A NEW PROJECT SCOast-DT : DONNÉES SPATIALES ET JUMEAUX NUMÉRIQUES AU SERVICE DES ZONES CÔTIÈRES

Projet labélisé SCO et financé
Collaboration FR-US
2024-2026

Construction et exploitation de jumeaux numériques
Zones et enjeux représentatifs
Projection climatique et analyse d'impact
Réponse à des problématiques locales
Résultats libres

France métropolitaine

Trait de côte, érosion / accrétion, zone intertidale

>10 ans de données satellite

Validation

Baie de Nokoué

Qualité de l'eau, pollution

Satellite + in-situ

Modélisation hydrodynamique

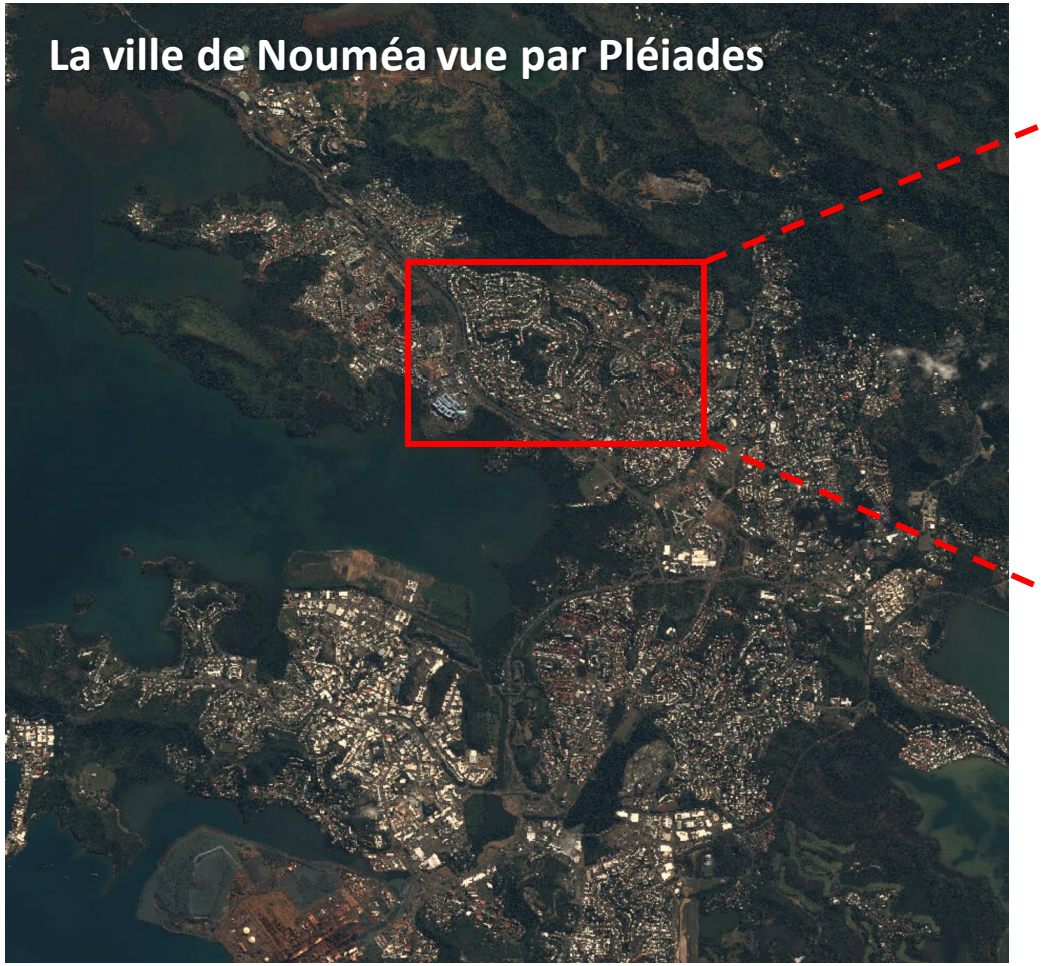
Nouvelle Calédonie

Submersion marine et inondations côtières

Satellite + in-situ

Modélisation hydrodynamique

IMAGERIE TRES HAUTE RESOLUTION 3D, OCCUPATION DU SOL

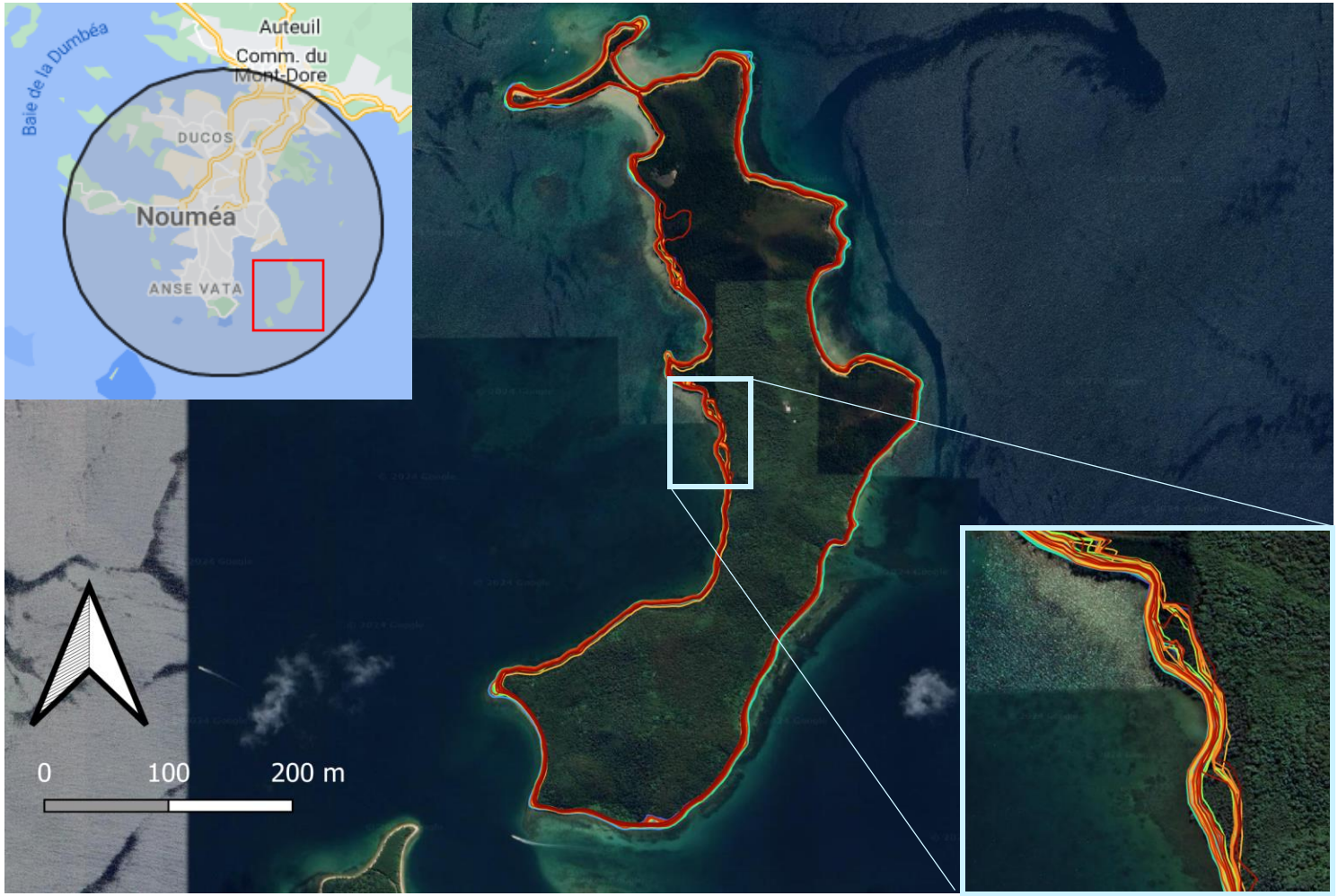


L'imagerie satellite très haute résolution (~30-50cm) permet de couvrir de grandes surfaces (>100km2), de manière réactive (~1j), et de dériver des informations d'occupation du sol en 3D !

