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Centre For Studies and Expertise on Risks, Environment, Mobility, and Urban and Country Planning

# Seminário Internacional: A Zona Costeira de Portugal. Como a podemos defender?

## Coastal erosion monitoring: French action plans and current developments

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Cerema - Water, sea and waterways department

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# Centre for Studies and Expertise on Risks, Mobility, Land Planning and the Environment

## A State agency of scientific and technical expertise

- In support of the definition, implementation and evaluation of public policies, on both national and local levels
- Under the French ministries in charge of sustainable development, town planning and transportation
- About 3,000 employees, 220 experts
- €250M turnover (2015)
- About 180 edited publications and 20 ongoing European projects

# 9 fields of operation

Land Planning, Development and Equality of Regions

Housing and Buildings

Energy Transition and Climate Change

Management of Natural Resources and Environment

Risk Prevention

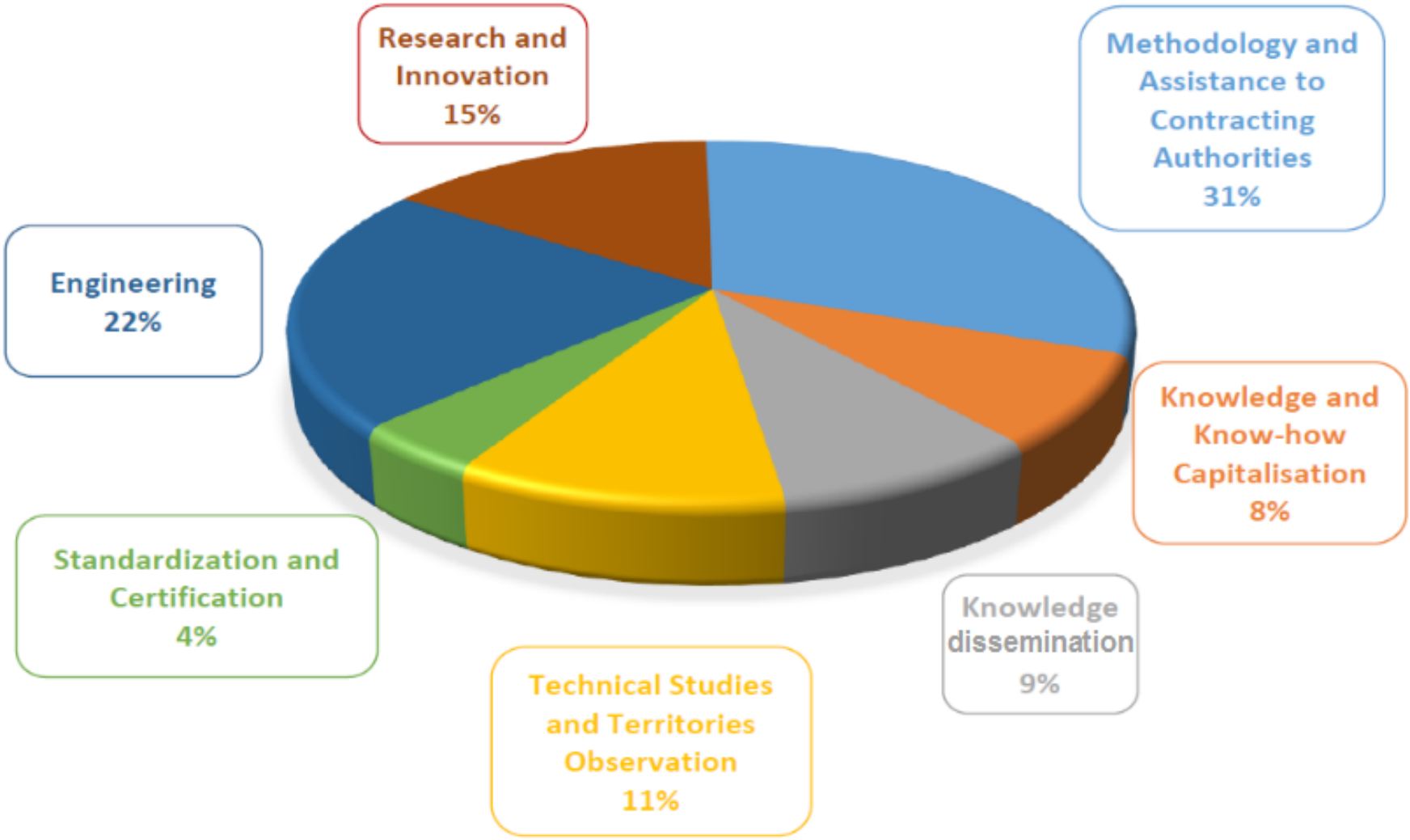
Well-being and Reduction of Pollution

Mobility and Transportation

Management, Optimization, Modernization and Design of Infrastructures

Towns and Urban Strategies

# Activity types



# Selected areas of excellence

## Risks

Vulnerability, prevention, resilience, crisis management

## Energy and climate

Renewable energies, energy efficiency

## Infrastructures and mobility

Safe and sustainable infrastructures for more efficient and greener mobility

## Transport infrastructures

Road infrastructures, waterways and railways

## Sea and coastal areas

Maritime spatial planning and integrated coastal management

## Urban and land planning

An integrated approach to sustainable development

# French national strategy for integrated coastline management

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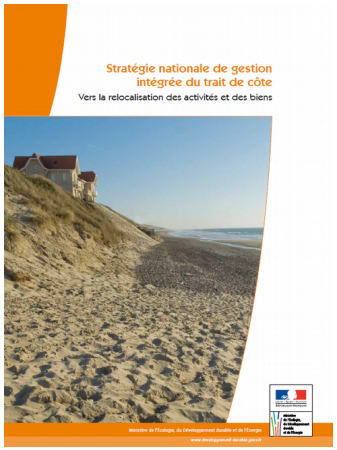
# Coastal management in France

## 2012: Implementation of a National strategy for integrated coastline management




- Following Xynthia storm disaster (2010)
- Taking into account coastal erosion (not only coastal flooding / EU Floods Directive)
- Increasing vulnerability of coastal areas (population growth)
- Preventing future coastal risks (sea level rise)

