

# LittoSCOpe

A satellite solution to support coastal resilience

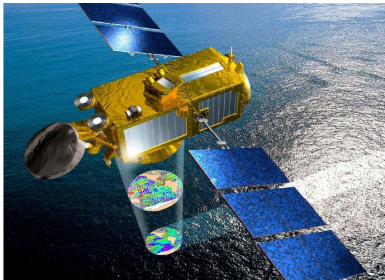


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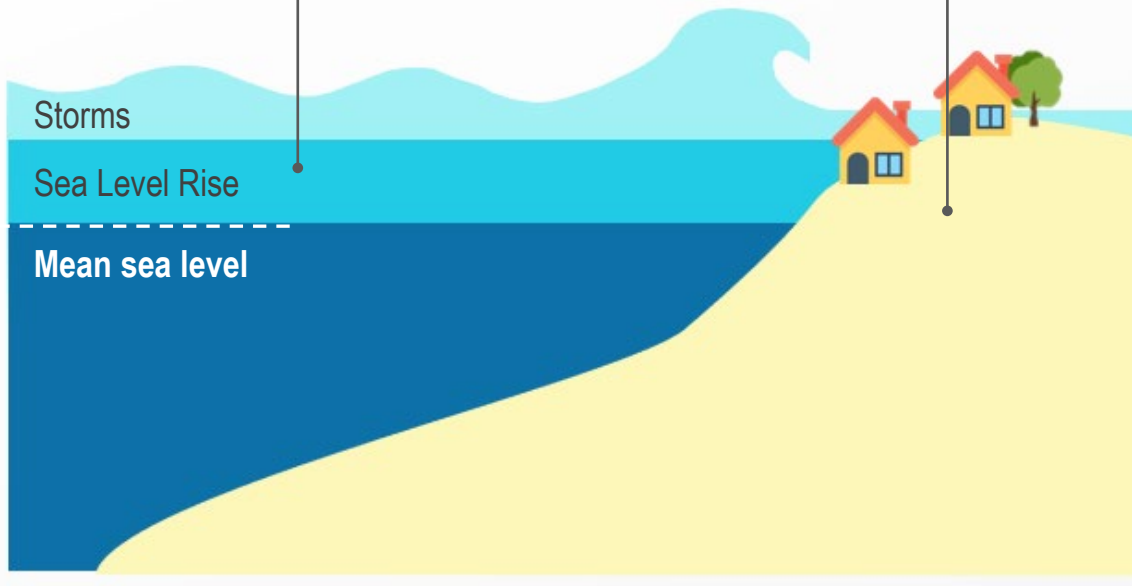
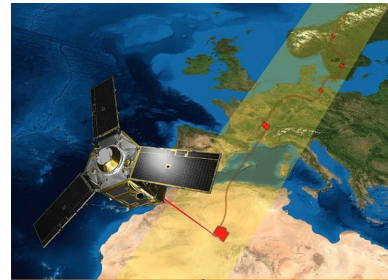


# Satellite observations over ocean and land to support decision making

Satellite Altimetry



Satellite VHR Optical Imagery



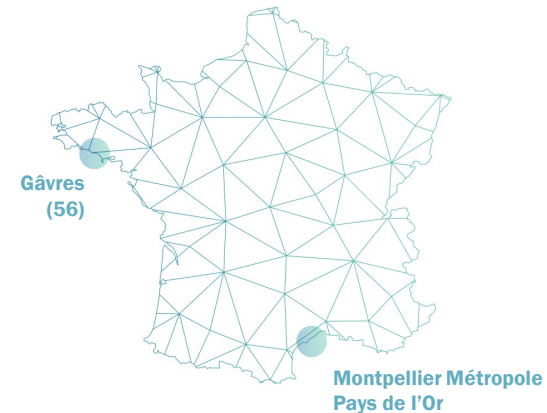
## SATELLITES OBSERVATIONS

Combining **altimetry** and **VHR optical imagery** to identify impacted areas and to propose **a replicable tool** for guiding **adaptation** of **every coastal areas** facing the effects of climate change

