



WP3 : MONITORING AND MITIGATION OF COASTAL EROSION

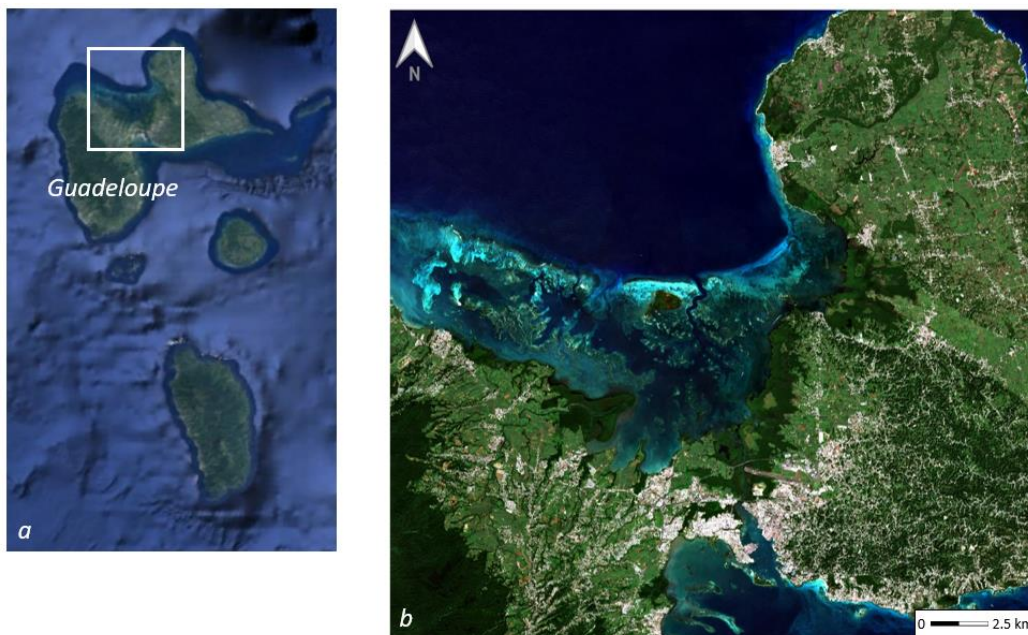
Mapping the distribution of mangrove ecosystems in the Caribbean using remote-sensing to assess their role in the protection against coastal erosion

Context

Mangroves are highly productive tropical and subtropical ecosystems at the interface between land and sea. They provide important ecosystem services, including helping to reduce coastal erosion and attenuate waves, which helps provide valuable protection against extreme natural events, the frequency of which increases with climate change. However, on a global scale, the extent of mangroves continues to decrease, with a net loss of 6,000 km², reduced by 4.3% between 1996 and 2016. The loss of mangroves in the world is linked to anthropogenic causes (human population growth and associated coastal development, land conversion for aquaculture and agriculture and environmental changes (sea level rise, increase in frequency and intensity of natural weather events , acidification and hypersalinization of the oceans). Since the mid-2000s, there has been an increased awareness of the services rendered by mangroves. In addition to being recognized by multilateral environmental protection agreements, mangroves have been at the center of attention of many international research or conservation programs and donors have funded mangrove conservation actions in the world over the past 15 years. Remote sensing has been widely proven to be an essential tool for monitoring and mapping highly threatened, often difficult to access, mangrove ecosystems. The study of mangroves benefits greatly from the current context of Earth observation with a multiplication of data sensors of different nature (optical and radar), resolutions (spatial, temporal and spectral), often free, associated with open tools. A reference methodological guide (IFRECOR, 2015) has been published to define indicators for monitoring the state of mangroves. With the last global mangrove mapping dating from 2010, the CARIBCAOST project produced an up-to-date mapping of mangrove distribution in the Caribbean from Sentinel 2 images at 10m resolution.

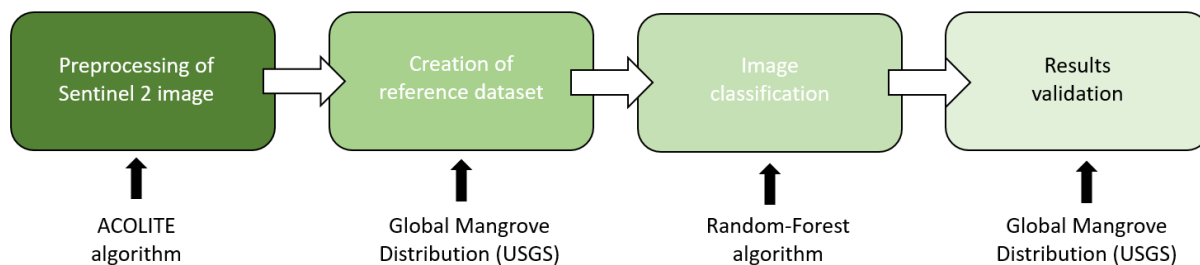
Data and methods

The mapping of the distribution of mangrove ecosystems in the Caribbean carried out under CARIBCAOST is based on the use of Sentinel 2 optical images 2 at 10 m spatial resolution. These images, freely available every 5 days, are provided by the European Space Agency within the framework of the Copernicus program (<https://www.copernicus.eu/fr/propos-de-copernicus/infrastructure/decouverte-nos-satellites>).



