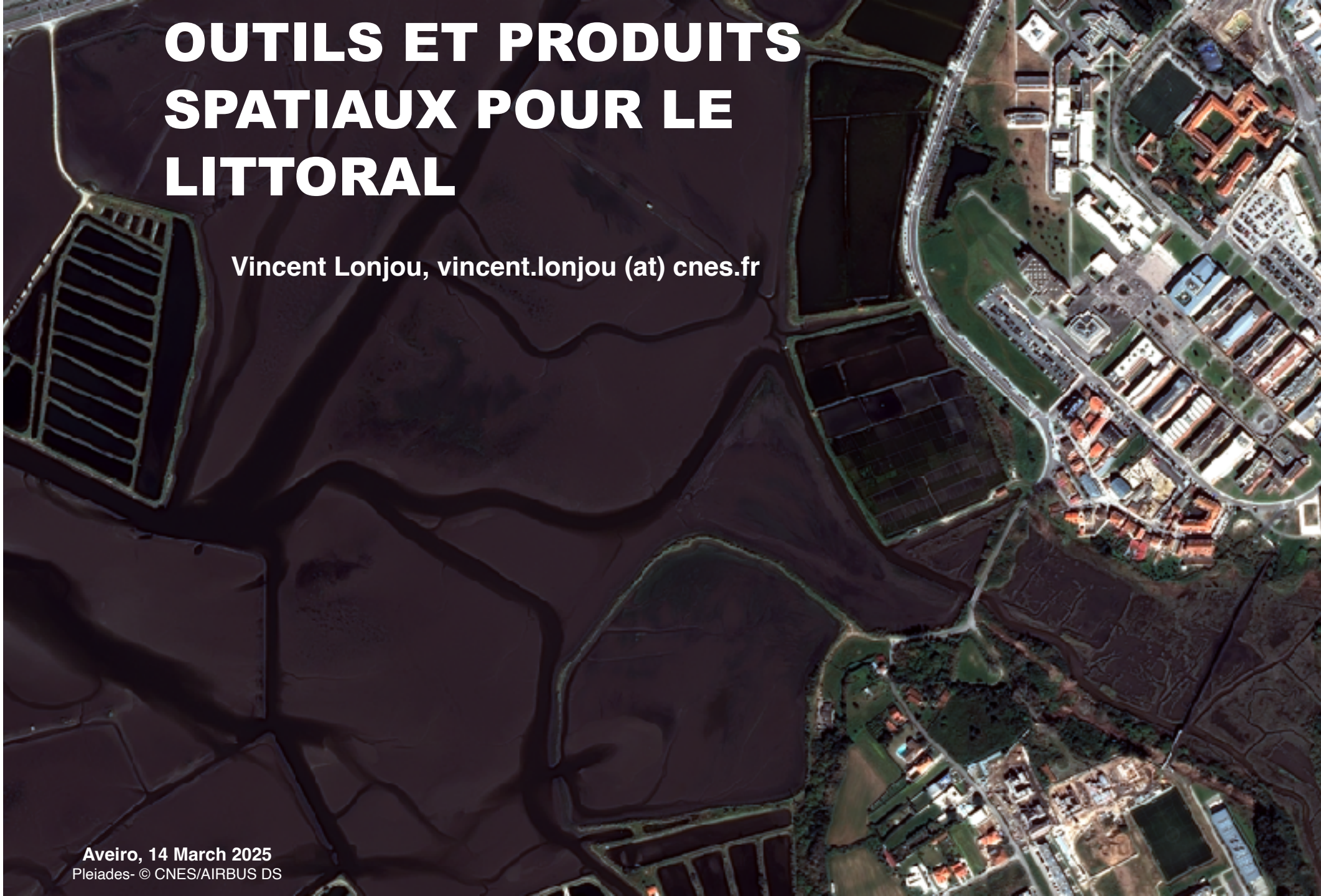
RÉPUBLIQUE FRANÇAISE
Liberté Égalité Fraternité

OUTILS ET PRODUITS SPATIAUX POUR LE LITTORAL

Vincent Lonjou, vincent.lonjou (at) cnes.fr

Aveiro, 14 March 2025



Pleiades- © CNES/AIRBUS DS

ACTUALITÉS

SCOast-DT : LES JUMEAUX NUMERIQUES POUR L'ETUDE ET L'ADAPTATION DES ZONES COTIERES

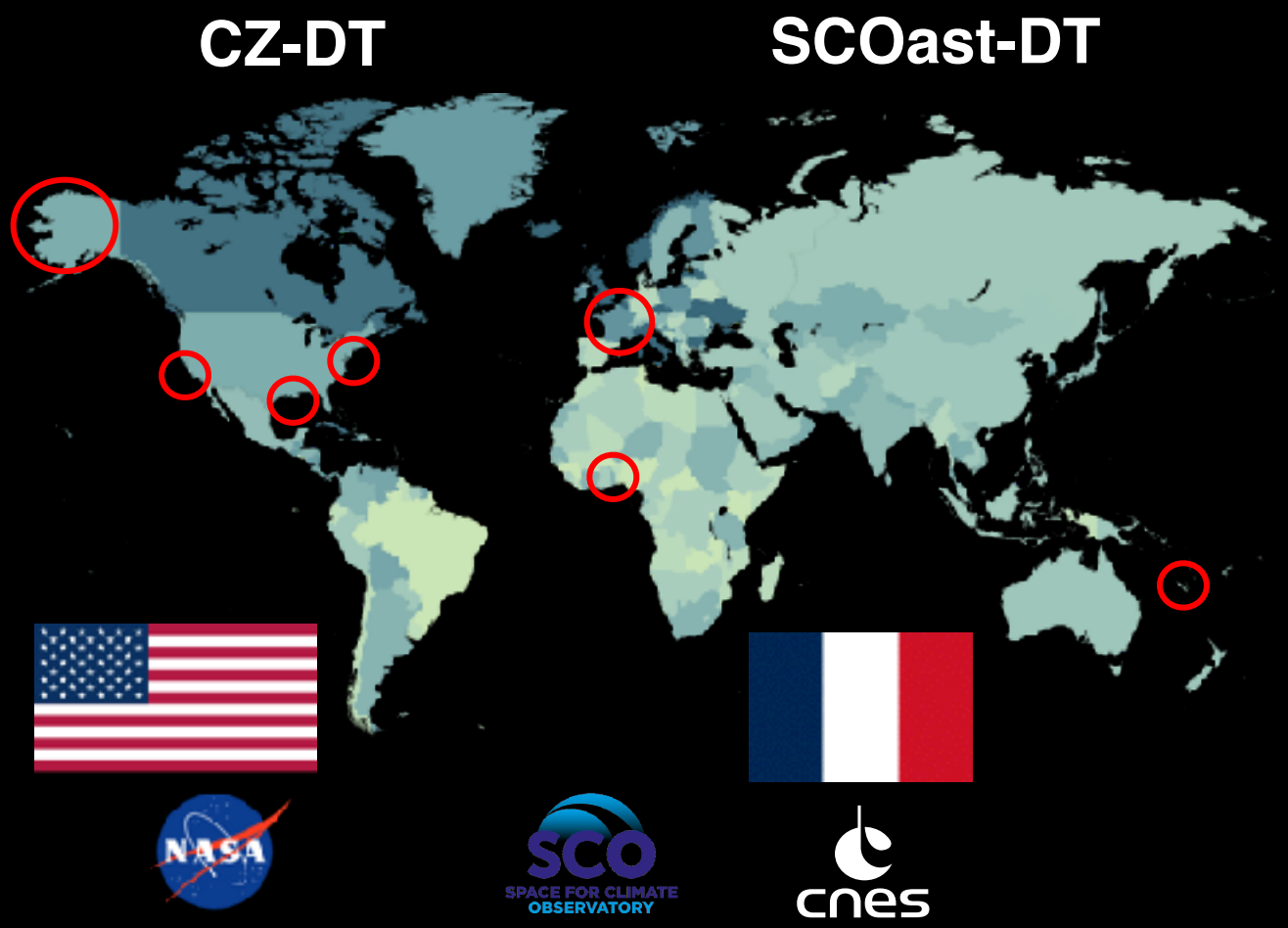
Kick-off 07/2025, durée 2 ans

DEMONSTRATIONS DE SERVICES INNOVANTS POUR LA CONNAISSANCE ET LE SUIVI DE LA BANDE COTIERE

Kick-off 07/2025, durée 3 ans

Service de suivi de la morphologie
Service de suivi des états de mer
Service de suivi des écosystèmes
Service de gestion de la bande côtière