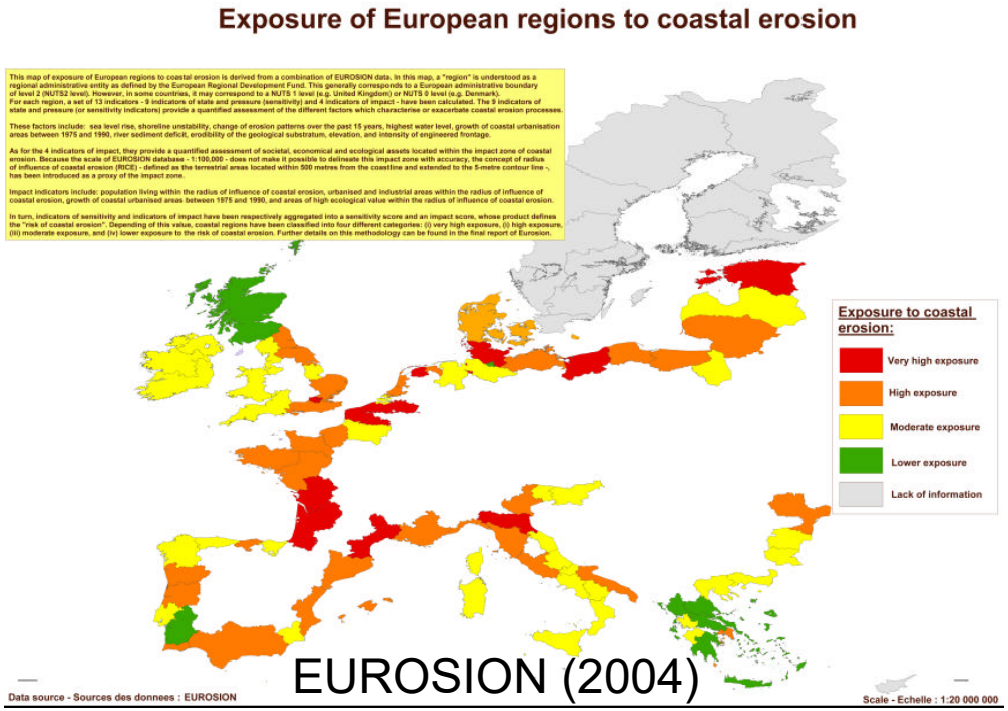
=> *National strategy for climate change adaptation*

- Adoption of action plans (2012-2015 and 2017-2019)

# Shared statements

Assessment of erosion impact on ecosystems, activities and goods to be improved

- Lack of knowledge:
  - No shared basis on coastal erosion rates
  - No vision of coastal erosion evolution in 2020, 2050, 2100...
  - No clear vision of coastal defenses (location/state/ maintenance costs...)

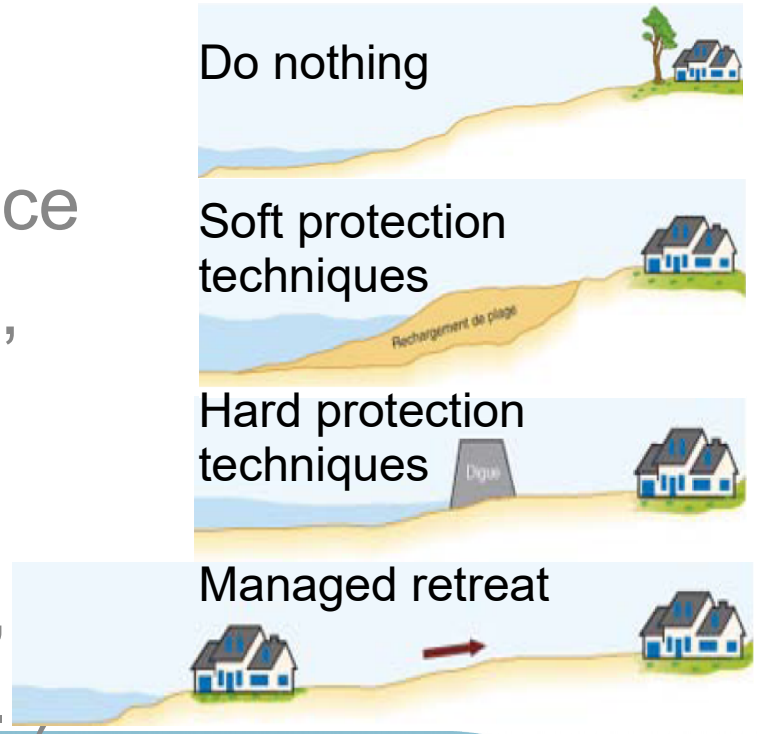



EUROSION (2004)

# Shared statements

Technical solutions are well defined… but governance and funding are complex!

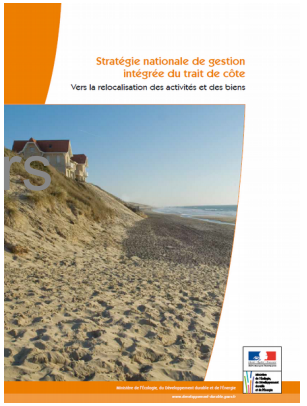
- Often « slow » but on large areas
- Exceeds local authorities' competence
- Many actors (State, local authorities, private owners…) but no leader
- Weak social acceptance of retreat
- Many public policies (town planning, coastal risks, public maritime domain..)



# French national strategy for integrated coastline management

## Towards the relocation of activities and property: a shared framework to be locally declined

- 8 common principles / 7 strategic recommendations
- Program of 9 actions for 2012-2015 through 4 axes:
  - Develop coastline monitoring and identify high erosion risk territories in order to prioritize public action
  - Design strategies shared by public & private stakeholders
  - Move towards a policy of land planning
  - Specify methods of financial intervention



# Common principles

1. Coastline is moving : it cannot and it must not be fixed everywhere
2. Managed realignment is to be planned now, although a long term process
3. No good or activity has to be settled in areas submitted to high coastal risks
4. Erosion and flood risks have to be considered together in “coastal risk prevention plans”
5. Integrated coastal zone management has to take into account economical, social, environmental and cultural issues
6. Integrated coastal zone management must balance town-planning, land-use planning, risk prevention and coastal development
7. Erosion and flooding risks have to be anticipated (10/40/90 years)
8. Coastal risks and ecosystems knowledge have to be shared with stakeholders

# Strategic recommendations

1. Articulate spatial scales: hazard sources, land planning and operational land management
2. Articulate land planning time scales (10/40/90 years): take into account erosion's evolution, anticipate resettlement as an alternative to holding the line based on cost-benefit analysis
3. Develop a consistent coastal management dealing with erosion and flooding risks, designate a leader to design the spatial planning and to ensure local stakeholders respect the plan
4. Justify coastal development through cost-benefit and multi-criteria analysis
5. Plan heavy infrastructure to protect the coastline only in strategic areas and design it in a way to allow long term resettlement
6. Use soft techniques to protect medium populated or agricultural areas
7. Protect and restore coastal ecosystems to limit coastal erosion and disperse marine energy

# 2012-2015 Action program
# A/ Observation and Knowledge

1. Create a coastline observatory network
    1. Promote a national shoreline observatory network
    2. Update « French atlas of hydraulic and sedimentary data involved in coastal change »

2. Map erosion risk and identify areas at risk of coastal erosion
    1. Define a national indicator for coastal erosion to qualify hazard
    2. Identify areas where potential significant erosion risk exists crossing erosion national indicator and land-use knowledge