Sentinel 2 (©ESA, 2020) image of January 2020 on Cul de Sac (b) in Guadeloupe (a, GoogleEarth background).

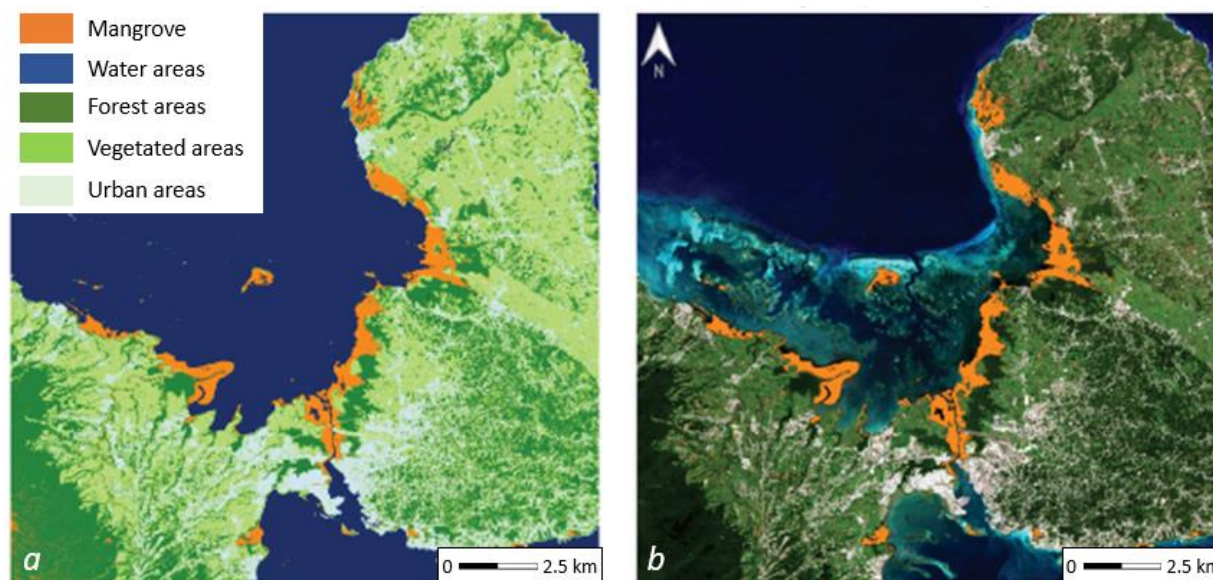
The mangrove mapping was carried out by a supervised classification approach on a Sentinel 2 image from January 2020 (preprocessed with the ACOLITE algorithm developed by the Royal Belgian Institute of Natural Sciences <https://odnature.naturalsciences.be/remsem/software-and-data/acolite>), using the USGS Global Mangrove Distribution benchmark as reference data (<https://data.unep-wcmc.org/datasets/4>) using a Random-Forest algorithm.



Methodological framework for the mapping of mangrove distribution using Sentinel 2

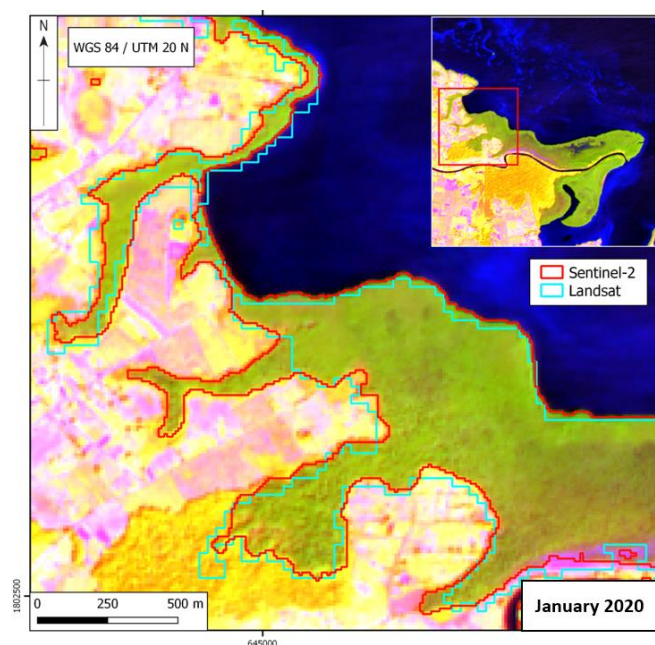
Results

The processing of the Sentinel 2 image from January 2020 made it possible to produce a 5-class land use map including the distribution of mangroves.