VISION, COLLABORATION & OBJECTIVES



Fr-US collaboration

Open science

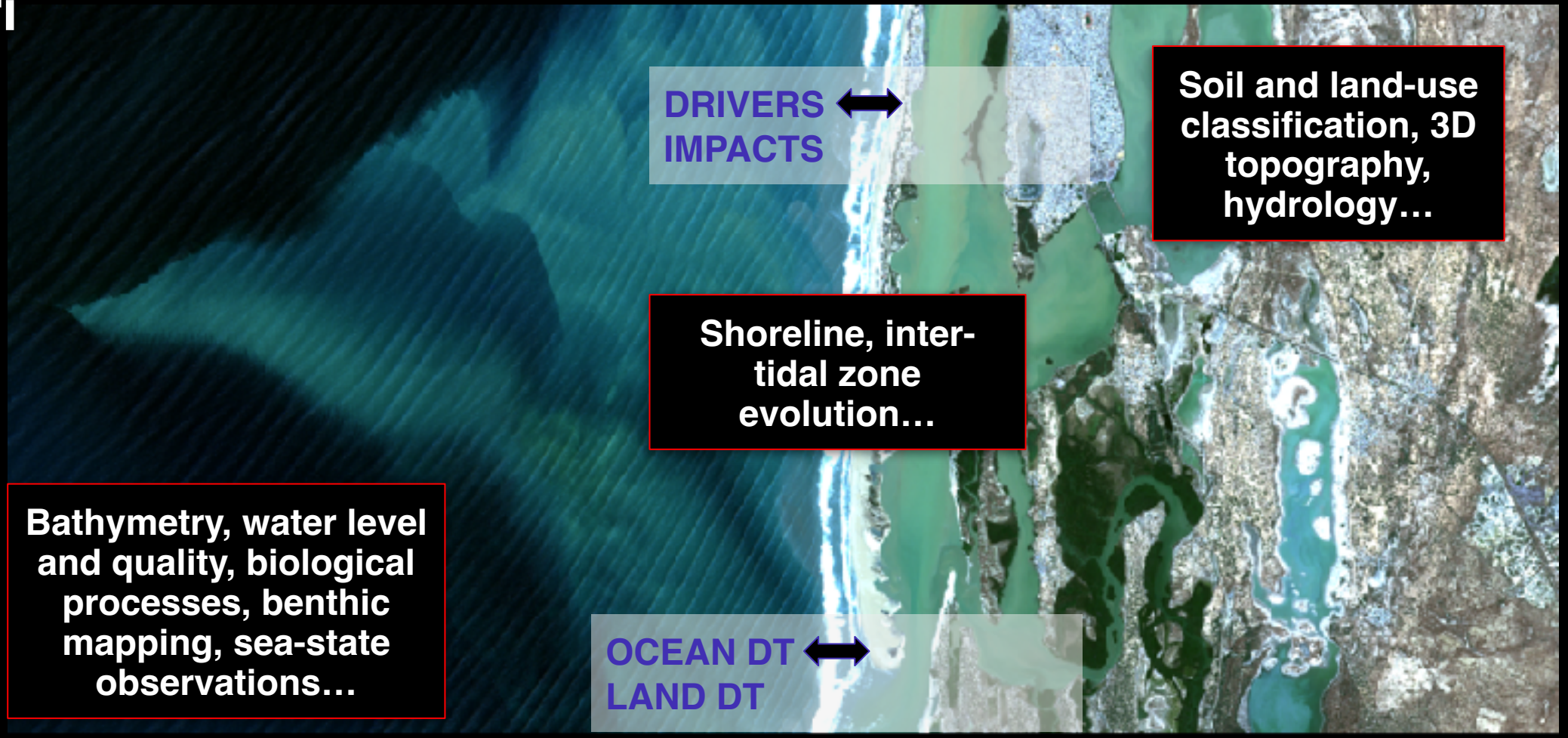
Use cases

Representative

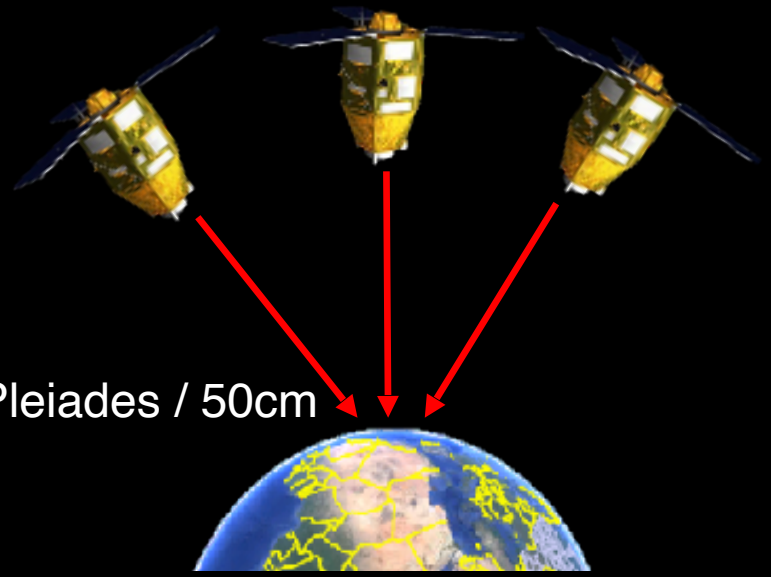
User involvement

User uptake

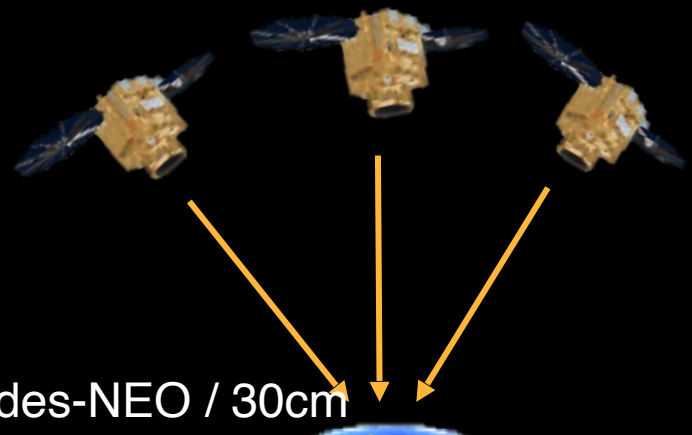
Une vision en 3D de la zone cotière, partout et n'importe quand, sans priori



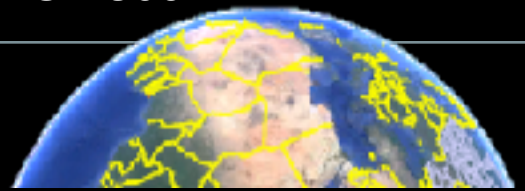
PLEIADES & PLEIADES-NEO TRI-STÉRÉO TASKING



Pleiades / 50cm



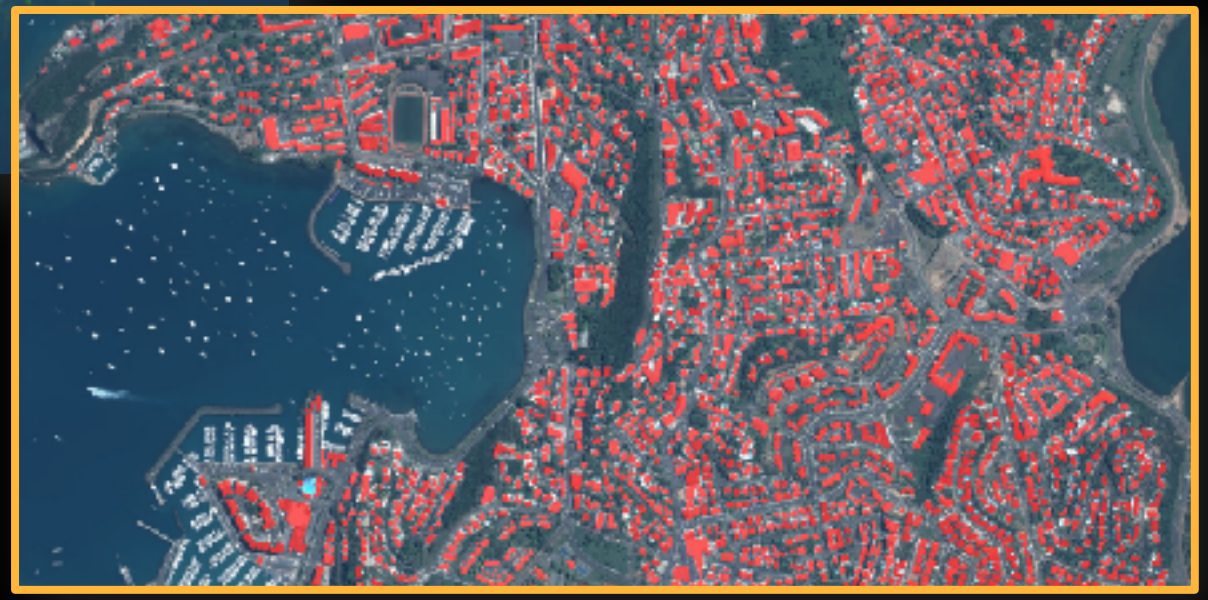
Pleiades-NEO / 30cm



VERY HIGH RESOLUTION DIGITAL REPLICA

Tri-stereo

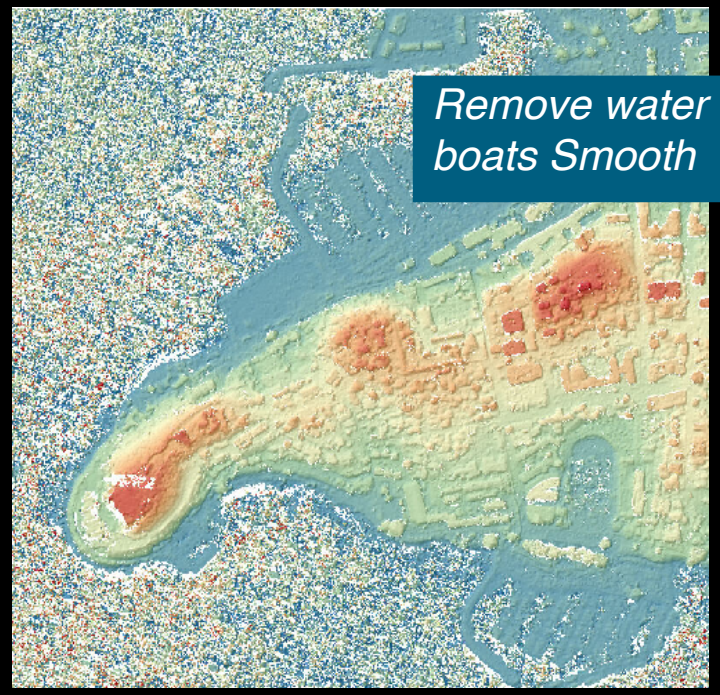
Détection d'infrastrutures



Dimitri.Lallement (at) cnes.fr ; Christian.Hummer (at) cnes.fr

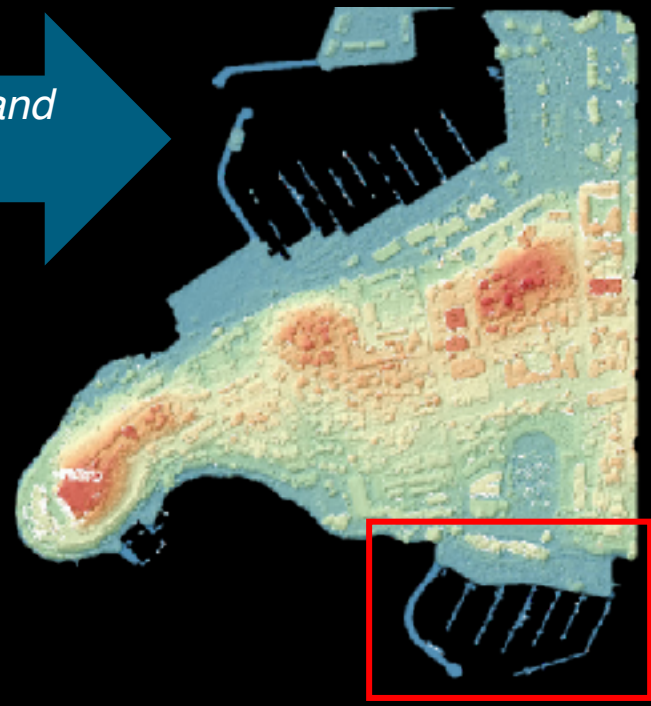
HUMAN INFRASTRUCTURES CHARACTERIZATION

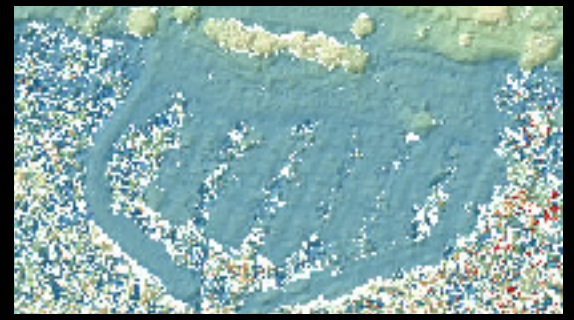
Tri-stereo



Remove water and boats Smooth

Raw DSM





Filtered DSM

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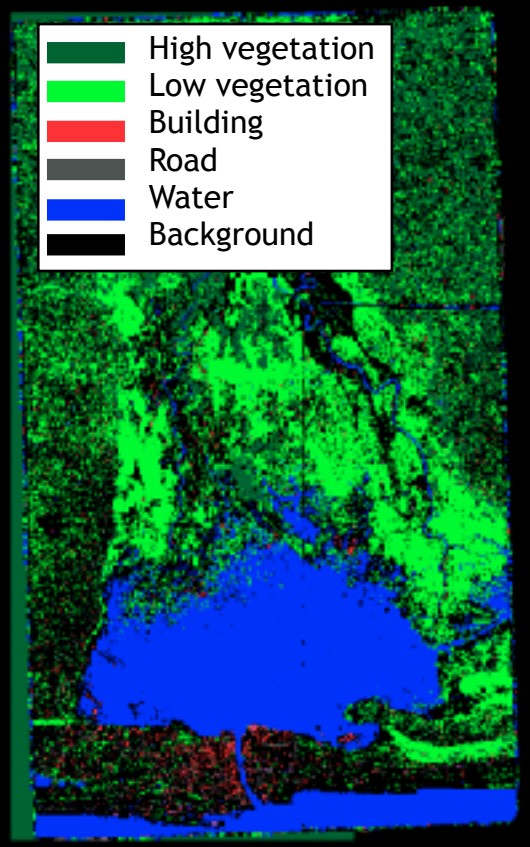
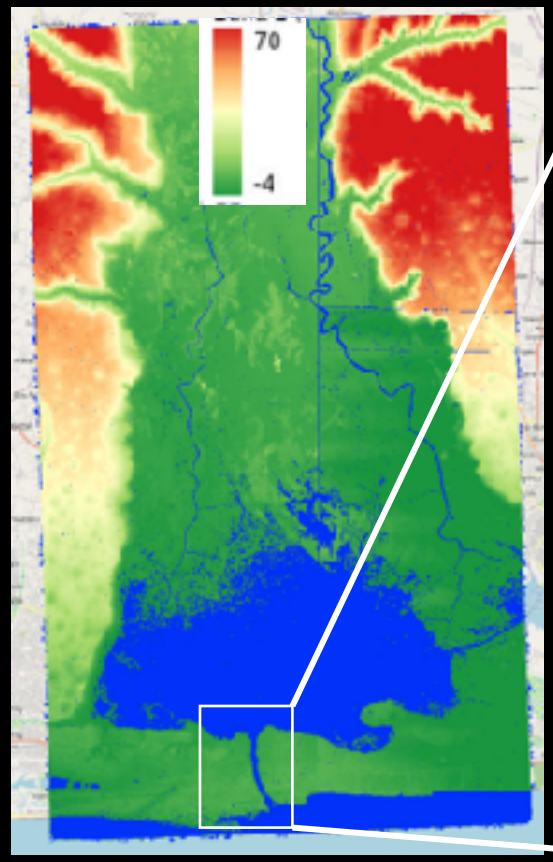
NOKOUÉ DIGITAL REPLICA

