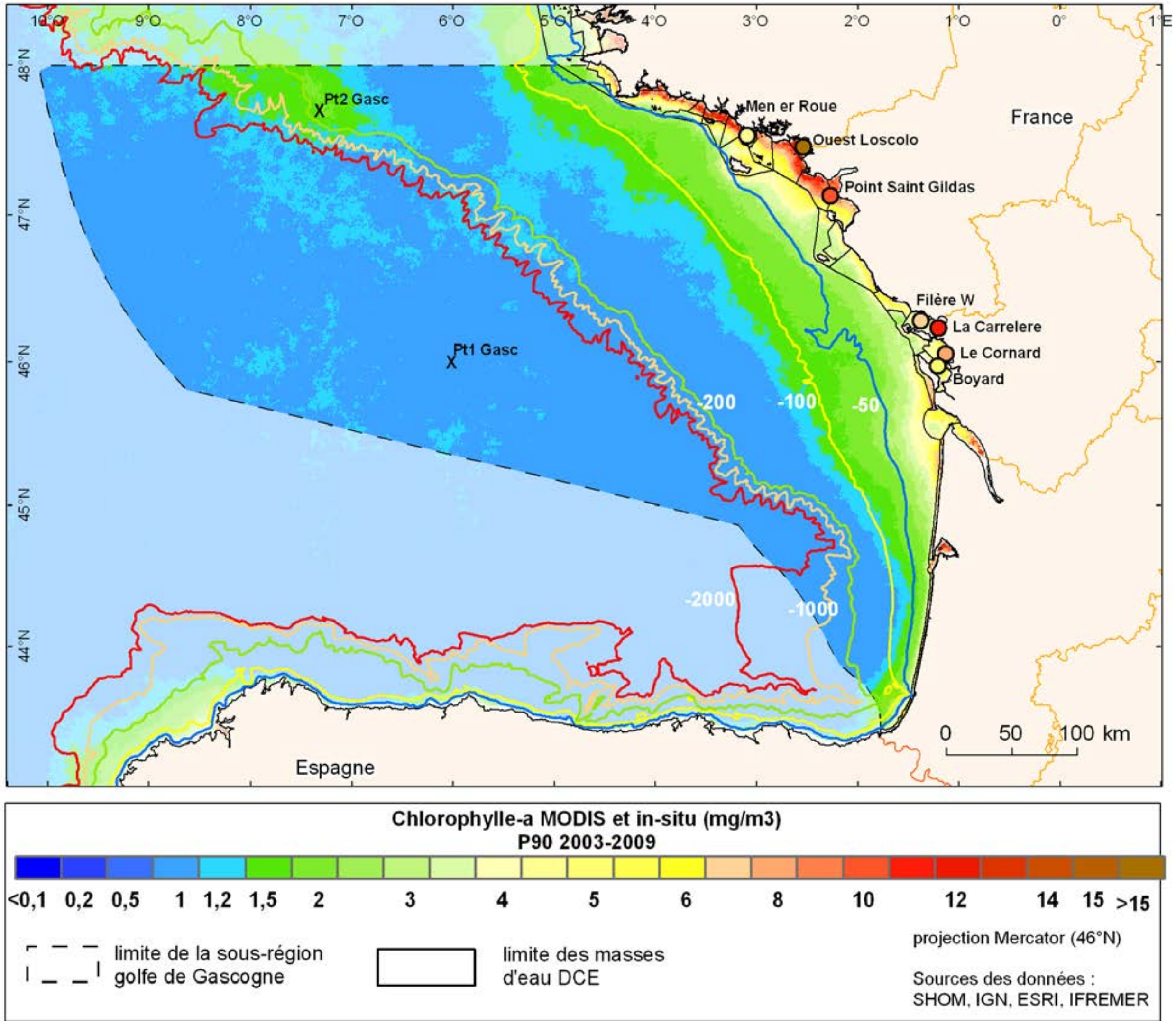
IFREMER DYNECO & CERSAT
Bertrand Saulquin & Francis Gohin

P90 Chlorophyll-a productive period (2001-2006)
MODIS-SeaWIFS OC5 IFREMER / INSITU.

IFREMER DYNECO & CERSAT
Bertrand Saulquin & Francis Gohin

Biomass indicator - "Chlorophyll-a" (2001-2006)
SATELLITES SeaWIFS MODIS OC5.

The Marine Strategy Directive



Conclusion

Coastal waters are optically complex but strong needs and capacities for monitoring several parameters of the marine environment (eutrophication, turbidity and water clarity, HABs) help to apply remote-sensing methods.

As MERIS proved to be an excellent sensor, we are looking forward to working with OLCI/Sentinel-3 data