CES couleurs des eaux continentales
(lacs, rivières, fleuves, estuaires…)

Prototype (R&D)

Production / Diffusion

cnes
CENTRE NATIONAL D'ÉTUDES SPATIALES

DATA eCLA
PÔLE ÉCOSYSTÈMES LACUSTRES

OFB
OFFICE FRANÇAIS DE LA BIODIVERSITÉ

INRAE

GEORECOVER

https://www.theia-land.fr/ceslist/ces-couleurs-des-eaux-continentales/

UNIVERSITÉ DE NANTES

magellium

Liberté • Égalité • Fraternité
RÉPUBLIQUE FRANÇAISE
Ministère de l'Environnement, de l'Énergie et de la Mer

ANA
NATIONAL WATER AGENCY - BRAZIL

Office de l'eau de la Réunion

OFB
OFFICE FRANÇAIS DE LA BIODIVERSITÉ

FRANCE NATURE ENVIRONNEMENT
HAUTE-SAVOIE

EDF

UNESCO

UnB

eawag
aquatic research

LEESU

LABORATOIRE edb
Comprendre la biodiversité

UNIVERSITÉ SAVOIE MONT BLANC

INRAE

Quels paramètres ?

Premier ordre	**Transparence (Zd, Zsd)**	**Matières organiques dissoutes colorées (CDOM)** **Matières en suspension (MES, turbidité)**	**Phytoplancton (chl-a, phycocyanine...)**
Second ordre		**Origine du carbone organique** **Granulométrie**	**Groupe d'espèces \espèce** **Pic chl-a**

Quels capteurs ?

Résolution Spatiale

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> 1:100 000

Basse à Moyenne

1:100 000 1:50 000

Haute

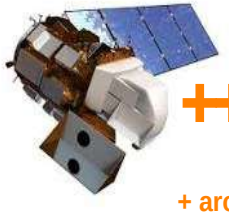
Sentinel-3 (OLCI) +
300 m
Journalier
21 bandes

VIIRS
750 – 375 m
Journalier
21 bandes

+++

Sentinel-2 (MSI)
10 m
1 image/5 jours
12 bandes

MODIS
1 km – 250 m
Journalier
36 bandes



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+ archive

Landsat-8 (OLI)
30 m - 100 m
1 image/16 jours
9 bandes

Résolution Spectrale Radiométrique Temporelle

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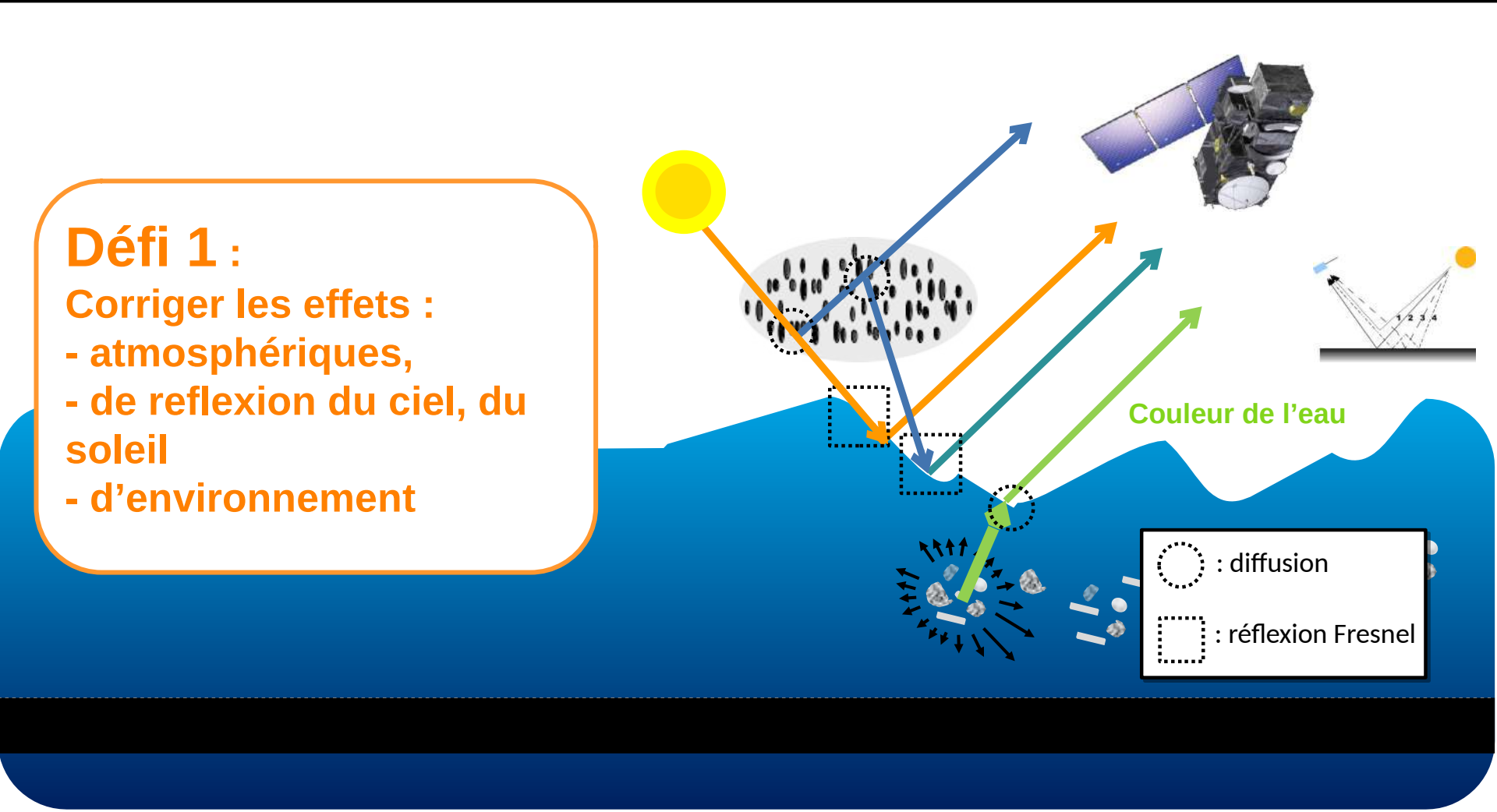
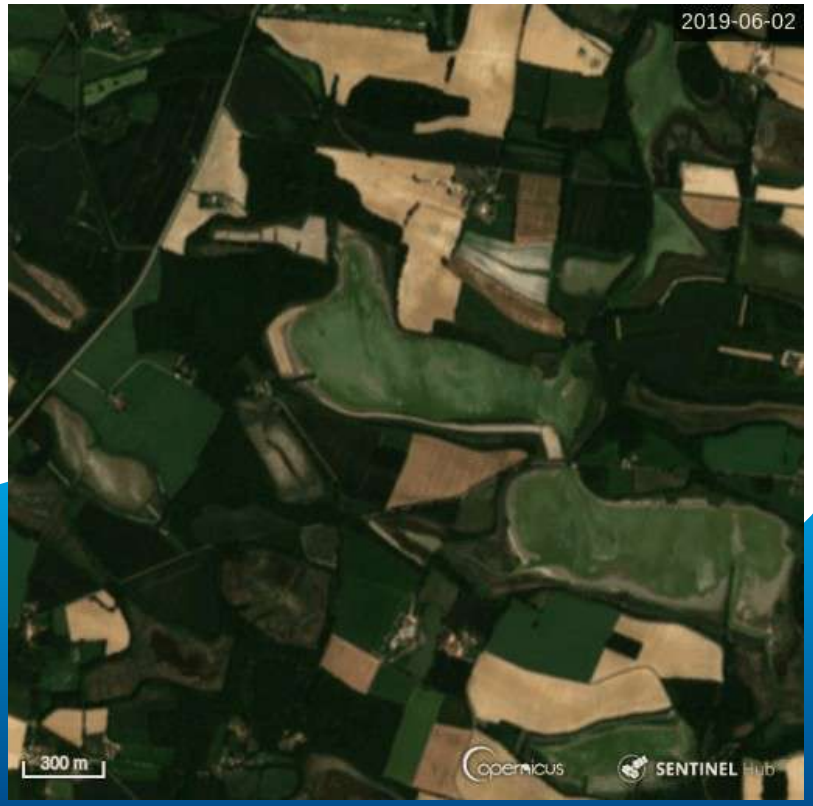
Les 3 grands défis

Défi 1 :
Corriger les effets :
- atmosphériques,
- de reflexion du ciel, du soleil
- d'environnement



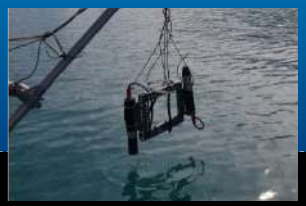
Les 3 grands défis

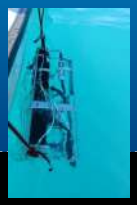
Défi 2 :
Masques nuages et eau performants

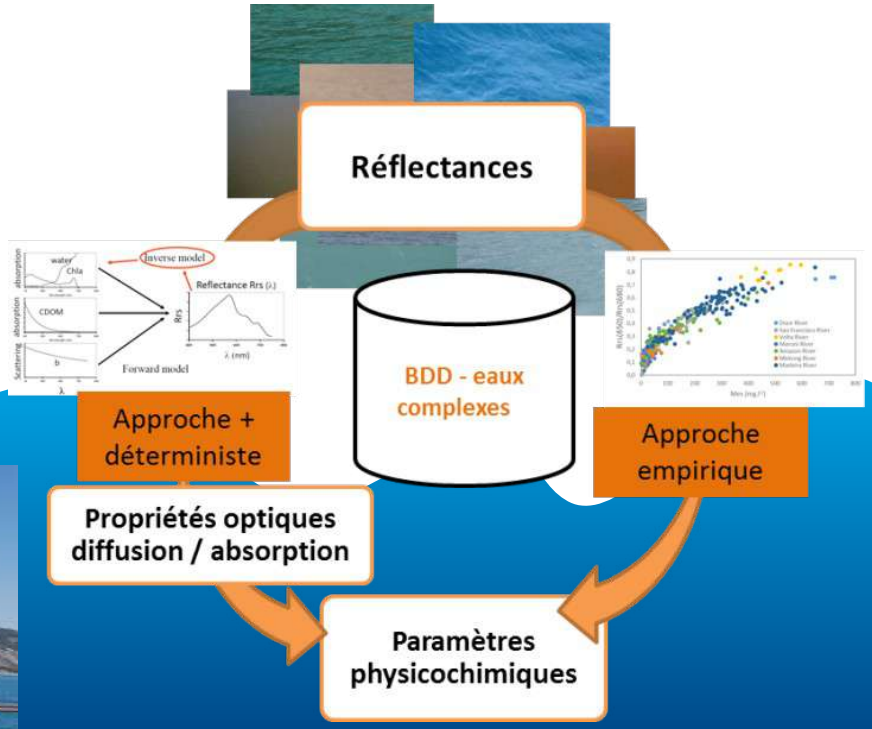


Les 3 grands défis

Défi 3 :
Méthodes robustes et efficaces pour l'estimation des paramètres de qualité et applicables sur les différents types



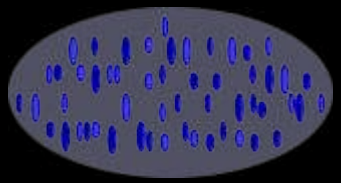




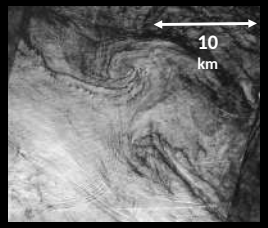
Les avancées

Défis R&D :

