Le devenir des apports du Rhône en Méditerranée NW: lien avec le PPR RIOMAR

Rabouille Christophe, LSCE

Projets CHIFRE, Granoflux, DeltaRhone (EC2CO)

NWMed workshop 16-18 nov 2022

Laboratoire des sciences du climat & de l'environnement

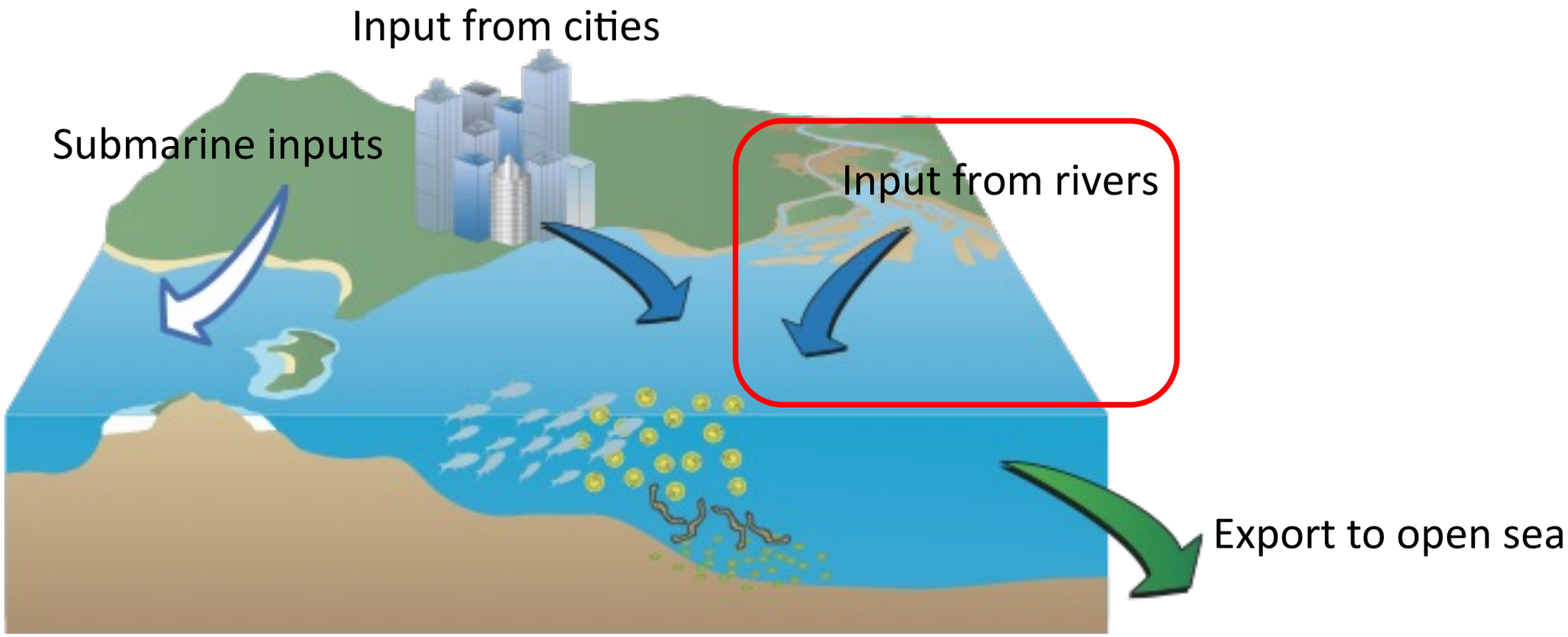
IMBIZO III- Biogeochemistry-ecosystem interactions on changing continental margins

C. Rabouille, R. Verney, I. Pairaud, F. Bourrin,
P. Kerhervé, N. Tisnérat, JL. Reyss, D. Doxaran,
Y. Lerrede

MERMEX-RIVERS

Influence of extreme events on river delivery of particulate organic carbon, nutrient and contaminants, their fate in the delta and continental shelf and their impact on ecosystems

RIVERS - Objectives



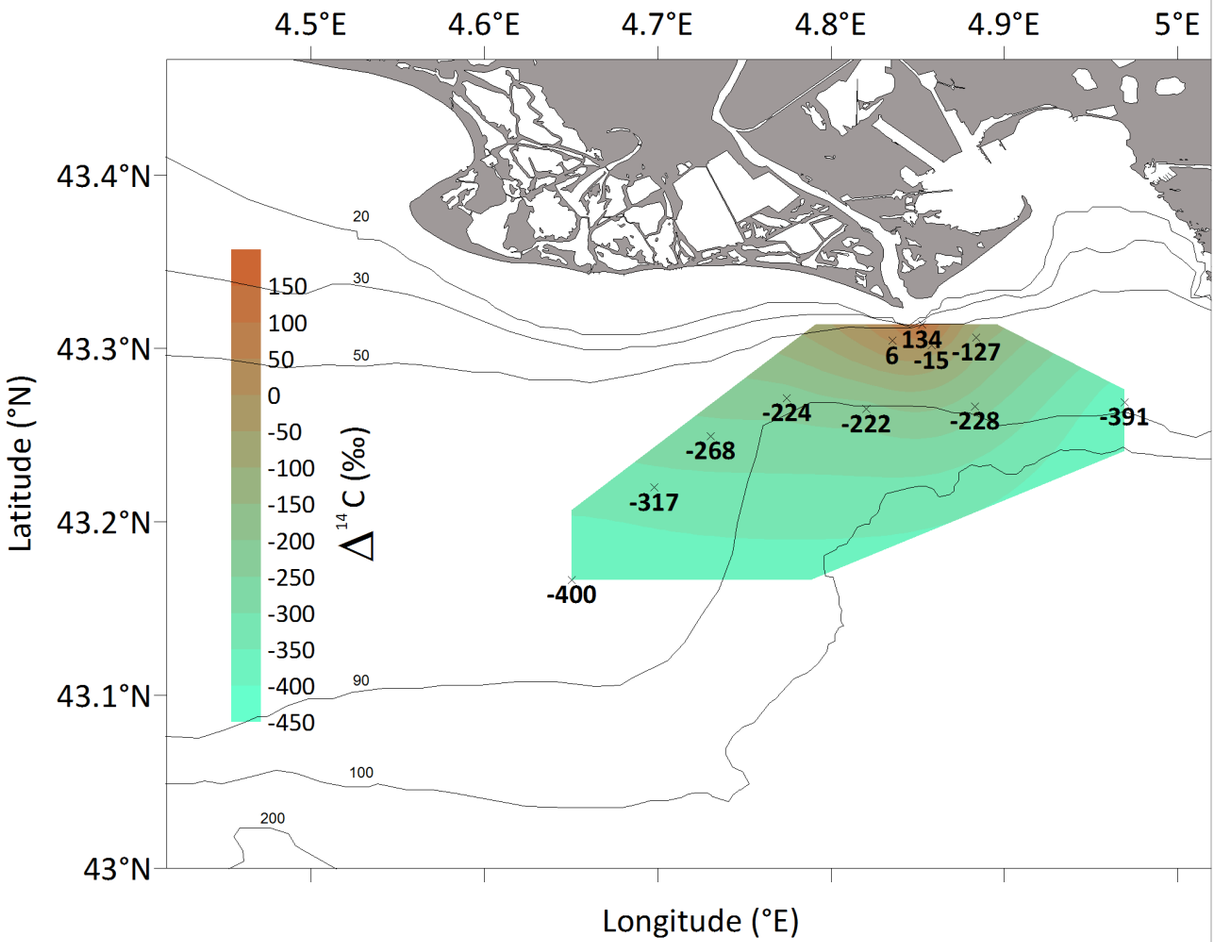
Objectives:

- Establish the mode of transfer and transformation of the river inputs to the shelf
  - Focus on the Rhône River (main particle delivery) and its dispersion on the shelf
  - Focus on particle dynamics (Org-C and contaminant carrier)
  - Fate of organic carbon after deposition in sediments
  - impact on and feedback from distribution of benthic fauna
- Focus on intense events, floods and storms

