Eoclima
EARTH OBSERVATION FOR CLIMATE ACTION

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INNOVATING SOLUTIONS

Eoclima for coastal risk management

We present ***Eoclima,*** GMV solution to support climate action through climate-related geo-information products, derived from satellite-based Earth Observation data. We will show how ***Eoclima*** contributes to **addressing coastal risk assessment challenges** and supports climate risk management and adaptation.

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CHALLENGES

Coastlines are highly dynamic natural systems that interact with terrestrial, marine and atmospheric processes and undergo continuous change in response to these processes. Global warming has raised global mean sea-level about 21–24 centimeters since 1880, with a third of that coming from the last two and a half decades. The rate of global sea-level rise will continue increasing in coming decades threatening nearly 2.4 billion people (about 40 per cent of the world's population) that live within the 100 km buffer coastal areas. Sea level rise leads to higher storm surges multiplying risks associated with coastal erosion and coastal flooding events that are affecting billions of lives and livelihoods and menacing critical coastal ecosystems.

Responding to such challenges is made all the more difficult for fast-growing communities, especially those in developing countries, due to a lack of long-term reliable data at resolutions that are appropriate for city-level planning and geospatial risk assessment.

SOLUTION

Coastal monitoring and historical coastal change assessment provides evidence-based support for policies and plans to improve resilience to current and future climate risks. **Earth Observation** (EO) data and services are vital tools for assessing the problems and exposure to future risks for coastal urban areas by identifying structural constraints, informing modelling activities, and identifying development opportunities.

GMV has worked on several projects to integrate EO services into the decision making and design processes to help solve a range of problems for coastal urban areas. As climate finance becomes increasingly aware of the strengths and benefits of EO data, they are being used for an even greater range of problem-solving to help build climate resilience in many different contexts.

Eoclima is GMV's catalogue of climate-related geo-information products to facilitate the management of environmental resources by organizations involved in the process: NGOs, multilateral climate finance initiatives, International Financial Institutions (IFIs), and environmental and conservation agencies as well as national and local Governments.

Eoclima meets all currently existing geospatial data standards so, our geospatial products can be downloaded into and/or consumed by any geo-viewer through Open Geospatial Consortium (OGC) standard services.

Eoclima SUPPORT FOR CLIMATE POLICY

Eoclima products support the climate resilient pathways through the societal transformational process to achieve long-term emissions reductions and sustainable resilient development. This support is decoupled into main broad applications that lead to climate services tailored into products, here presented, and EO-derived parameters.

Application	Service	Product	Parameter

Climate risk management and adaptation	Climate risk assessment and monitoring	Climate adaptation and mitigation synergies
- Water resources management - **Coastal risk management** - Ecosystem sustainability - Forest condition assessment - Agriculture and food security - Livestock - Cities and urban areas	- Floods - Landslides - Soil erosion - Water scarcity - Wildfire - Extreme temperatures - Compound risks	- REDD+ / LULUCF - Sustainable forestry

Eoclima **coastal risk management** service offers the following **products**:

The **Coastal flooding** product provides identification, delineation and grading of flood events and mapping of flooding potential in coastal and riverine environments. Flooding likelihood integrates analyses of coastal erosion, sea level rise, and land subsidence using EO data.