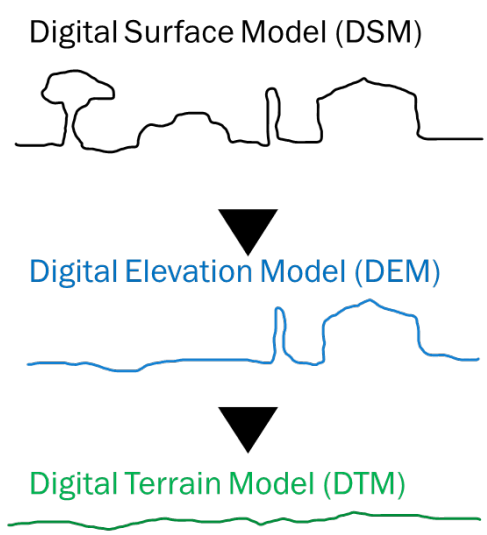
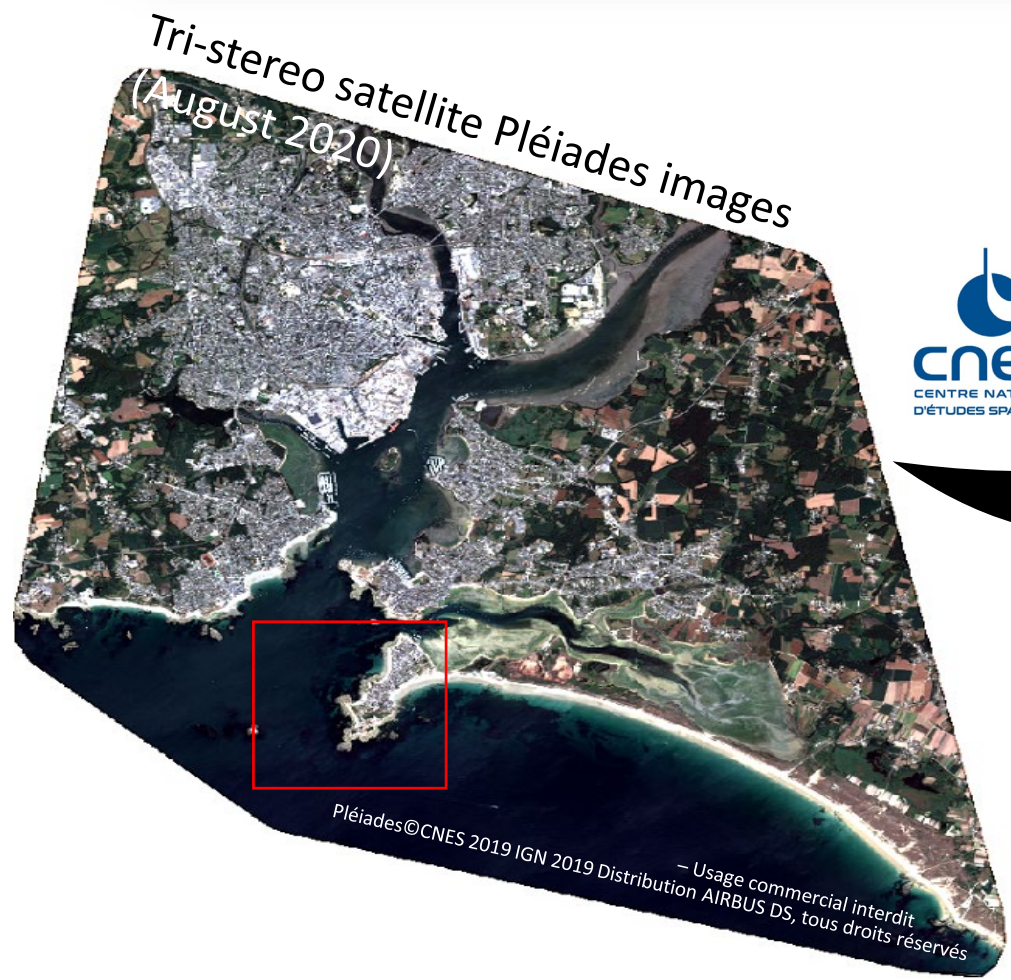
## FOR AND WITH COASTAL TERRITORIES



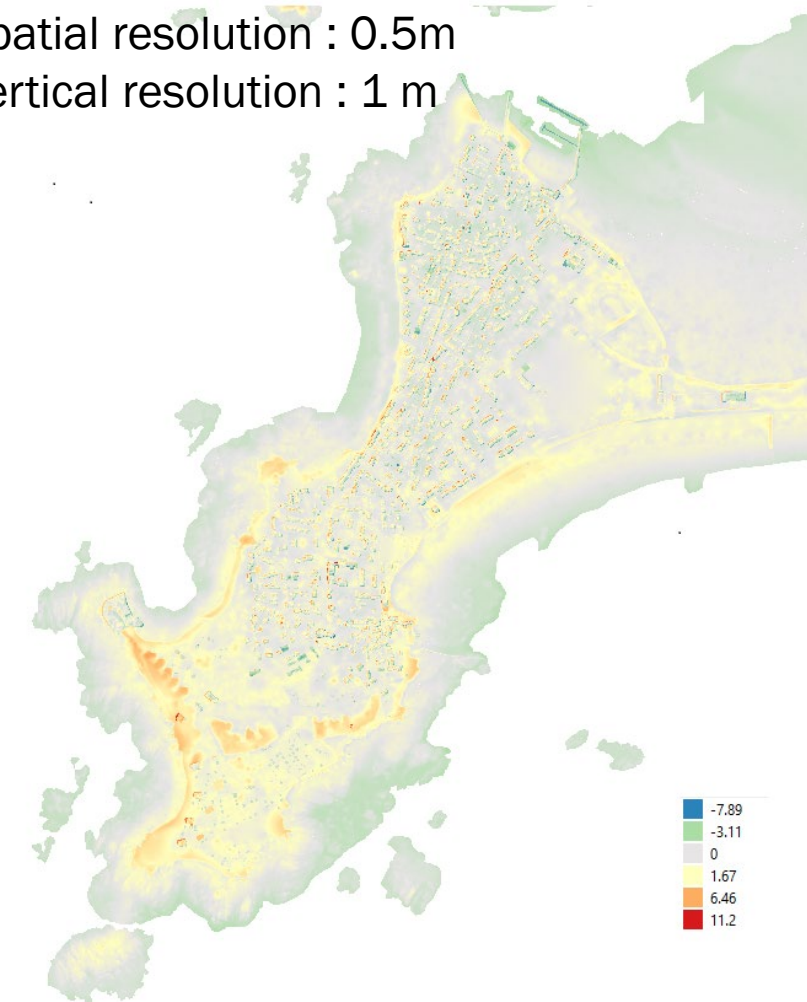
Through **interviews** and **feedbacks**, the risk indicators and the web platform have been built in **collaboration with coastal territories** to best meet their needs and develop a relevant tool



# Digital Elevation Model from VHR optical satellite imagery



Spatial resolution : 0.5m  
Vertical resolution : 1 m



Comparison with LIDAR DEM : 0.2 m bias , 1m std



# Digital Elevation Model from VHR optical satellite imagery



Digital Surface Model (DSM)