# 2017-2019 Action program
# A/ Develop and share knowledge

1. Implement the national coastline observatory network
2. Increase national knowledge on coastal erosion and vulnerability
3. Develop knowledge on coastal dynamics
    1. Share local/national syntheses on coastal dynamics & evolution
    2. Increase knowledge of climate change impact and sea level rise on coastal risks
    3. Develop knowledge on sedimentary stocks & sediment transport
    4. Create and share a national database on coastal defenses

# Results and current developments

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# Map of a national indicator for coastal erosion

## Issues and aims

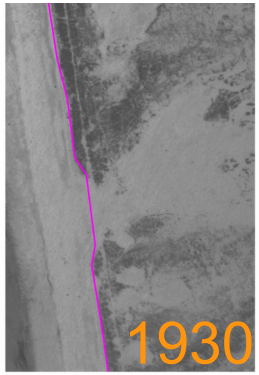
- No national index for long-term coastline evolution monitoring
- No national, homogeneous methodology (monitoring and map) to identify strong erosion areas and heavy human settlement (property and uses)
- However necessary in order to prioritize public action: (funding, works and land planning...)

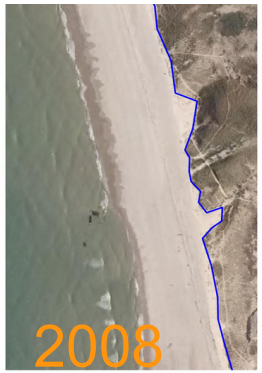
# Map of a national indicator for coastal erosion

## An homogeneous national methodology


- Built on observed rates of evolution (geometric parameters)
- An initial status of coastal evolution from shoreline digitization on aerial photographs (ortho-photos) at a national level:
  - Choice of shoreline indicators visibles on orthophotos
  - Digitization of 2 orthophotos: the newest and the oldest available

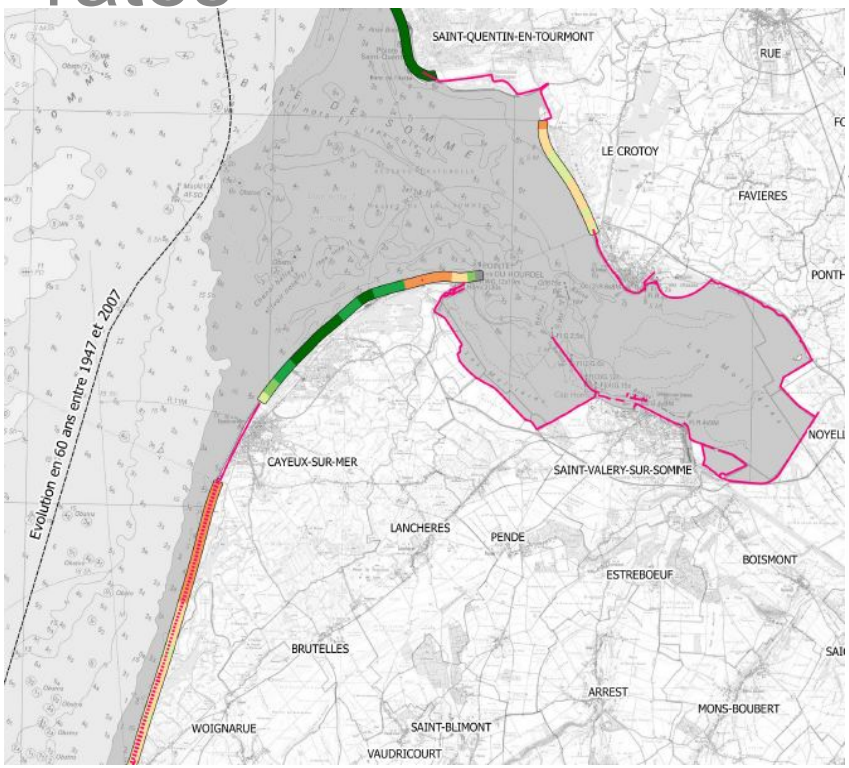
# Map of a national indicator for coastal erosion

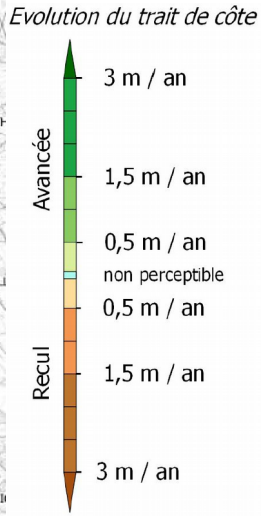




## Automatized calculations of historic evolution rates



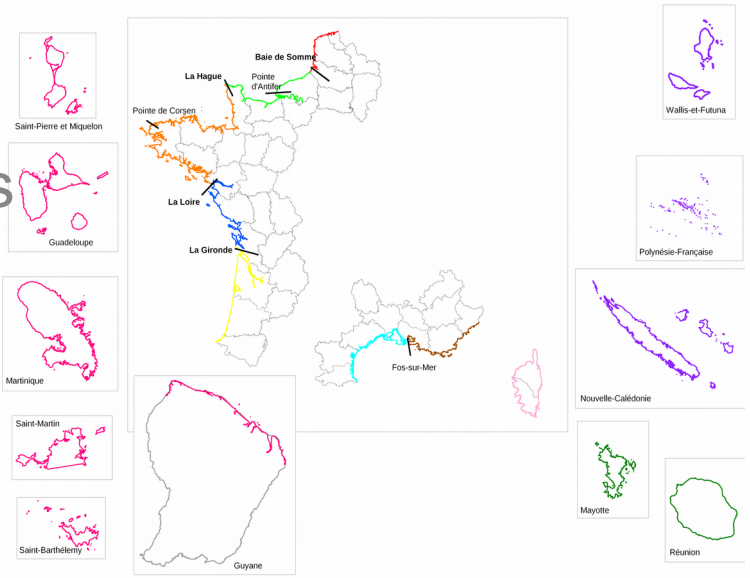




- Development and use of the MobiTC software
- One rate calculated each 200 m of the coastline
- Map at 1/100 000

# National synthesis of coastal erosion and evolution mecanisms

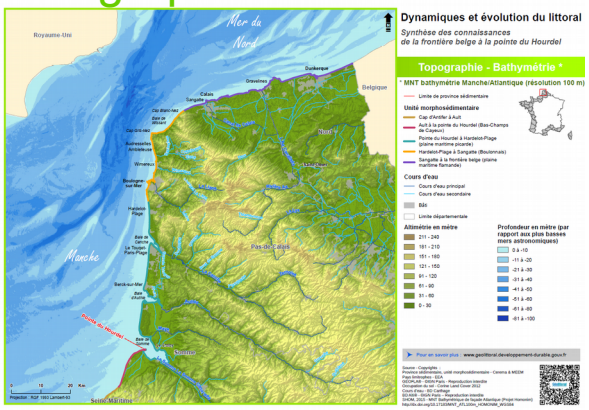
Inventory and share knowledge on coastal erosion and dynamics