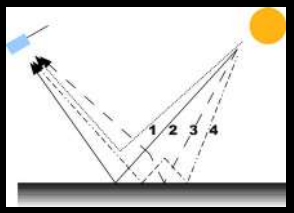
Molécules & aérosols



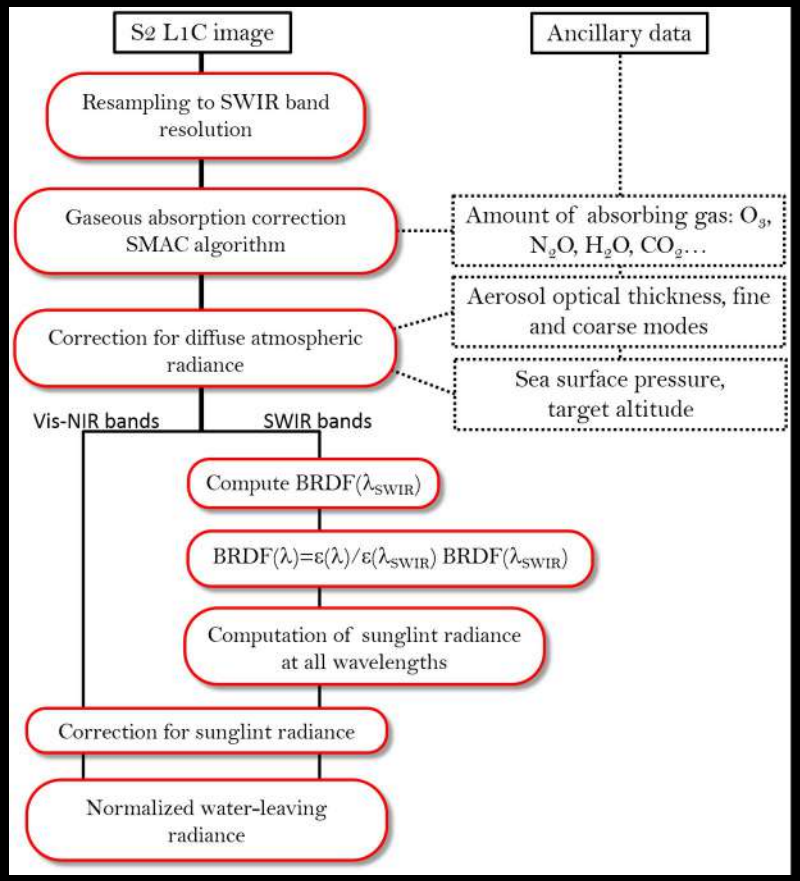
Sunglint



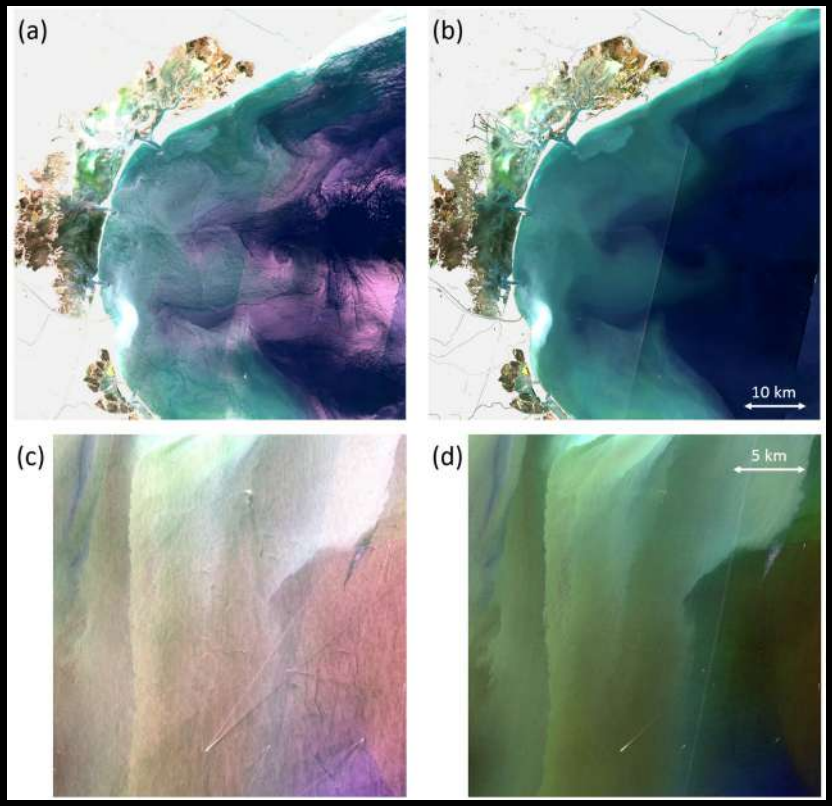
Effets d'environnement



<u>Défi 1</u> : Corrections des perturbations du signal sortant de l'eau



Harmel et al., 2018, Morin et al., in preparation

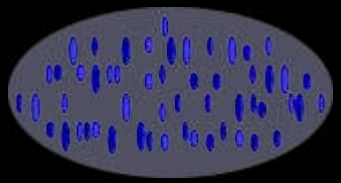


Les avancées

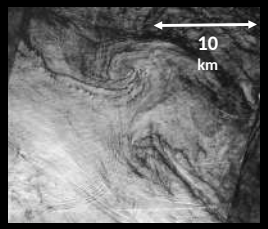
Défis R&D :

<u>Défi 1</u> : Corrections des perturbations du signal sortant de l'eau

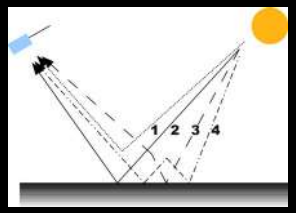
Molécules & aérosols

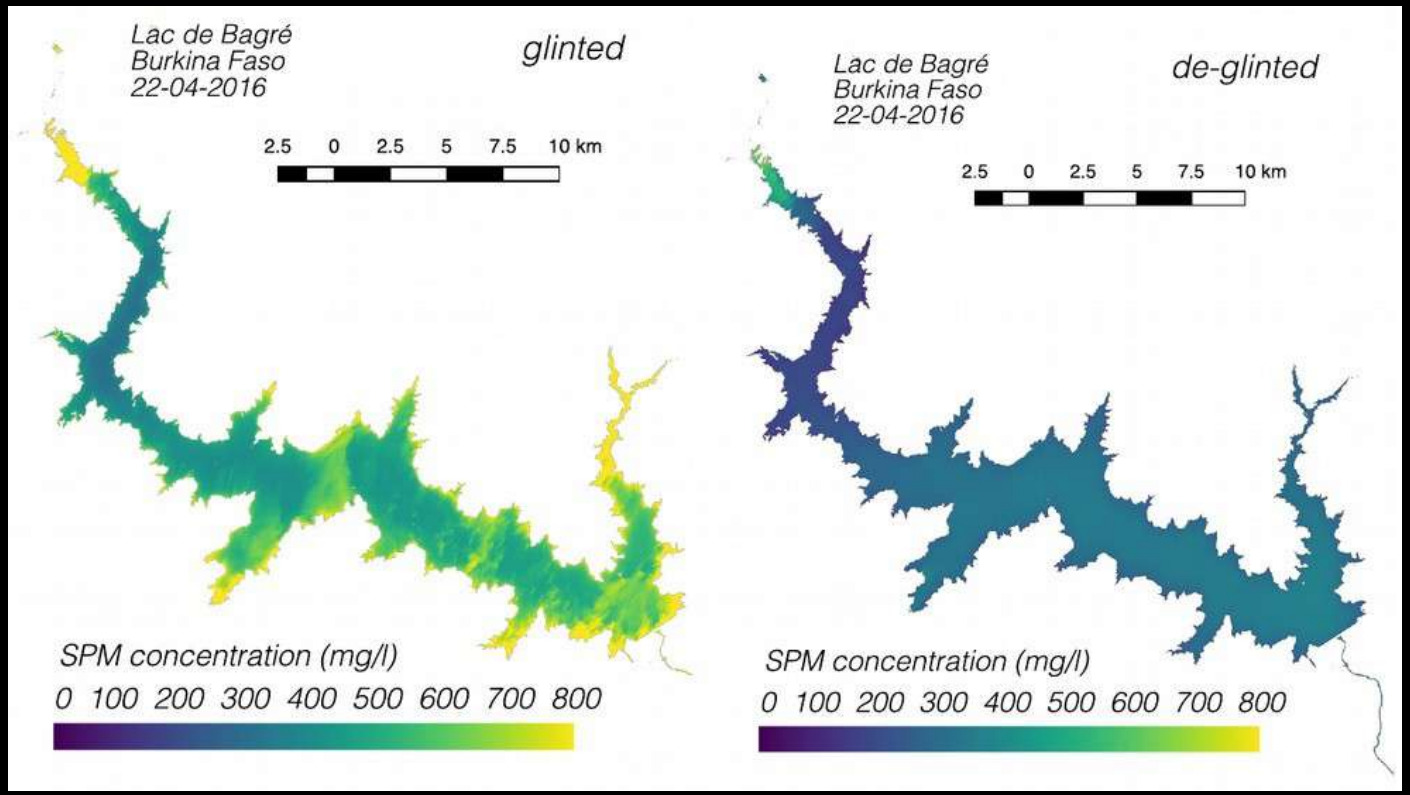


Sunglint



Effets d'environnement



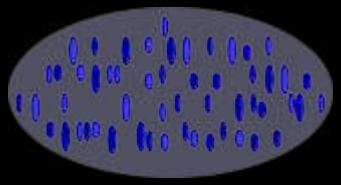


Les avancées

Défis R&D :

<u>Défi 1</u> : Corrections des perturbations du signal sortant de l'eau

Molécules & aérosols



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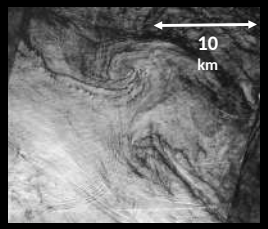
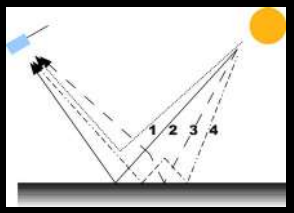
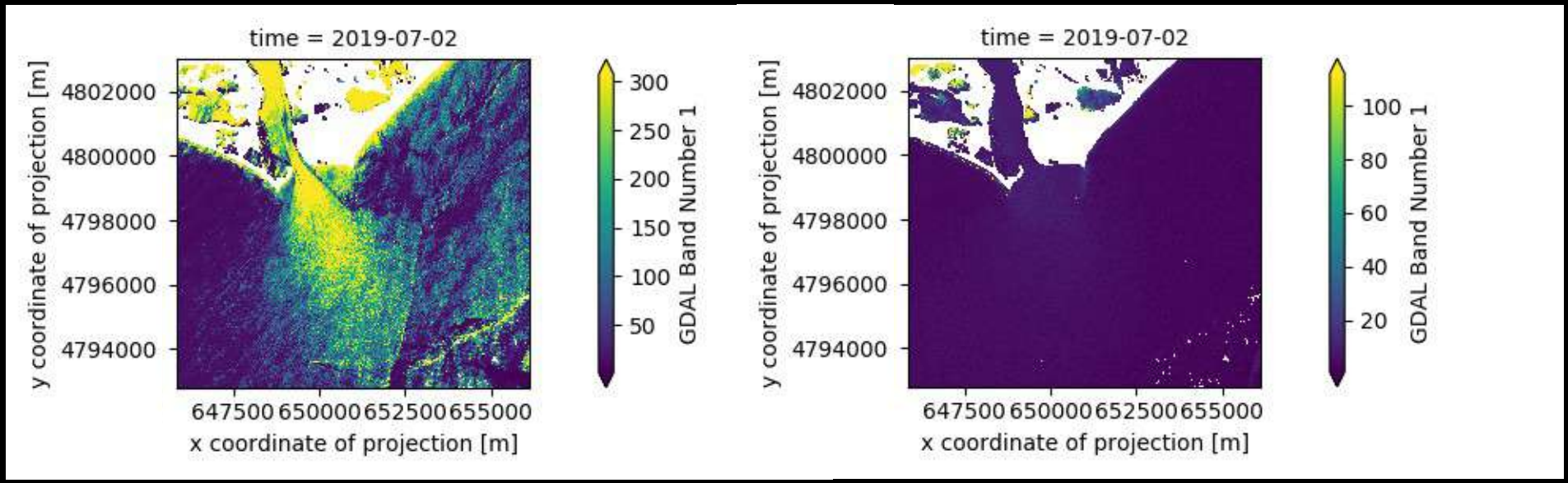


Effets d'environnement



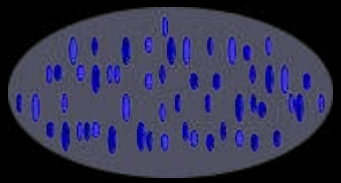


Les avancées

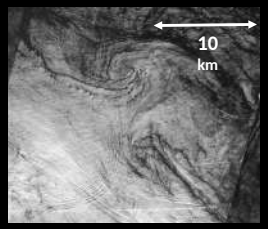
Défis R&D :

<u>Défi 1</u> : Corrections des perturbations du signal sortant de l'eau

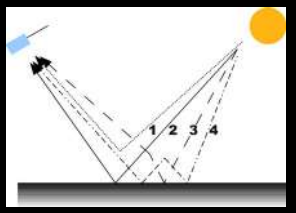
Molécules & aérosols



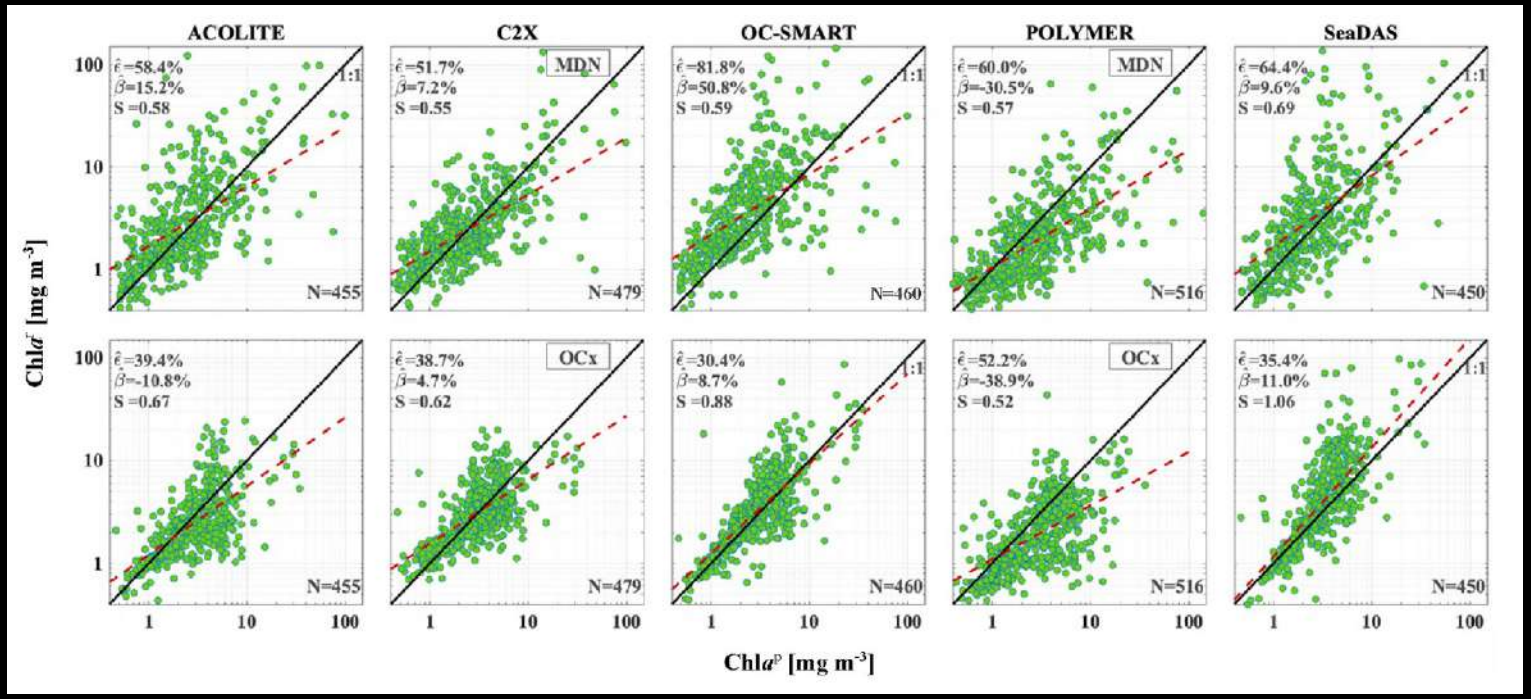
Sunglint



Effets d'environnement



Harmel et al., 2018, Morin et al., in preparation



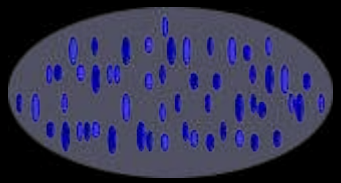
Pahlevan et al., 2021
[Chlo-a]