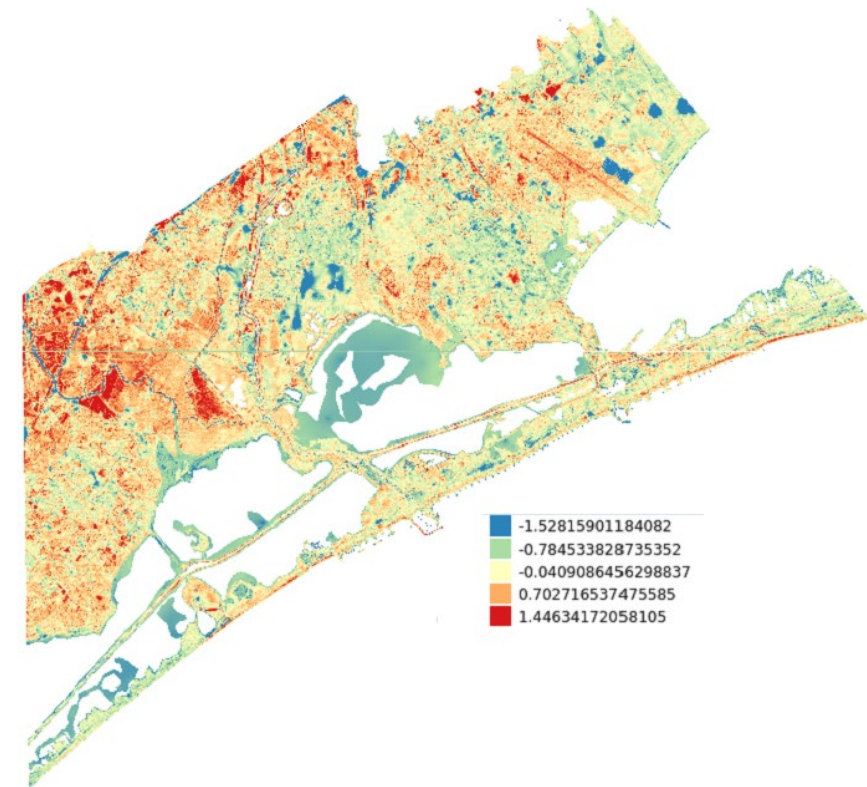
Digital Elevation Model (DEM)



Digital Terrain Model (DTM)



Spatial resolution : 0.5m  
Vertical resolution : 0.6m

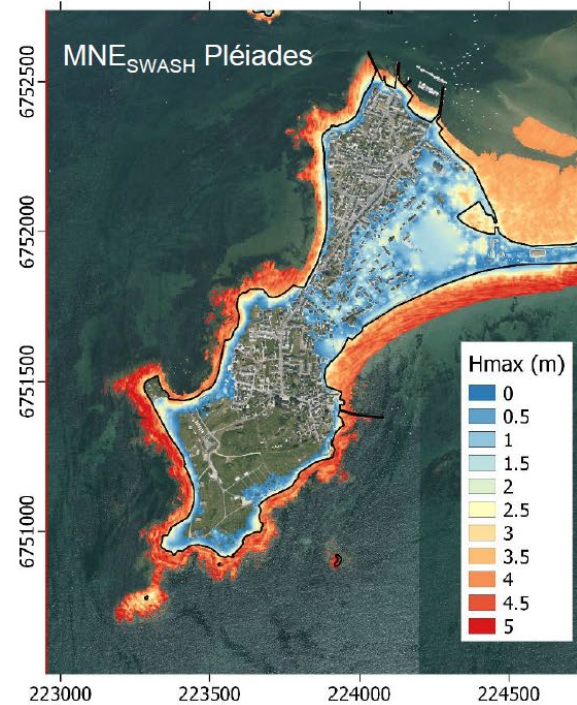
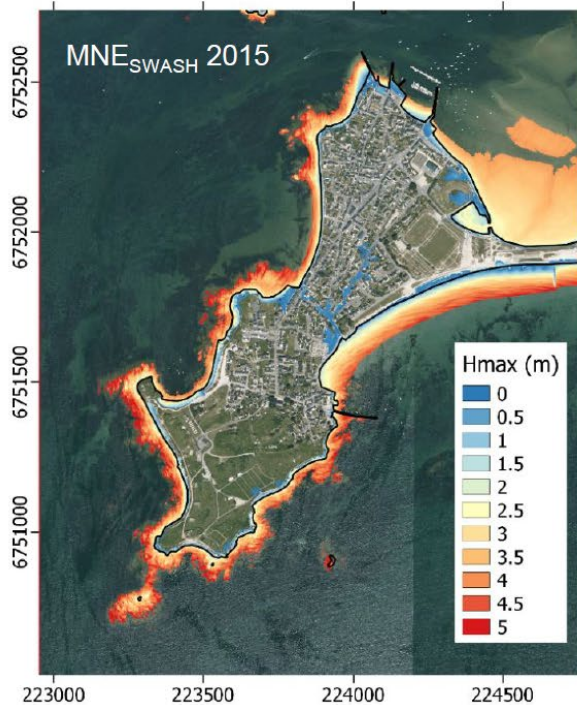


Blue	-1.52815901184082
Green	-0.784533828735352
Yellow	-0.0409086456298837
Orange	0.702716537475585
Red	1.44634172058105

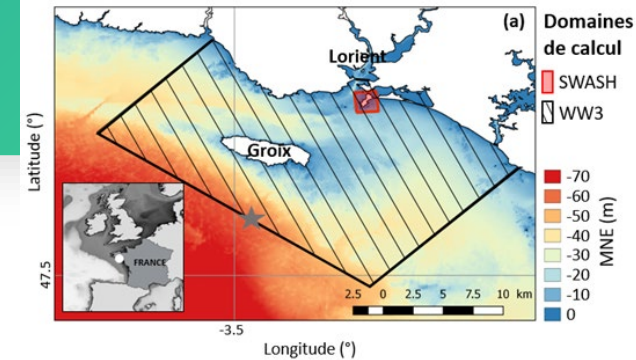
Comparison with LIDAR DTM : 0.05 m bias , 0.6 m std



# Coastal hazards HR modeling with satellite DEM



Maximum  
Water  
height



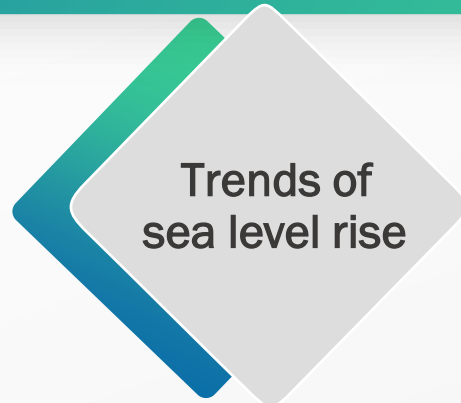
- ❑ HR hydrodynamic Meta-modeling chain
- ❑ Reproducing a major coastal flood event in 2015 (Storm Johanna)
- ❑ DEM from LIDAR measurements → replaced by the satellite-derived DEM
- Flooding over-estimation with satellite DEM
- Satellite DEM accuracy to be improved (processing, new missions) when HR modeling is needed