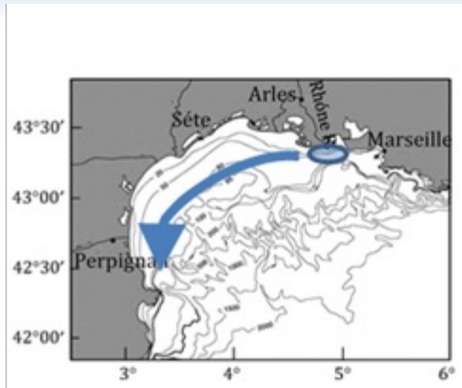
The Rhône River and the Gulf of Lion

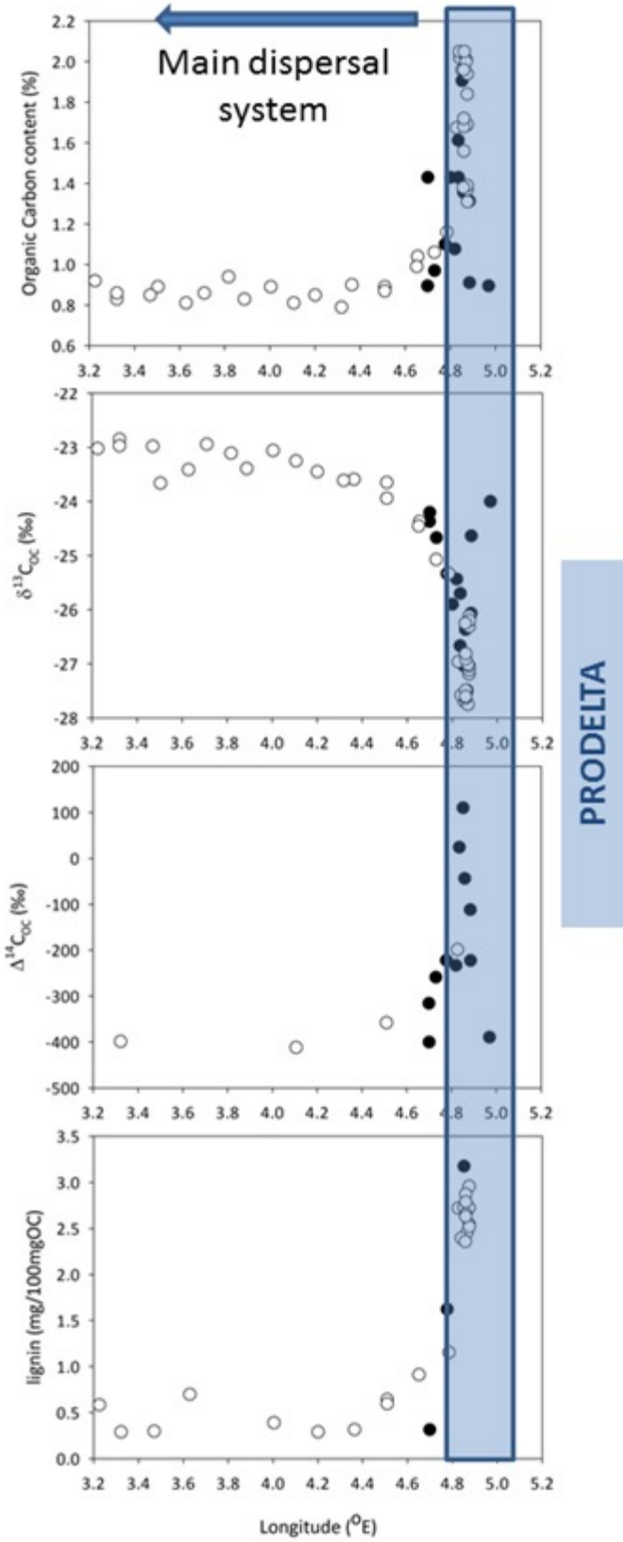
The Rhône River is the main driver of changes in organic carbon composition in the Gulf of Lion

The Rhone prodelta and nearby shelf is by far the most active region for these transformations



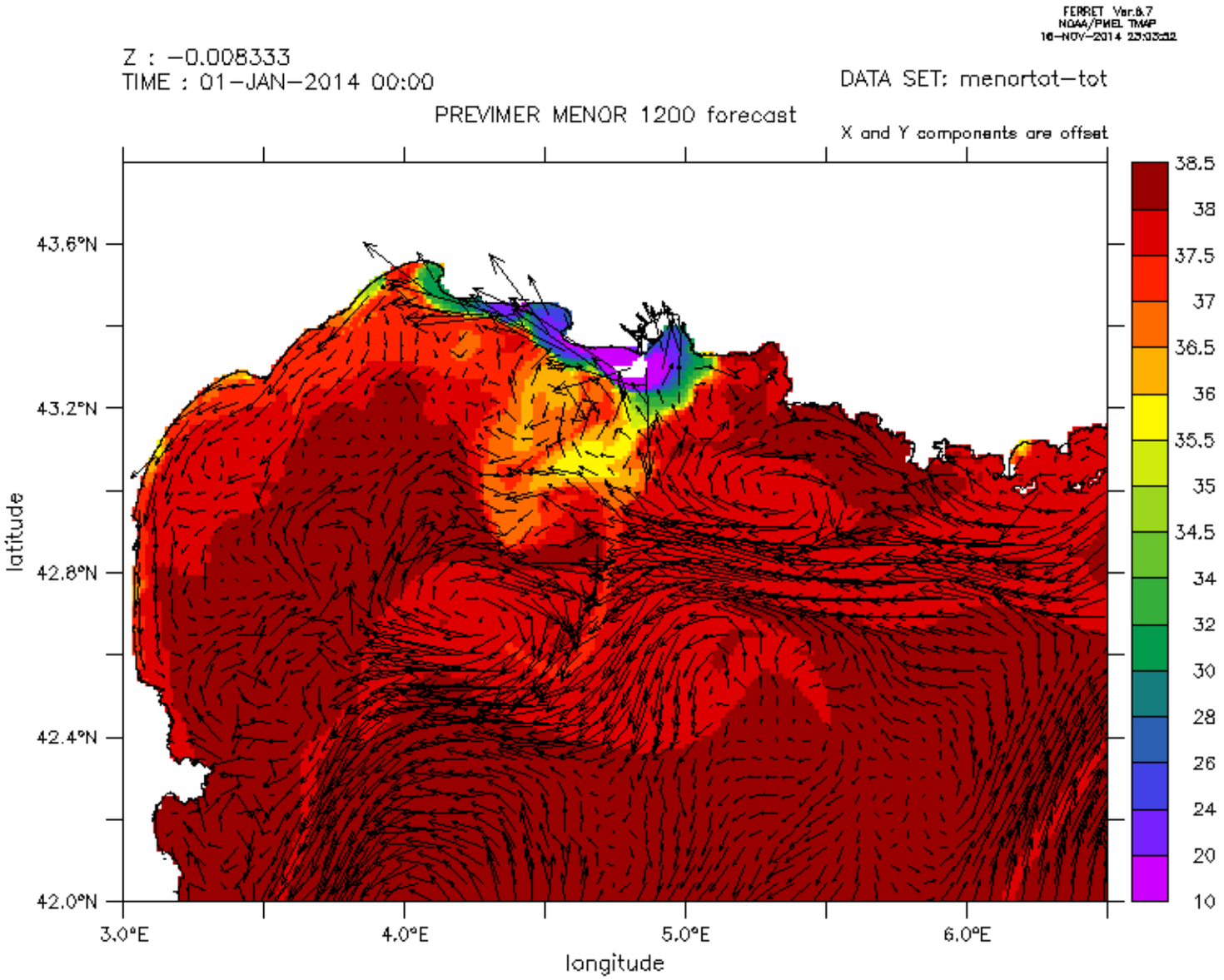
Cathalot et al., GCA, 2013



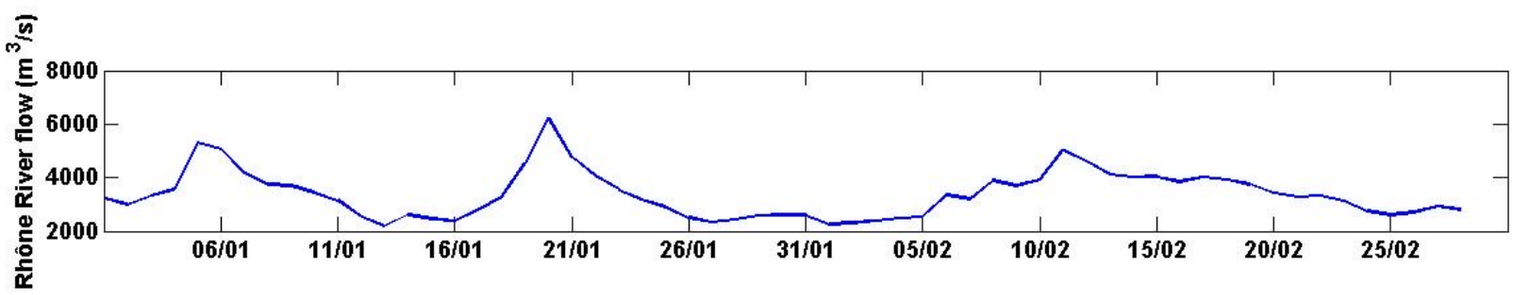


Hydrodynamics, floods and high frequency

Winter time dynamics: interaction between floods (Rhône and other rivers) and storms

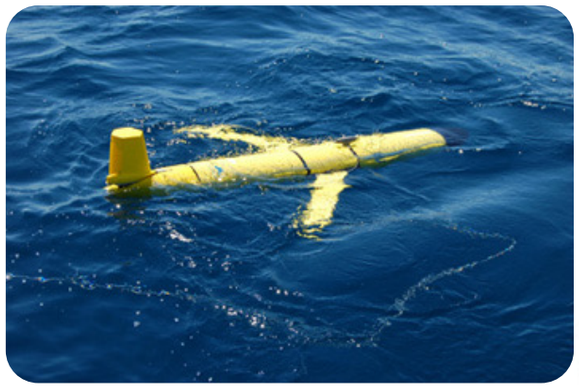


salinity (1e−3)