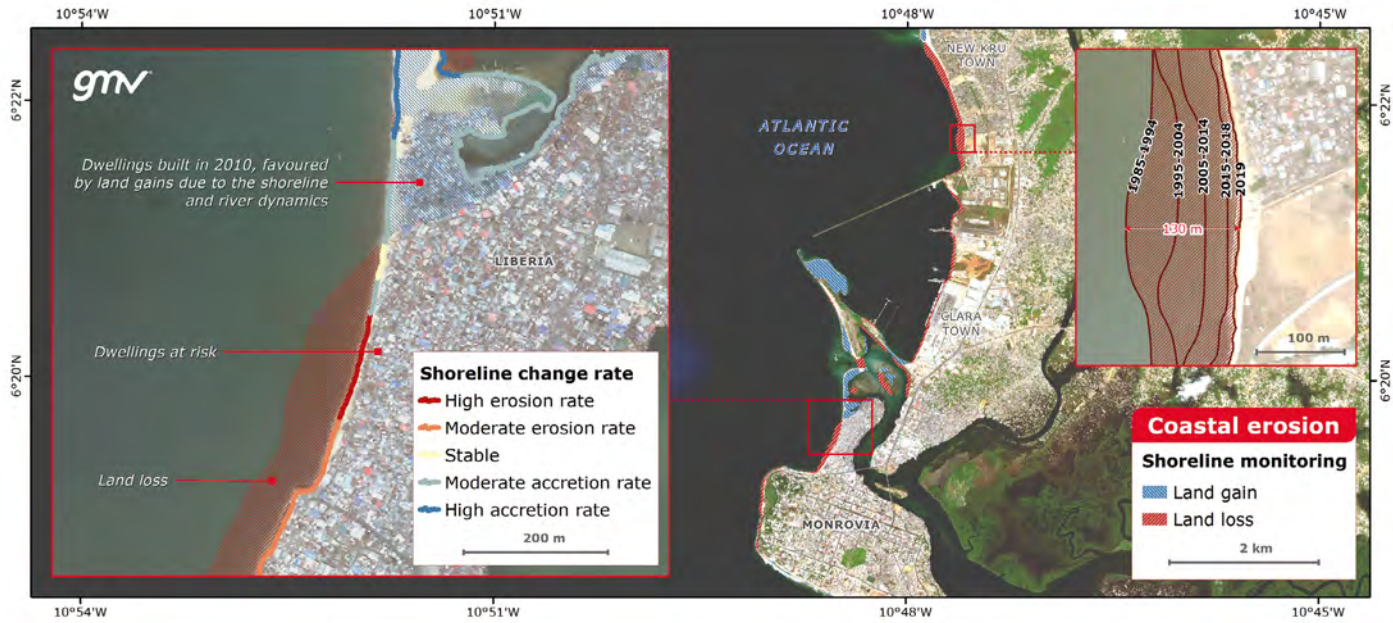
The **Coastal erosion** product evidences the shoreline changes for a defined time period. Shoreline change detection and monitoring utilizes a thoroughly tested methodology for consistent and reliable water body detection based on combined satellite optical and SAR imagery. Accretion and erosion levels are derived from the shoreline changes and the geomorphologic analysis of the coast.

The **Sea-level rise** product provides access to both historic and projected global time-series information on sea level changes and anomalies using EO data and climate projections.

USE CASE 1: MAPPING COASTAL EROSION IN GREATER MONROVIA, LIBERIA

Since 2013, sea-level rise and coastal erosion have displaced more than 6,500 and destroyed 800 houses in the West Point township of Monrovia, Liberia. Sea-level rise leads to erosion and causes the shoreline to retreat landwards, increasing the risk of displacement. Dwellings built in 2010, favoured by land gains due to the shoreline and river dynamics, are at a high risk of coastal flooding. The World Bank is developing a systematic exchange of information on capacity-building and investment project financing with the Liberian authorities to identify adaptation policies that can help Monrovia be better prepared to absorb urban growth in a context of extreme poverty, fragility, and increasing risks from climate change.

Monrovia's shoreline evolution is monitored through a satellite image time-series of nearly 40 years. Shorelines are retrieved by satellite imagery at different time periods to take into consideration the natural water flow (waves, heavy swell, and tides). The coastline erosion rate is estimated from the shoreline changes and adjusted by the coastal geomorphology obtained from very high spatial resolution satellite imagery. By monitoring and mapping the impact of historical coastal erosion, the coastline can be categorised according to its resilience and decisions can be made to either adapt, defend, or move coastal communities and assets. The Earth Observation coastal erosion product supports World Bank' studies to determine where to best make investments and identify hotspot areas that need immediate intervention.



(Left) Analysis of the shoreline change rate and (right) temporal shoreline gain and loss (1984 -2019) in Greater Monrovia.

USE CASE 2: MODELLING COASTAL FLOOD RISK IN GREATER MONROVIA, LIBERIA

Mapping of sea-level driven flood risk helps to understand risks in coastal areas and to make more informed decisions about how to reduce or manage the risk. Following IPCC's definition, the climate risk is the function of hazard, exposure and vulnerability. The analysis performed for the World Bank project includes the analysis and projected impact of the coastal hazards such as sea-level rise rate and coastal erosion from shoreline changes in Greater Monrovia's from the 80's, land subsidence rate using satellite radar altimeters, coastal low-lying areas likely to be flooded and the identification of critical facilities. The coastal hazards are combined with the exposure and vulnerability analysis of the socio-economic features obtained from the population density, critical infrastructures and settlements detected from satellite imagery and ancillary data resources to estimate a flood risk assessment.

The **potential coastal flooding** product supports the flood modelling analysis in Monrovia, evidencing the coastal flooding risk for the city in the near future. A flood modelling and mapping can help authorities to identify the most effective actions to manage flood risk and develop adaptation plans, considering where risk management could be most effective, and enable better planning decisions to avoid unnecessary development in risk areas.

The map shows the coastal flood risk analysis in West Poin and Clara town (Greater Monrovia, Liberia) devired by analyzing potential coastal hazards (flooding, land subsidence and sea-level rise, erosion) and the exposure and vulnerability (settlements, population density, critical urban elements).

Remote Sensing
&
Geospatial Analytics

For more information on the products under this service and the parameters included contact us on eoclima@gmv.com!

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