Images

COS



DTM



DHM

Pleiades- © CNES/AIRBUS DS

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NOKOUÉ DIGITAL REPLICA

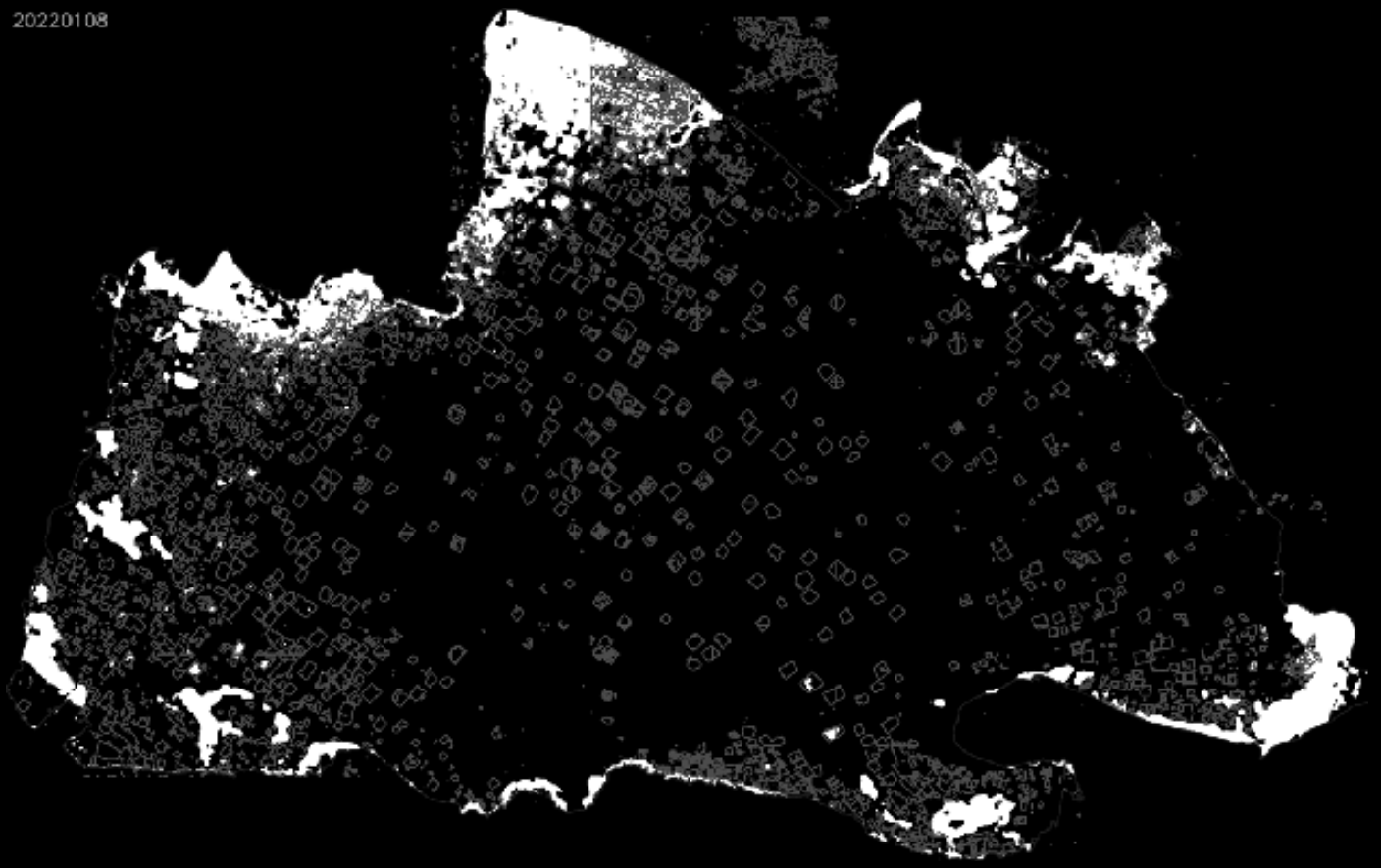
Water hyacinths invasion dynamic maps

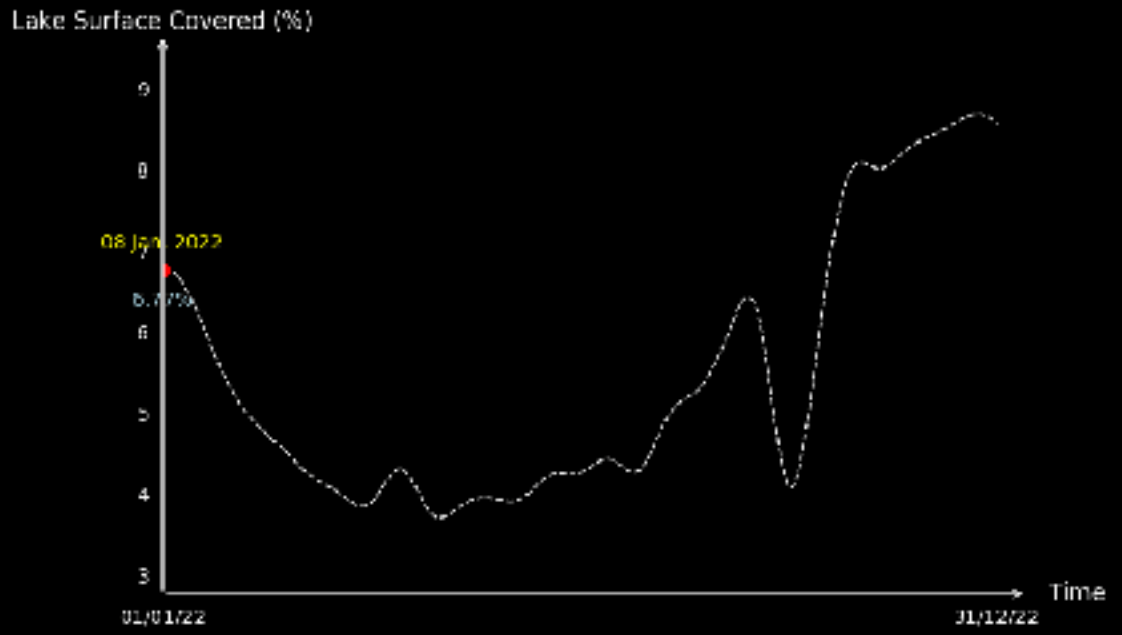
20220108

Acadjas maps

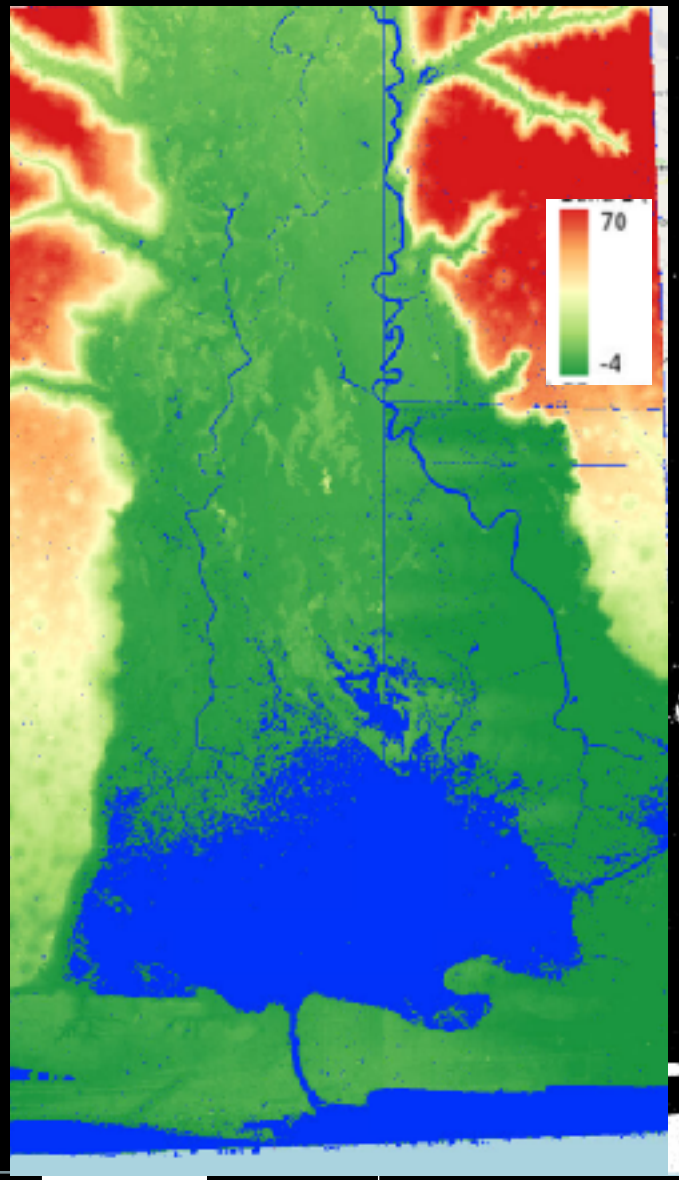
IA object detection

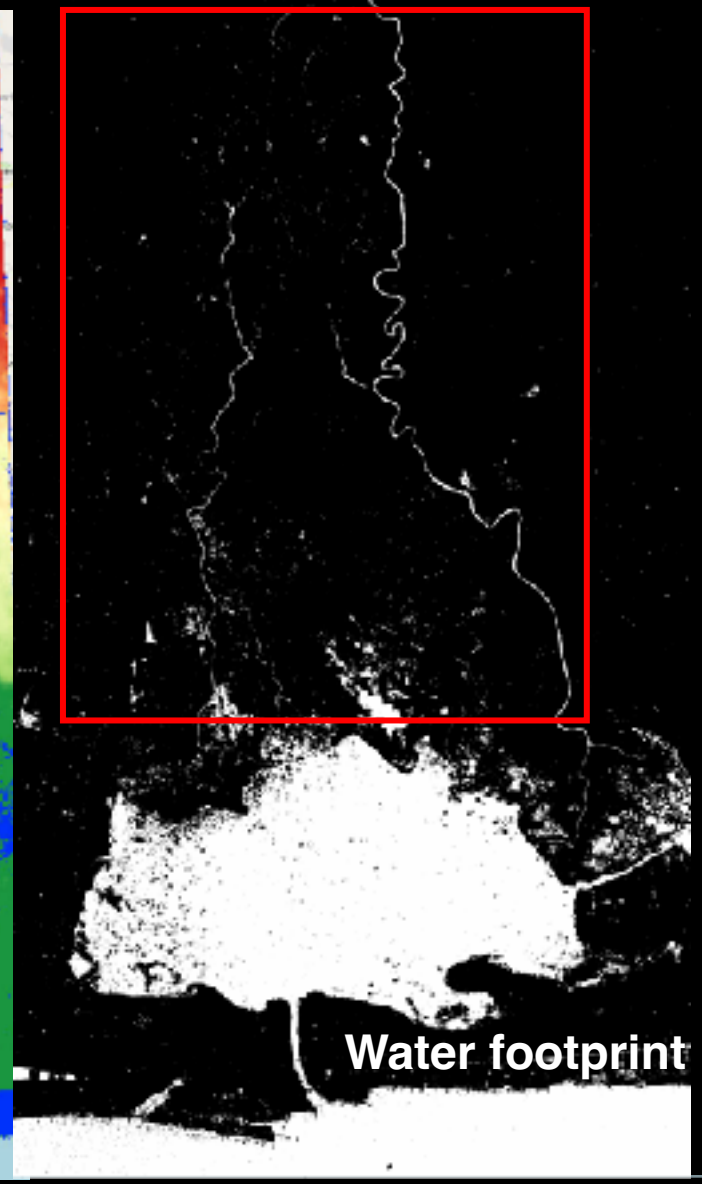
NOKOUÉ DIGITAL REPLICA : WATER HYACINTHS INVASION DYNAMIC MAPS

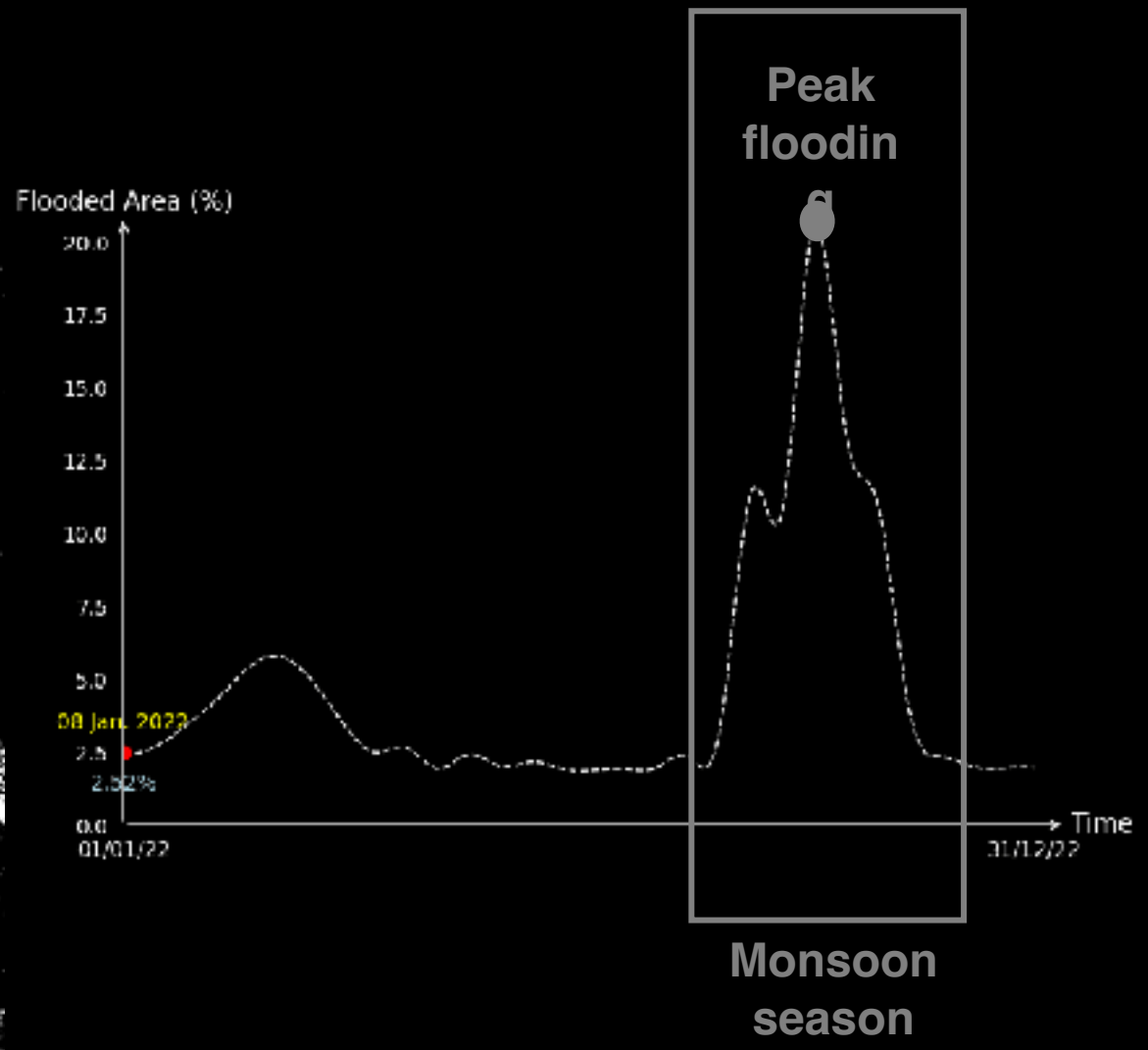




NOKOUÉ DIGITAL REPLICA : 2022 FLOOD MAPS