EXEMPLE DE LIGNES D'EAU INSTANTANÉES EN NOUVELLE-CALÉDONIE

Example of waterline tracking in New Caledonia:

- 5 years of data : 2019 – 2024
- All Sentinel-2 data, filtered on clouds
- Raw shorelines, not tide-corrected:



DIGITAL TWIN CONCEPT

Digital Twin

It's a virtual representation of a system that allows you to respond to "what now?", "what if?" and "what's next?"

cnes
Digital Twin

- Localized
- Temporally defined
- Thematic
- Ad hoc
- On request

We're aiming to rely on and complement other Digital Twin projects, not to replace them

DIGITAL TWIN FACTORY (DTF)

Inputs

Region Of Interest

Date(s)

Topic

Data providers

External models

Ingester (preprocessing)

DTF CORE

Models

Physical models

Surrogate models (a cookbook approach)

Digital replica

Processed data layers

Simulated data layers

Standards APIs and formats (OGC, STAC, etc.)

DTF PLATFORM

Super computer

CLOUD

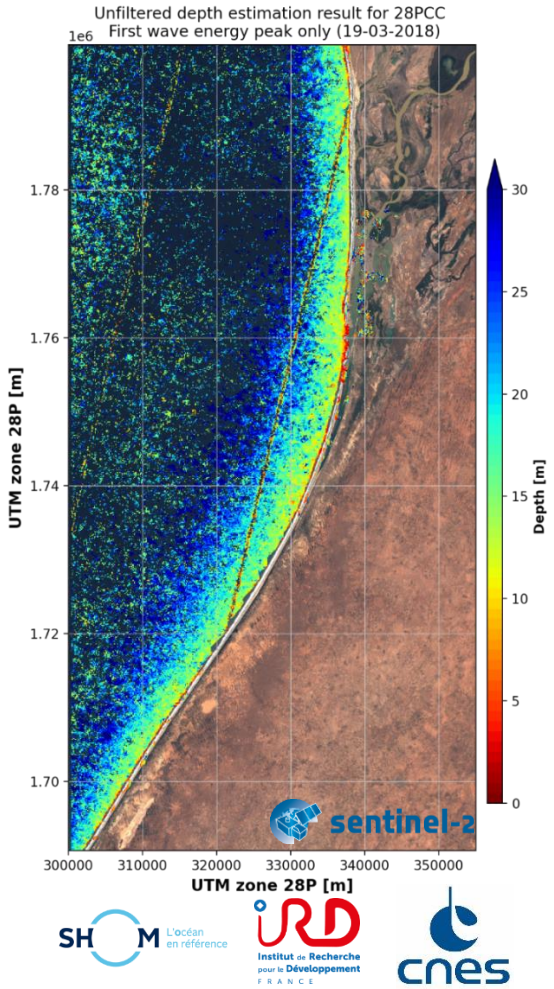
Datacube

Dashboard

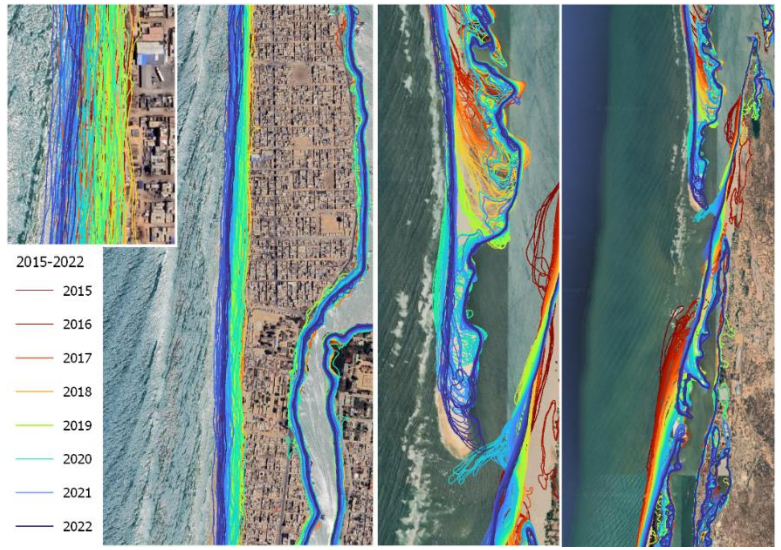
COASTAL DIGITAL REPLICA (GEOPHYSICAL)