- State of the art on coastal erosion:
  - Major studies, maps and datasets
  - Past and future evolutions & parameters
- Available on the Internet
- 1 national & 20 local documents:
  - 10 mainland and 10 overseas territories
- 11 local editorial boards

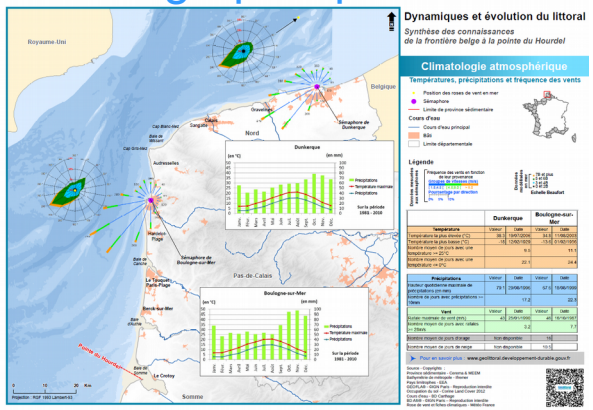


# National synthesis of coastal erosion and evolution mecanisms

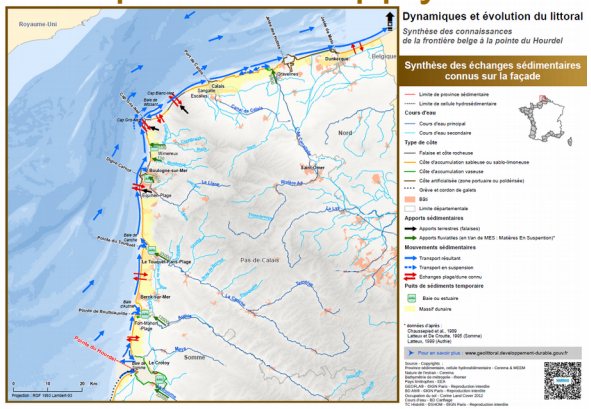
## Chapter 2: Geographical context



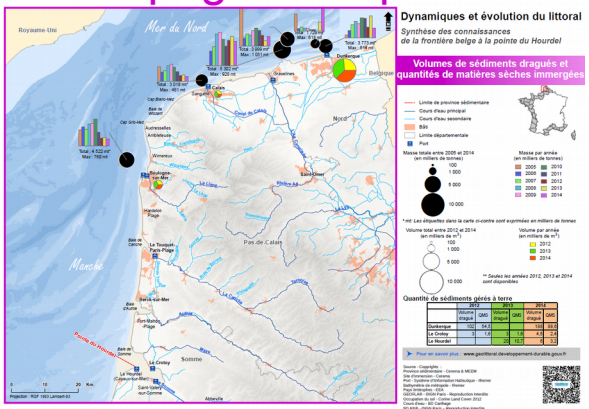

## Chapter 3: Hydraulic and oceanographic parameters



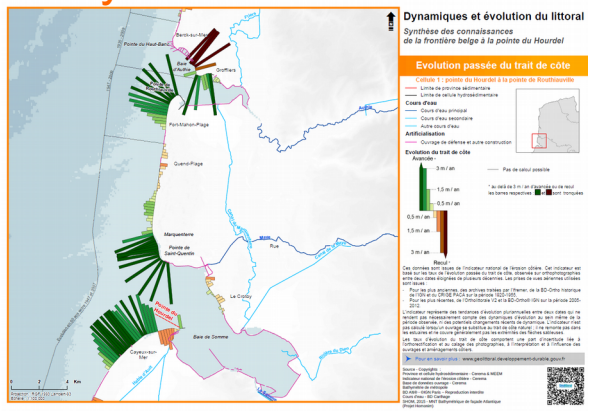

## Chapter 4: Sediment transport and supply




## Chapter 5: Anthropogenic impacts

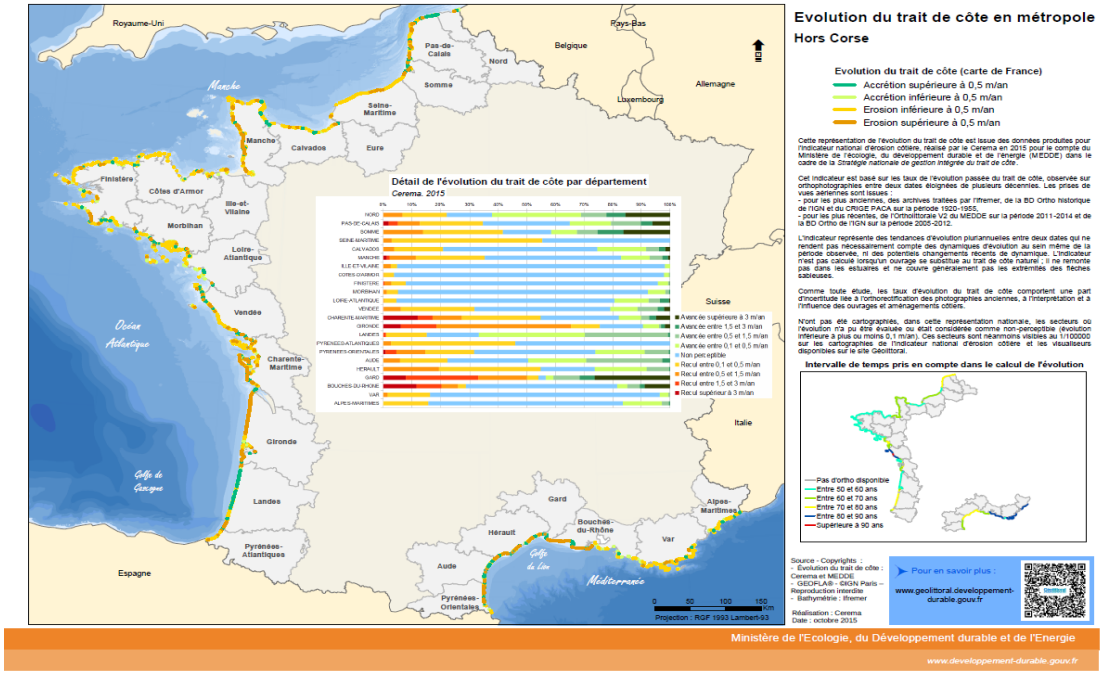



## Chapter 6: Shoreline and bathymetric evolutions



# National synthesis of coastal erosion and evolution mecanisms

## 1st information leaflet (labelled COP21)


- Main characteristics of French coasts
- Coastal evolution parameters and rates
- Impact of climate change
- 1st results of national indicator of coastal erosion