# Coastal flood hazard first-level assesment

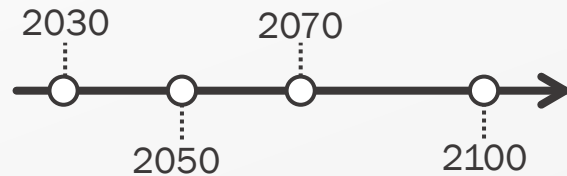
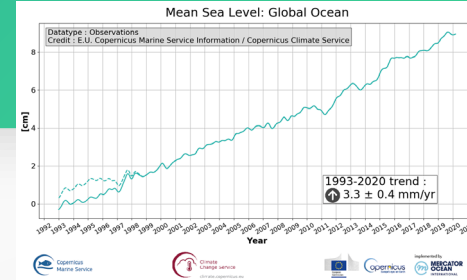


- › Satellite DEM
- › Water level at the coast
- › Static flooding method
- › 24 scenarios on both territories



-Satellite Observation

-IPCC scenario from SROCC (RCP 2.6 et 8.5)



4 dates, 3 SLR trends; with or without decadal storm/tide combination



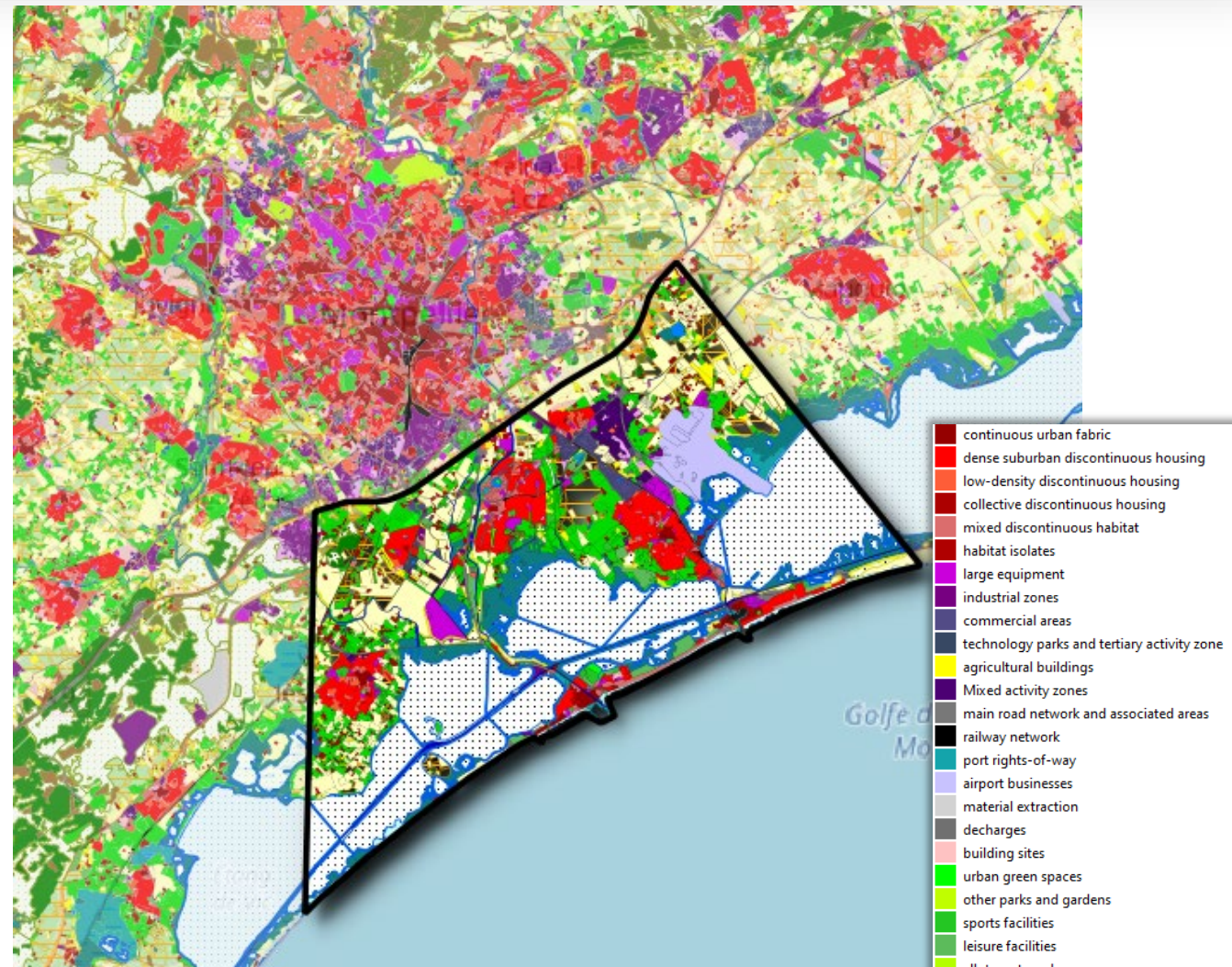
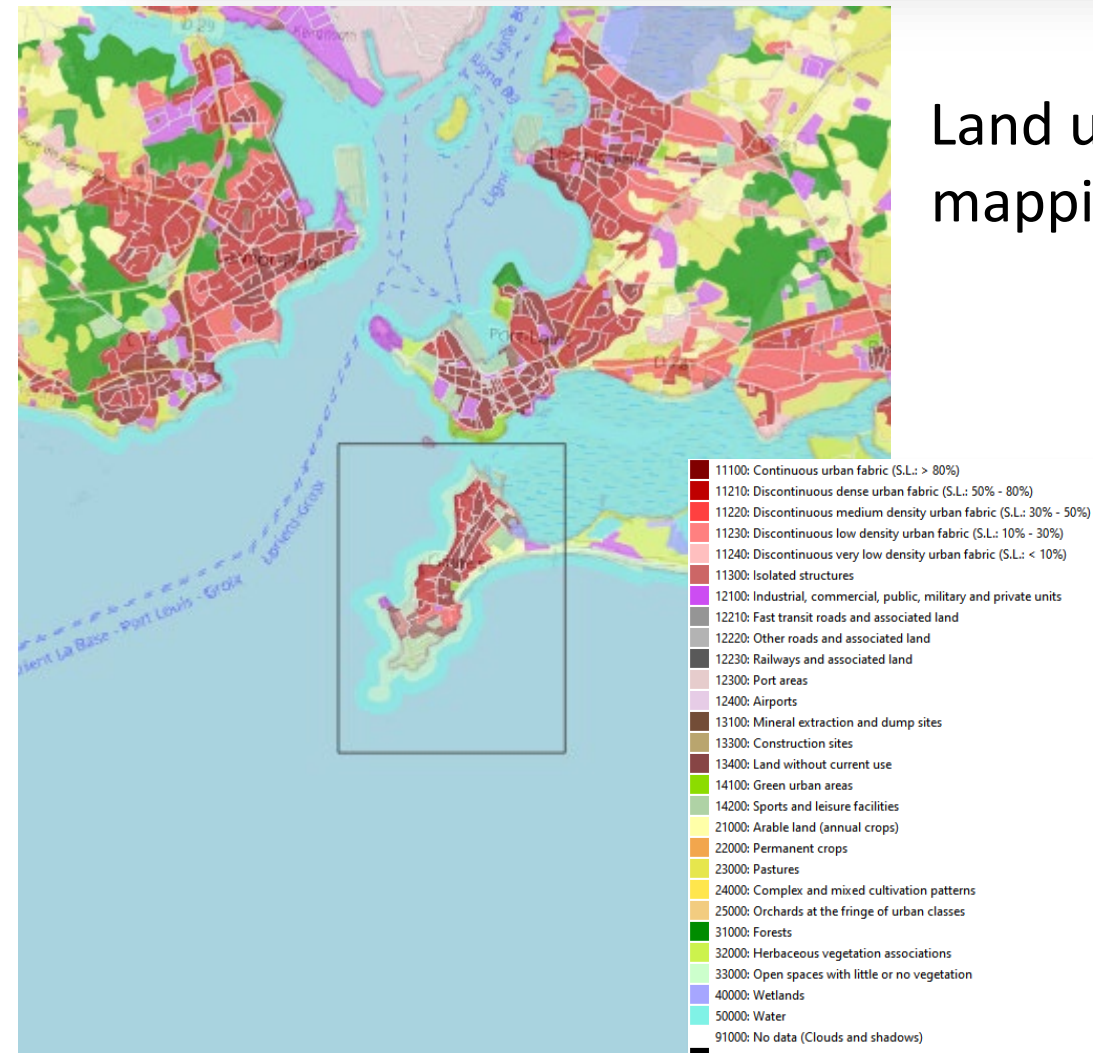
Decadal storm (with/without)