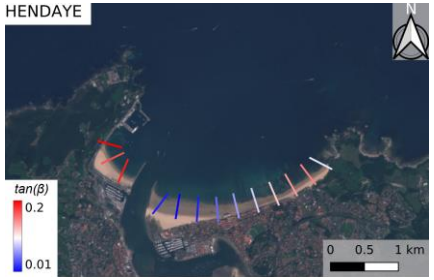
Bathymetry

Shelf to nearshore



Shorelines and inter-tidal topography

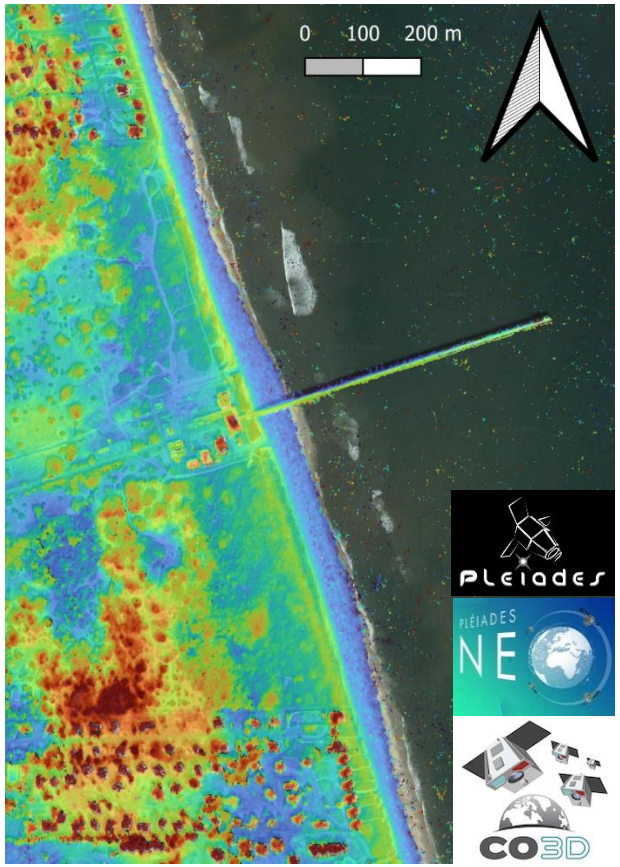




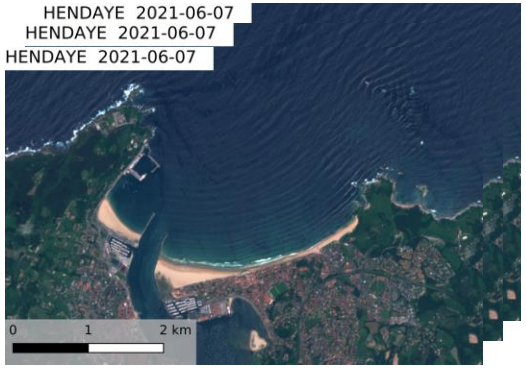
Time-average beach slopes

Topography of the inter-tidal zone

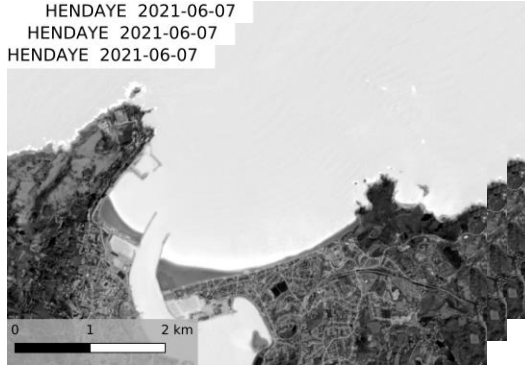
Topography



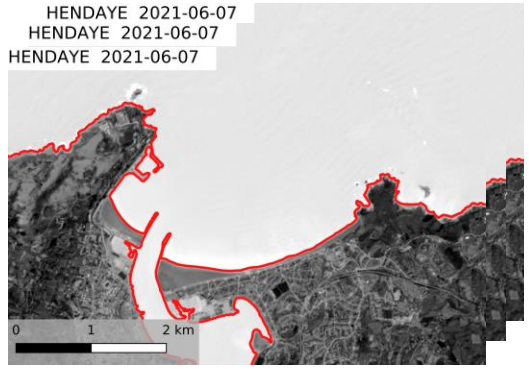
SHORELINER



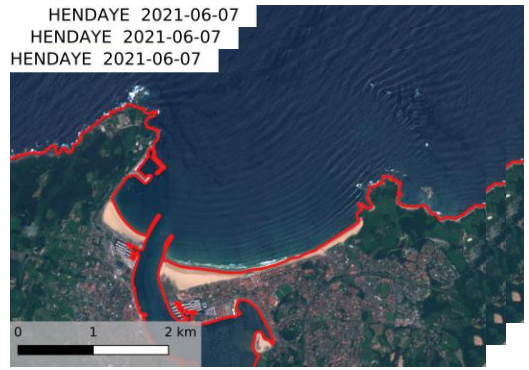
Sentinel-2 (L1C)