# Monitoring coastal erosion with remote sensing tools

## Tools developed on Pleiades imagery


- National plan for satellite applications
  - Theme « Coastal zone and sustainable development »
  - A.6-Develop a pilot project for coastal mapping framework
- Monitoring the shoreline:
  - On-site surveys: mainly based on botanic or geomorphological indicators, submetric precision, can be biaised, time-consuming
  - Digital mapping: limited by visible indicators, decametric precision, can be biaised, time-consuming

# Monitoring coastal erosion with remote sensing tools

Specific methods developed on microtidal or macrotidal environments

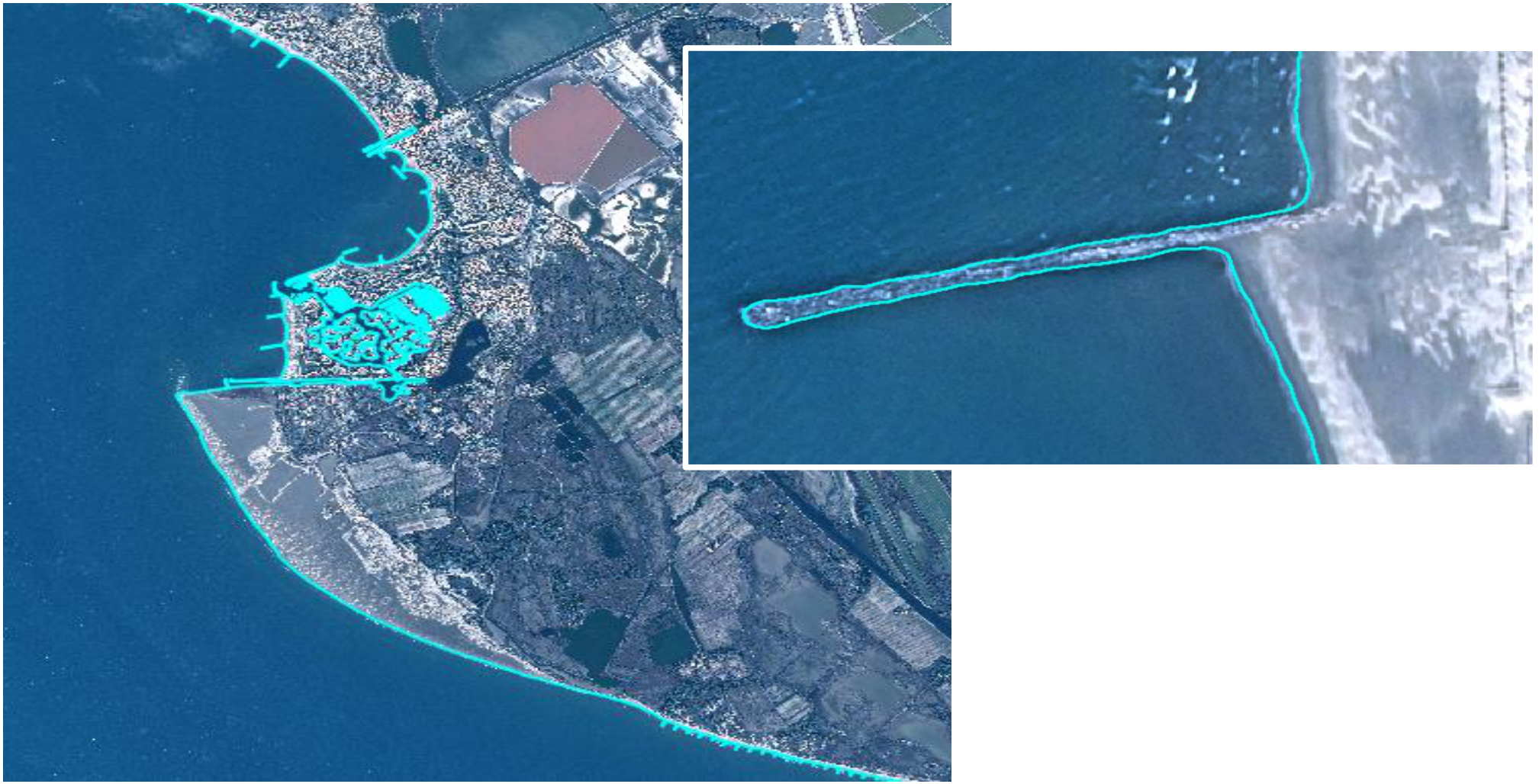
- Microtidal: shoreline position and coastal defenses
  - Identify dry/humid pixels and define shoreline as the intersection
  - Identify unexpected straight lines in shoreline detection
- Macrotidal: shoreline position
  - Map land cover (different classification methods tested)
  - Define the shoreline as the intersection of terrestrial and maritime domains