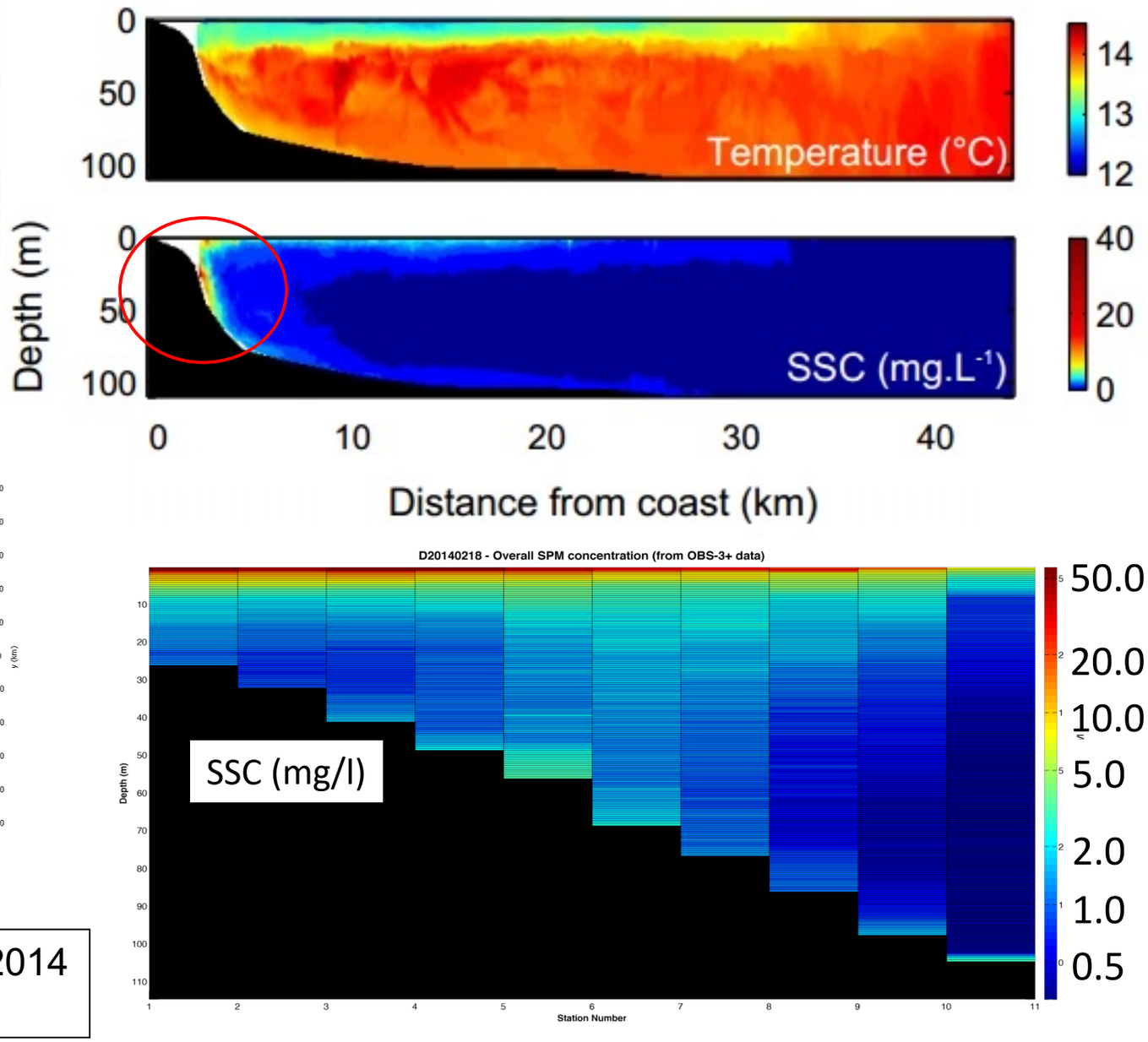


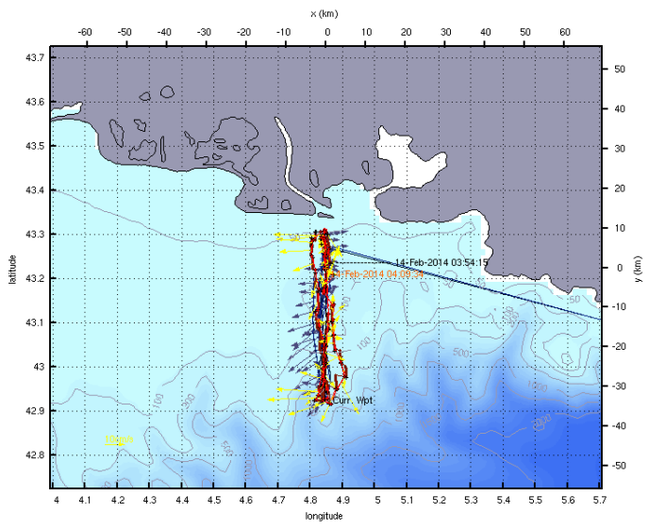
2014

Particle dynamics during floods: export and deposition



Gliders equiped with T, S, Turb, Fluo and O2 sensors

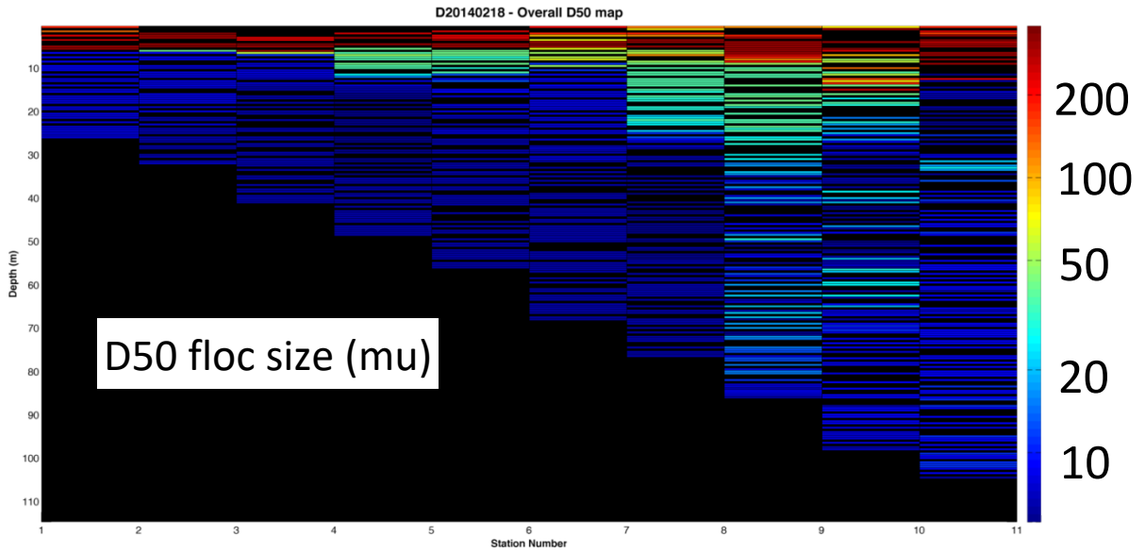


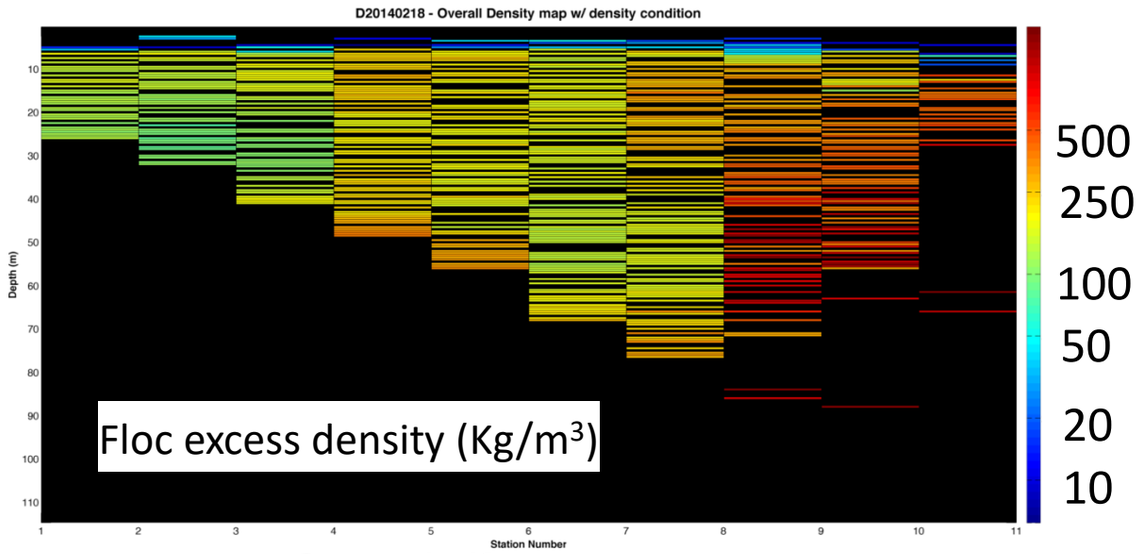


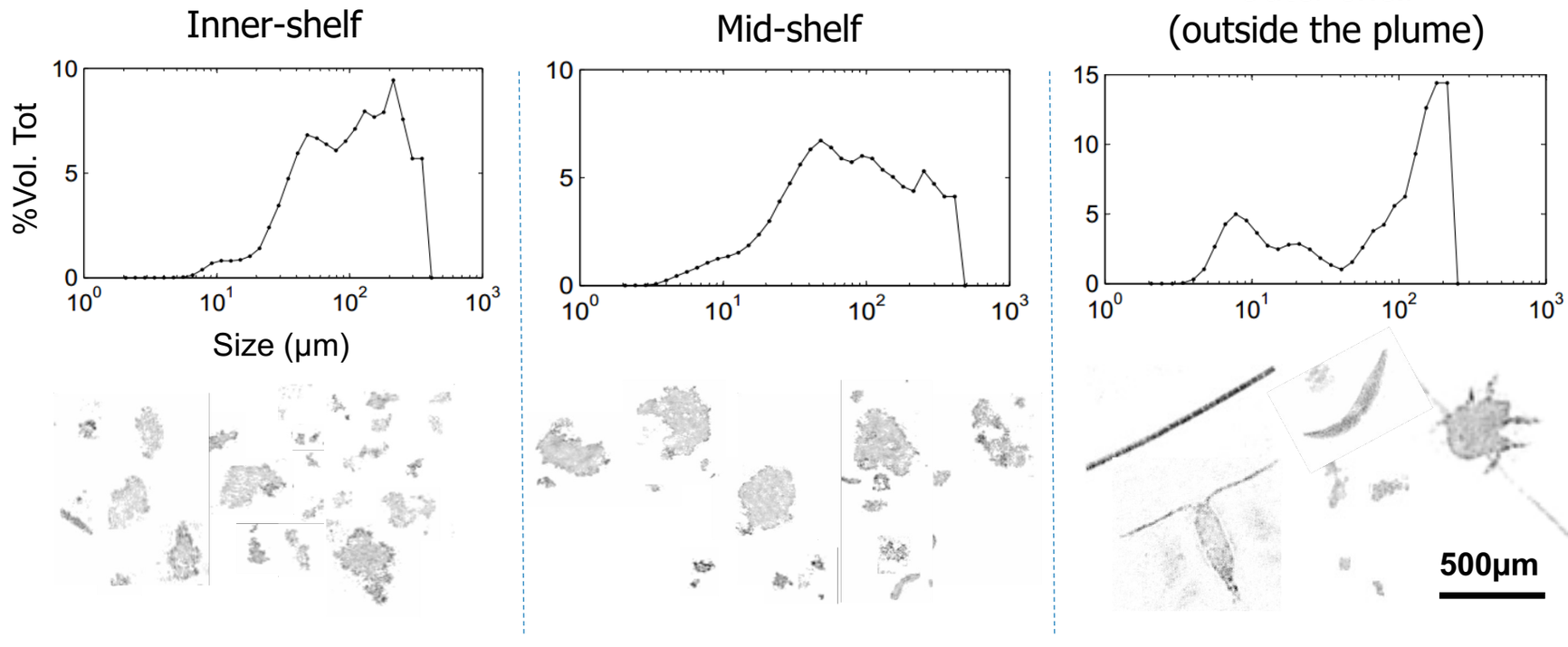
Campagne TUCPA – Février 2014
Many et al., 2016