OUTILS CNES OPEN SOURCE DE TRAITEMENT THR ET STEREO

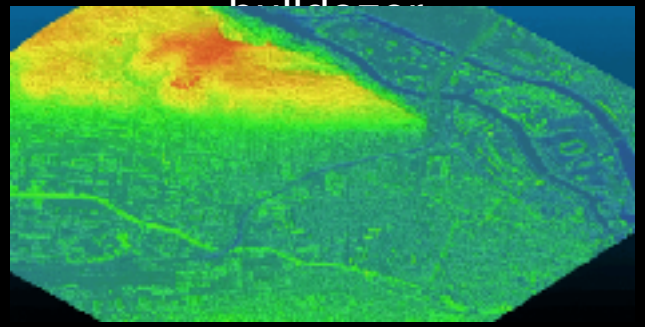
Stéréo => MNS

https://github.com/CNES/cars

David.Youssefi (at) cnes.fr

MNS => MNT + MNT

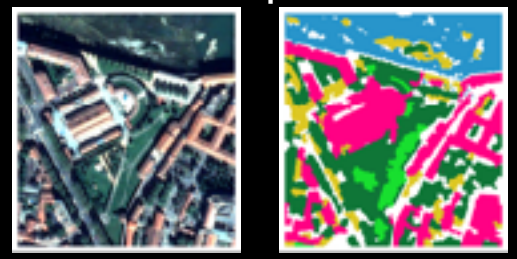
https://github.com/CNES/



Dimitri.Lallement (at) cnes.fr

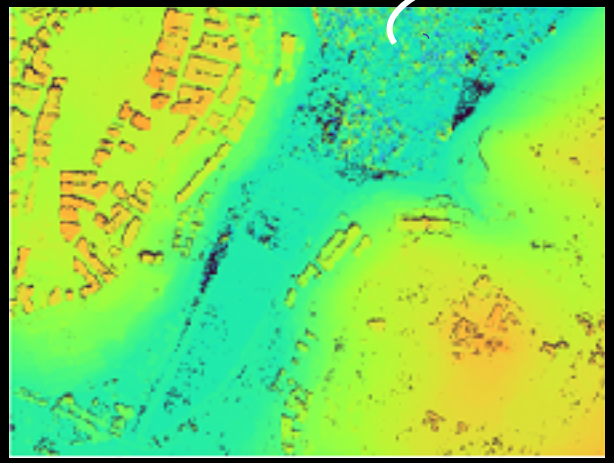
COS THR

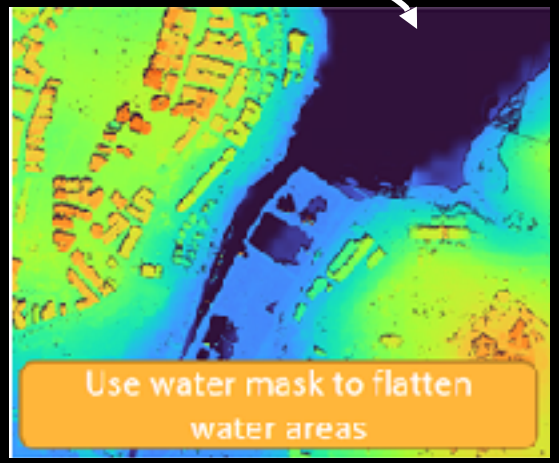
https://github.com/CNES/slurp/

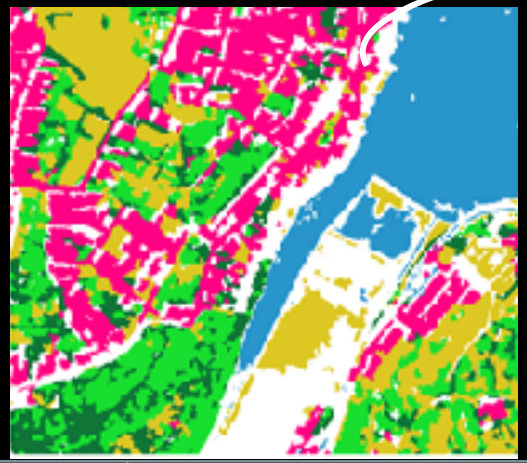


Yannick.Tanguy (at) cnes.fr

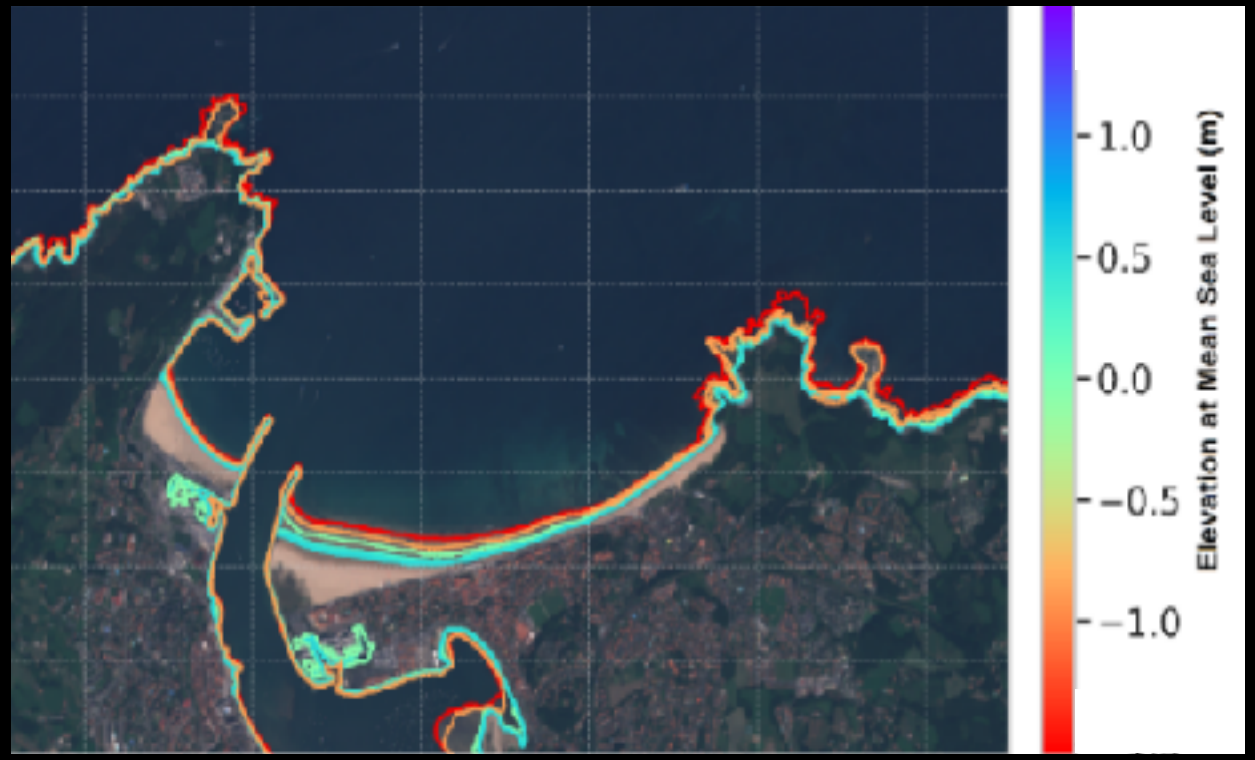
DATA HYBRIDRATION (3D + LCM)