# Monitoring coastal erosion with remote sensing tools

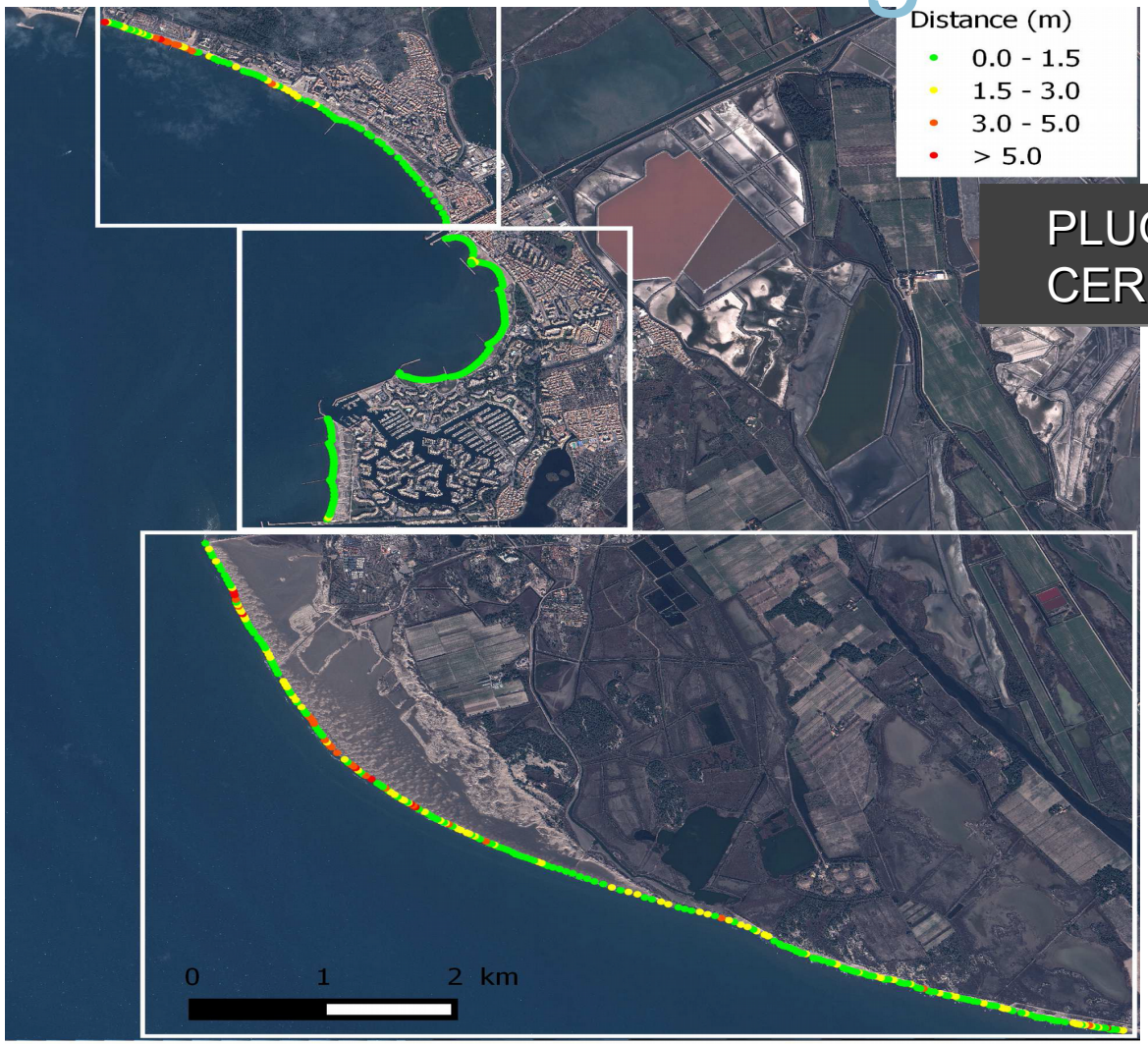
## Microtidal environments

(Grau-du-Roi, Gard)


# Monitoring coastal erosion with remote sensing tools



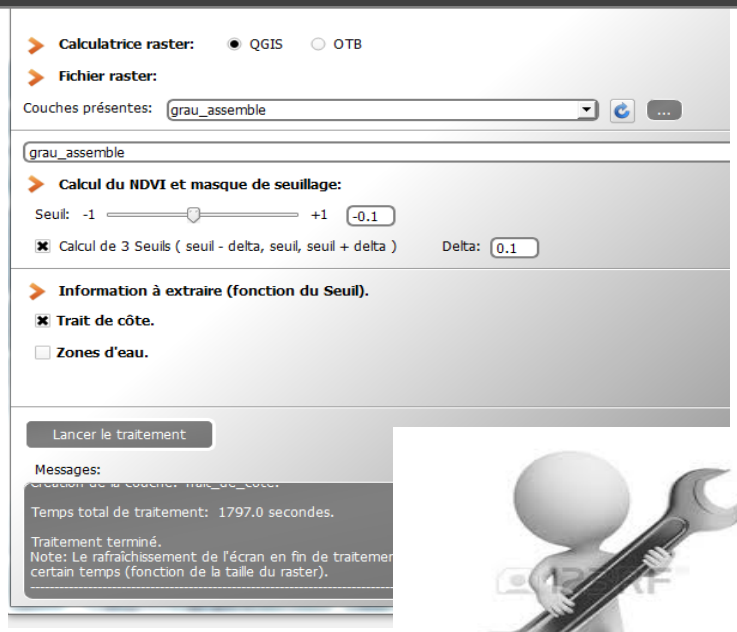
# Monitoring coastal erosion with remote sensing tools




→ Metric precision (>photointerpretation)

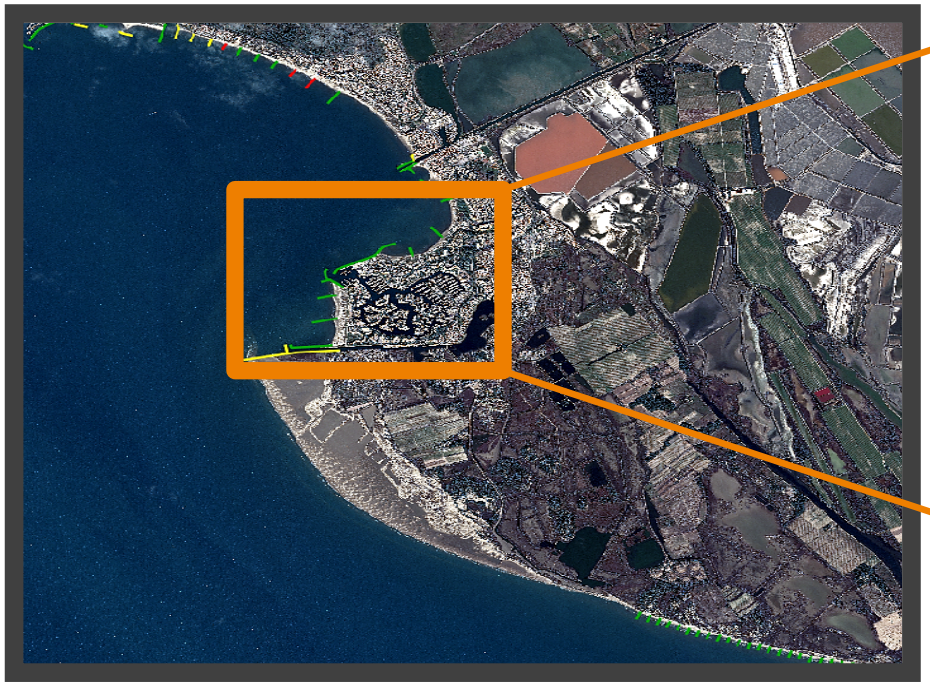
→ Quick treatment (6min for 20 km)