SPM composition in the GoL during floods

Rhone river plume during the 2014 flood



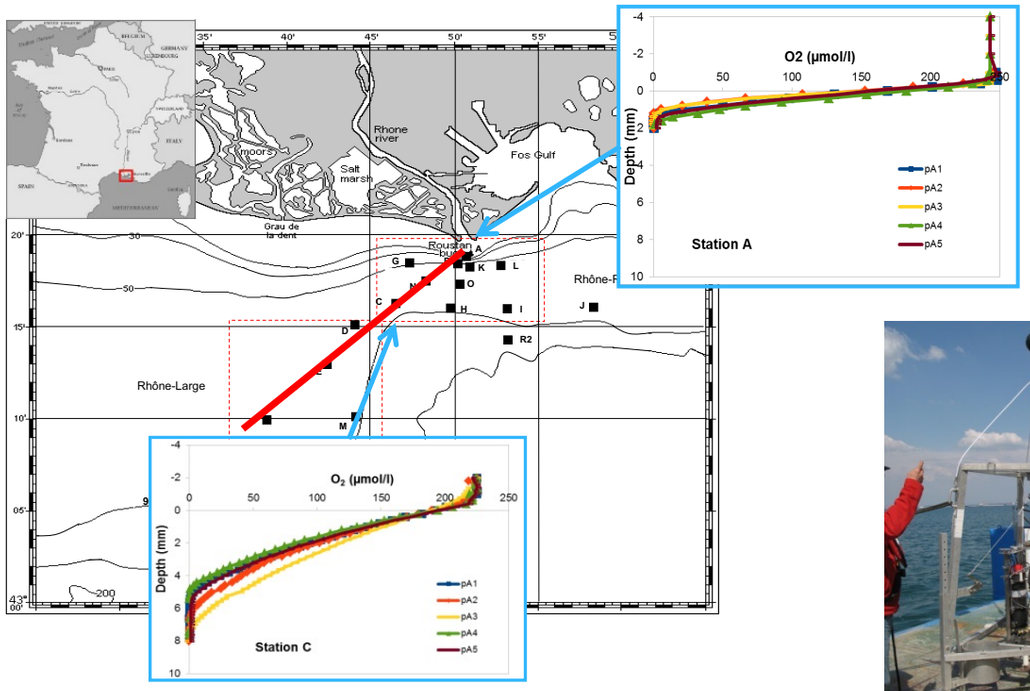


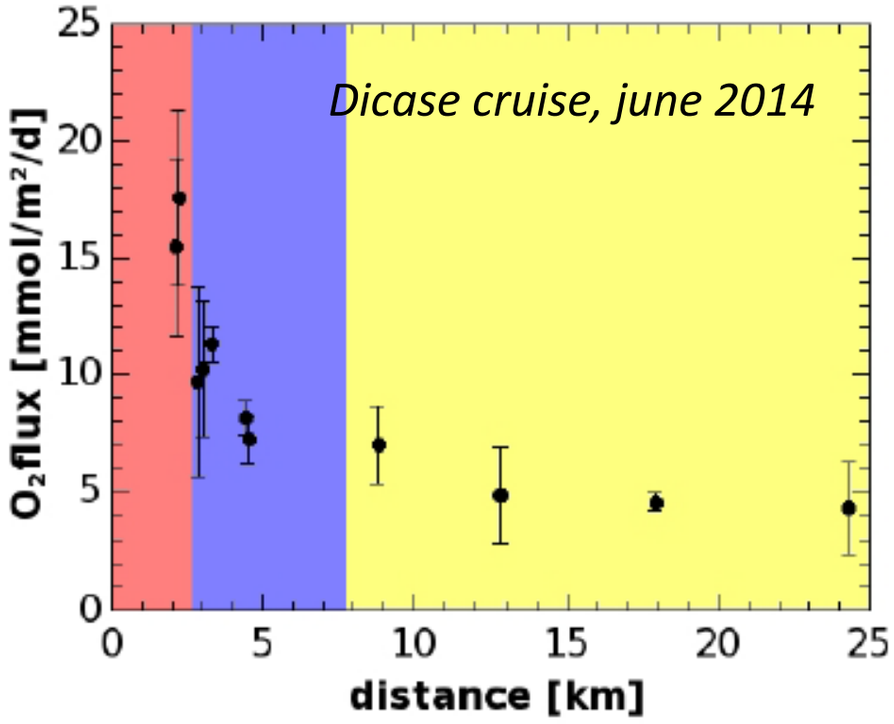


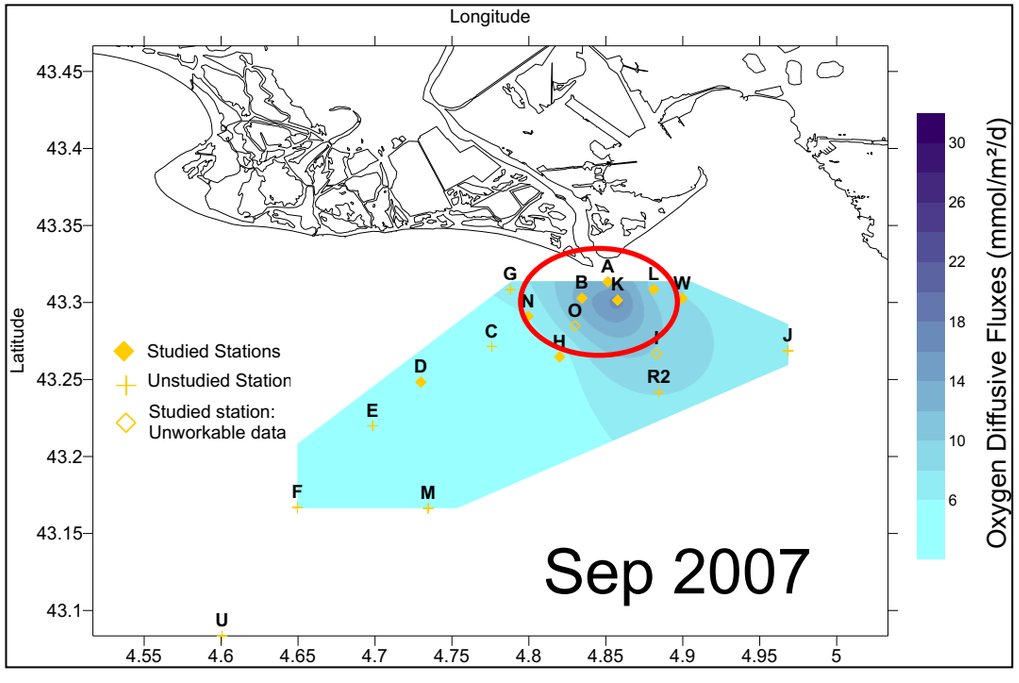
Coupling of LISST-100 (Laser diffraction: 1,25-250µm) et LISST-HOLO (Holography: 20 à 2000µm)