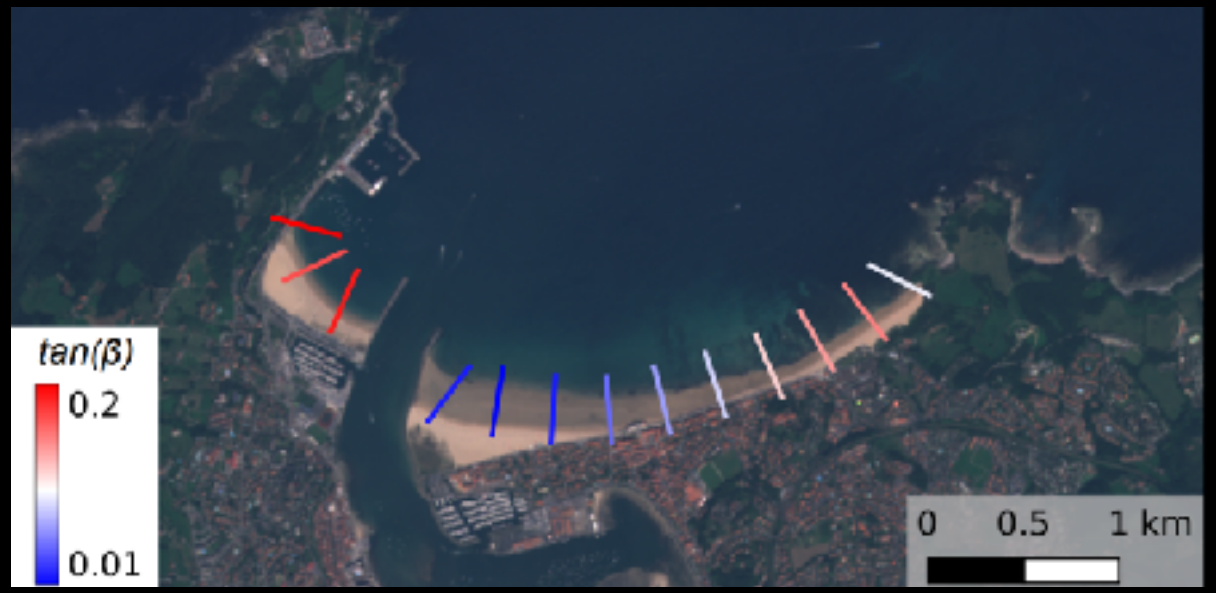




Instantaneous shorelines



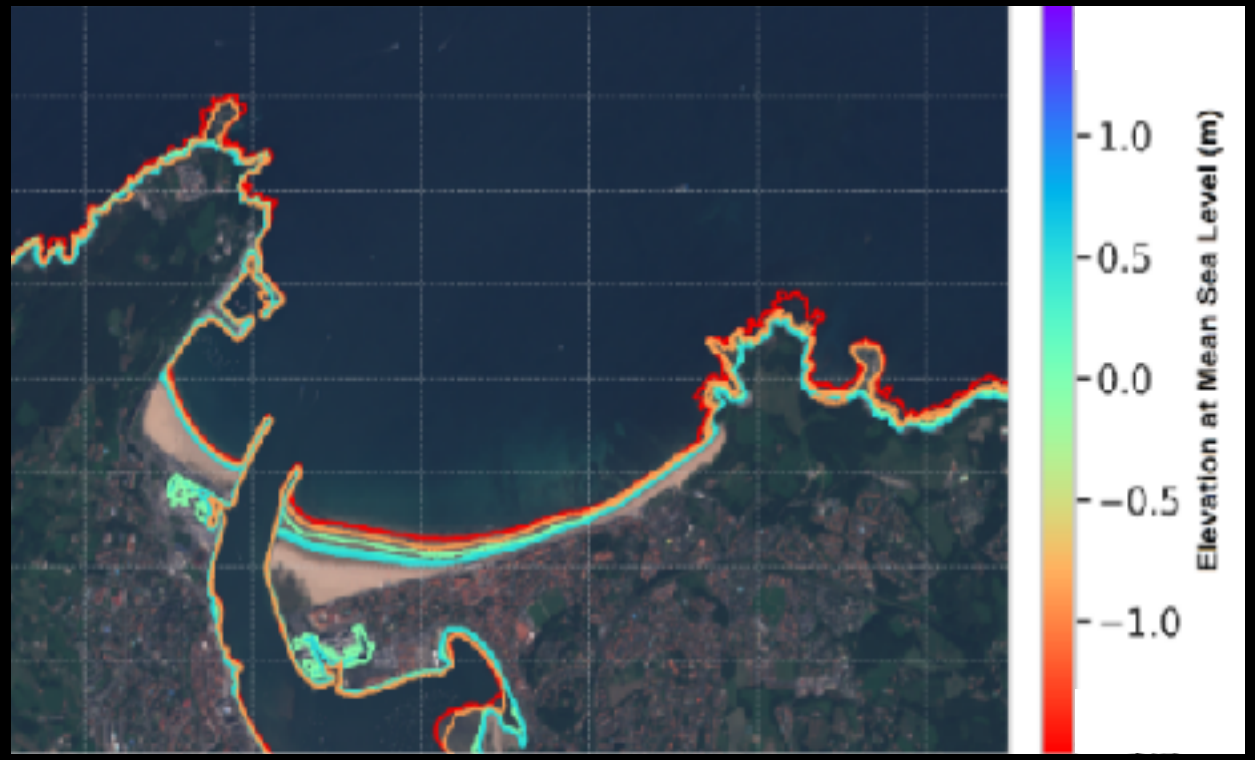
Beach position & slope, by combination of date/tides



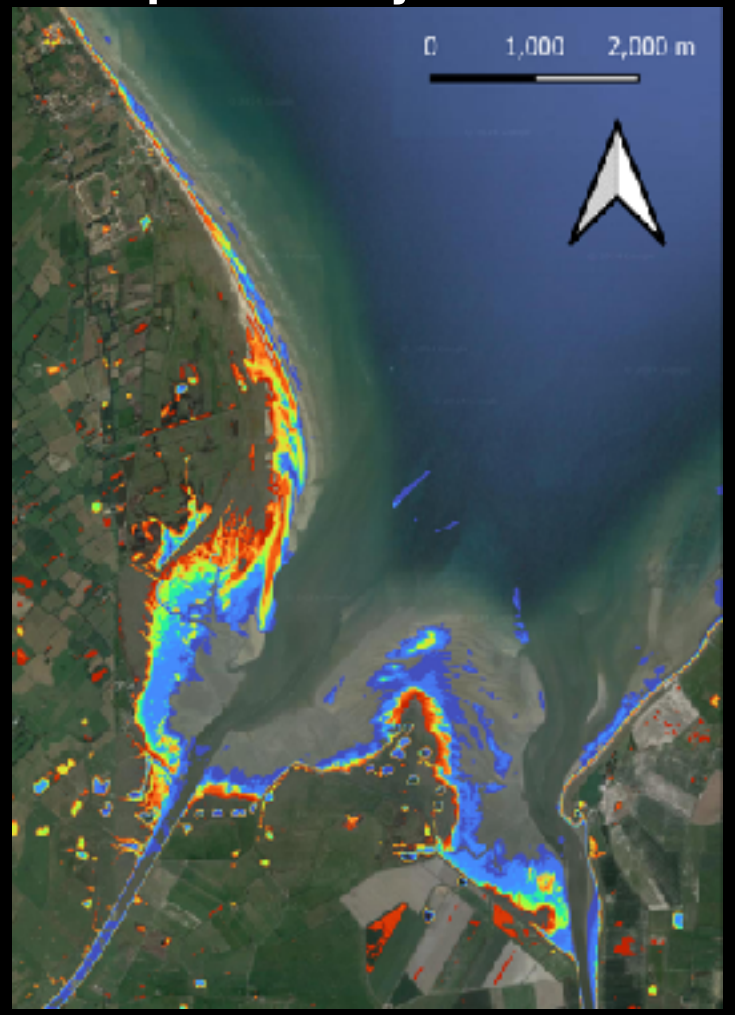
Erwin.Bergsma (at) cnes.fr

Shoreliner: A sub-pixel coastal waterline extraction method for multi-spectral satellite optical imagery , *Remote Sens.* **2024**, *16*(15), 2795

Instantaneous shorelines



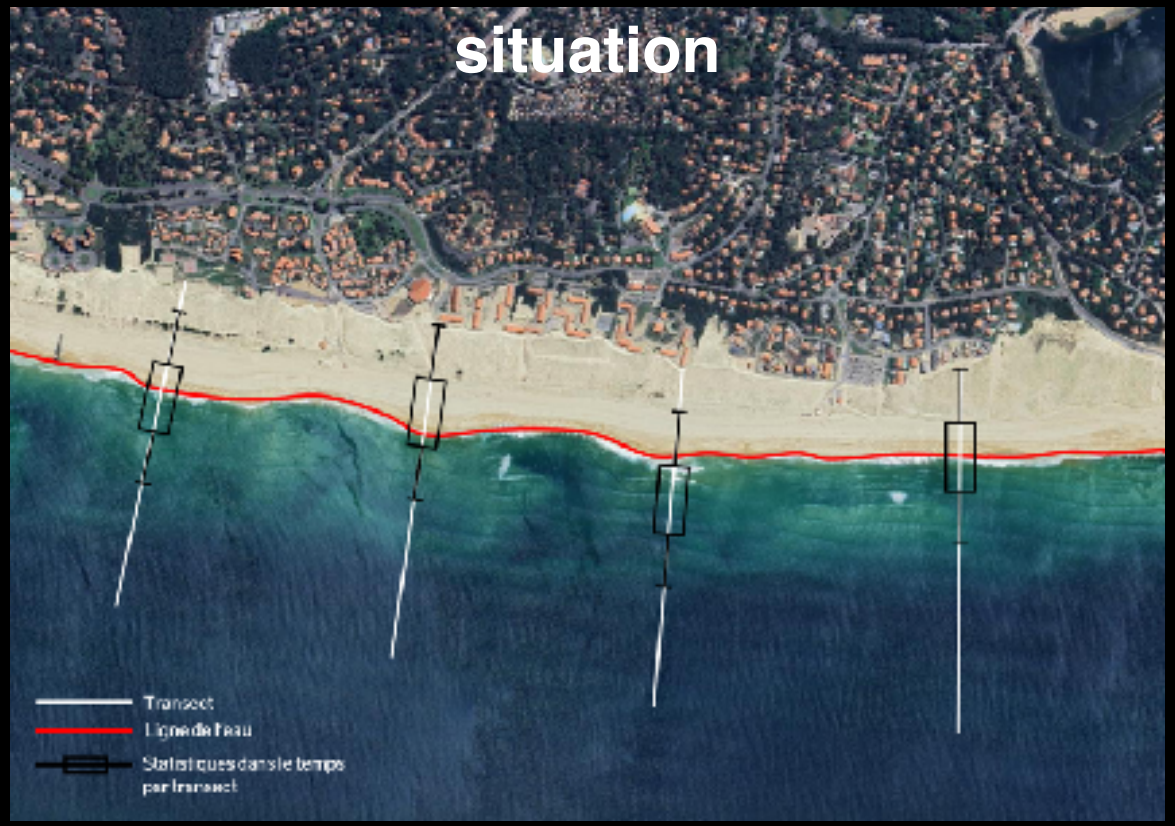
Water probability occurrence



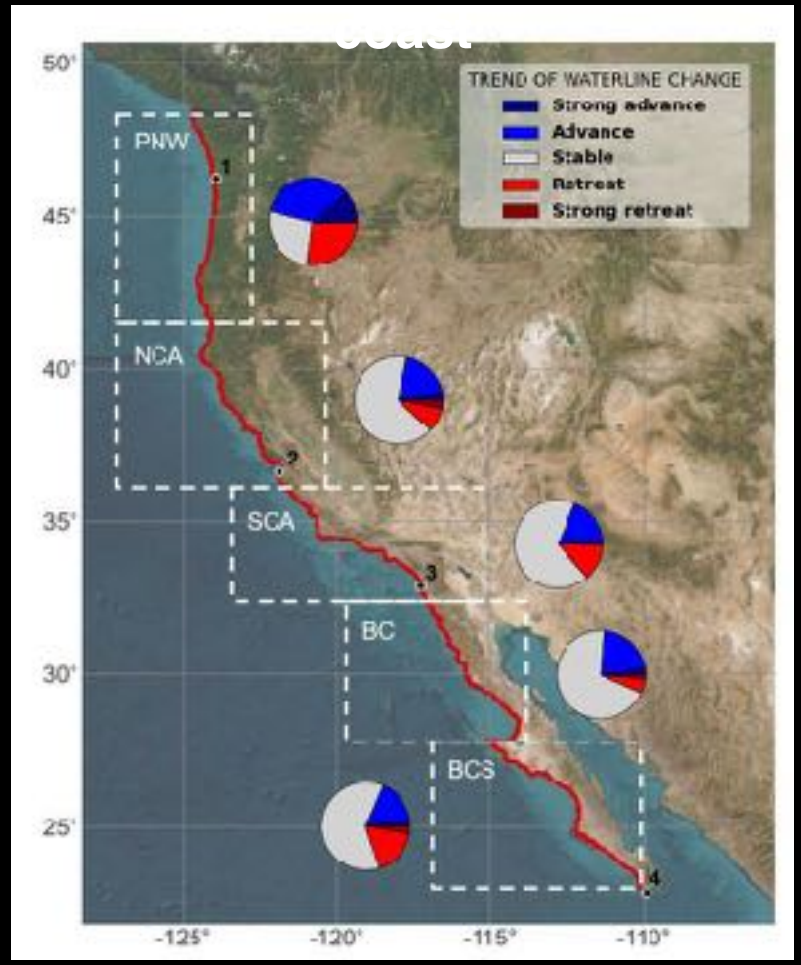
Erwin.Bergsma (at) cnes.fr

Shoreliner: A sub-pixel coastal waterline extraction method for multi-spectral satellite optical imagery , *Remote Sens.* **2024**, *16*(15), 2795