Les avancées

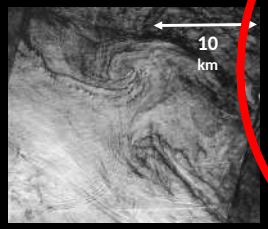
Défis R&D :

<u>Défi 1</u> : Corrections des perturbations du signal sortant de l'eau

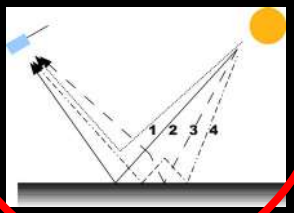
Molécules & aérosols



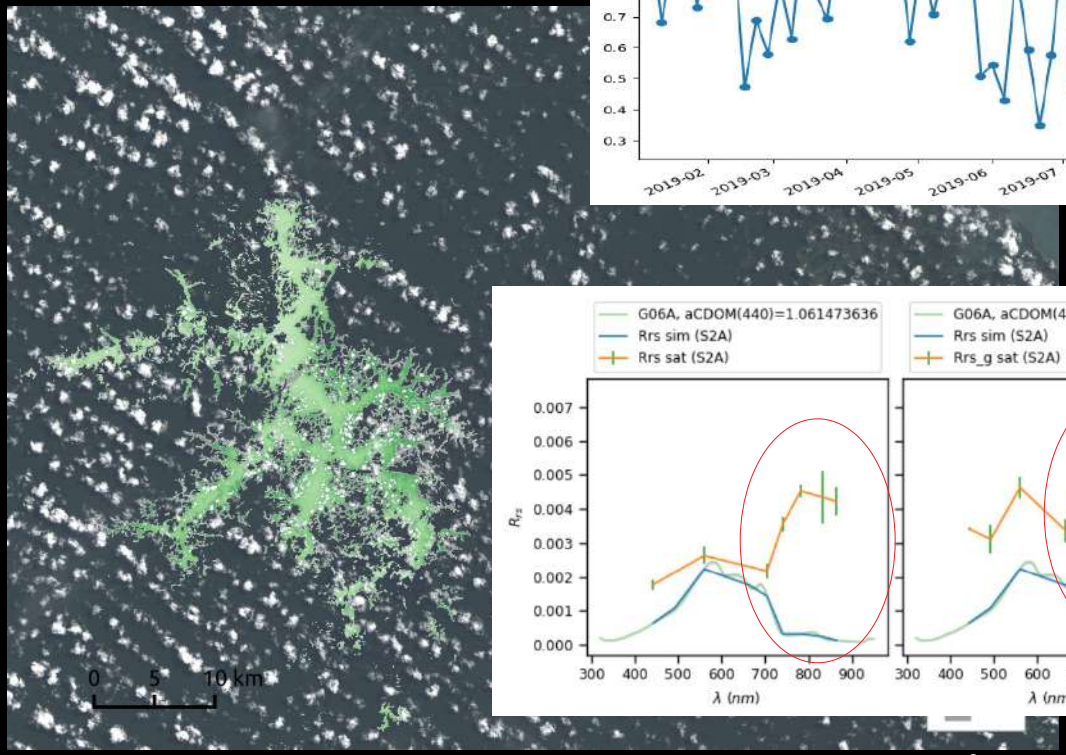
Sunglint



Effets d'environnement



Concentration en CDOM



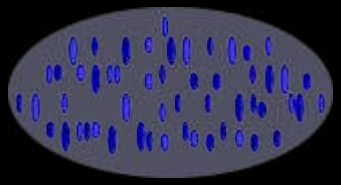
Coque , 2019 ; Coque et al. 2022 (in preparation)

Les avancées

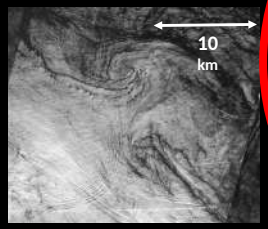
Défis R&D :

<u>Défi 1</u> : Corrections des perturbations du signal sortant de l'eau

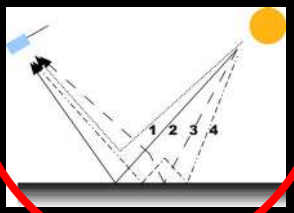
Molécules & aérosols

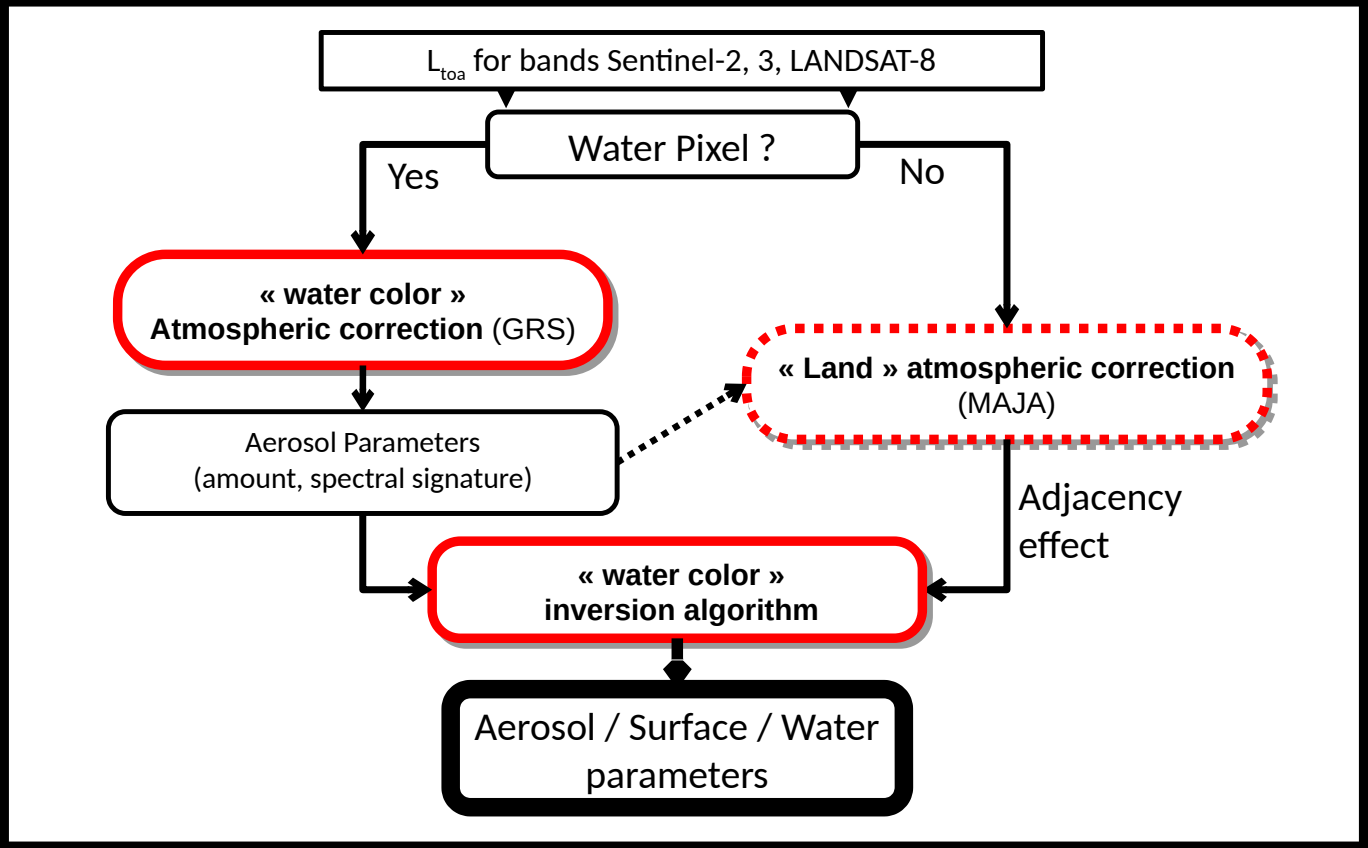


Sunglint



Effets d'environnement

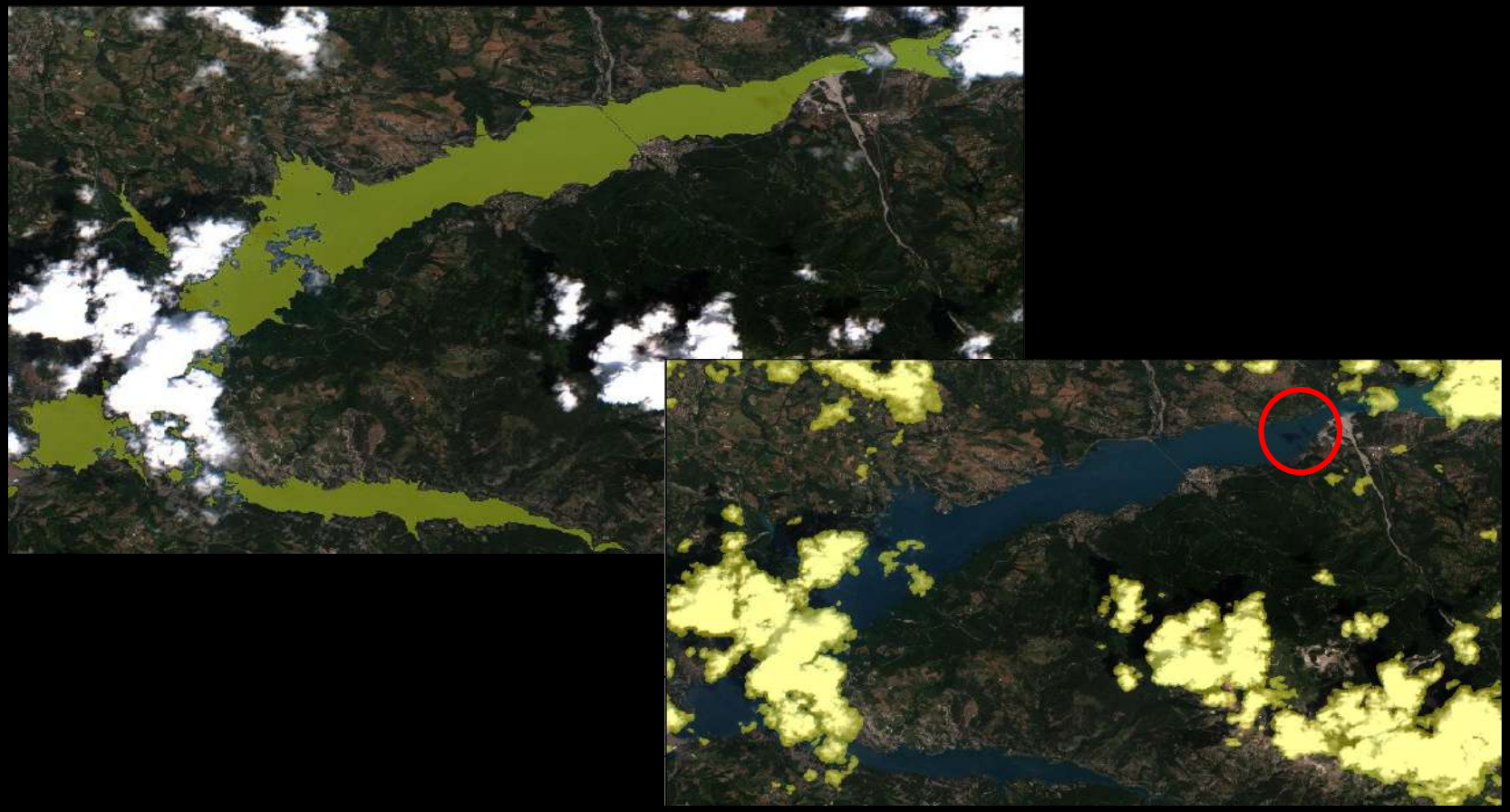




Les avancées

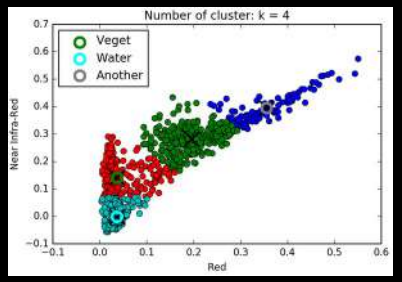
Défis R&D :