Mapping of land cover (a) and the distribution of mangroves in orange (b) of the Cul-de-Sac area (Guadeloupe) from a Sentinel 2 image from January 2020 (©ESA, 2020).

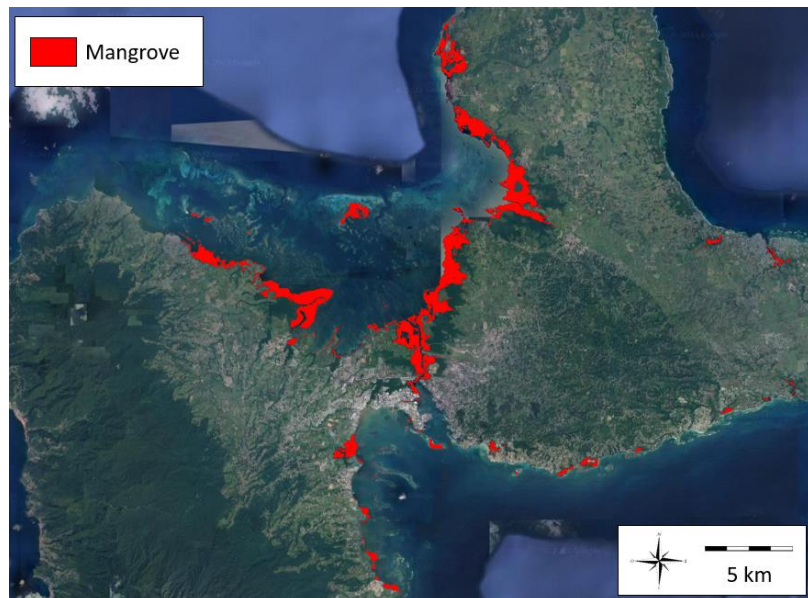
The comparison between the results obtained in 2020 with Sentinel 2 at 10 m resolution and the “Global mangrove distribution” product at 30 m resolution from Landsat in 2010 shows that Sentinel 2 images offer real added value for the mapping of mangroves, by allowing better detection and finer mapping, which improves knowledge on the distribution of mangroves.



Comparison between the results obtained in 2020 with Sentinel 2 at 10 m and the « Global Mangrove Distribution » product at 30 m from Landsat in 2010 on Cul-de-Sac (Guadeloupe).

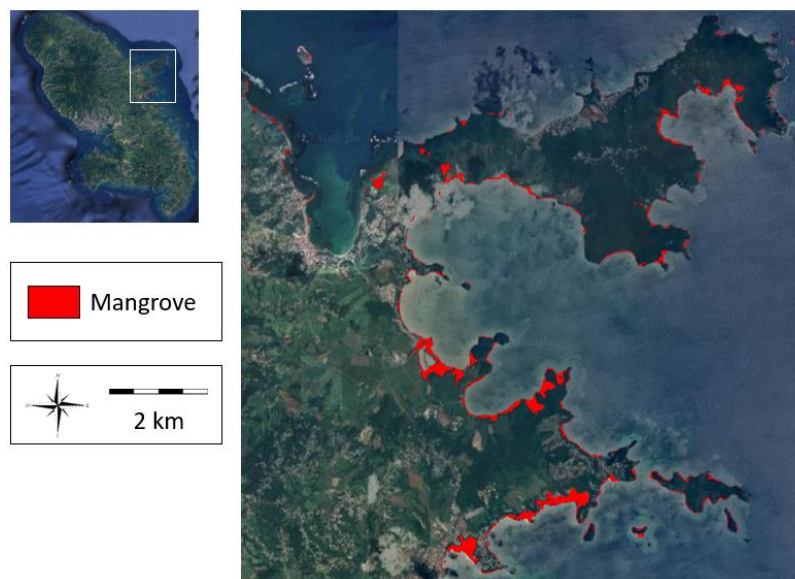
The availability of Sentinel 2 data and the automation of the method presented above make it easy to reproduce the process for the regular updating of the mangrove distribution map. The mangrove distribution maps on all the project pilot sites are presented below, and can be viewed on the CARIBCOAST project digital portal.