Seasonal variation vs. current situation



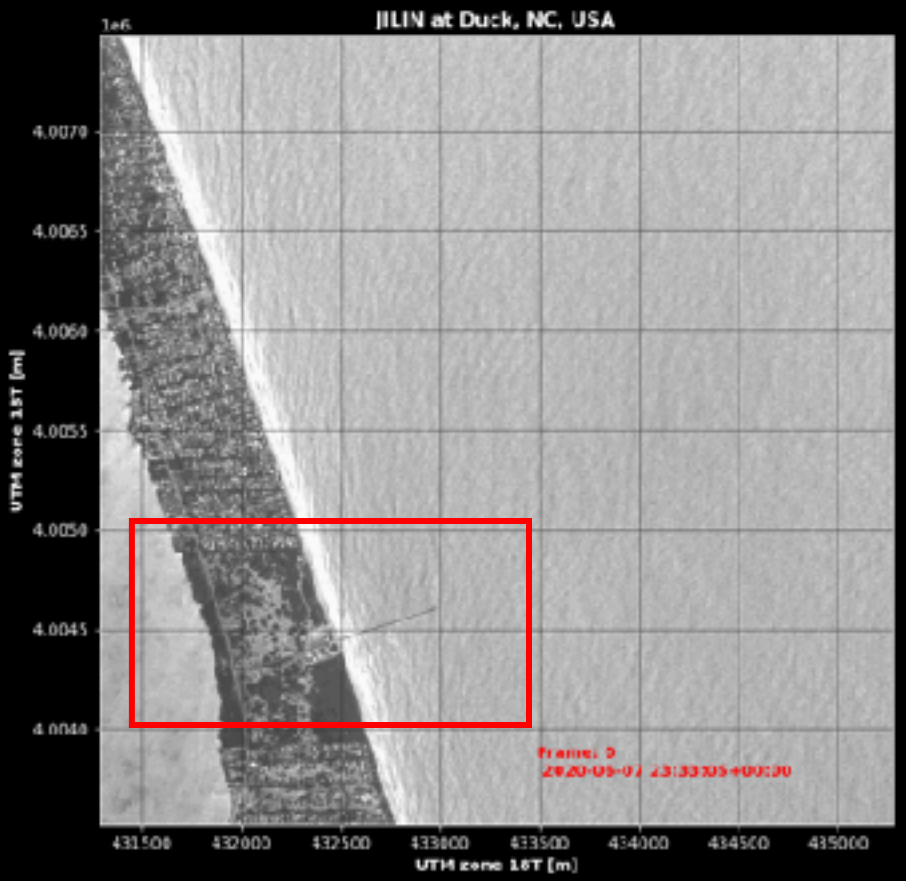
Large scale trend, US west coast

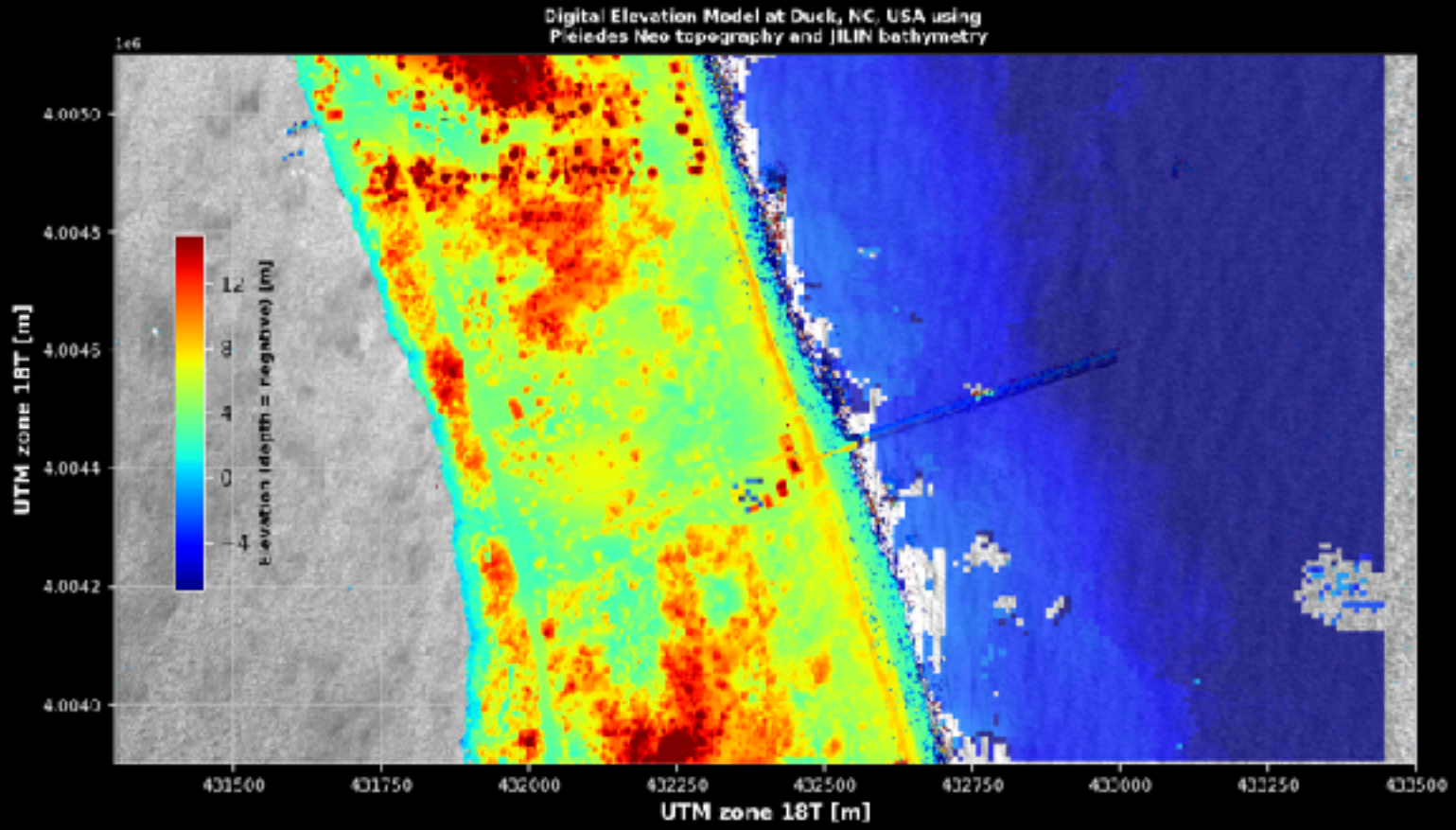


Erwin.Bergsma (at) cnes.fr

Graffin et al., under review

TOPOGRAPHIE & BATHYMÉTRIE





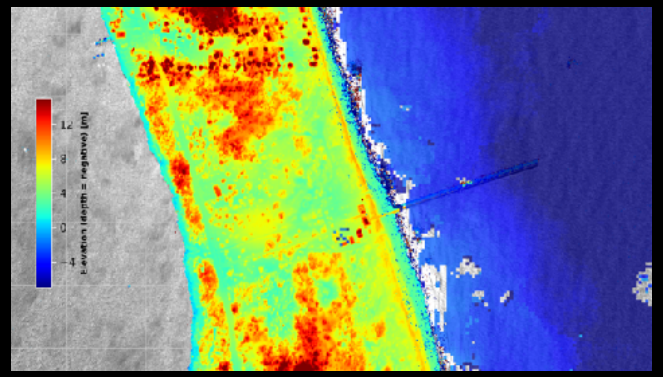
https://cnes.fr/actualites/terre-co3d

OUTILS CNES OPEN SOURCE

A VENIR https://github.com/CNES/

Images/Vidéos => Bathymétrie

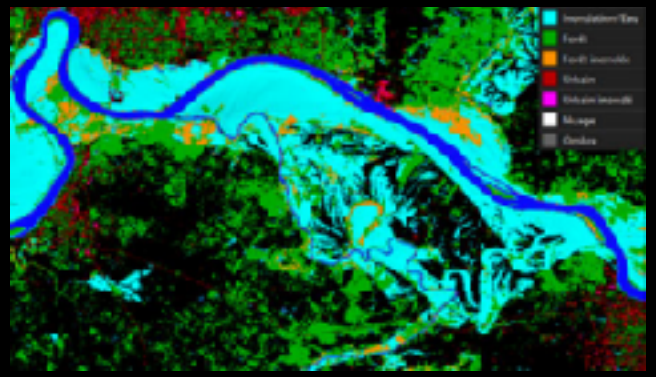
https://github.com/CNES/S2Shores



Erwin.Bergsma (at) cnes.fr

Sentinel-1 => Emprises innondées

https://github.com/CNES/floodml



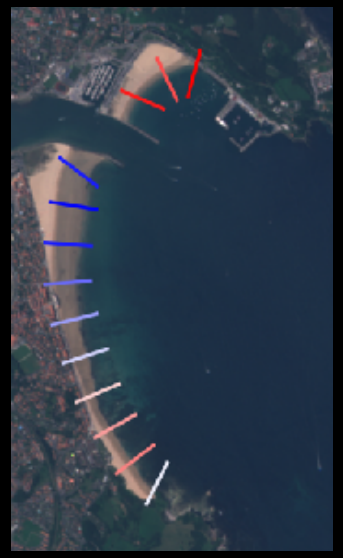
Raquel.RodriguezSuquet (at) cnes.fr

Détection de changement THR

Première version cet été !