Mineralization of organic matter in prodelta sediments

In situ microprofiler





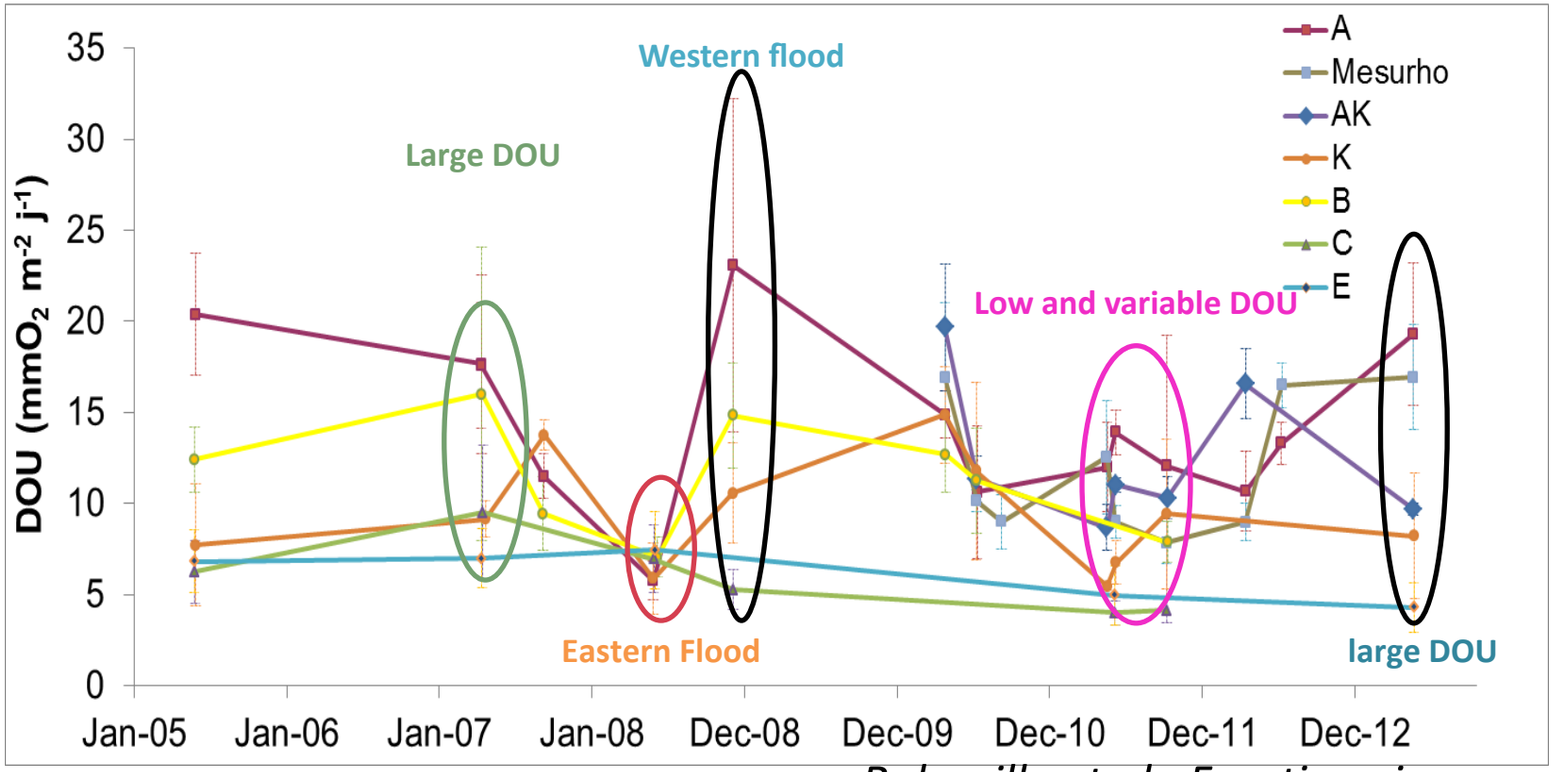


Cathalot et al., BG, 2010

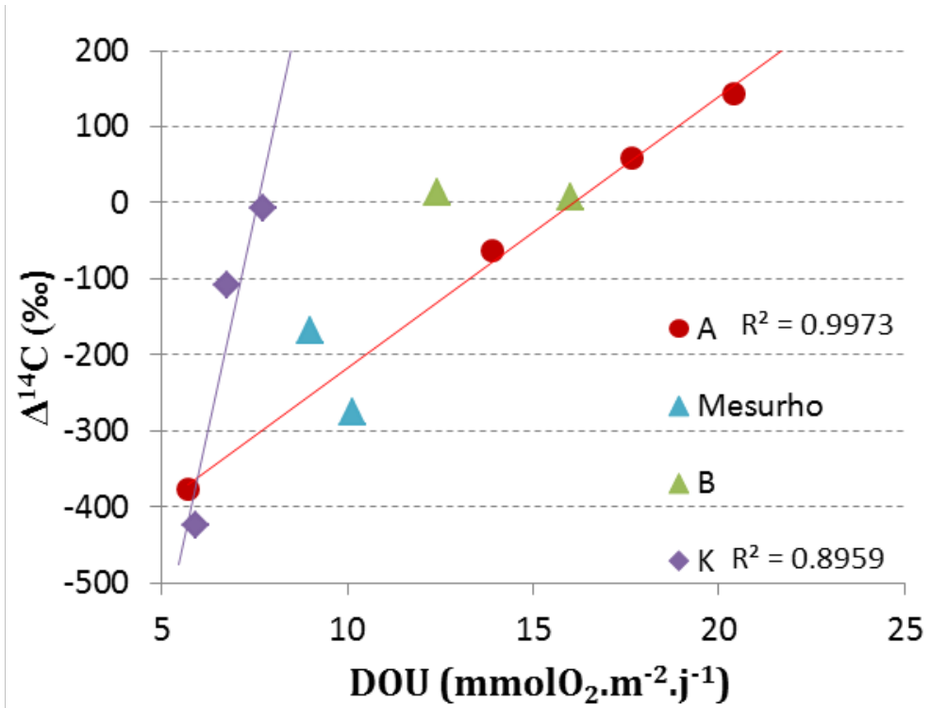
Intense benthic mineralization near the river mouth decreasing offshore

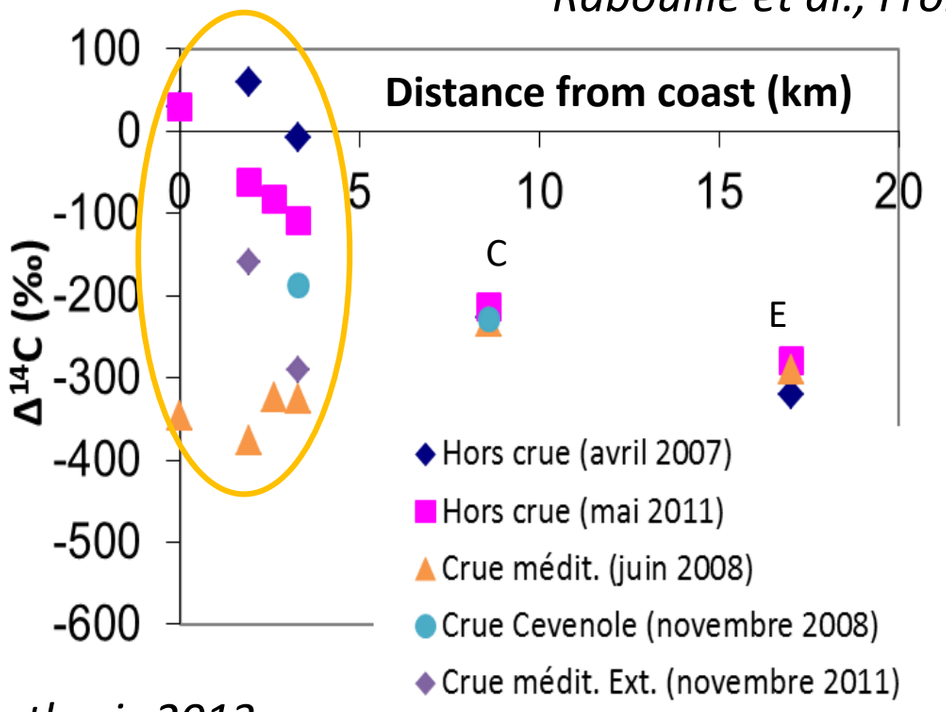
Recycling of organic matter and its lability

- Large interannual variability of offshore DOU gradient
- Temporal stability of carbon recycling and composition on the shelf (C & E)
- Large variability of $\Delta^{14}C$ of OM (a proxy of lability) in prodelta, related to flood type together with oxygen demand (mineralization)



Rabouille et al., Frontiers, in prep.



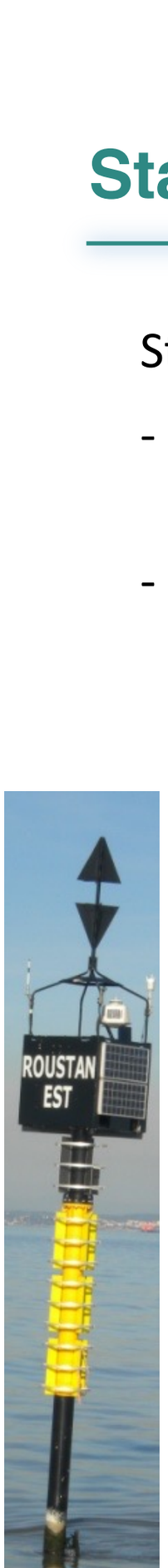


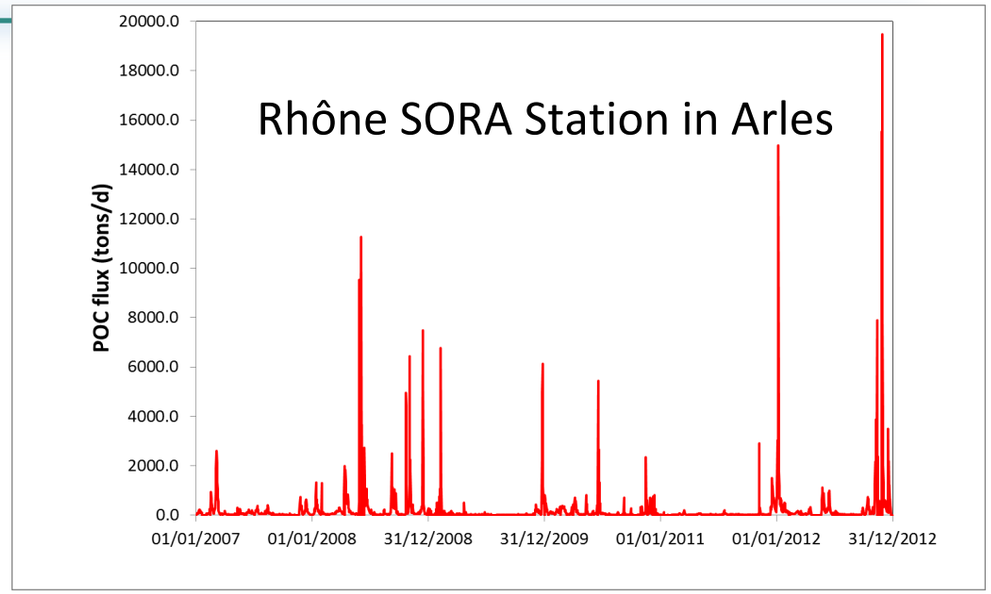
Toussaint, thesis 2013

Station monitoring of inputs and fate of river particles

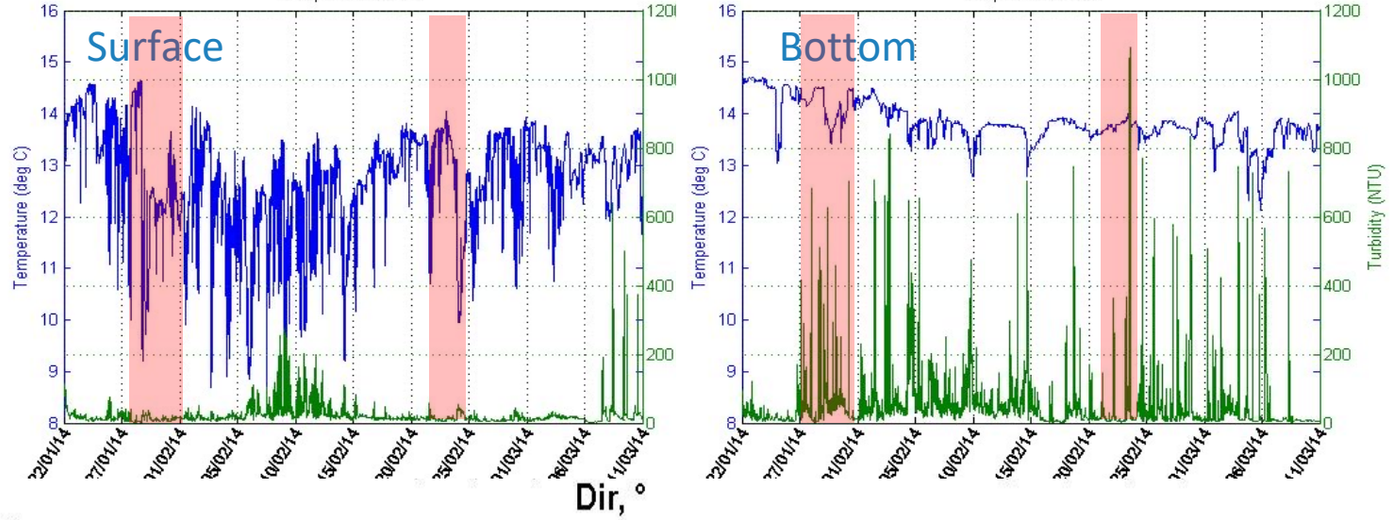
Station Mesurho and MOOSE-SORA

- Fluxes of POC to the Med Sea are dominated by floods
- Mesurho station records the water and particle flux at river mouth and particle dynamics