<u>Défi 2</u> : Masques nuages et eau

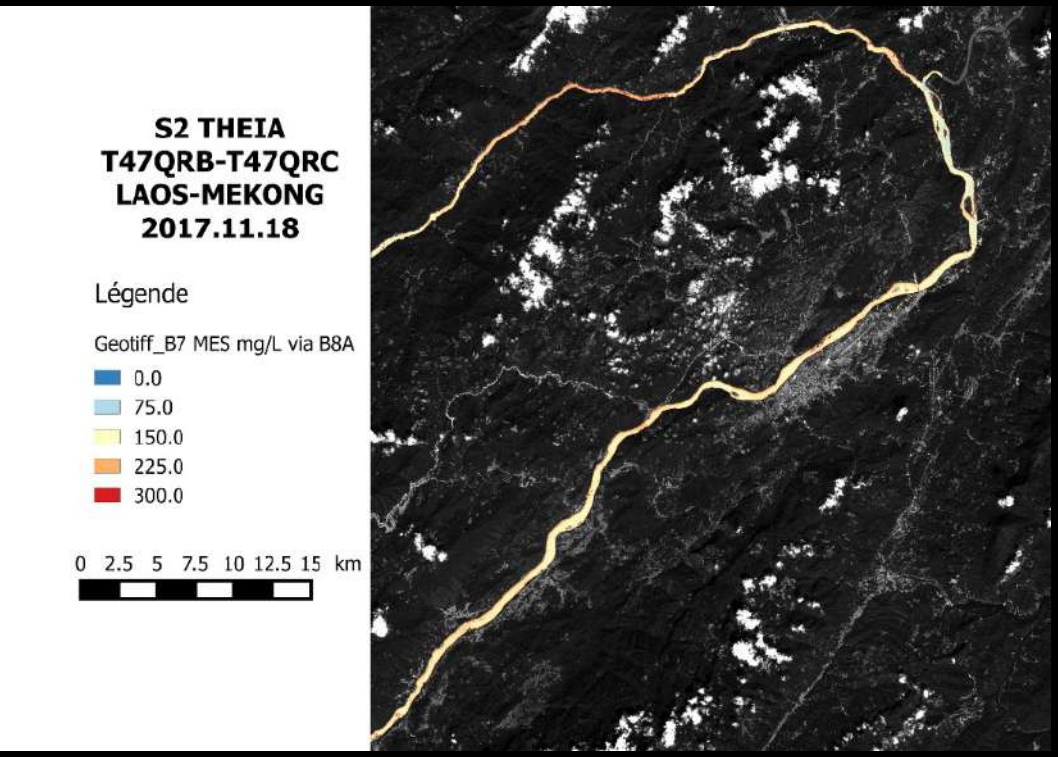


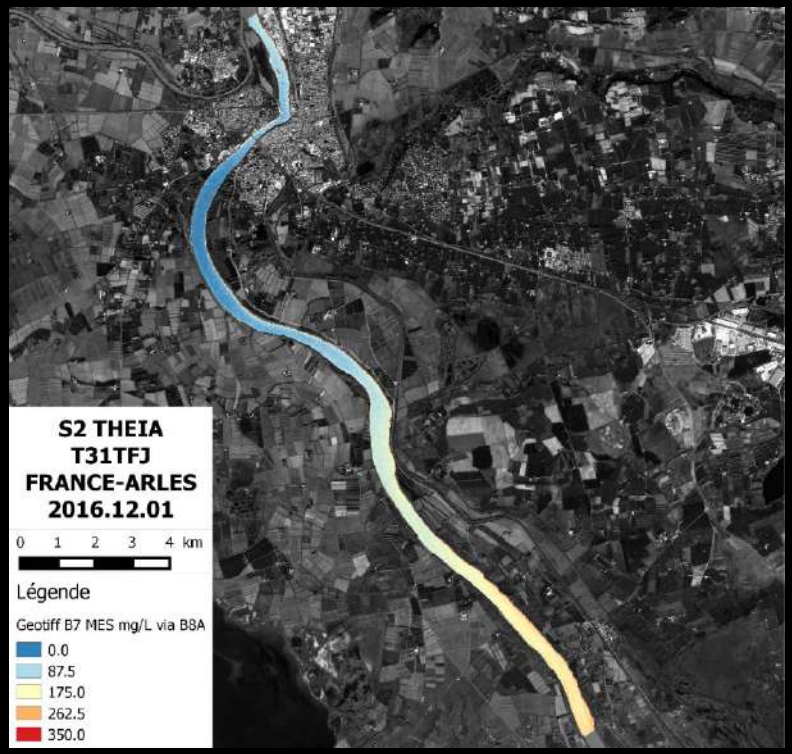
Les avancées

Défis R&D :



<u>Défi 2</u> : Masques nuages et eau



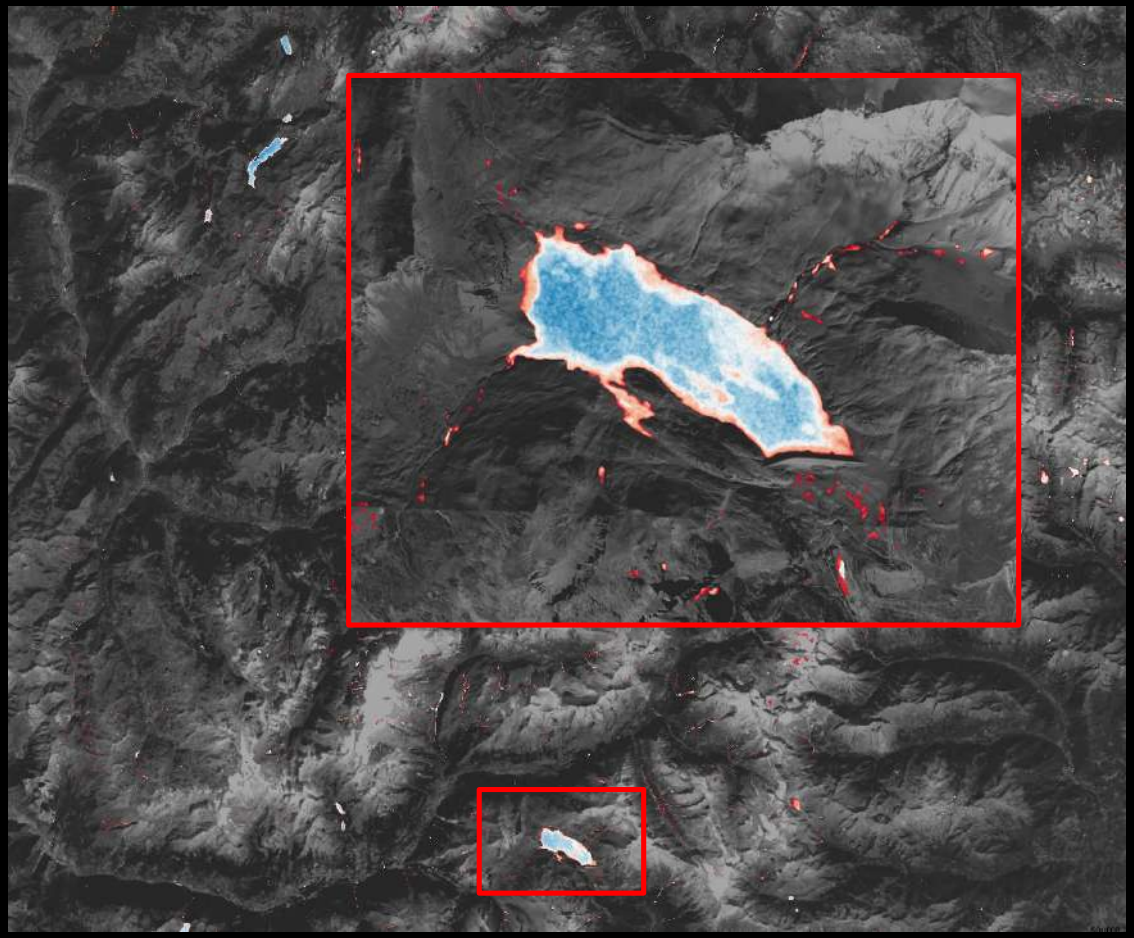


Waterdetect (Cordeiro et al., 2021)

Les avancées

Défis R&D :

<u>Défi 2</u> : Masques nuages et eau

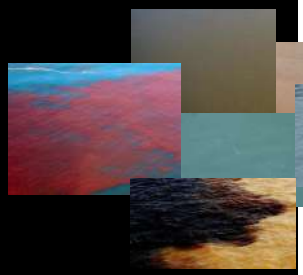


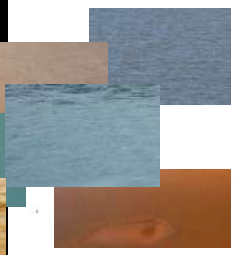
CES Cartographie et suivi des surfaces en eaux

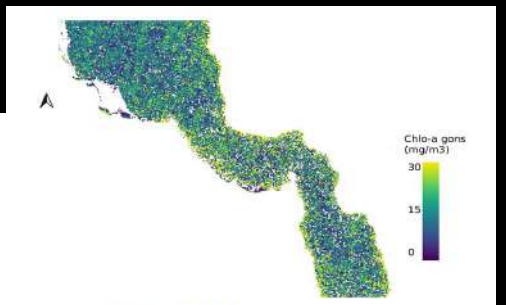
Les avancées

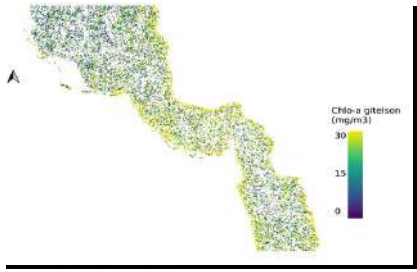
Défis R&D :

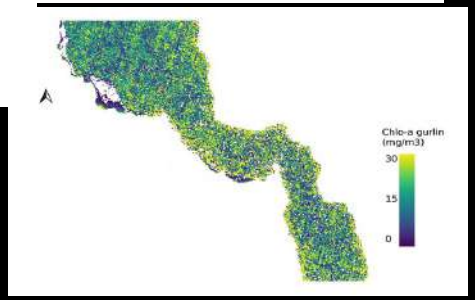
<u>Défi 3</u> : Inversion du signal sortant de l'eau en paramètres et métriques







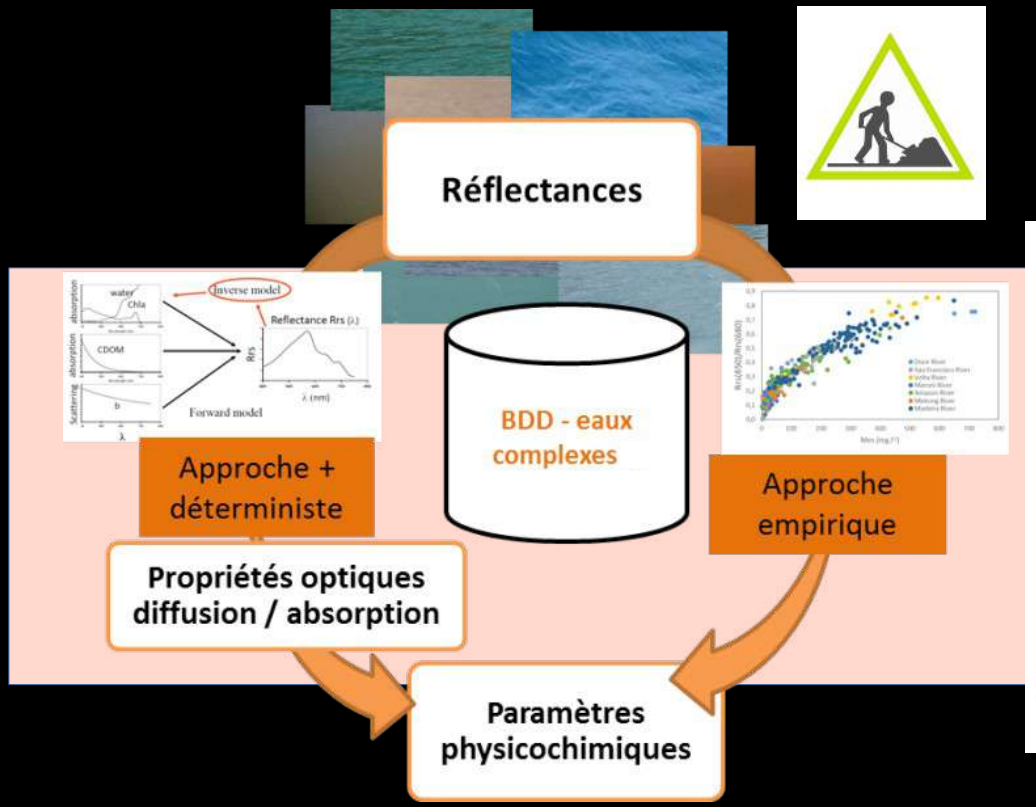


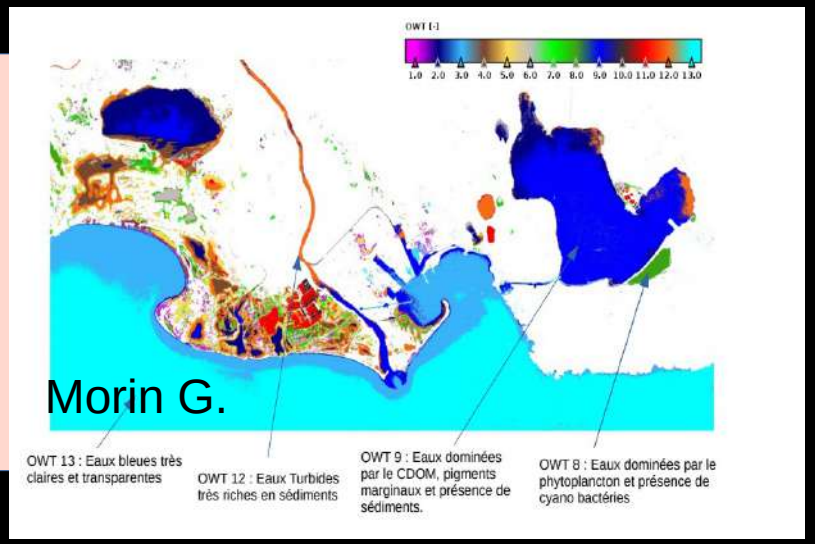


Les avancées

Défis R&D :