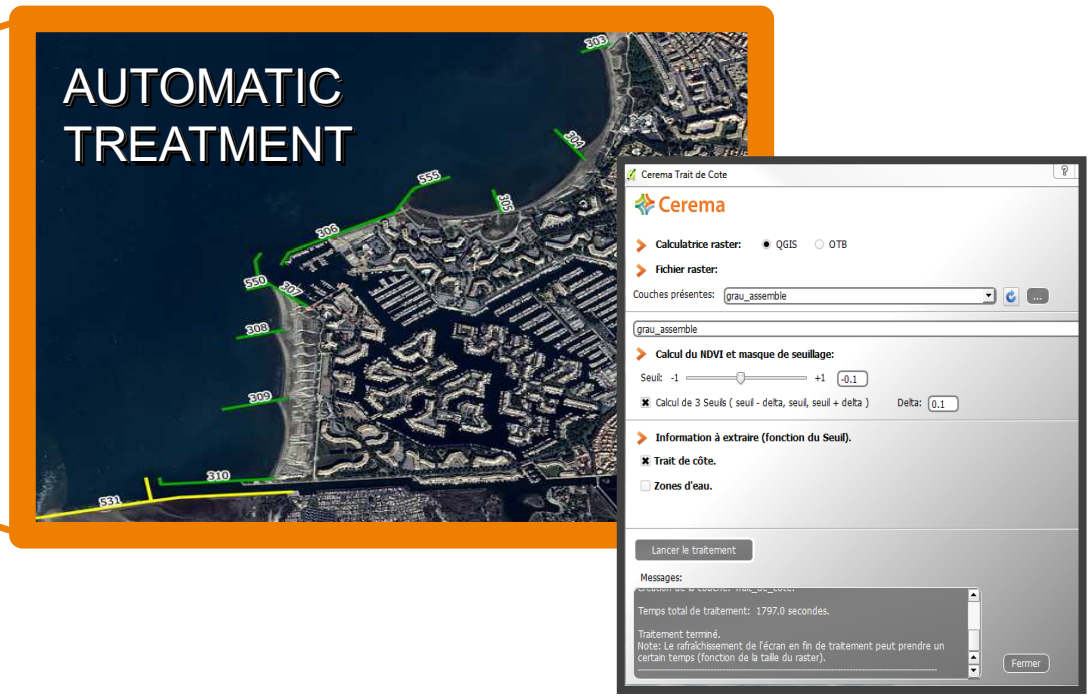
**PLUGIN QGIS DEVELOPPED BY CEREMA**



# Monitoring coastal erosion with remote sensing tools

PLUGIN QGIS DEVELOPPED BY CEREMA





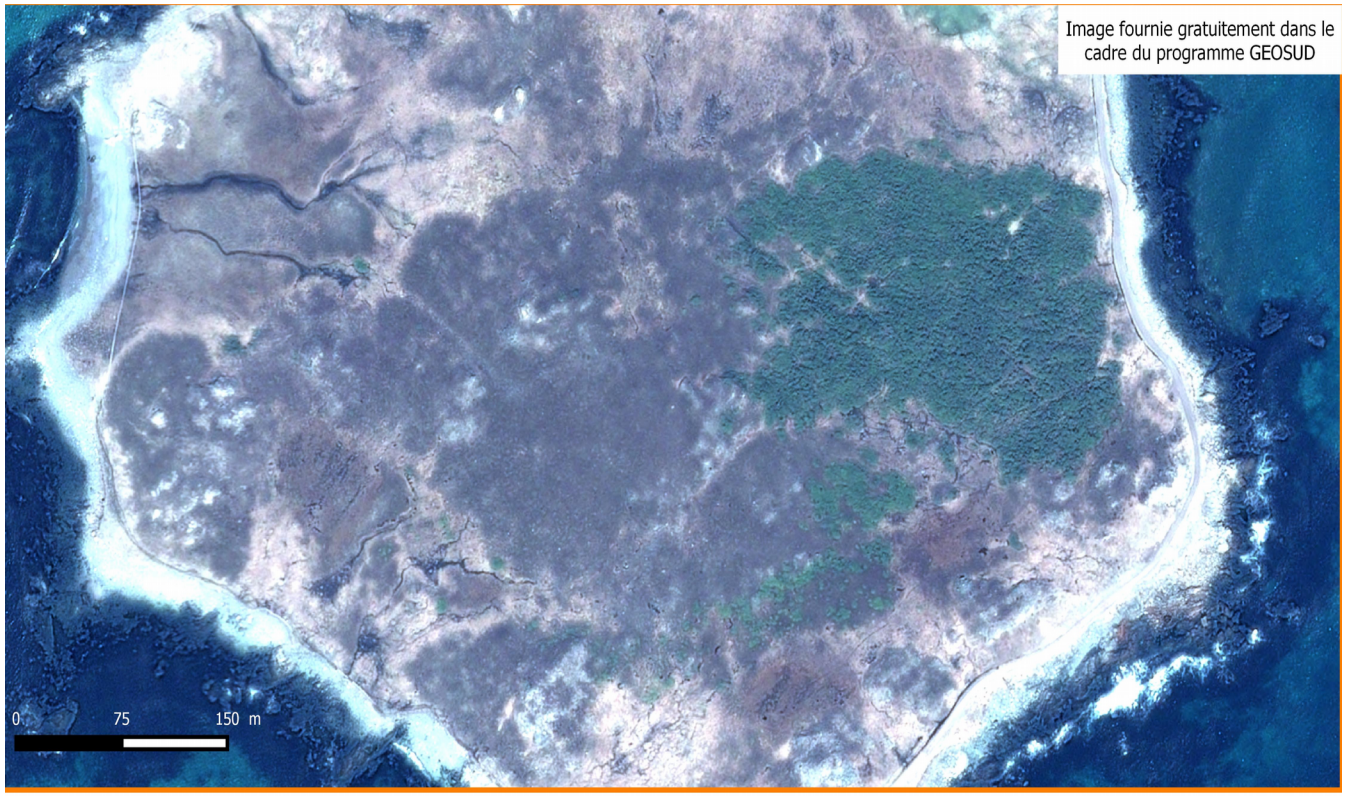

***Comparaison des ouvrages détectés à partir d'une image PLÉIADES avec ceux relevés sur site***

- Ouvrages non détectés (5 %)
- Ouvrages totalement détectés (83 %)
- Ouvrages partiellement détectés (12 %)
- Ouvrages sur-détectés (non existants)