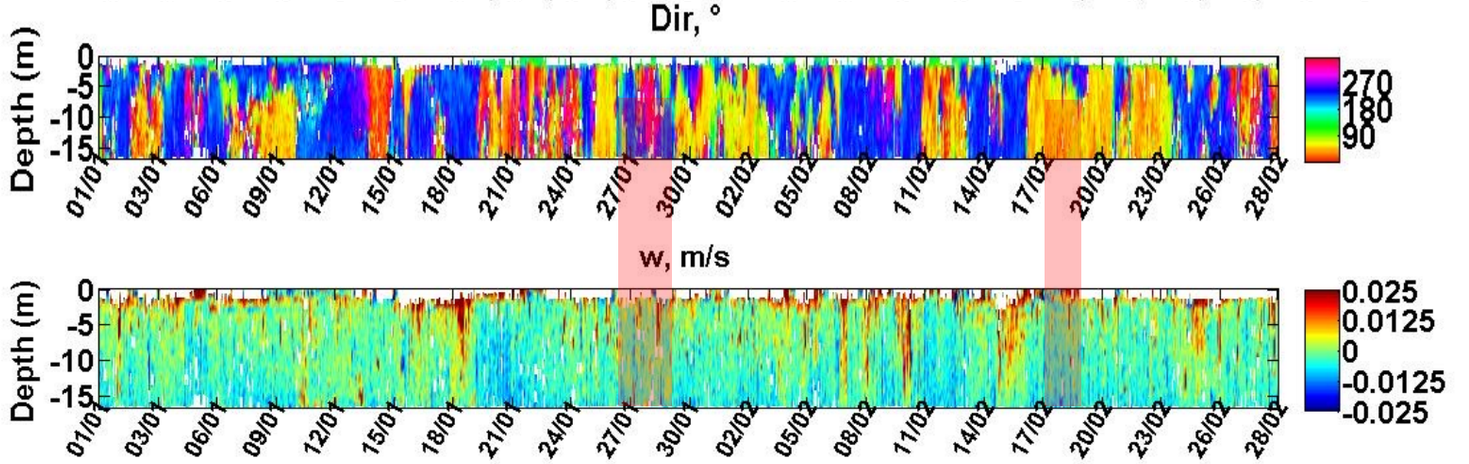




Buoy sensors during TUCPA

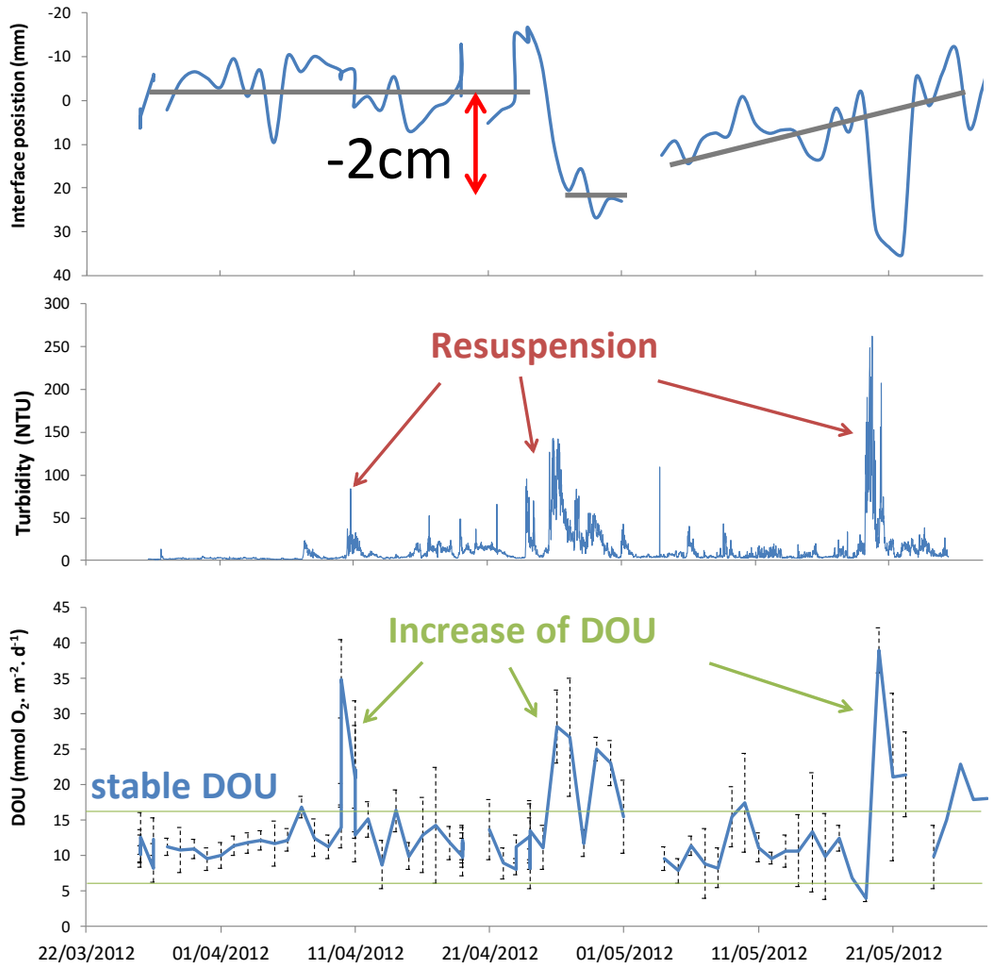


ADCP during TUCPA



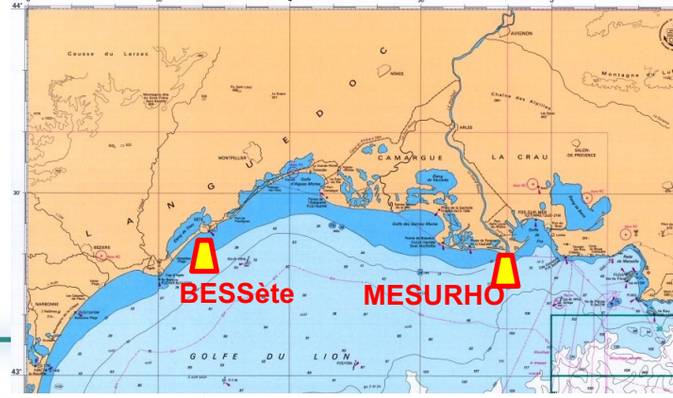
Station monitoring of inputs and fate of river particles

Link with carbon fate by the LSCE benthic station: one example with resuspension events in April 2012

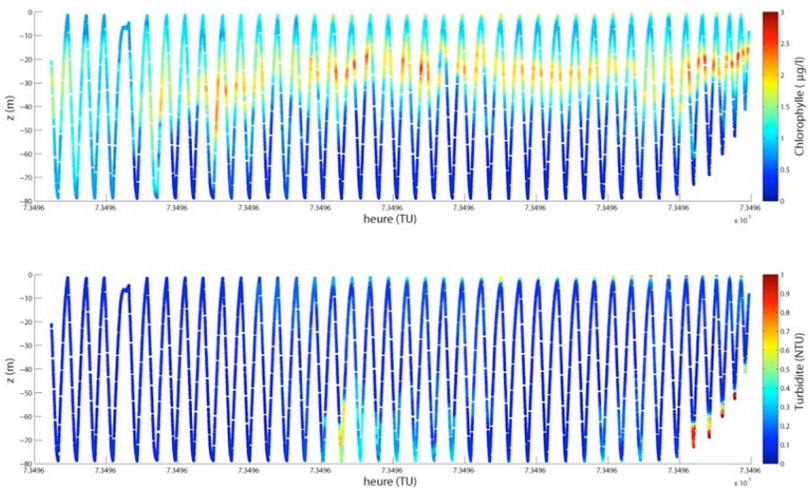


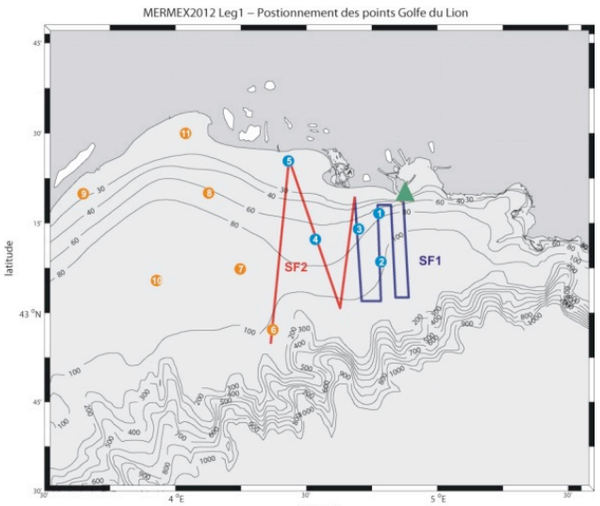
Toussaint et al., L&O-M, 2014

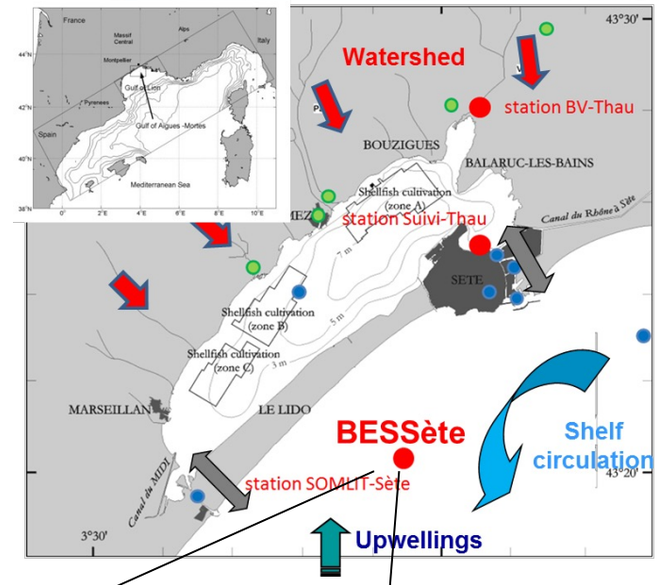
Western extension and smaller rivers



BESSETE station and the Access transect to the West: from the Rhone to Sete, transit zone, extension of Rhone floods, Herault and smaller river floods