<u>Défi 3</u> : Inversion du signal sortant de l'eau en paramètres et métriques





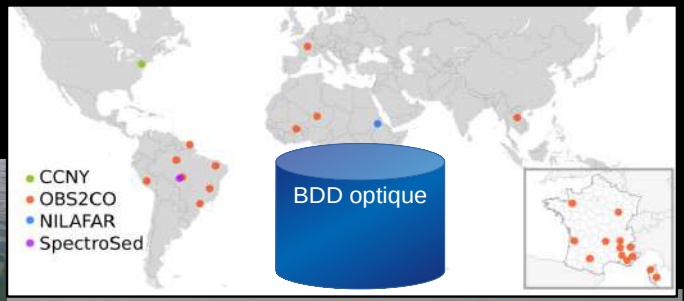
Les avancées

Défis R&D :

<u>Défi 3</u> : Inversion du signal sortant de l'eau en paramètres et métriques

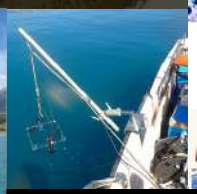
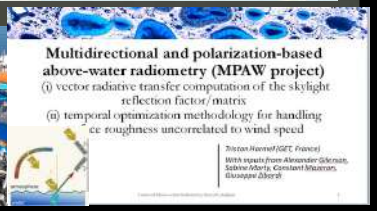


DATA insitu




~ 10 Campagnes de mesure / an

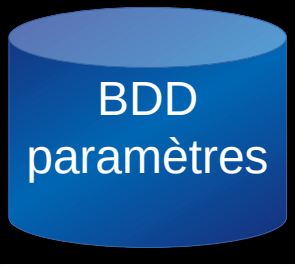


Les avancées

Défis R&D :

<u>Défi 3</u> : Inversion du signal sortant de l'eau en paramètres et métriques

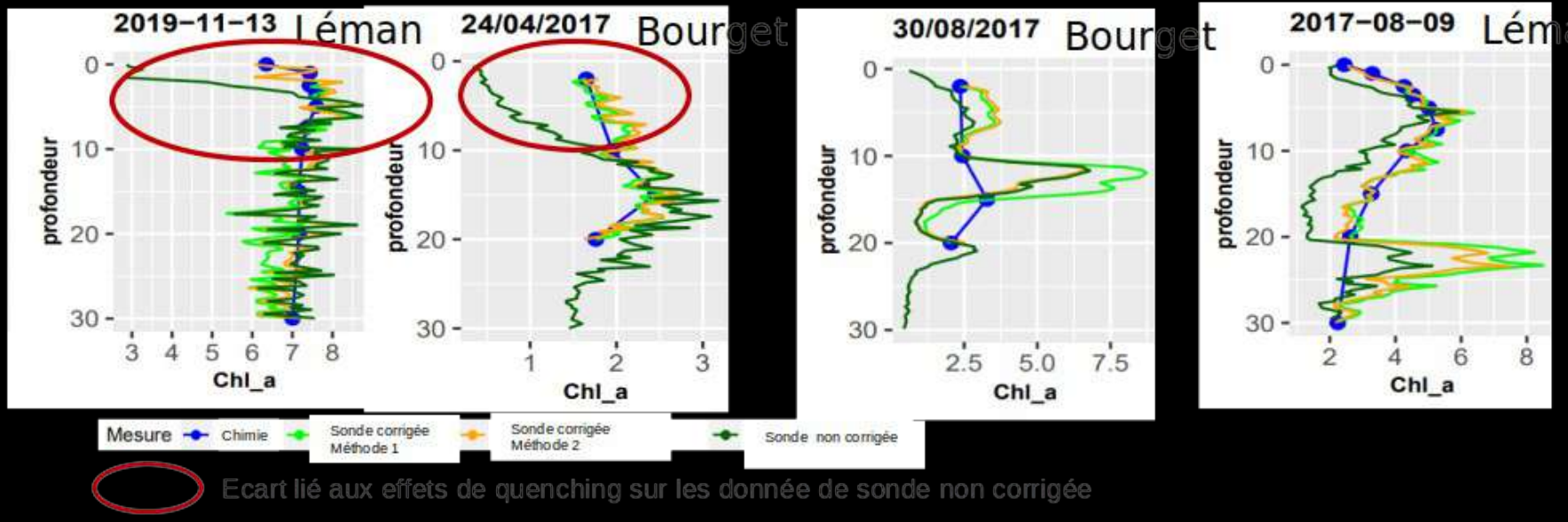


Param	Nombre de matchup	Nombre de site	Nombre d'algo	Range	Mean sd
Chlo-a (mg/m3)	7541 (L8) 1512 (S2) 2082	307 170 50	5 up to 15	0 – 865 0 – 865 0 – 193	1.5+/-4.6 2.3+/-5.9 104+/-3.4
SPM (particulate matter) (kg/m3)	8816 (L8) 1761 (S2) 1902	411 212 36	4	0 – 15439 0 – 2441 0 – 15439	2.3+/-107 1.5+/-29.8 2.6+/-135
SD (transparency) (m)	4620 (L8) 1512 (S2) 975	300 262 31	up to 3	0.05 – 2463 0.055 – 1380 0.5 – 380	100+/-113 106.9+/-115.3 96.4+/-82.9
DOC (aCDOM) (mg/m3)	5386 (L8) 1326 (S2) 1191	403 211 28	1 up to 4	0.09 – 56 0.09 – 44 046 – 30.9	3.8+/-4.2 3.5 ± 3.6 3.02+/-3.6

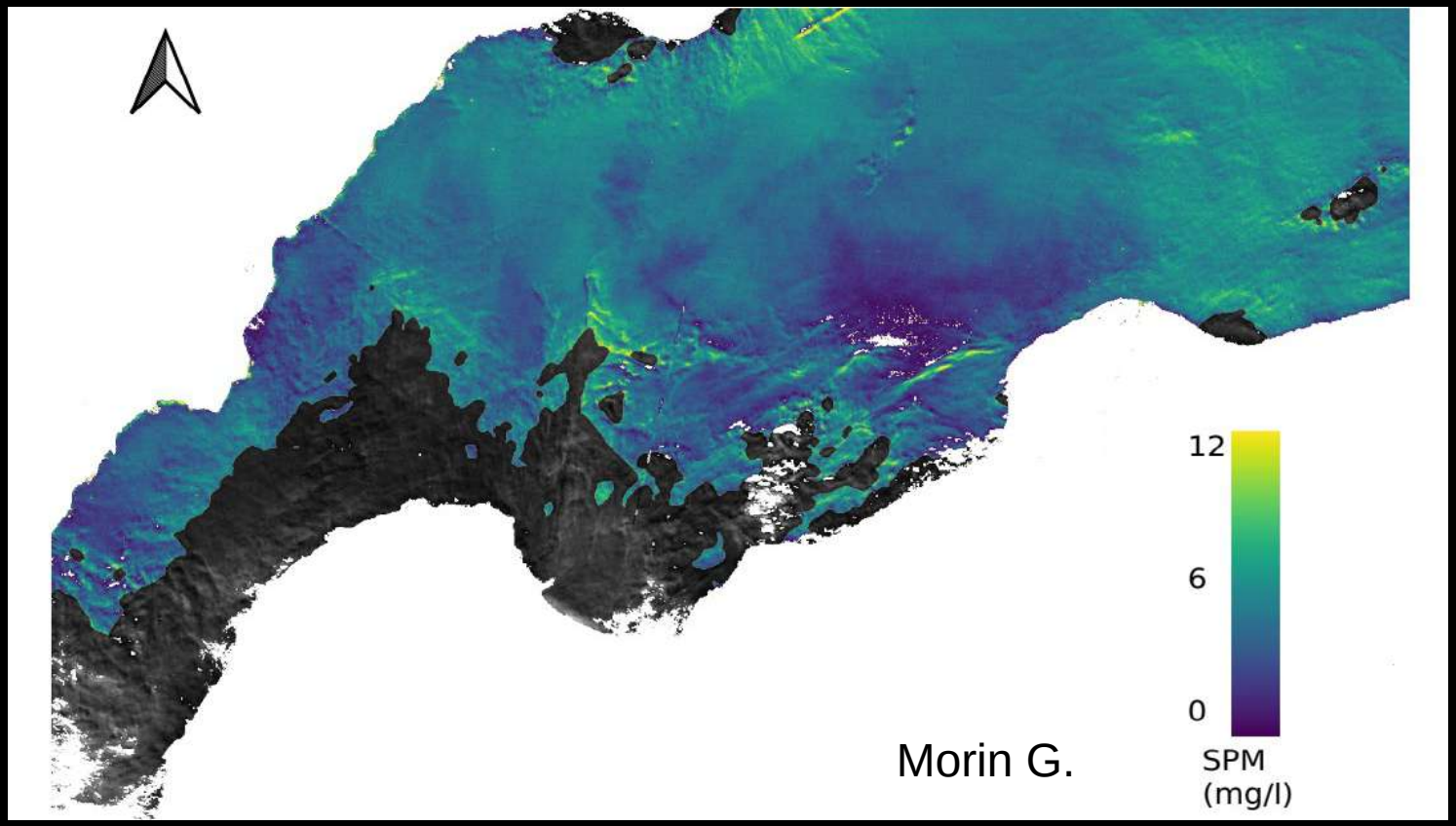
Les avancées

Défis R&D :