# Monitoring coastal erosion with remote sensing tools

## Macrotidal environments (Saint-Pierre-et-Miquelon archipelago)

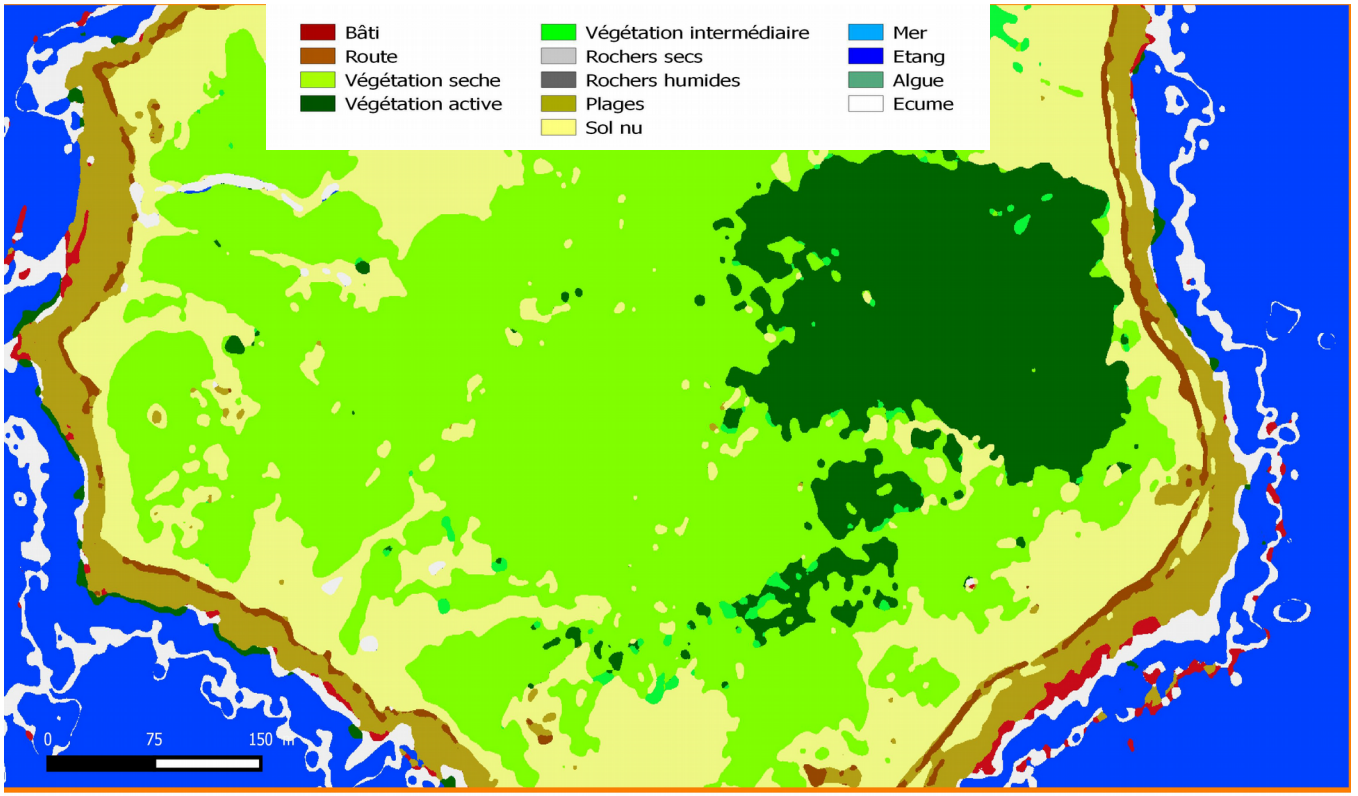
**Pleiades image in 2012 on Saint-Pierre island**



# Monitoring coastal erosion with remote sensing tools

## Macrotidal environments (Saint-Pierre-et-Miquelon archipelago)

**Automatic treatment of land cover**



# Monitoring coastal erosion with remote sensing tools

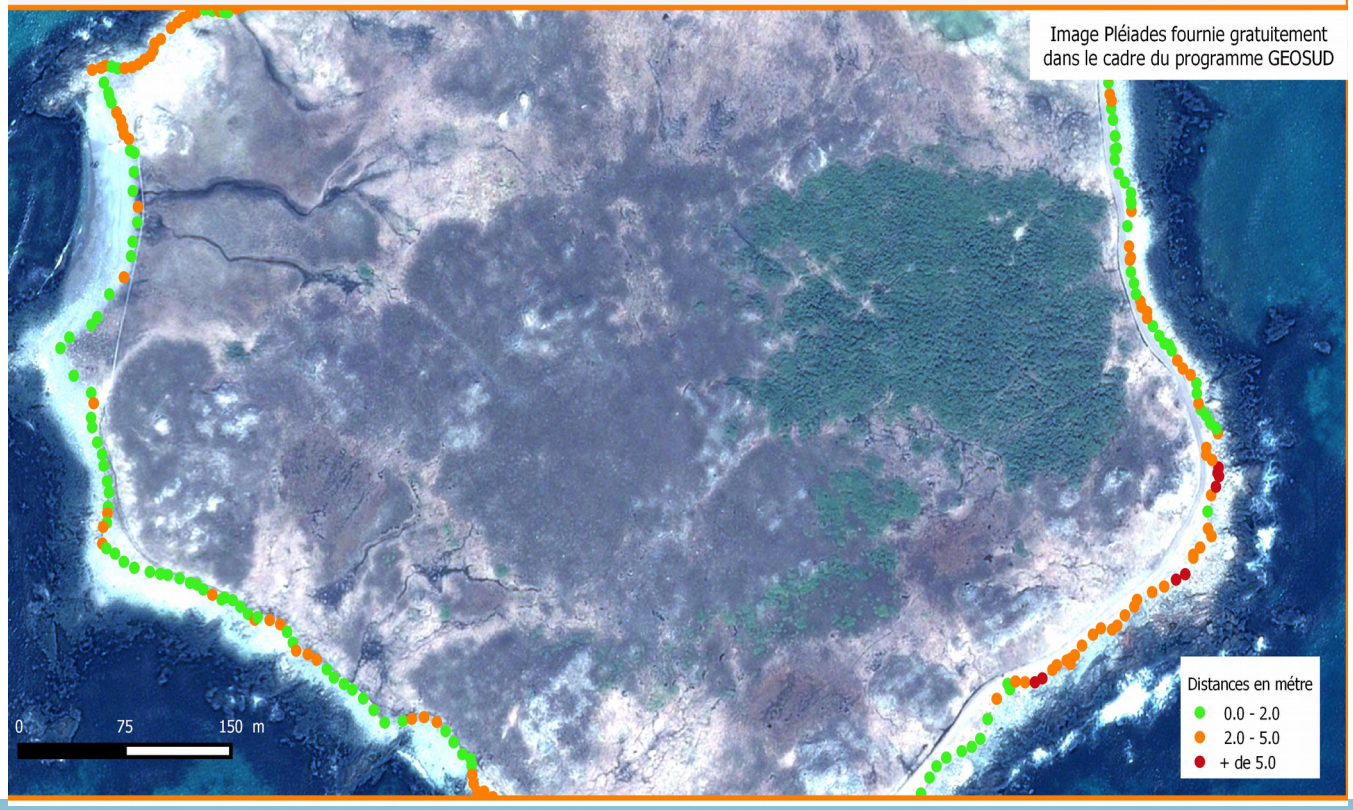
## Macrotidal environments (Saint-Pierre-et-Miquelon archipelago)

**Semi-automatic treatment of shoreline detection**

# Monitoring coastal erosion with remote sensing tools

## Macrotidal environments (Saint-Pierre-et-Miquelon archipelago)

**Semi-automatic treatment of shoreline detection**



# Conclusion

## On-going developments and short-term perspectives

- Develop a prospective indicator of coastal erosion to quantify vulnerability of human settlements
- Increase the precision of the national indicator of coastal erosion by integrating more dates (and different time scales)
- Create a national database of coastal works and estimating averaged costs (contruction, maintenance…)
- Publish the 21 syntheses of coastal dynamics
- Transfer imagery tools to local authorities (QGIS-plugins)

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# Thank you for your attention!

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