



Space for shore

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European Space Agency

















Anticipate and prevent erosion impacts : a wordwide issue



GIEC, 2014: Changements climatiques 2014: Rapport de synthèse. Contribution des Groupes de travail I, II et III au cinquième Rapport d'évaluation du Groupe d'experts intergouvernemental sur l'évolution du climat [Sous la direction de l'équipe de rédaction principale, R.K. Pachauri et L.A. Meyer]. GIEC, Genève, Suisse, 161 p

recur annually

Climate change

annually after 2100

Sea level rise ⇒ erosion & submersion

- ⇒ 70% of the coastlines will face sea level rise within the average IPCC projections
- ⇒ Geopolitical threats
 - ⇒ Impairing the territorial integrity of island states and countries mainly coastal
 - ⇒ Massive population migration by 2100
- ⇒ Extreme hundred-year events will become annual
- ⇒ Ecological and economical threats: loss of invaluable ecosystems





2200

2250

2300

(m) Global mean sea level

2150

2100

year

change relative to 1986-2005

IPCC, 2019: Summary for Policymakers. In: IPCC Special Report on the Ocean and Cryosphere in a Changing Climate [H.-O. Pörtner, D.C. Roberts, V. Masson-Delmotte, P. Zhai, M. Tignor, E. Poloczanska, K. Mintenbeck, A. Alegría, M. Nicolai, A. Okem, J. Petzold, B. Rama, N.M. Weyer (eds.)].

"For the 21st century, the benefits of protecting against increased coastal flooding and land loss due to submergence and erosion at the global scale are larger than the social and economic costs of inaction"

The cost of inaction ...

- US coastal property loss: 500 M\$ / an (NOAA, 2013)
- West Africa coastal degration: 3 800 M€ & 13 000 victims (WACA Program, World Bank, 2019)
- France worst IPCC projection, removing the protection infrastructures and measures: **47 300** endangered housing, representing a property value of **8 000 M**€ (Cerema, 2020)

... compared with the action cost

- US expenses of the federal government to control erosion: 150 M\$ / an (NOAA, 2013)
- Vietnam coastal adaptation to climate change: 3 000 M\$
- Europe (2001) coastline protection measures: **3 200 M€** (Eurosion, 2004)

France – favorable IPCC projection, maintaining the protection infrastructures and measures: **5000** endangered housing, representing a property value of **800** M€ (Cerema, 2020)

ESA's cardinal requirements

Coastal Erosion Project

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- Involve final end-users all along the project
 - Express their requirements
 - Participate in / coorganise demo meetings
 - · Assess the products' adequacy and utility
 - Analyse the feasibility of their integration in their working practice
 - Express their willingness to buy, in the future, the service & products
- Make use of freely available and historical datasets to the largest possible extent
 - Sentinel 1 and Sentinel 2 missions (Develop and demonstrate innovative EO products)
 - Combined with ERS-1, ERS-2, Envisat and SPOT archives
- Provide erosion analysis over a minimum of 1500 linear km of coast split into 4 different member states and provide the best products suited to end user requirements over the past 25 year

i-Sea's vision

A service platform to support decision making

- A solution embracing all European Seas
- A monitoring solution for all **coastal geomorphologies**
- Products prescribed by their final end-users
- Products tested, approved and recommended by the scientific community
- Products for a worldwide resilient coastline





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DigitalGlobe esa AIRBUS Large volume of EO data processed OPERPICUS Europe's eyes on Earth **≊USGS** cnes SPOT Sentinel 2 Sentinel 1



Landsat



Worldview 2

Pléiades

7

04/06/2023



Large portfolio of algorithms & products built during the last 2 years

The total production effort encompasses 2400 linear km of coast split into 5 different member states

More than 3 000 sat images - ½ SAR ½ Optical 1/3 of the final products (about 1500) based on the Sentinels

- Based on the high priority-products requested, coastal dynamics was analysed for 1264 linear km of coast split into 5 different member states
- Based on the products requested, coastal dynamics was quantitatively analysed for 975 linear km of coast split into 3 different member states (FR, GE, RO) & for 7 products:
 - Submerged sandbars (FR, GE, RO)
 - Bathymetry (based on optical data) (FR)
 - Waterline (GE, RO)
 - Upper swash limit (FR)
 - Dune foot (FR Nouvelle Aquitaine & Normandy)
 - Cliff lines (FR Nouvelle Aquitaine & Normandy)
 - Cliff vertical movement (FR Nouvelle Aquitaine & Normandy)



Monitoring time and space dynamics of coastal sediment supply, essential for effective action



Precision up to 40 cm reached



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Watching out large-scale shoreline monitoring, the most used coastal indicator by scientists and managers







04/06/2023

Pushing back the limits of image resolution – In search of gravity movements



SBAS & PSI methods tested using hundreds of SAR data



Supervised classifications using optical imagery



Google Eart



Missions for this third year of project

Complete the coastal monitoring until the end of the projet for the former sites



Conclusions, ambitious objectives for an ambitious project

TOWARDS AN OPERATIONAL COMMERCIAL SERVICE WITH SUPER PORTFOLIO

- About to provide a service affordable, easy-to-use, easy-to-update, flexible, adapted, multi-scale, and borderless!
- Help in operational issues for coastal management:
 - Pre-storm vulnerability supporting beach nourishment operations
 - Early-warning coastal landslide
 - Coastal conservation
 - Adaptation to climate change
 - · Feed undocumented regions that cannot invest in field surveys

ROAD MAP TO REACH THIS GOAL: BE EVEN CLOSER TO COASTAL MANAGERS

- Better fit to end-users' habits, expectations, and competences
- Promote widely our service