SCoWI index



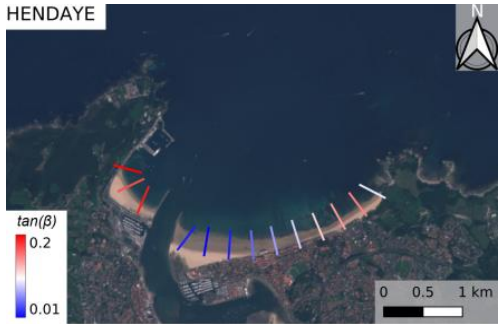
Threshold SCoWI Terre/Mer



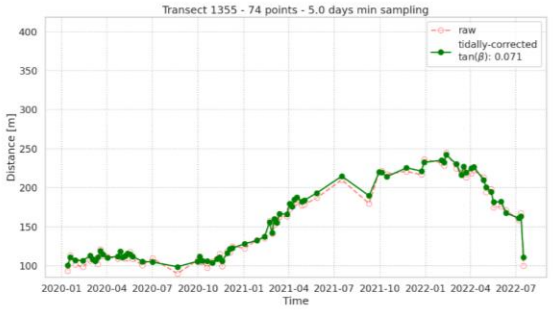
Instanteneous waterline

Limites Terre/Mer instantanées

Topographie de la zone intertidale



Pentes de plages moyennes

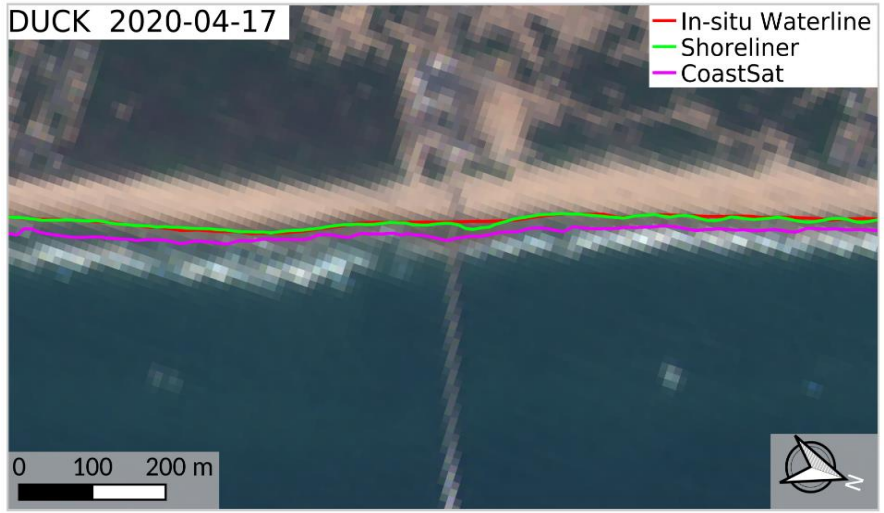


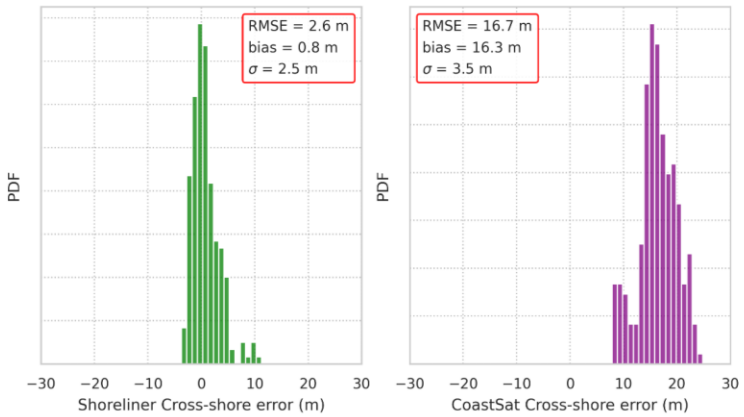
Position du trait de côte dans le temps

Modèle de marée FES 2022

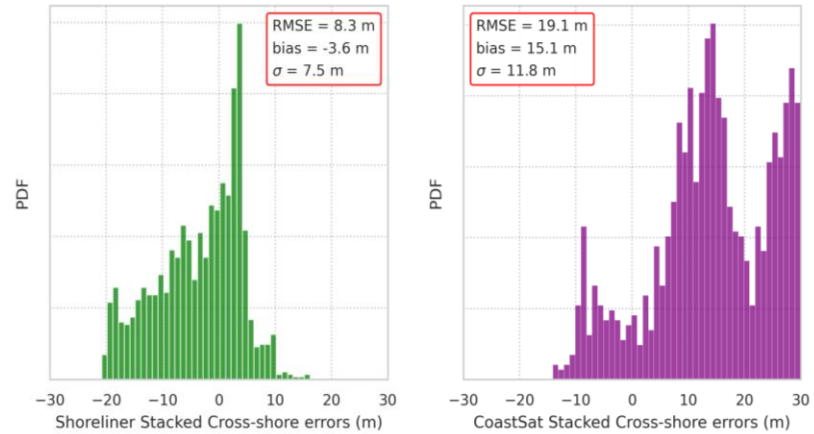
SHORELINER

Validation avec des données in-situ à Duck, NC ; comparaison avec Coastsat :





Global statistics



Shoreliner' performance (evaluated over the 6 dates for which surveys are available)

- Land/Sea boundary position RMSE < 10 meters (< pixel S2)
- Best case Land/Sea boundary position RMSE = 2.6 meters (1/4 pixel S2)
- Comparison with CoastSat :
  - best RMSE
  - 12x faster on average on ROI
  - More robust (memory limitation on a full CoastSat tile)