# Mapping socio-economics assets from satellite VHR optical imagery

Land use mapping





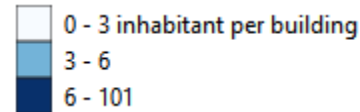
# Mapping socioeconomic assets from satellite VHR optical imagery

Low season

Population distribution (building level)



Gavres



- 11100: Continuous urban fabric (S.L.: > 80%)
- 11210: Discontinuous dense urban fabric (S.L.: 50% - 80%)
- 11220: Discontinuous medium density urban fabric (S.L.: 30% - 50%)
- 11230: Discontinuous low density urban fabric (S.L.: 10% - 30%)
- 11240: Discontinuous very low density urban fabric (S.L.: < 10%)
- 11300: Isolated structures
- 12100: Industrial, commercial, public, military and private units
- 12210: Fast transit roads and associated land
- 12220: Other roads and associated land
- 12230: Railways and associated land
- 12300: Port areas
- 12400: Airports
- 13100: Mineral extraction and dump sites
- 13300: Construction sites
- 13400: Land without current use
- 14100: Green urban areas
- 14200: Sports and leisure facilities
- 21000: Arable land (annual crops)
- 22000: Permanent crops
- 23000: Pastures
- 24000: Complex and mixed cultivation patterns
- 25000: Orchards at the fringe of urban classes
- 31000: Forests
- 32000: Herbaceous vegetation associations
- 33000: Open spaces with little or no vegetation
- 40000: Wetlands
- 50000: Water
- 91000: No data (Clouds and shadows)
- 92000: No data (Missing imagery)

High season





# From exposure to risk

- Risk calculation: **CVI (Coastal Vulnerability Index)** developed par Gornitz & al. (1992)

ENVIRONMENTAL SCIENCES DIVISION  
A COASTAL HAZARDS DATA BASE FOR THE  
U.S. EAST COAST

Contributed by  
Vivien M. Gornitz  
National Aeronautics and Space Administration  
Goddard Institute for Space Studies  
New York, New York

Includes physical and morphological parameters as well as et socio-economical data from the coastal zone  
Calculation of « Risk index » on a 1 to 5 scale





# Synthetic Index to evaluate coastal risks

Combining coastal flooding hazard intensity with 5 types of exposure (normalised as an index on a 1 to 5 scale)



## Human

- Number of people
- Vulnerable population rate (<10 years old and > 65 years old)



## Socio-economic

- Land cover
  - Gâvres : HR (Urban atlas)
  - Palavas : MR
- Number of jobs
- Number of companies/businesses
- Number of touristic accomodation units
  - Gâvres : HR (Google search)
  - Palavas : MR (municipality level)



## Environmental

- Presence of 1+ natural protection areas  
(RAMSAR, ZNIEFF I & II, Natura 2000, ZICO, APB...)