<u>Défi 3</u> : Inversion du signal sortant de l'eau en paramètres et métriques

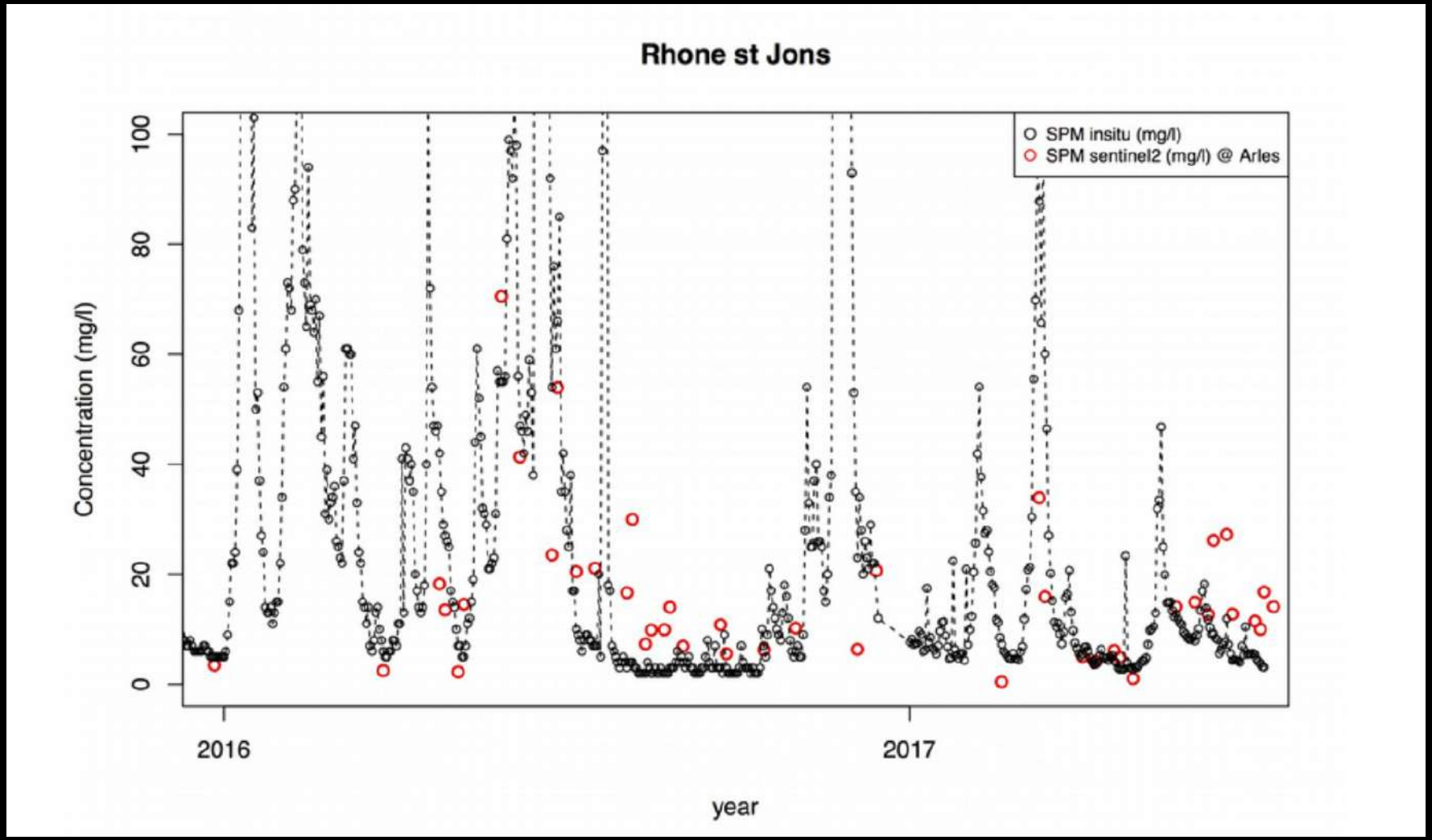


Les avancées

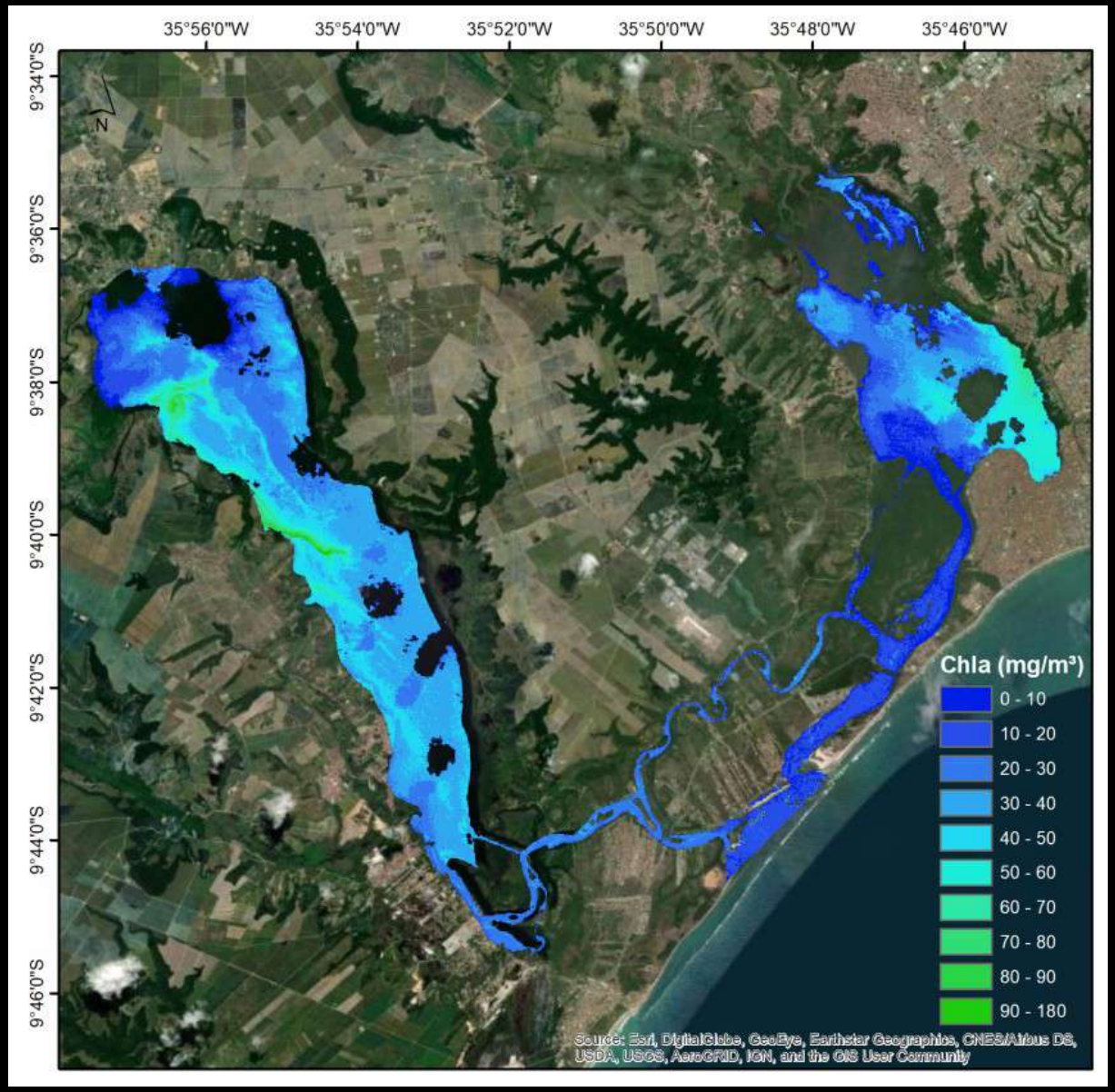


Léman

Les avancées



Les avancées



Tavares et al. 2021

Les avancées

Application à Sentinel-2 (étang Berre, 4 oct. 2020)

Gernez et al.

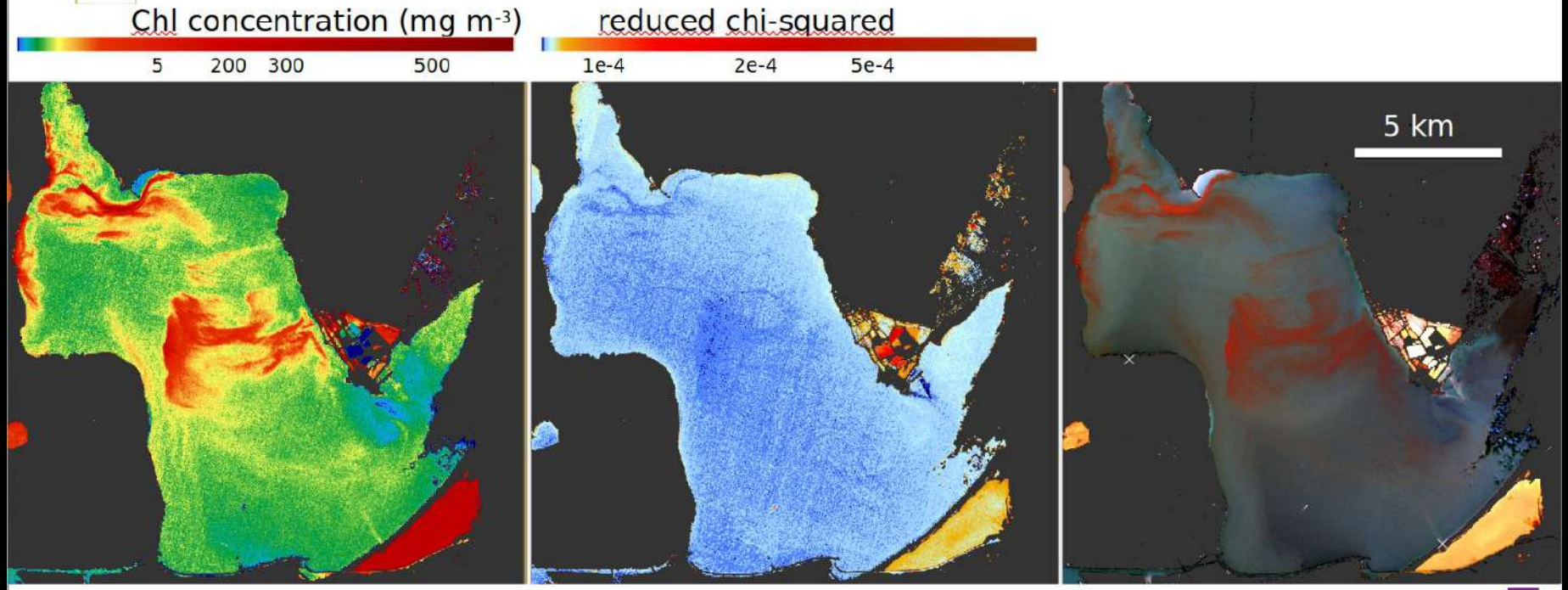


Figure 5. S2 image of Berre laguna (20201004). Retrieved Chl concentration of *M. rubrum*; inversion uncertainty; False color composite

(Gernez et al., in prep.)

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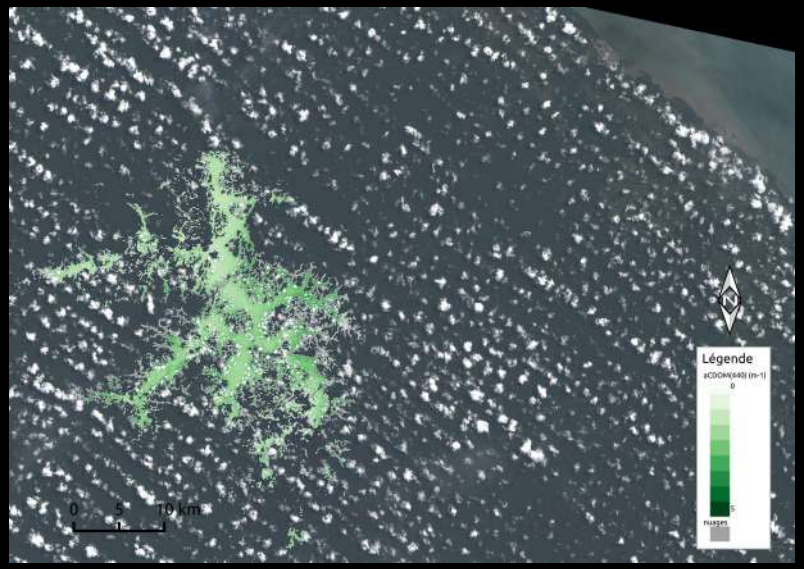
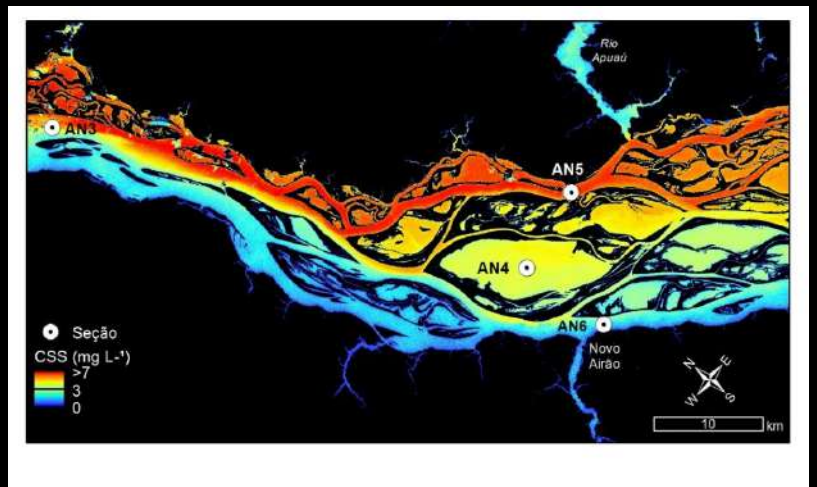
Les avancées