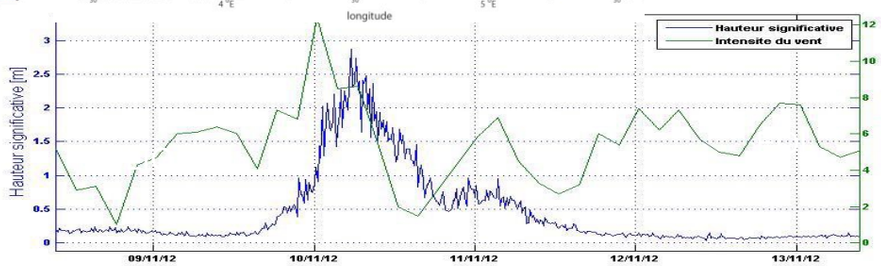


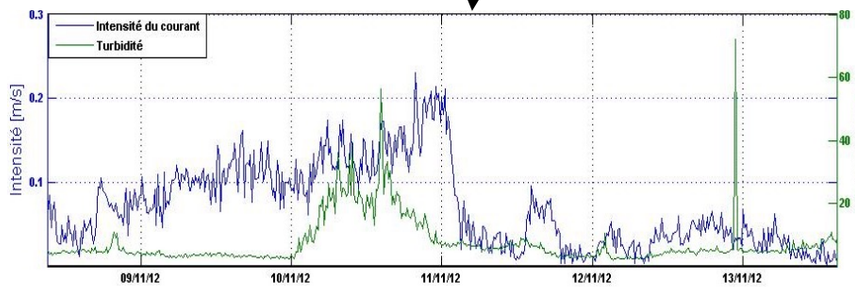




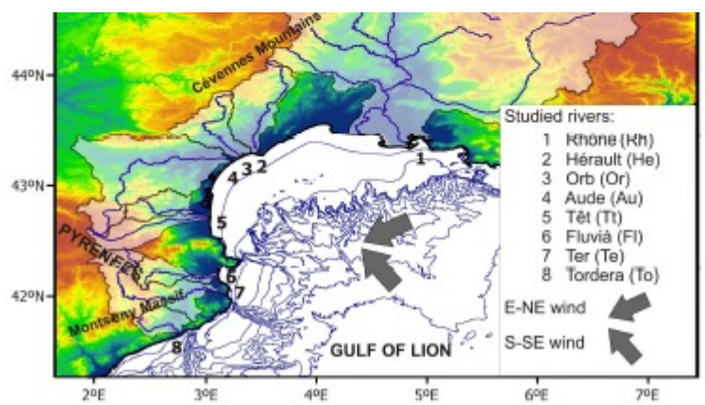
Meteo and waves

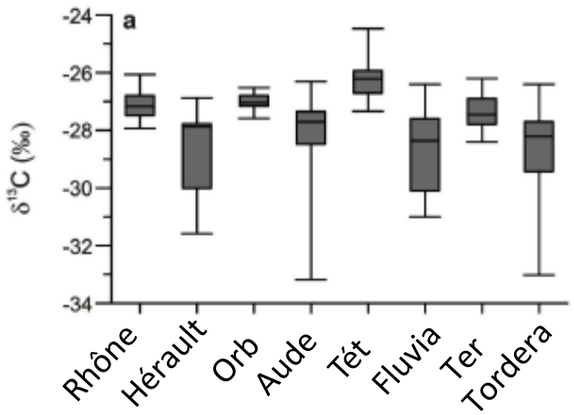
Coastal sea hydrology and biogeochemistry





Characterization of OM from 8 Mediterranean rivers : assessment of their floods and prodelta deposition during the CASCADE cruise





Higueras et al., BG, 2014

PROJET CHIFFRE: Coastal High Frequency Response to Extreme Events, storms and floods

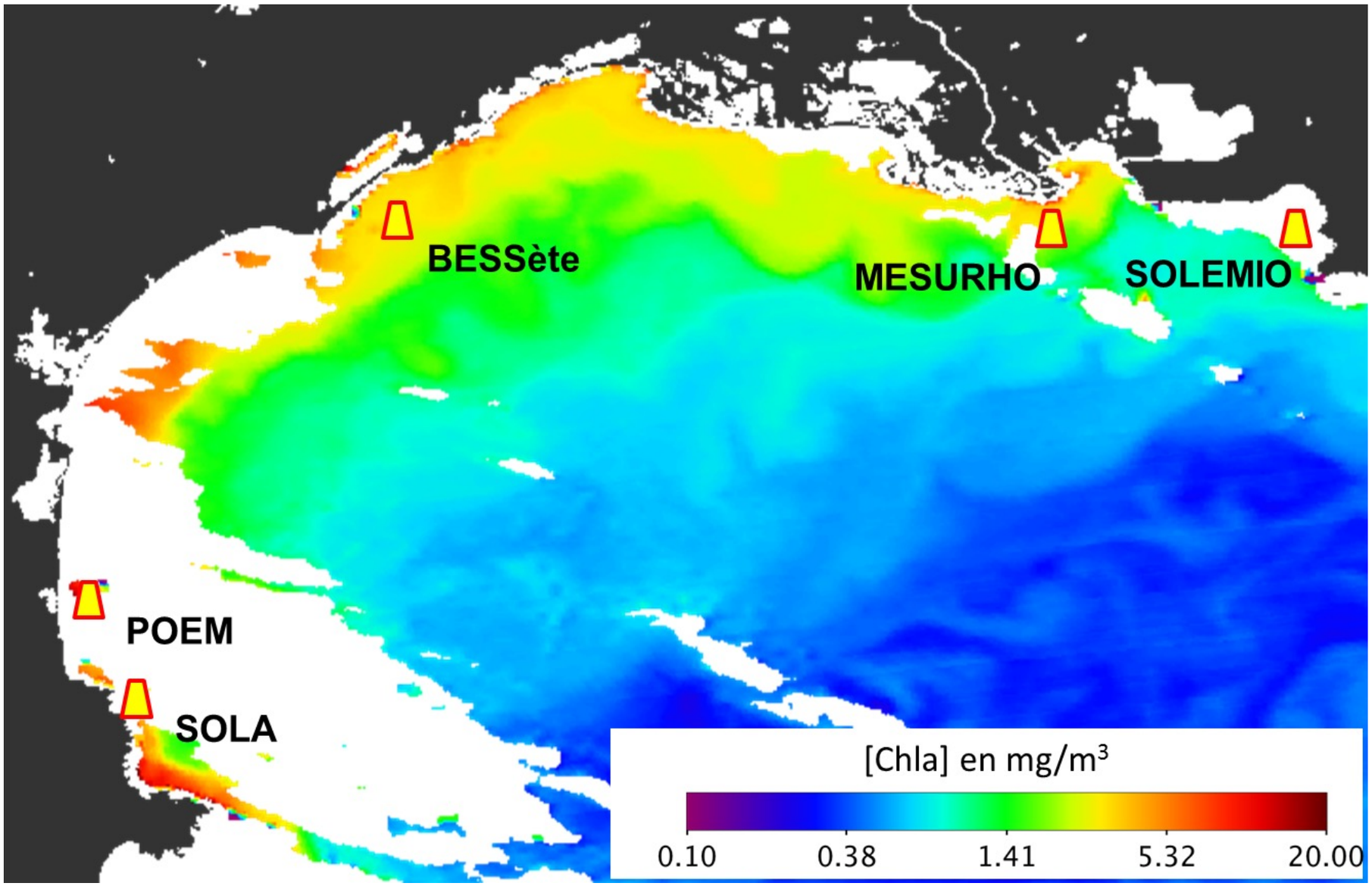
Choix d'un outil principal: les stations côtières HF (Haute Fréquence)

+ apports outils complémentaires

prélèvements BF (Basse Fréquence) SOMLIT-like,

télédétection, modélisation numérique,

(campagnes en mer, gliders, station benthique)