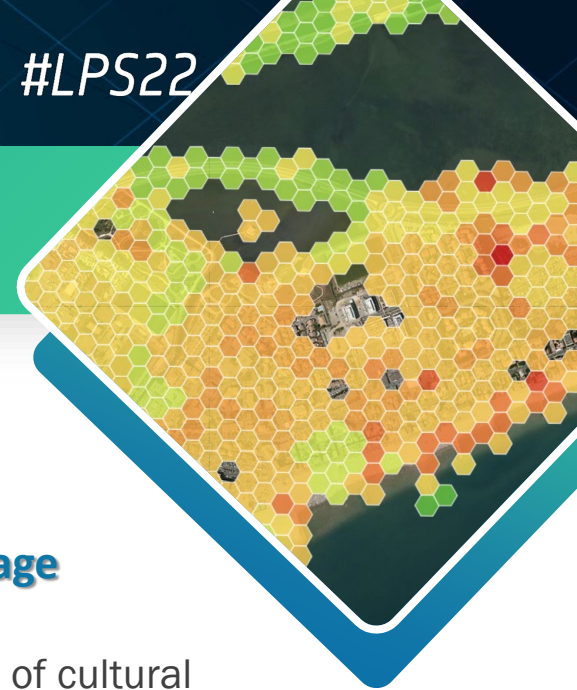


## Heritage

- Presence of cultural sites classified or registered



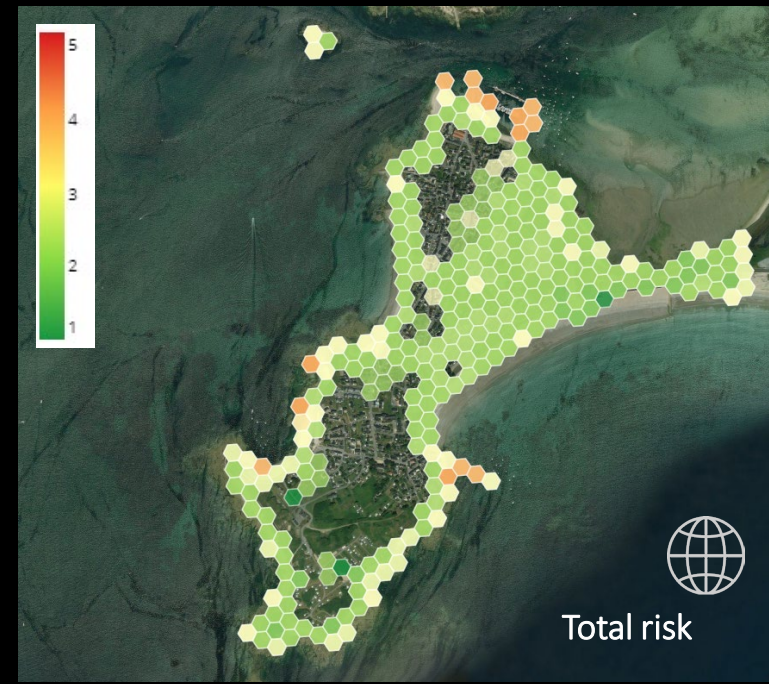
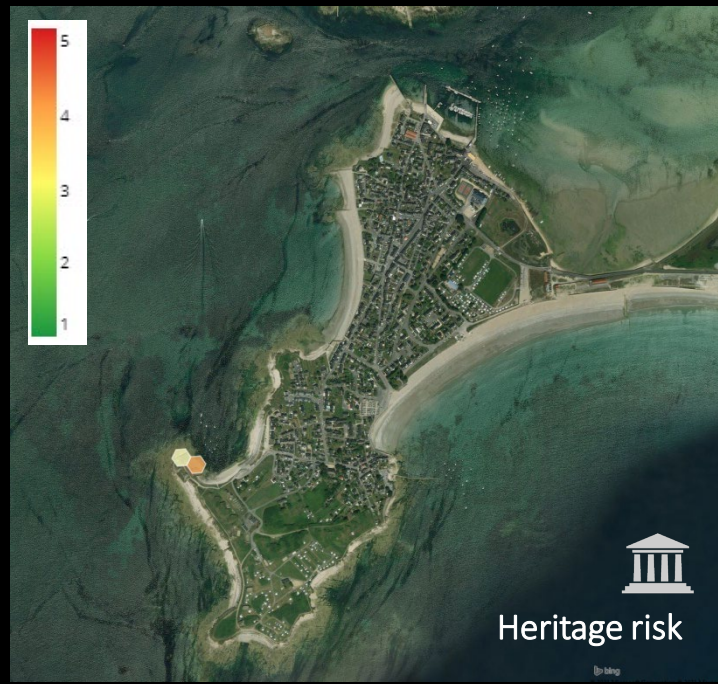