Avec une instance dédié au littoral à suivre

Images optiques => trait de côte & produits dérivés



Fin 2026

France métropolitaine, 30-40 ans de données

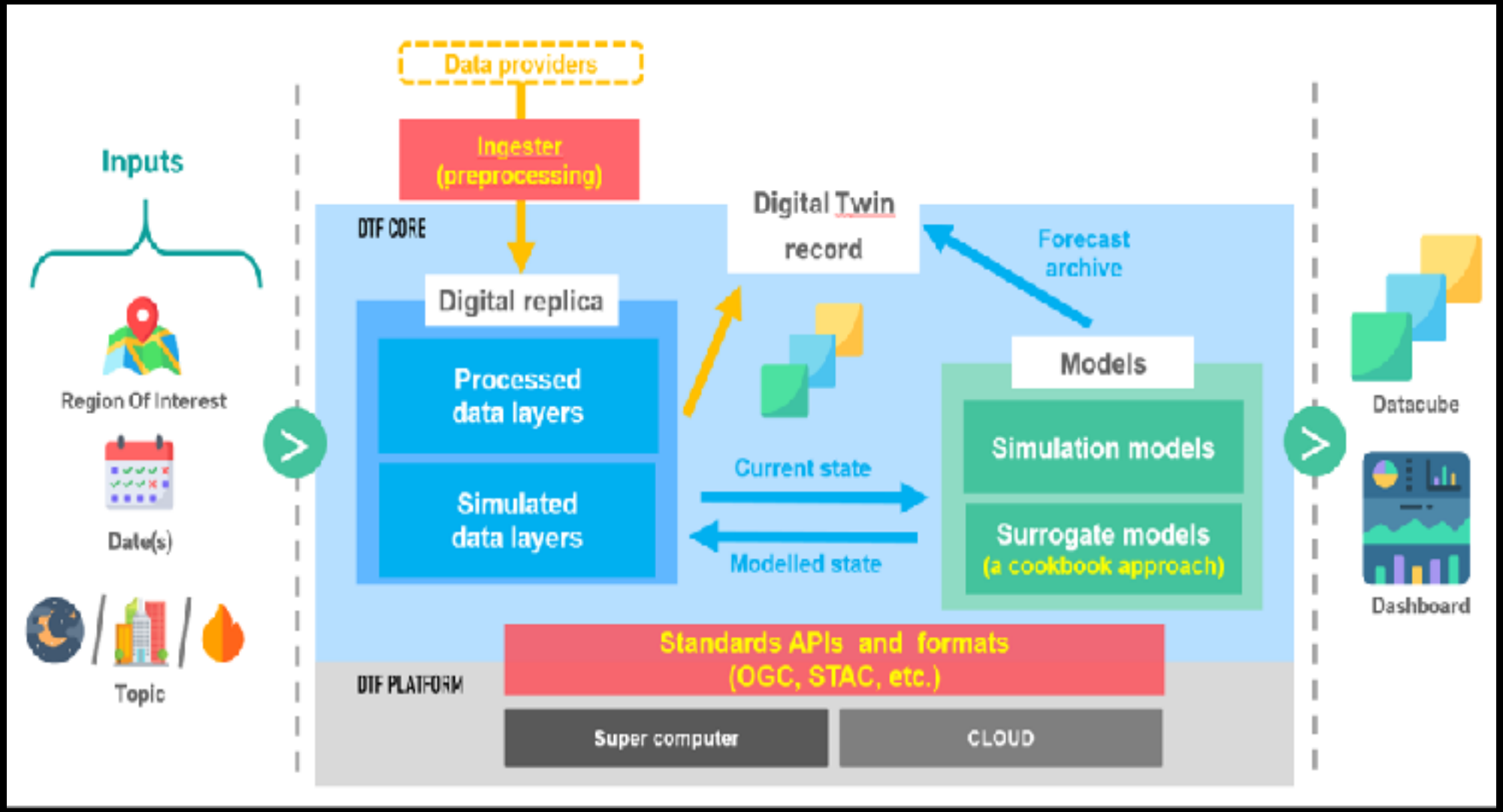
Merci pour votre attention

Vincent Lonjou

vincent.lonjou (at) cnes.fr

BACKUP SLIDES

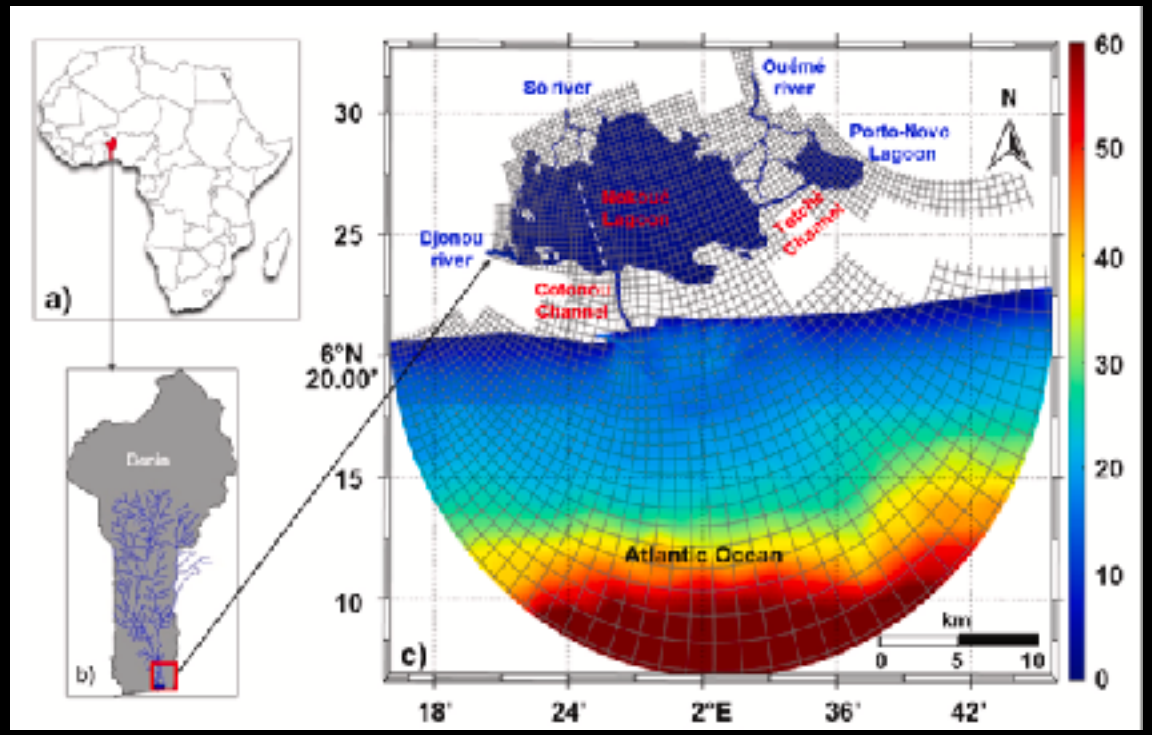
JUMEAU NUMÉRIQUE ?

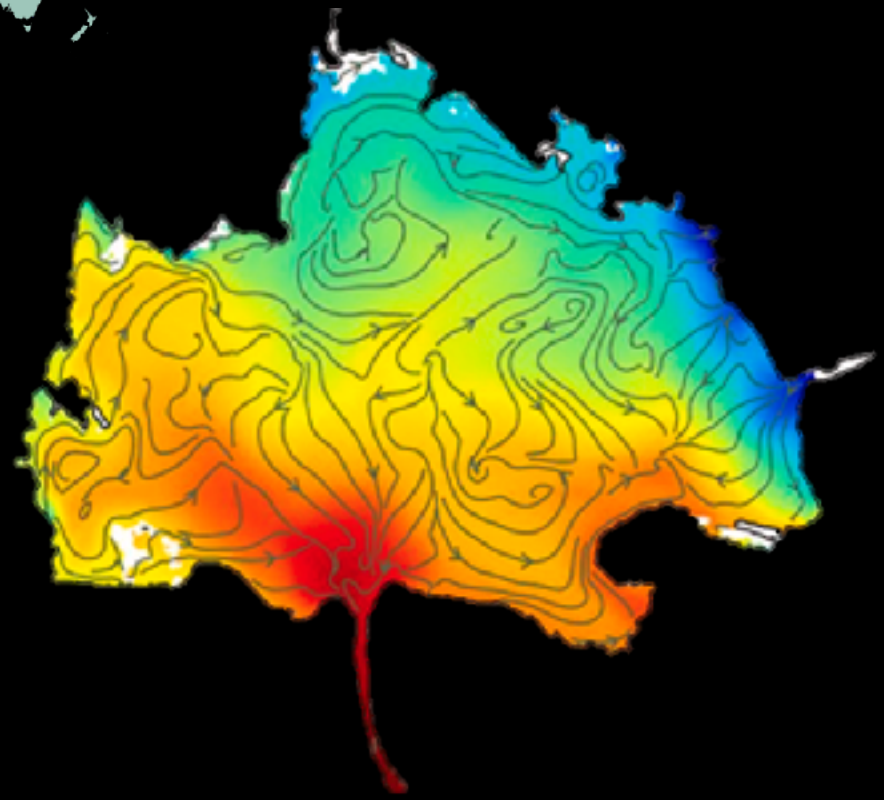


Insérez dans la zone de pieds de page, si besoin, vos informations annexes (légendes, sources, crédits, restrictions, logos partenaires, etc).

MODELING

Model : **SYMPHONIE**





Model Salinity (color) & Circulation streamlines, May 2018

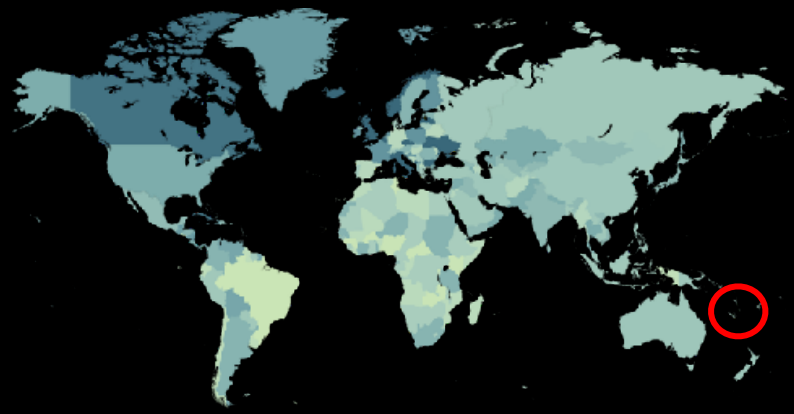
yves.morel@univ-tlse3.fr, alexis.chaigneau@ird.fr

Model : **SYMPHONIE**, *https://sirocco.obs-mip.fr/ocean-models/s-model/*

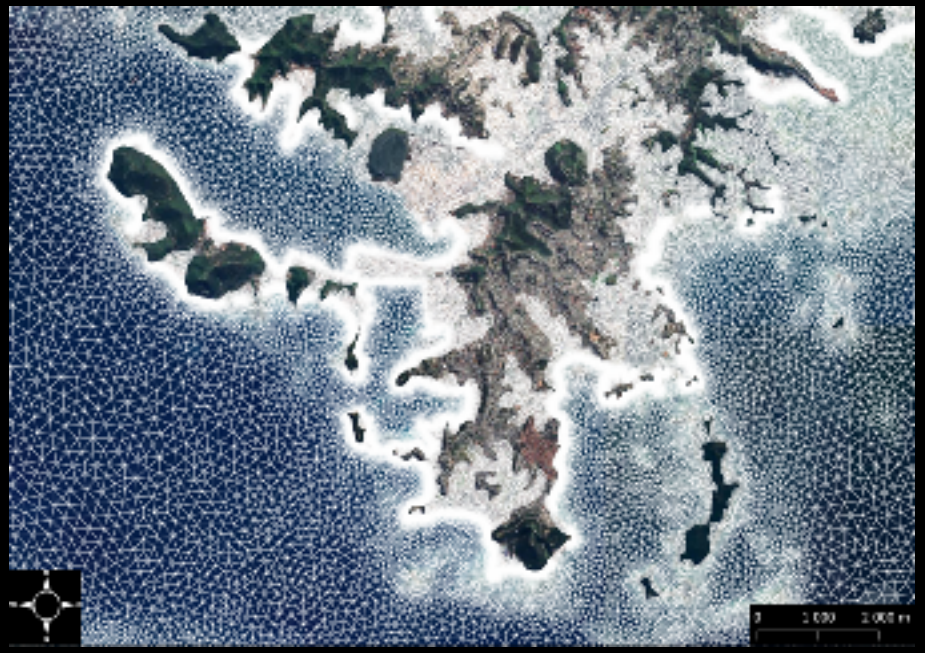
Okpeitcha et al, RSMS, 2024
Honfo et al, OM, 2024

MODELING

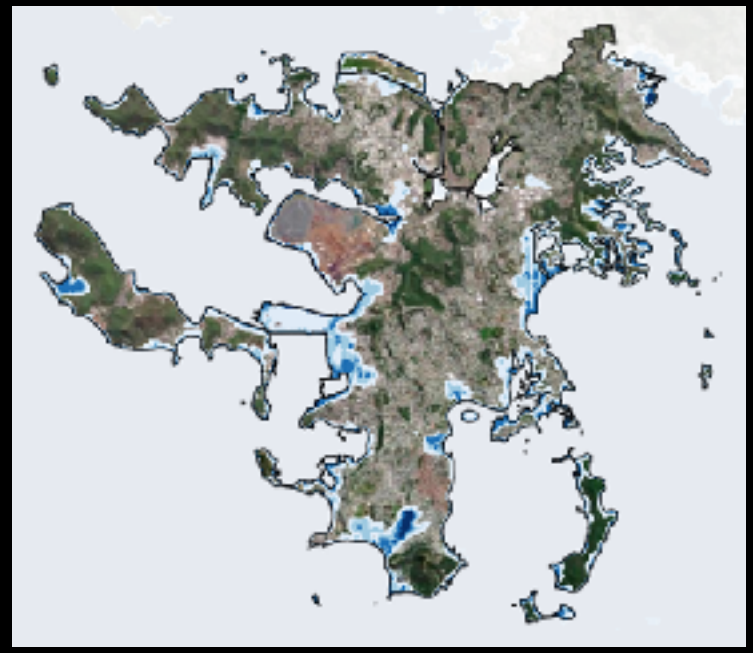
Model : **TELEMAC**



Mesh Generation based on spatial bathymetry and topography



Submersion computation with uncertainty



Identification of flooded buildings

Coulet Christophe c.coulet@brgm.fr
https://www.opentelemac.org/

USER UPTAKE

CZ-DT Architecture Workshop
04/2024

Nokoué Digital Twin first Workshop
28/11/2024

> 10 institutions

CNES / New-Caledonia government collaboration agreement
02/2024
2 meetings

PI : jeff.walter@nasa.gov
https://esto.nasa.gov/earth-system-digital-twin/
yves.morel@univ-tlse3.fr, alexis.chaigneau@ird.fr
vincent.lonjou@cnes.fr; c.coulet@brgm.fr

Release

Data
Digital Replica
Code

Interoperability

HPC, cloud

Publication

Science

Synchronization and sharing with other initiatives

CEOS Committee on Earth Observation Satellites

Open Geospatial Consortium

SCO SPACE FOR CLIMATE OBSERVATORY

UNITED NATIONS

Destination Earth

Digital Replica . . . What now?

An integrated picture of the past and current states of Earth systems.

Forecasting . . . What next?