Guadeloupe



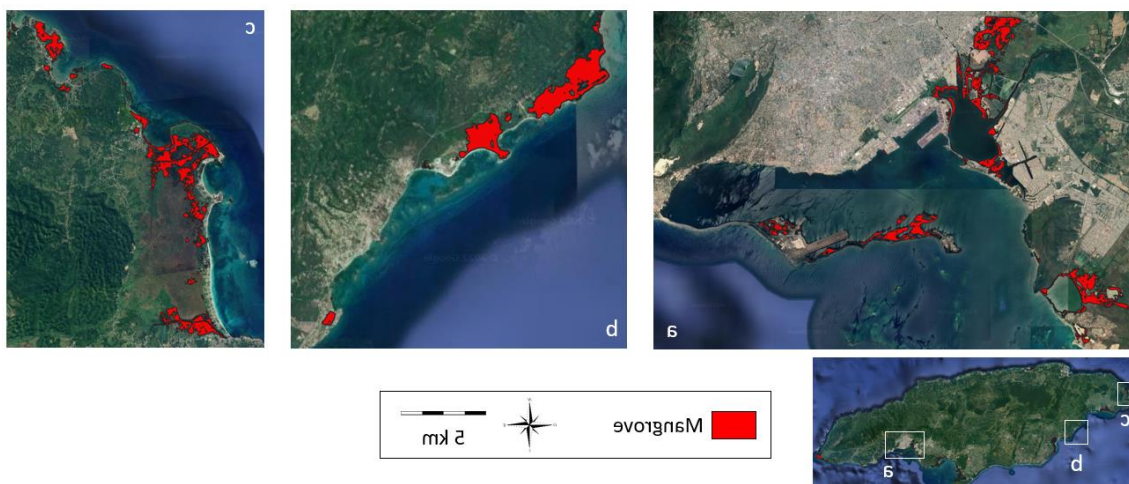
Mapping of the distribution of mangroves in Guadeloupe from a Sentinel 2 image from January 2020 (©ESA, 2020).

Martinique



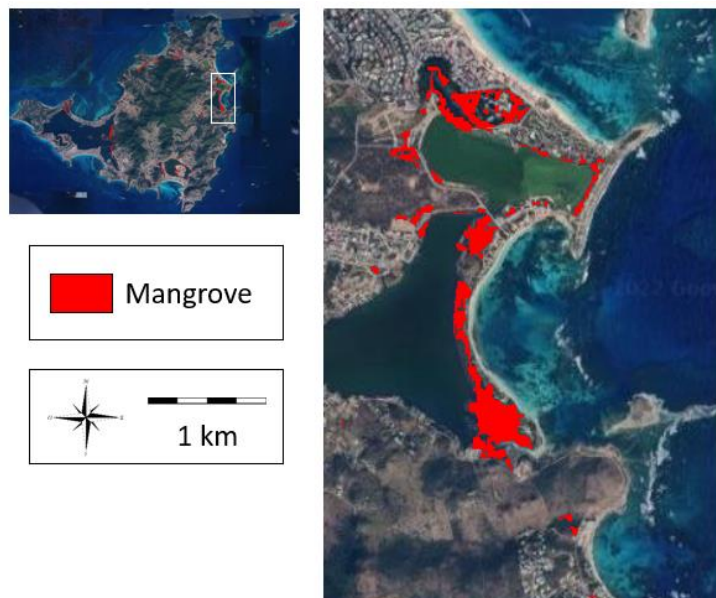
Mapping of the distribution of mangroves in the Anse Etang area (Martinique) from a Sentinel 2 image from April 2020 (©ESA, 2020).

Jamaica



Mapping the distribution of Jamaican mangroves in Kingston (a), White House (b) and Negril (c) from Sentinel 2 images from December 2019 to March 2020 (©ESA, 2019 and 2020).