Concentration en CDOM

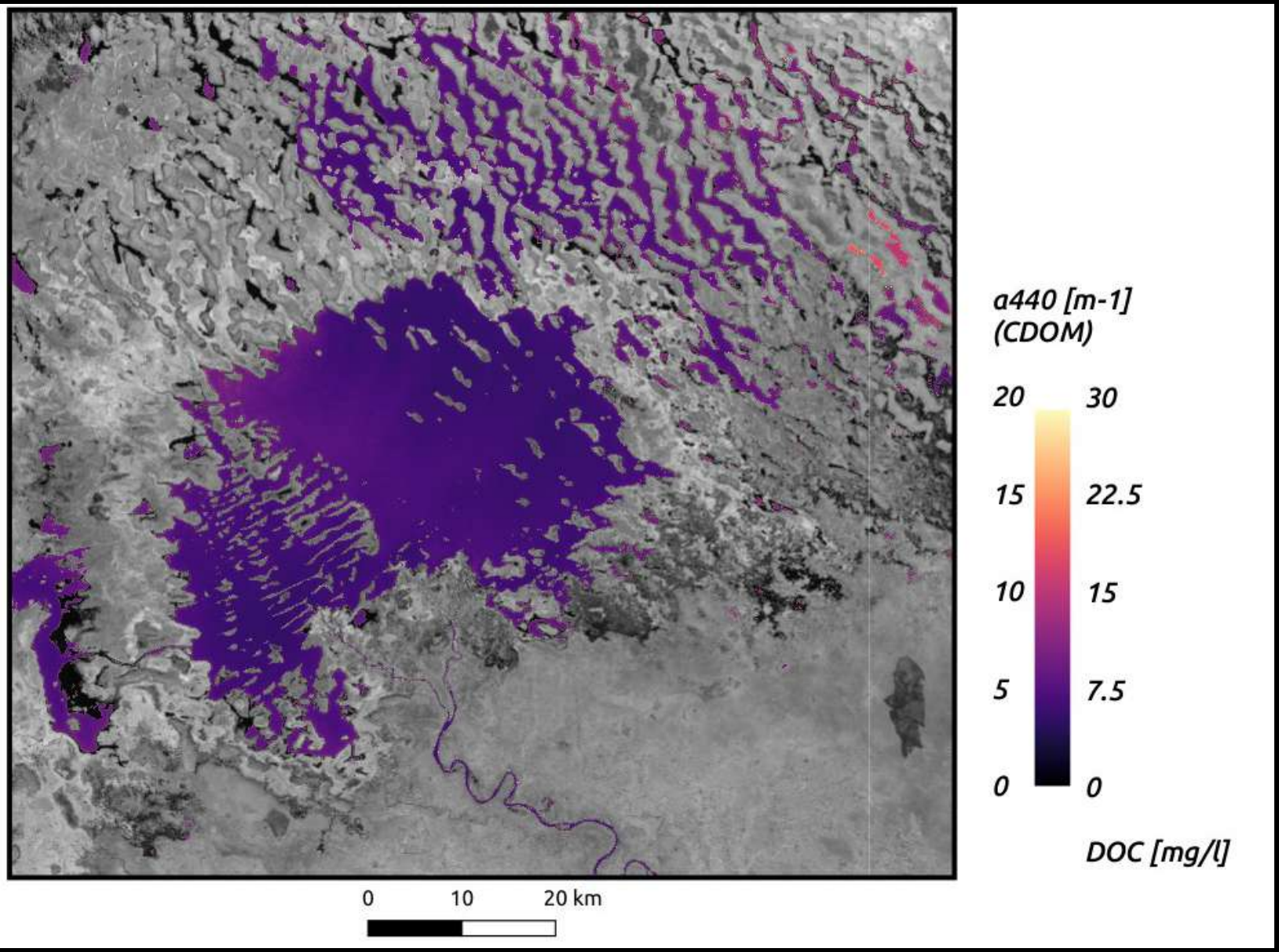


Coque , 2018

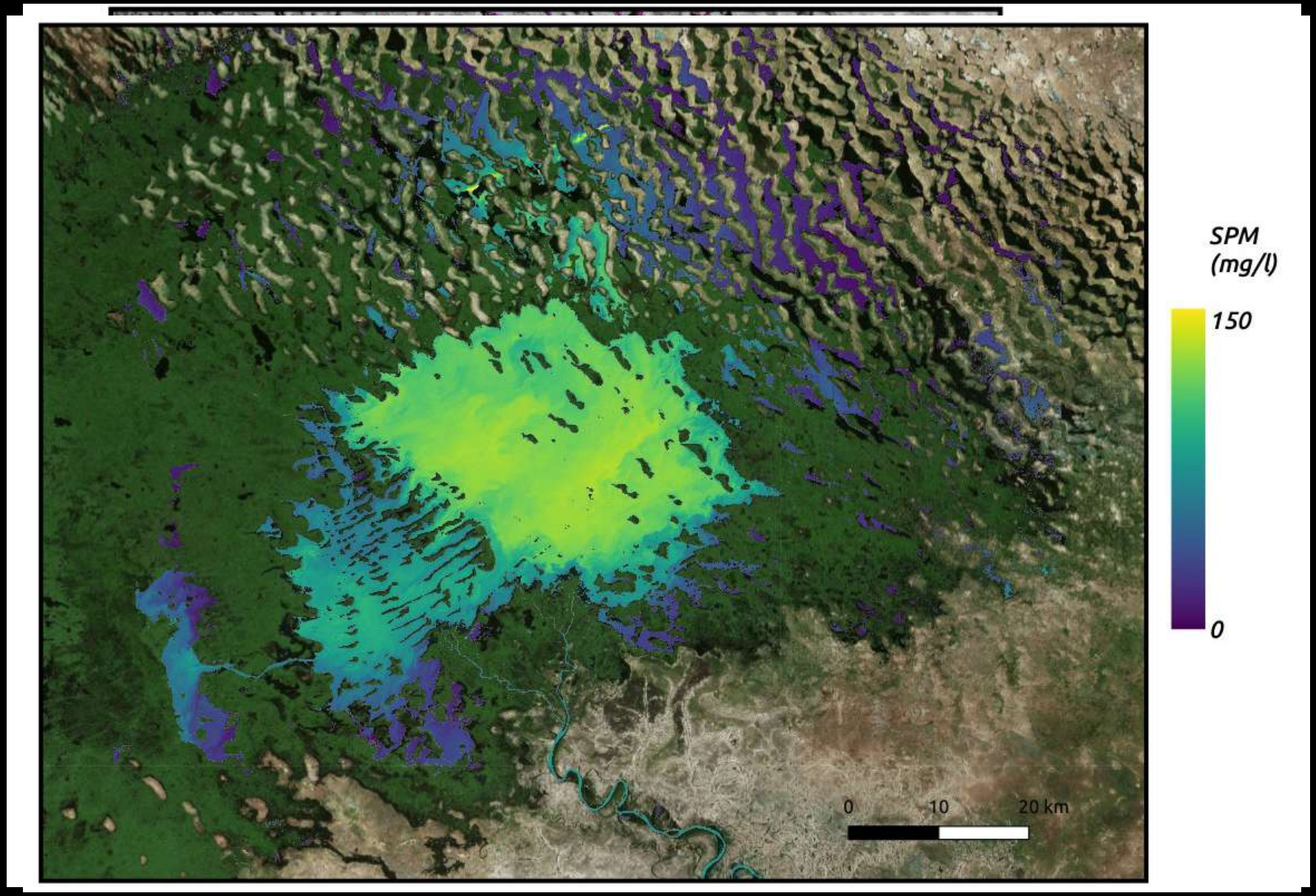


R. Marinho et al. 2021

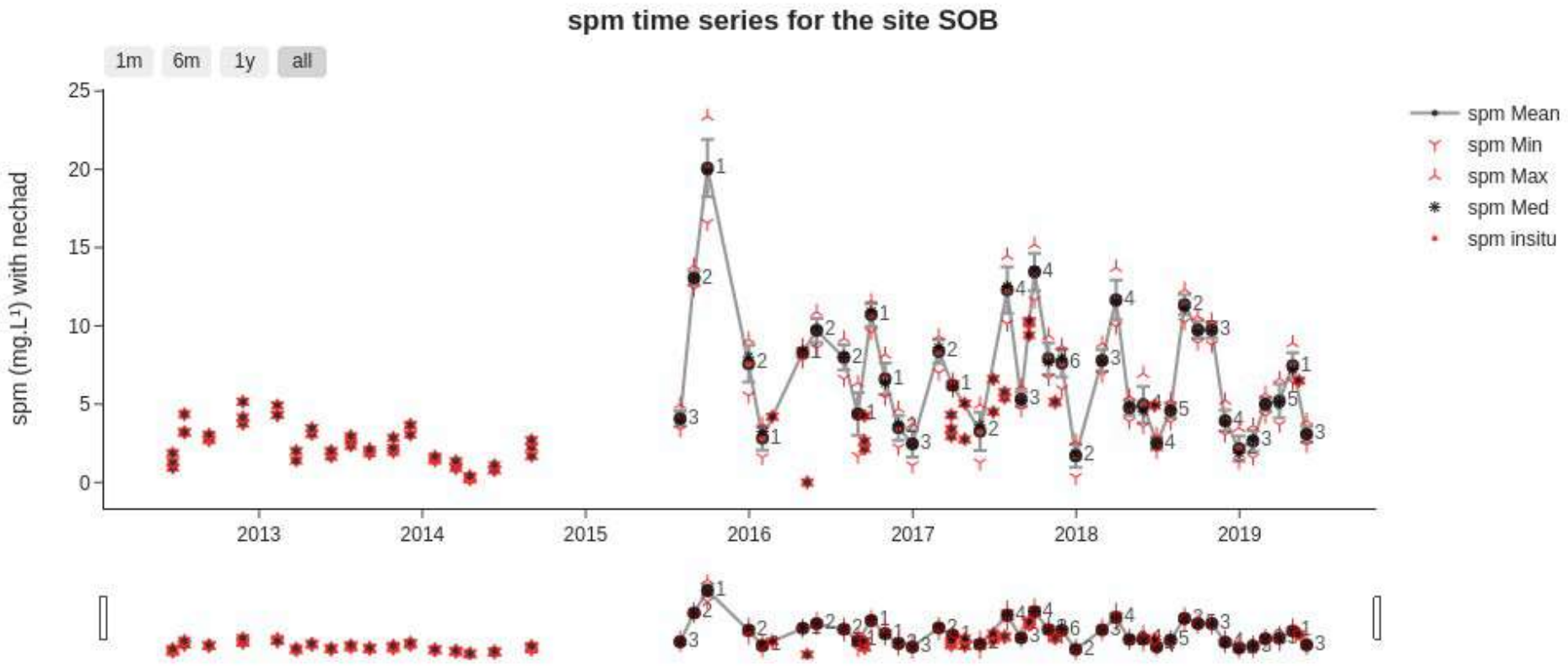
Les avancées



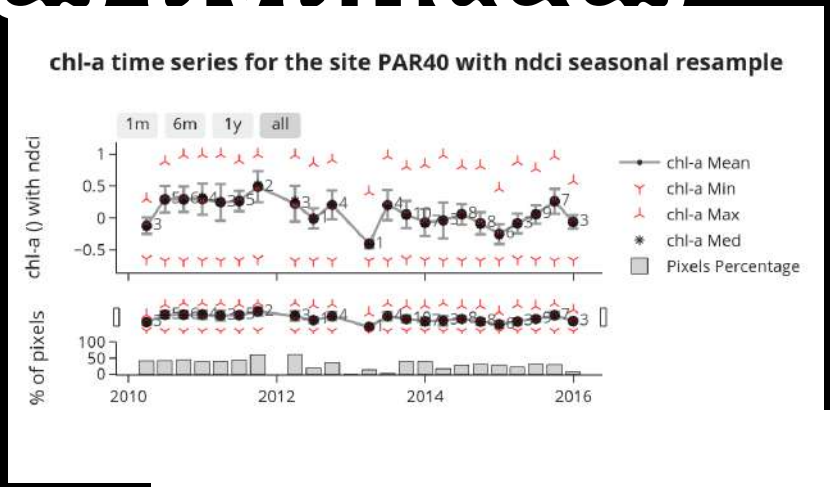
Les avancées

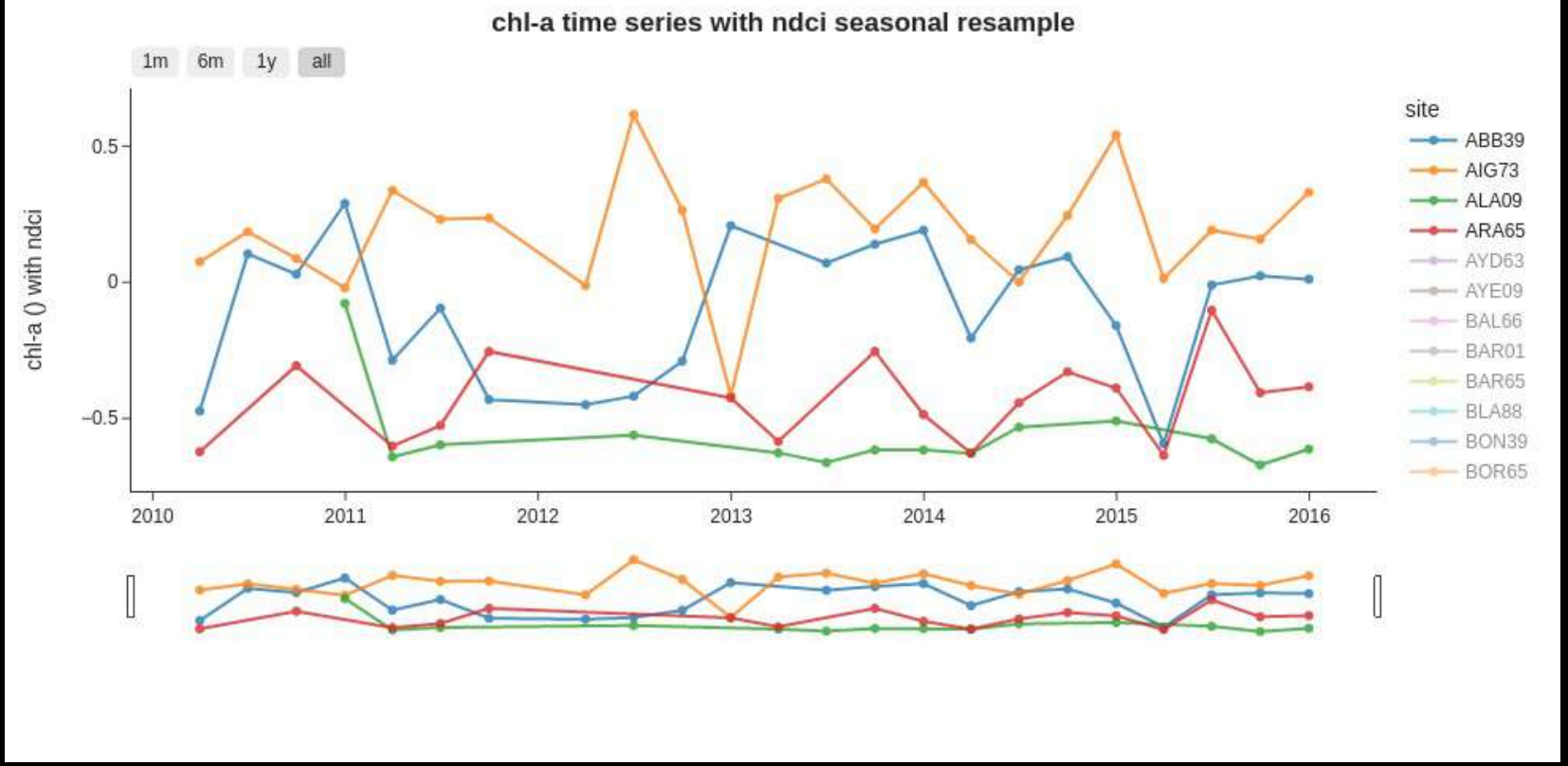


Les avancées



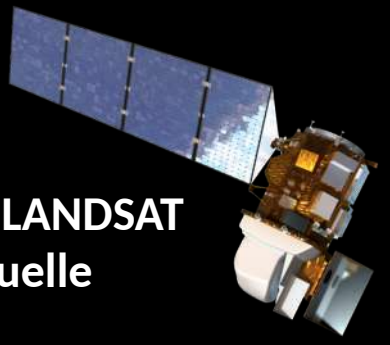
Les avancées





(température)