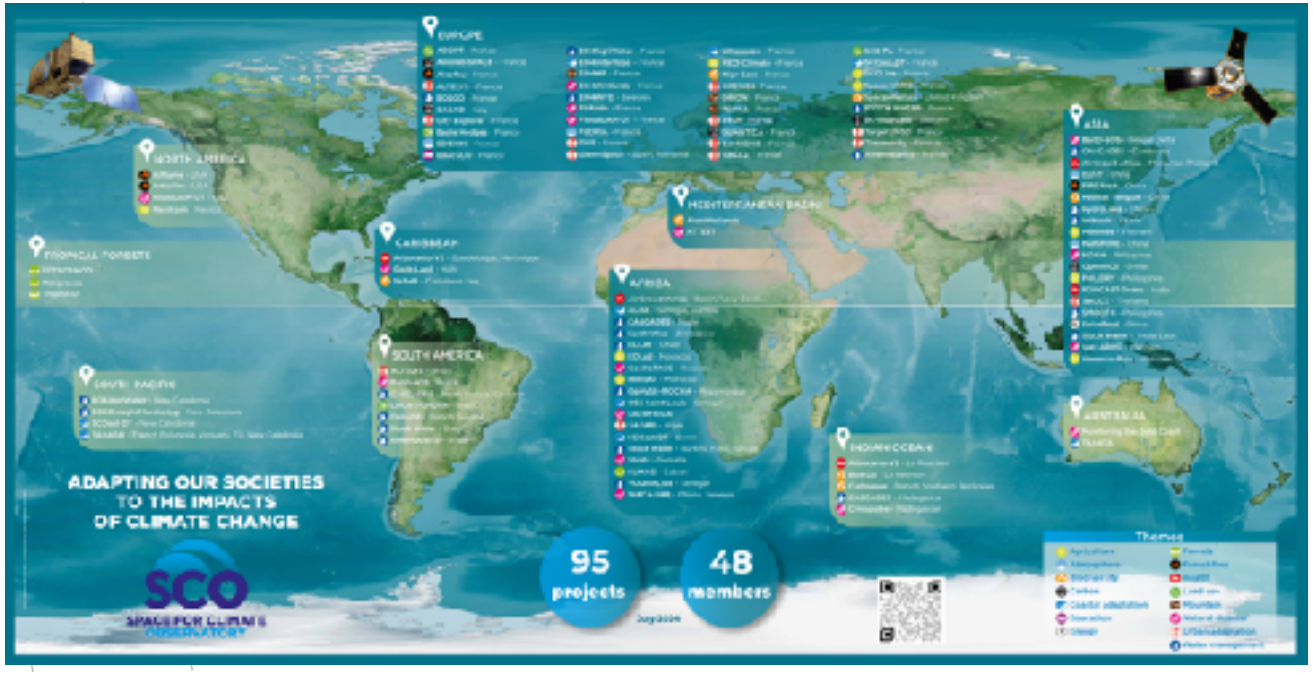
An integrated picture of how Earth systems will evolve in the future from the current state.

Impact Assessment . . . What if?

An integrated picture of how Earth systems could evolve under different hypothetical what-if scenarios.

- **Continuous observations** of interacting Earth systems and human systems
- From many **disparate sources**
- Driving inter-**connected models**
- At many **physical** and **temporal scales**
- With fast, powerful and integrated **prediction, analysis** and **visualization** capabilities
- Using **Machine Learning, causality** and **uncertainty quantification**
- Running at **scale** in order to improve our **science** understanding of those systems, their **interactions and** their **applications**

SPACE FOR CLIMATE OBSERVATORY



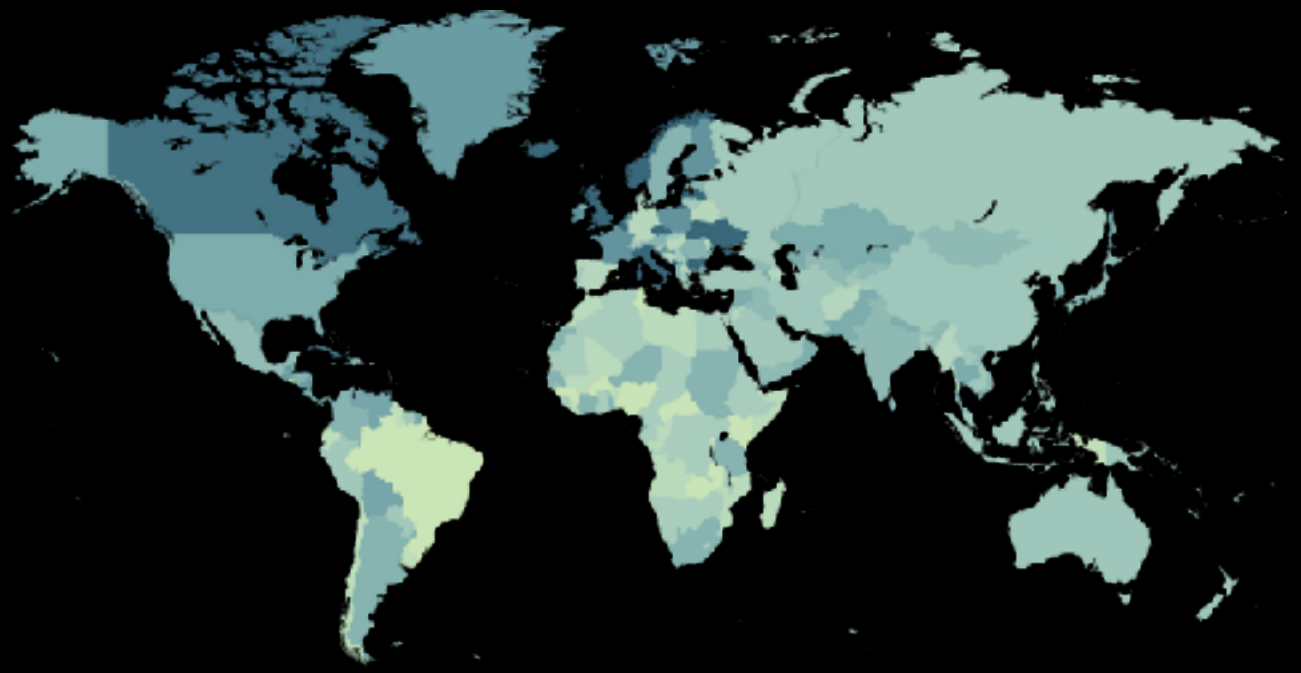
Space for Climate Observatory in a nutshell

- CNES program
- to promote the use of spatial data to combat and adapt to climate change
- First projects in 2020, 1 call for project / year
- 95 on-going or terminated projects

https://www.spaceclimateobservatory.org/fr

SCO
SPACE FOR CLIMATE
OBSERVATORY

VISION, COLLABORATION & OBJECTIVES



2 500 000 km

World coastline length

hour, day, year

Dynamic

Climate Change

Sea Level Rise, cyclones …

Digital Twin

Models & scenarios

2 500 000 km

World coastline length

hour, day, year

Dynamic

Adaptation and mitigation

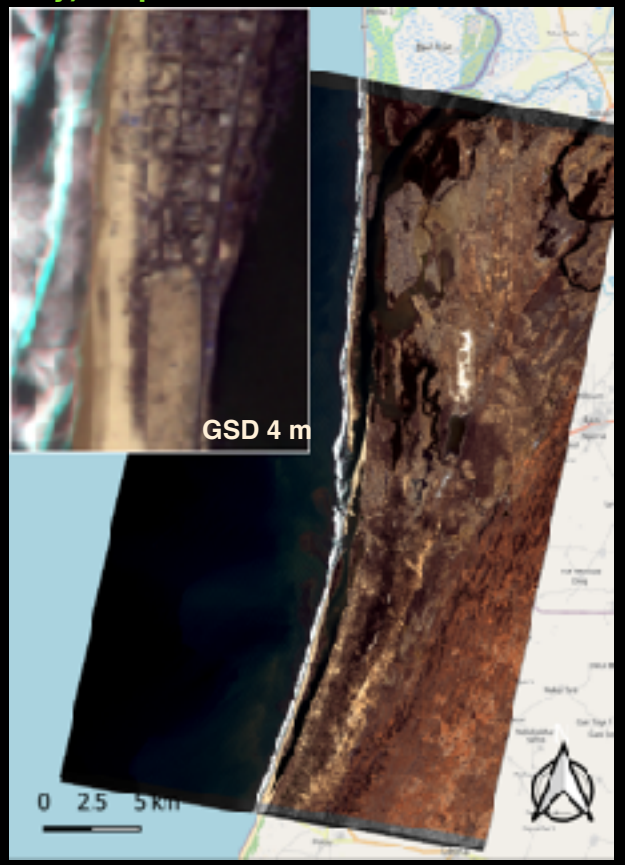
Climate change

EARTH OBSERVATION DATA

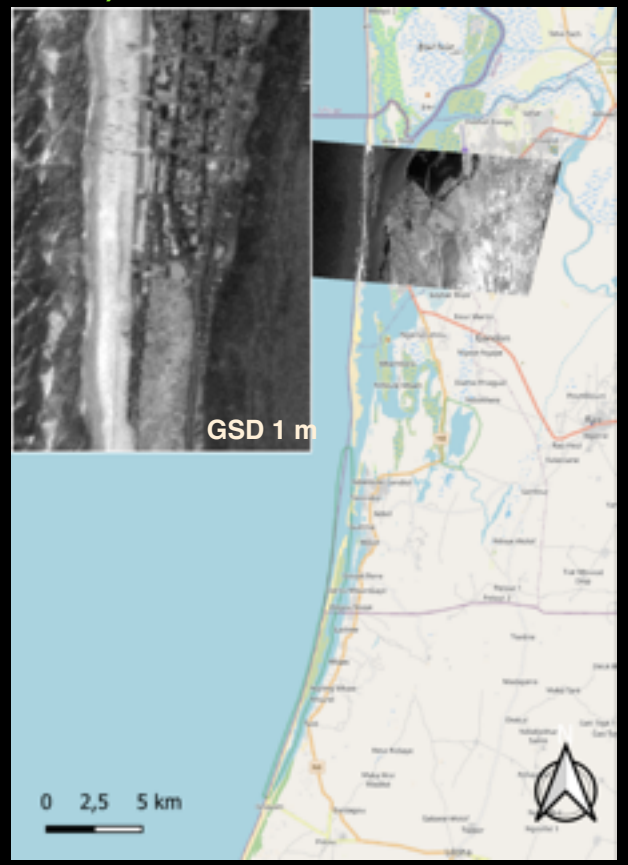
RANGE OF “EASILY ACCESS” DATA; REDUCING REVISITS

Sentinel-2 (3 March 2023 – 5 days) Public

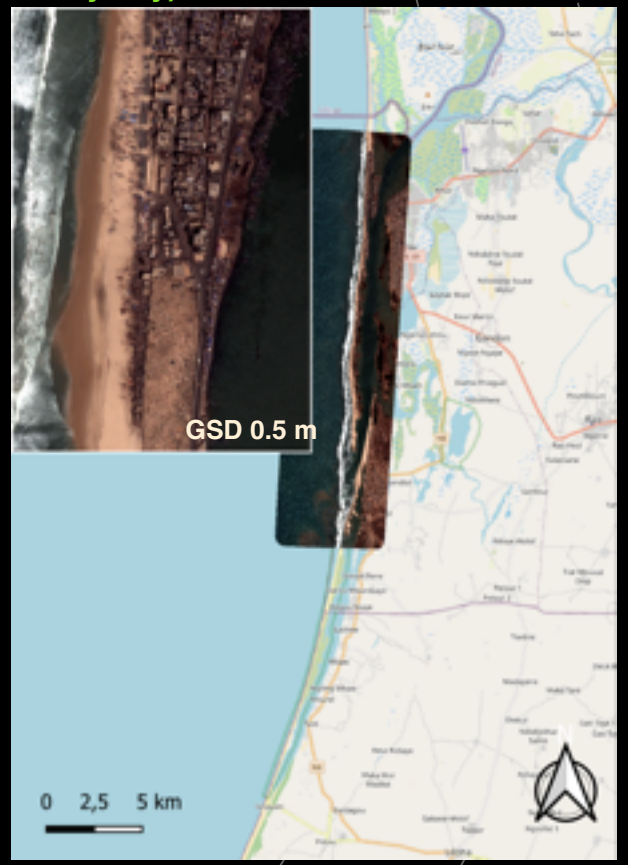
VENμS (1 March 2023 – every day) Experimental



Jilin-1 (22 April 2022 – « one-shot ») on demand



Pléiades (1 march 2023 – every day) on demand



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