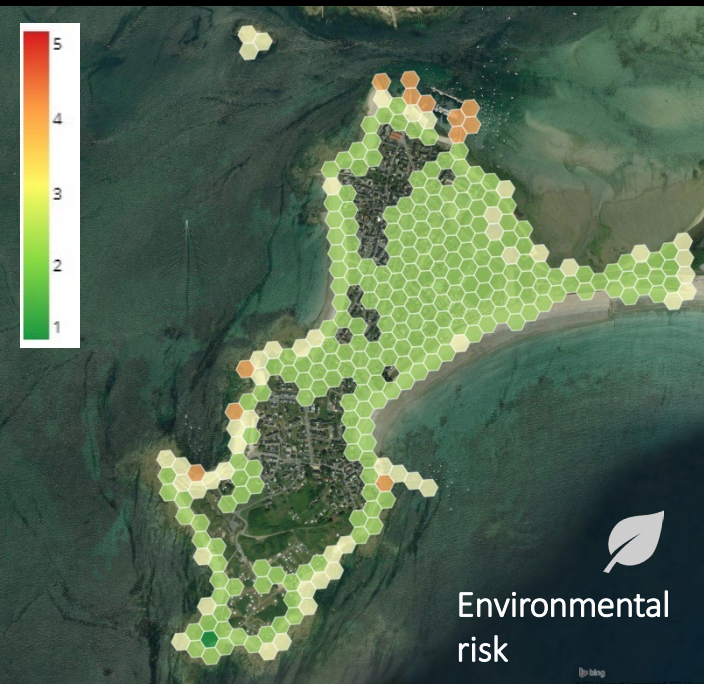
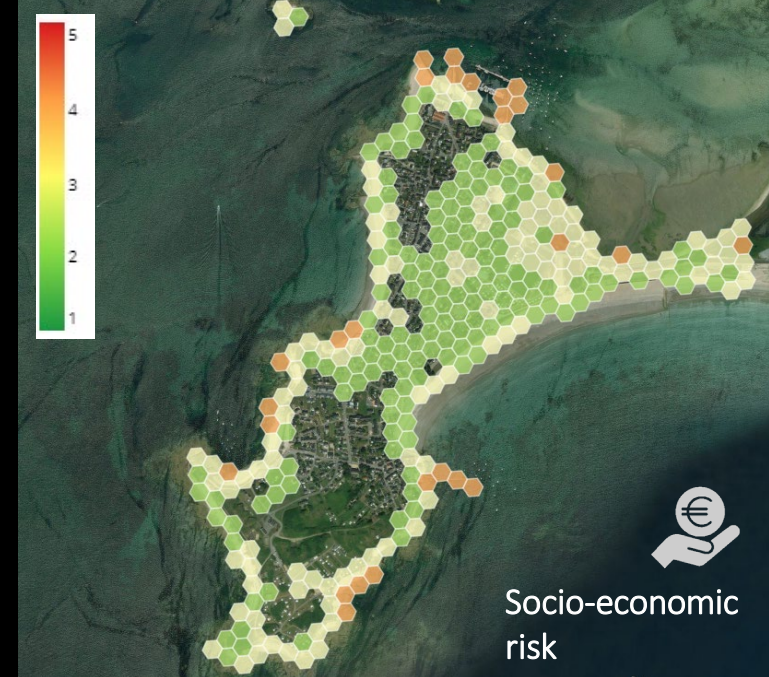
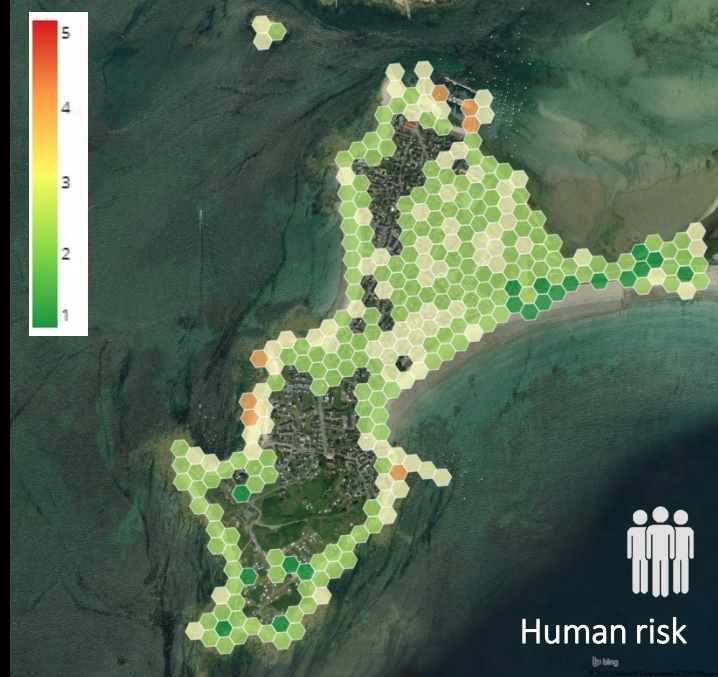
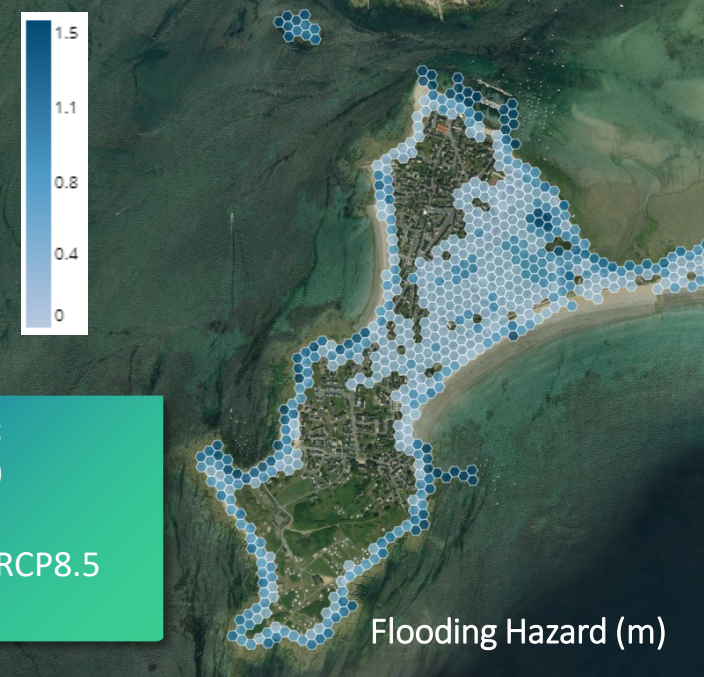
Total exposure