Erreur : +/- 1à 2 °C
Pixel eau de chaque dalle



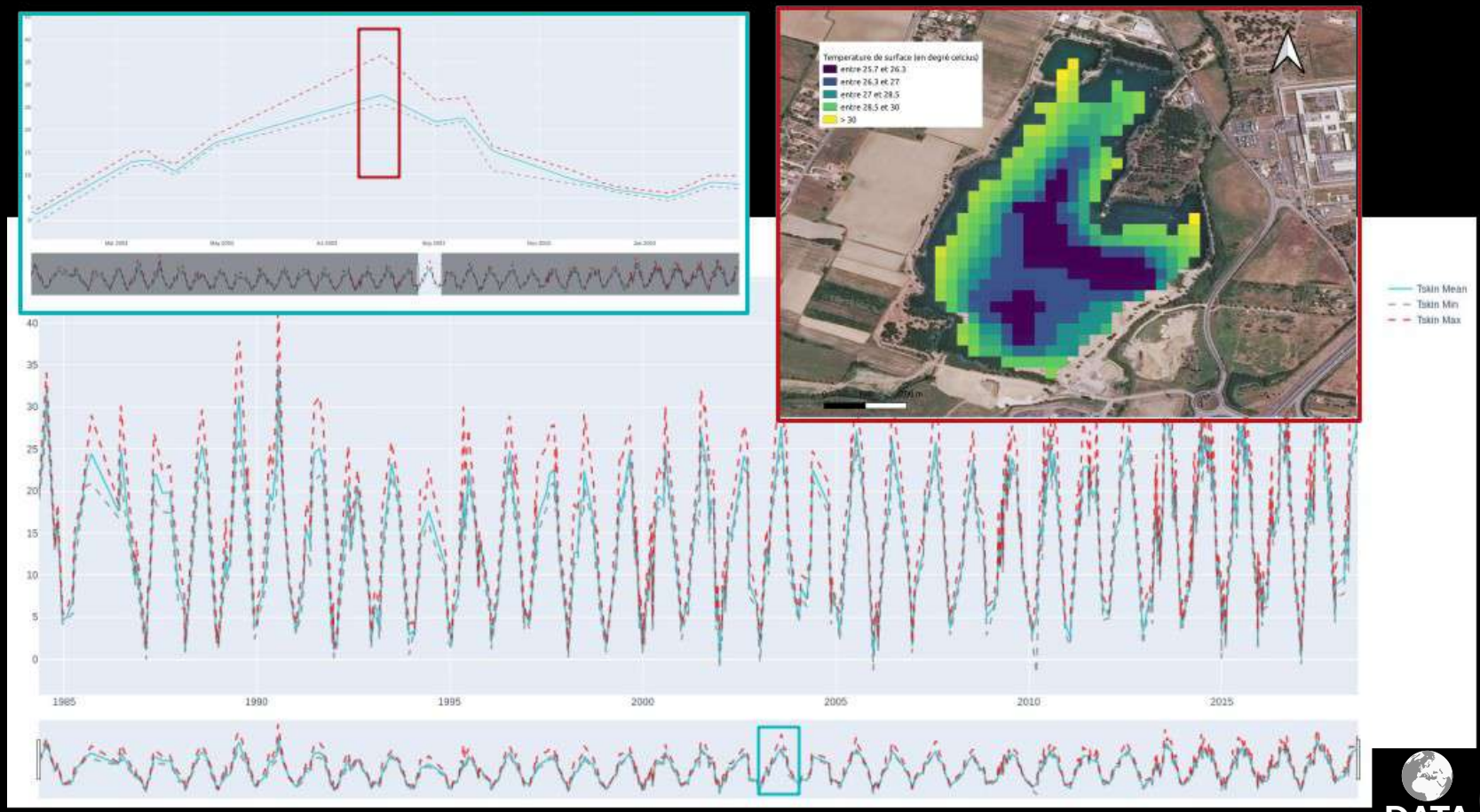
Archives LANDSAT
MAJ annuelle

Simon 2014 ; Prats, 2016

(température)

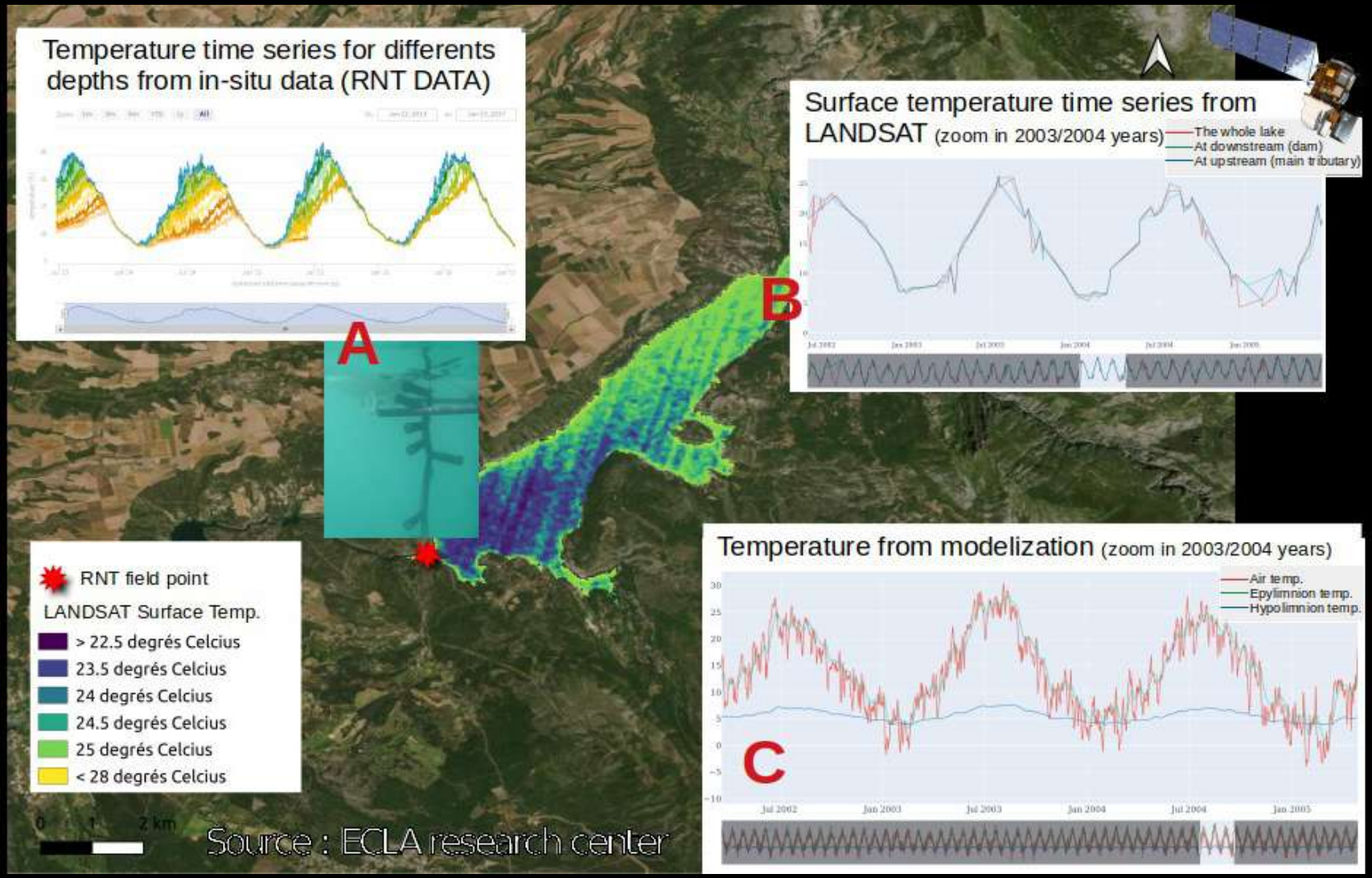
Erreur : +/- 1à 2 °C
Pixel eau de chaque dalle

Archives LANDSAT
MAJ (t -2 mois)



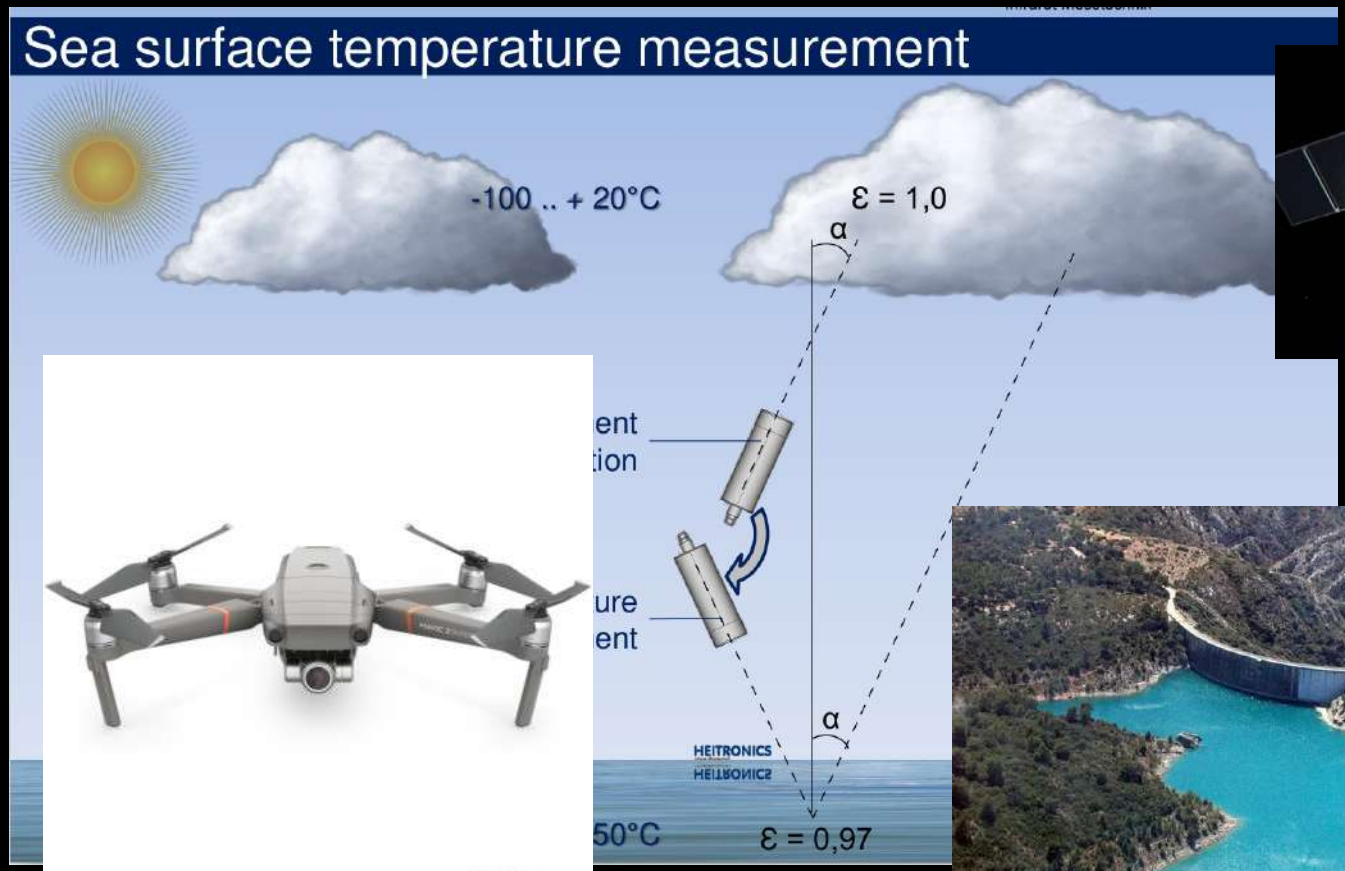
Simon 2014 ; Prats, 2016

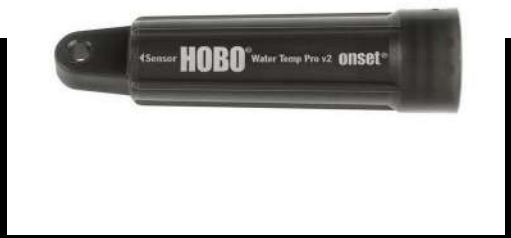
(température)



(température)

Cal /Val TRISHNA





Techniquement

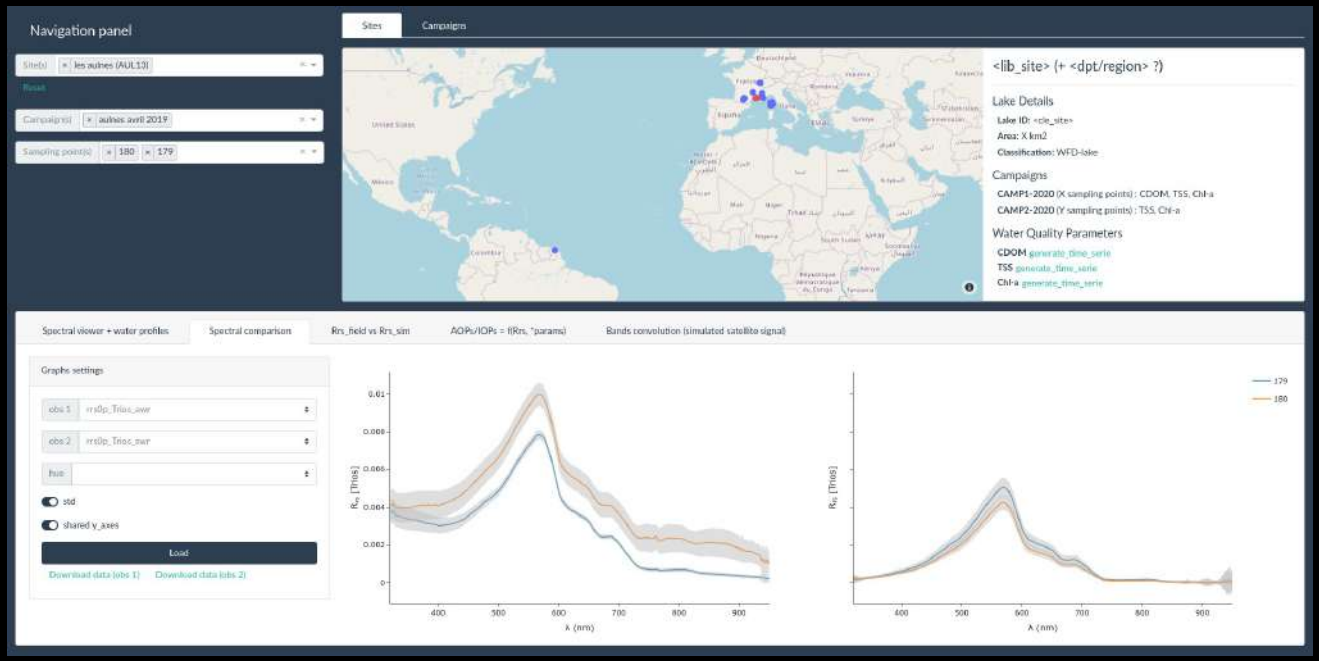
* **SISPPEO** (Satellite Imagery & Signal Processing Packages for Earth Observation) + **algo GRS**

GRS SISPPEO

INRAE OFB GEORECOVER

cnes CENTRE NATIONAL D'ÉTUDES SPATIALES

* **Plate-forme de valorisation des données optiques**



DATA ECLA

CES couleurs des eaux continentales
(lacs, rivières, fleuves, estuaires…)

Prototype (R&D)

https://www.theia-land.fr/ceslist/ces-couleurs-des-eaux-continentales/

Production / Diffusion

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