Saint-Martin

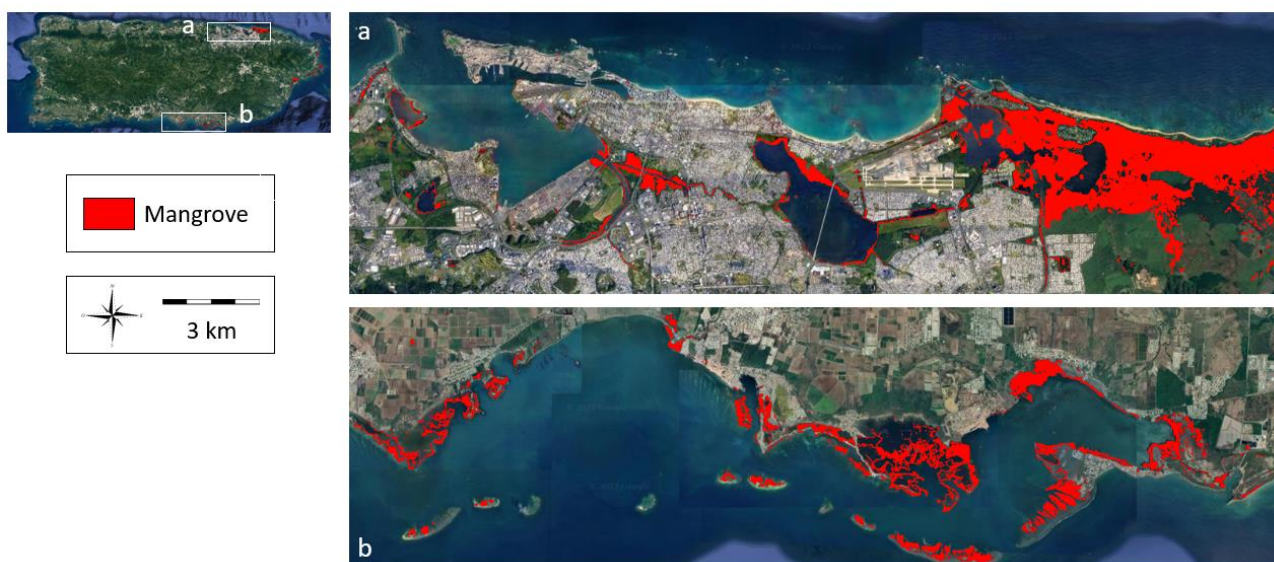


Mapping of the distribution of mangroves in the Etang Barrière aux Poissons area (Saint-Martin) from a Sentinel 2 image from May 2020 (©ESA, 2020).

Puerto-Rico

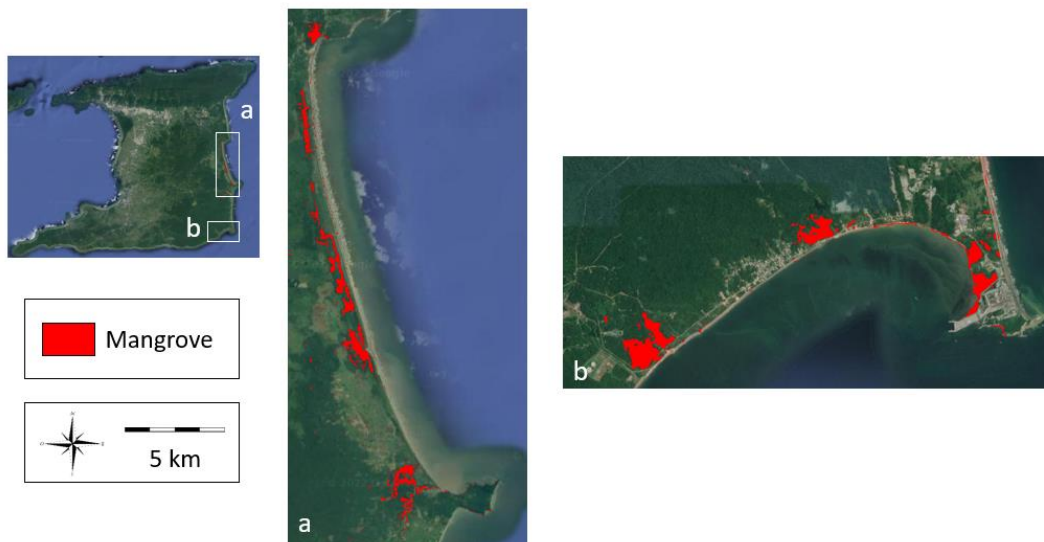


Map of the distribution of Puerto Rico's mangroves in (a) Rincon, (b) Yabucoa and (c) Fajardo from a Sentinel 2 image from February 2020 (©ESA, 2020).



Map of the distribution of Puerto Rico's mangroves at (a) Isla Verde and (b) Jobos from a Sentinel 2 image from February 2020 (©ESA, 2020).

Trinidad and Tobago



Map of the distribution of mangroves from Trinidad and Tobago to (a) Manzanillas and (b) Cocos from a Sentinel 2 image from July 2019 (©ESA, 2019).

References

Florent TAUREAU, Marc ROBIN, et Françoise DEBAINE (2015), "Guide méthodologique pour la cartographie des mangroves de l'Outre-mer français," *Documentation Ifreco*, <http://ifreco-doc.fr/items/show/1839>.