5  
4  
3  
2  
1

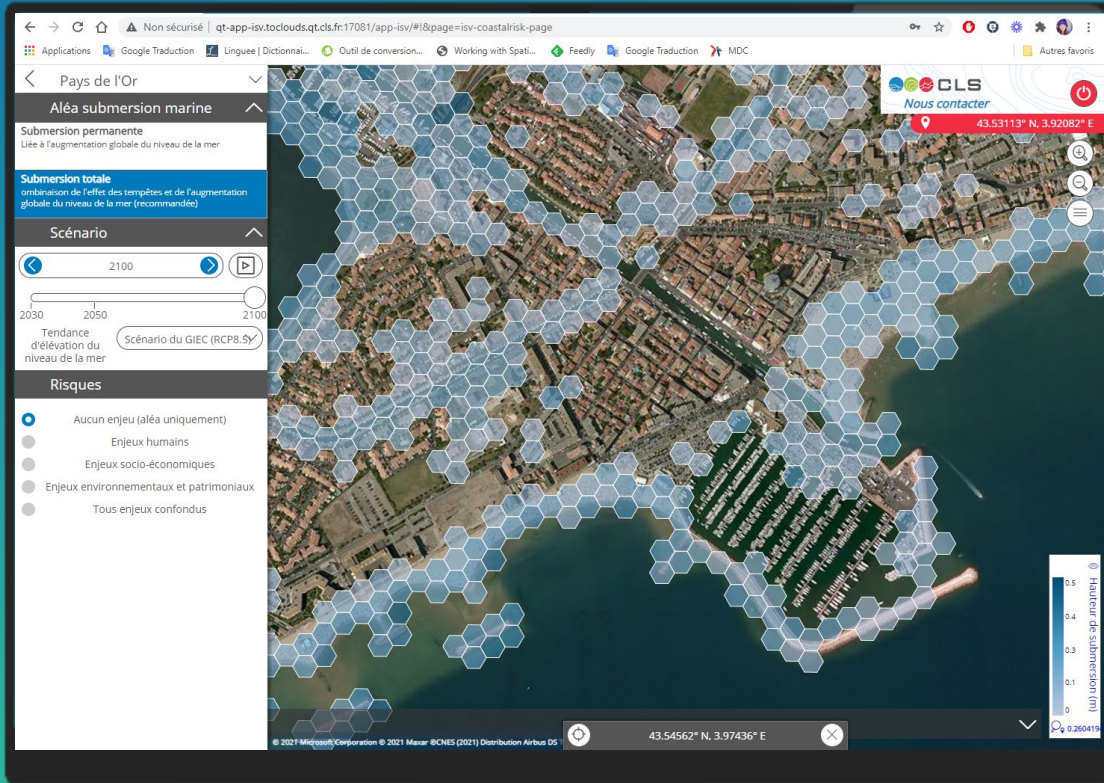


Test on a specific scenario: MA100  
Decadal storm  
Trend from IPCC RCP8.5  
Year 2100





# Improved knowledge for better decision making



## Inform decision-makers

Make information available through an **interactive web interface** to help managers familiarize themselves with the risks to their coastal area.

Provide an **enlightening** and **easy-to-use** decision guiding tool.

Co design of the platform with end users



Hazards Identification



Risk Evaluation





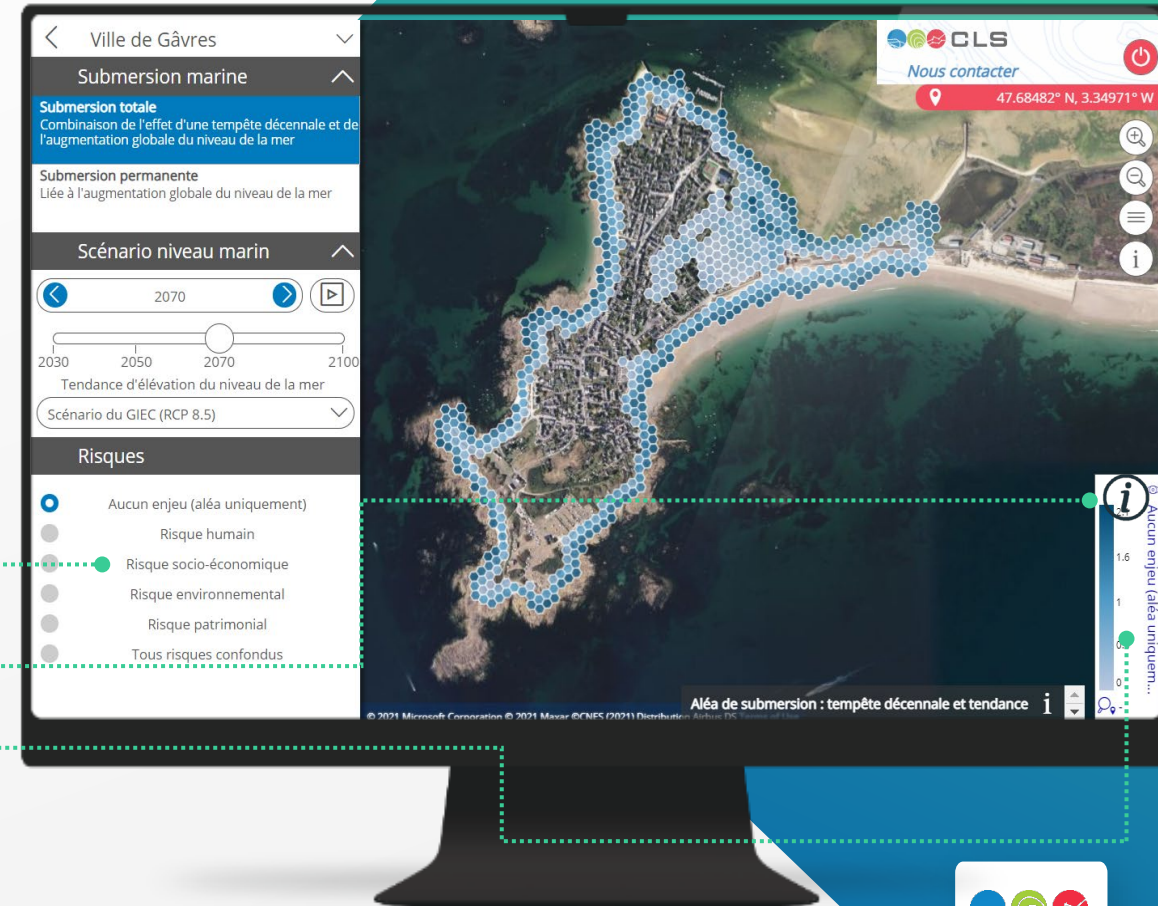
# Users feedback



- ✓ Interested in the maps to increase their knowledge about risks
- ✓ a tool for local dialogue within elected /managers
- ✓ Design and ergonomiy +++
- ✓ Authenticated access to control the dissemination of this sensitive information about risks

## Future Evolutions:

- ▶ Make the educational content more accessible and complete
  - › Tooltips and buttons
  - › Highlighting of data units and colorbar
- ▶ Communicate more on limits and application scales of the results







Thank you

## LittoSCOpe

a satellite solution in support of coastal resilience

For and with coastal territories