- Robustness against various scenes (e.g. turbidity)

LARGE SCALE PROCESSING; SENTINEL-2 BATHYMETRY

HPC 6th generation :

- All Sentinel data to our disposal
- Large scale applications (time and space).

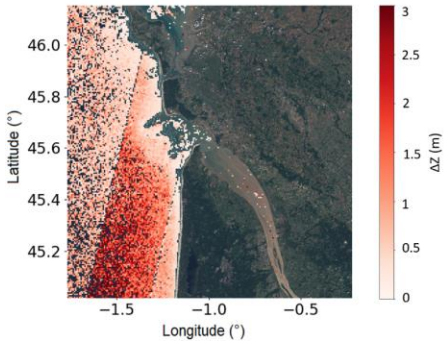
- S2Shores (open-source foreseen in 2024)
  - Bergsma et al., 2019 : principle Radon based Fourier slicing approach
  - Bergsma et al., 2021 : updated approach including the topography – single orbit topo/bathy
  - Almar et al., 2019: spatial correlation method
  - Klotz et al., in prep. : temporal correlation method

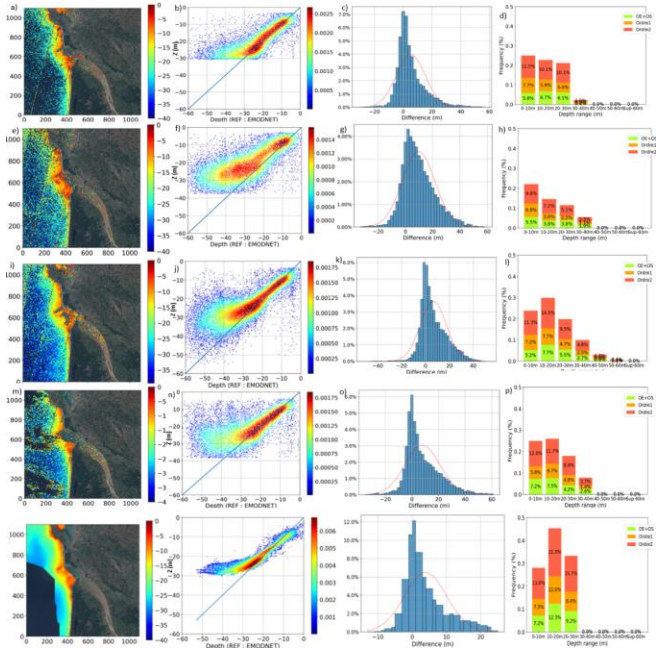
Processing chain S2Shores v7.1

- Tide correction FES2022 including DAC
- Time-delay optimisation (Binet et al. 2022)
- IHO classification of the performance

Effect of the time-delay on the depth estimation

ESA manual – time delay following (Binet et al. 2022)





Final regional product

S2Shores v7.1