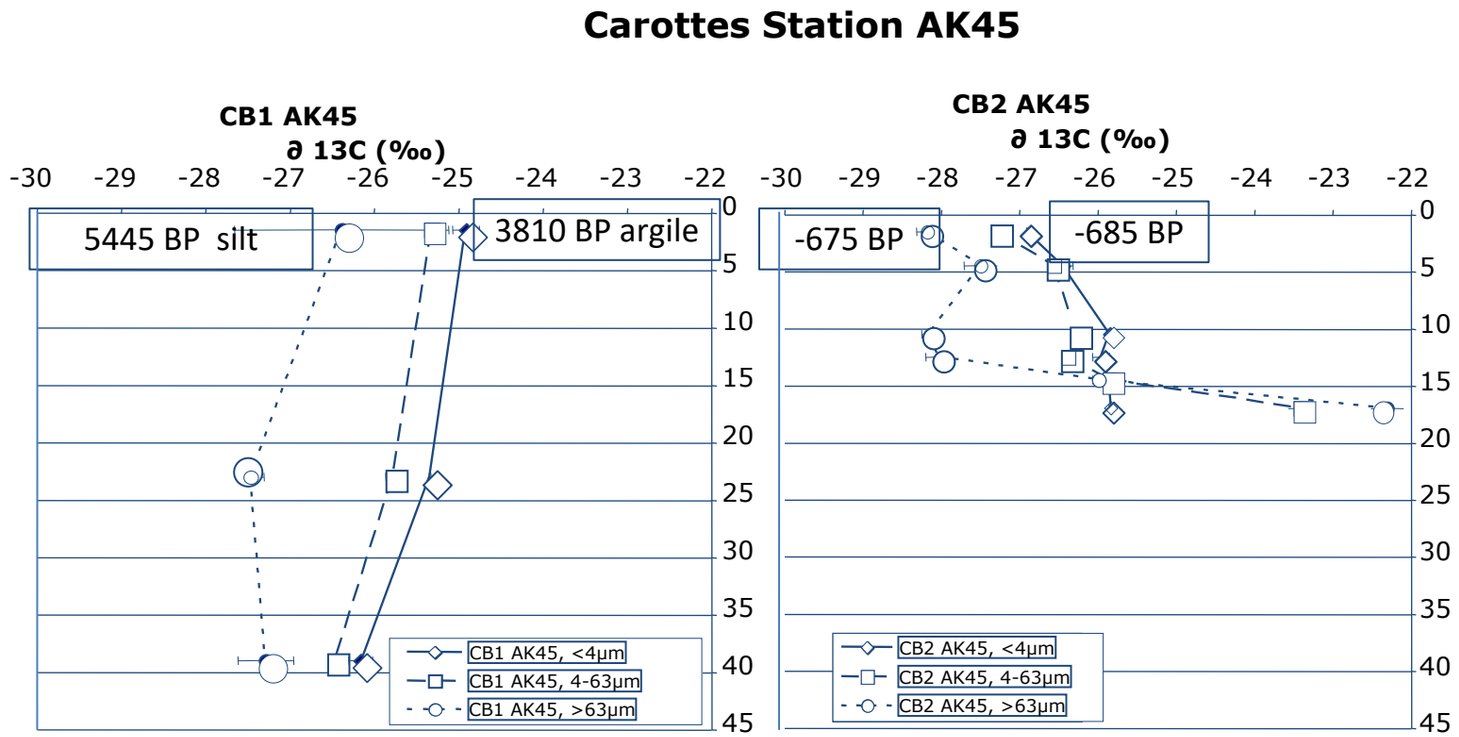
Zone d'étude et position des stations côtières HF. Fond de carte, image MODIS-Aqua du 8 mars 2013. Crédits : D. Doxaran.

Principaux résultats attendus du projet CHIFRE

- Opérationnalité des stations côtières HF du Golfe du Lion pendant 2 ans en continu
- Validité des mesures, apports des mesures BF SOMLIT-like
- Etude de la réponse HF à plusieurs évènements « extrêmes »
- Variabilité des réponses inter et intra évènements
- Soutien et complémentarité aux actions Mermex-Merite et ANR COCCOLITTO

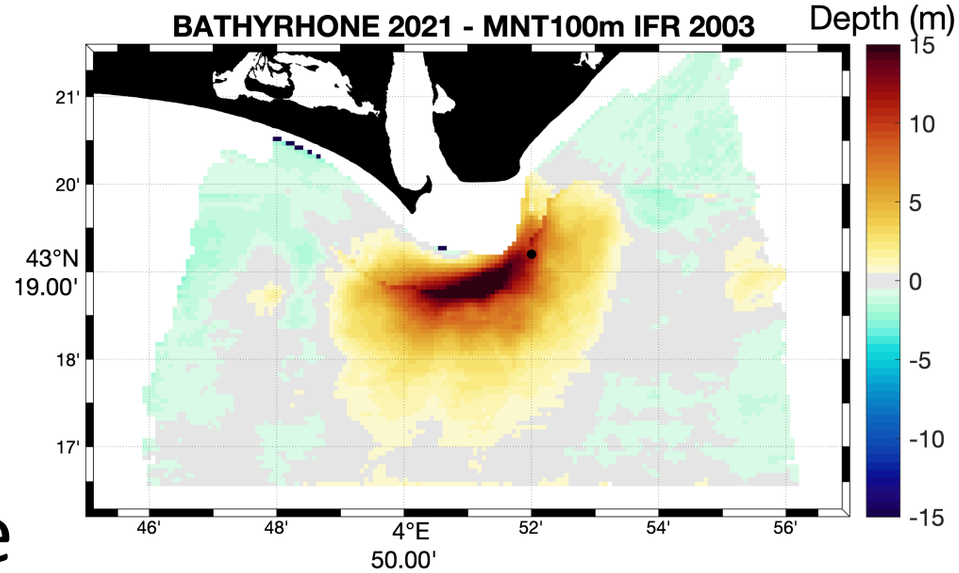
Projet GranoFlux

- Evaluer les apports de carbone et leur granulométrie lors des évènements de crue
- Depuis le fleuve jusqu'au dépôt dans les sédiments, suivre origine dans les fractions granulo
- Mesure de la composition isotopique des fractions de MO ($\delta^{13}C$ et $\Delta^{14}C$)



EC2CO-DeltaRhone

- Estimer les bilans de matière (particules, carbone, microplastiques) à l'interface Rhône-Med
- Variabilité, influence des extrêmes sur les apports du fleuve et les exports vers le plateau
- Effectuer des mesures du couplage pélagique benthique particules, carbone, microP
- Estimer l'enfouissement dans le delta (C et microP) par bathymétrie différentielle



- Coupler observation fixe et mobile, satellite et modèles pour estimer les bilans dans la zone du prodelta

Conclusions

Observations de plateformes multiples:

- Observatoires, gliders, campagnes
- Colonne d'eau et sédiments
- Proches du Rhône avec une extension vers le GoL central

Apports de fleuves sont complexes en quantité et nature:

- Quantité liée aux évènements intenses
- Qualité (i.e. degradabilité du C) est liée à l'origine des apports

Dynamique dans le prodelta du Rhône et le plateau est très intense:

- Dynamique des particules est essentielle à contraindre pour comprendre le transport et transformation du C, N, P et contaminants
- Reminéralisation du C varie à toutes les fréquences et répond aux évènements intenses

Petits fleuves montrent un grande variabilité et influencent fortement localement

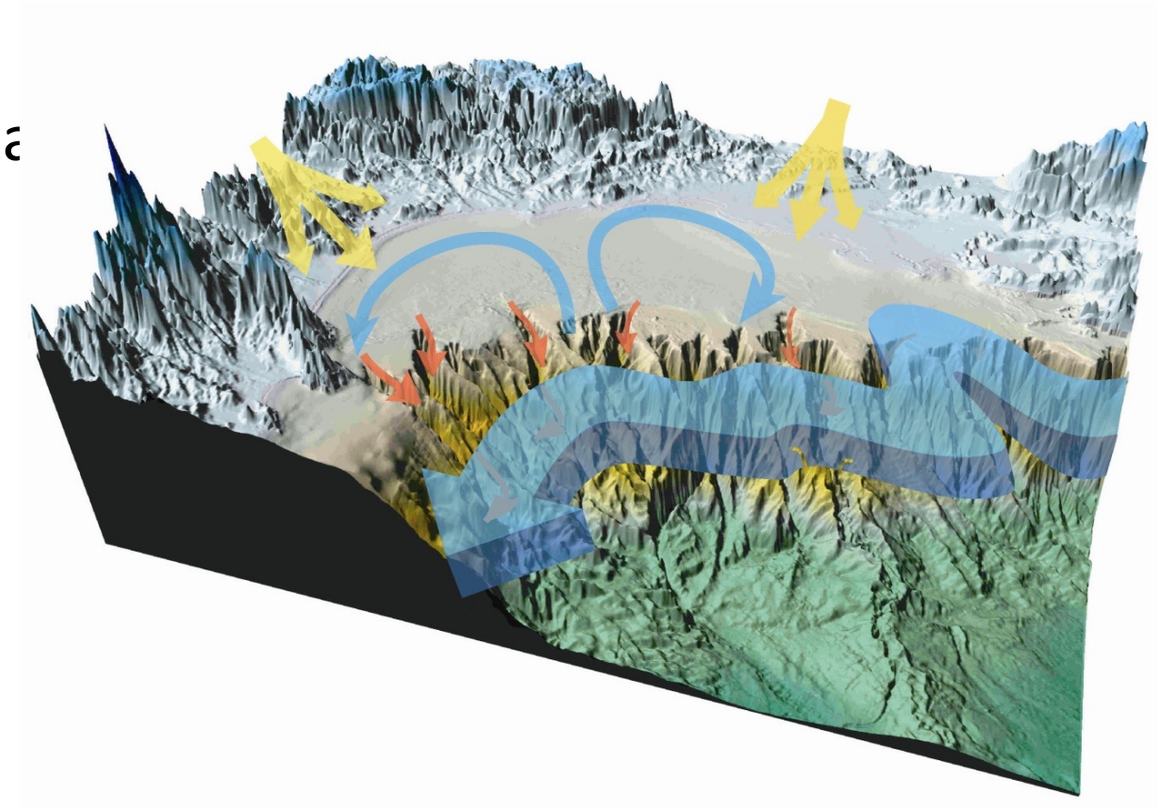
Besoin d'intégration des observations avec les modèles
Apporter une spatialisation accrue des données et un couplage pélagique-benthique pour le devenir du carbone, nutriments, et contaminants pendant les évènements intenses

PPR-RiOMar/WP8: **Gulf of Lion – Rhône**

WP leaders: François Bourrin , Sabine Charmasson

WP8 Objectives

- increase the spatial coverage of in-situ data from existing networks (IR ILICO including COAST-HF, SOMLIT, MOOSE, PHYTOBS, DYNALIT...)
- impact of extreme events (floods, storms, heat waves and dense shelf water cascading) on nutrients, O_2, pH and in the transfer of particles and associated contaminants in the land-to-sea continuum
- document the benthic-pelagic coupling



Task description

- **Task 8.1: Instrumentation: mastodon lines/ Glider surveys/ satellite data with focus on 3 areas (off the river mouth, central area**

- **Task 8.2: Observation of the impact of extreme events front of the Rhone River => benthic station + biweekly short campaigns (**water column particle characterization, nutrients and sediment cores

- **Task 8.3: a large-scale cruise over the Gulf of Lion => Benthic-pelagic coupling + sediment and contaminant accumulation in the mid-shelf mud belt**