Sustainable Blue Economies Technical Assistance Platform

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Non-technical summary of
Project ShoreSecure (Grenada): Nationwide Shoreline Change

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SBE Document Control

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Introduction

Project ShoreSecure (Grenada) investigates the dynamics of shoreline change and resilience across coastal regions, with the aim of informing sustainable management strategies for local communities and policymakers. This non-technical summary (NTS) of *Barnes et al., 2026. Project ShoreSecure (Grenada): Nationwide Shoreline Change. Sustainable Blue Economies Programme Project #220* presents evidence-based insights into long-term trends, hurricane impacts, and practical recommendations for strengthening the protection and adaptive capacity of Grenada's coastline in the face of environmental hazards and climate change.

The shoreline analysis method, outlined in this video, employed combines historical mapping[1] with up-to-date satellite imagery and field observations to assess changes over time. By utilising geospatial tools and statistical techniques, the study quantifies rates of erosion and accretion, pinpointing areas most vulnerable to natural disturbances and human activities. This robust approach ensures that findings are grounded in both long-term data and recent events.

Summary of Results

Selected results are shown below. Although this NTS, and the *Barnes et al. (2026),* only discuss selected beaches, nationwide shoreline change results are available and presented for the whole of Grenada in the Appendices.

(i) Background rates of change: The erosion/stability/accretion ratio for Grenada is 34/33/33%. Several shorelines exhibit moderate to high rates of erosion. For example, Sauteurs has the highest erosion and accretion rates in Grenada, concentrated along a single 800-meter section of shoreline (Figure 1). The construction of the Sauteurs breakwater in 2017 has significantly influenced shoreline dynamics, causing erosion on the western side of up to 46 m and accretion in the breakwater lee of up to 130 m. Potential mitigation measures for the eroding shoreline include modifying the existing breakwater's size (length and/or elevation), recycling beach sediment from accreted to eroded areas, or introducing additional engineering solutions.

The south-facing shorelines at Maurice Bishop International Airport are slowly accreting, however the eastern section next to the groyne/outfall pipe is eroding (Figure 2). This structure may have been constructed to deliberately trap sediment in front of the three airport ponds immediately landward, however, the updrift accretion is starving western beaches (around 10 m retreat between 2010 and 2025, which has almost outflanked the structure and therefore poses a risk to its integrity and any landward infrastructure.

[1] Only available historical shorelines were included. It is acknowledged that there are other historical datasets that could, with some effort, be processed and incorporated to provide a more robust and complete analysis. For example, scanning, georeferencing and digitising shorelines from historical aerial photos, extracting shorelines from satellite data owned by NGOs, or shoreline extraction from Landsat and Sentinel satellites with new methods that work well on coarse resolution data.

In contrast, Hillsborough Bay on Carriacou shows a patchwork of eroding, stable and accreting beach sections, but with moderately high rates of change in some locations (-2.2 – 0.79 m/yr) (Figure 3). Despite these patches of erosion and accretion, the average rate of change is near zero, which could mean that beach volume is stable within the bay.

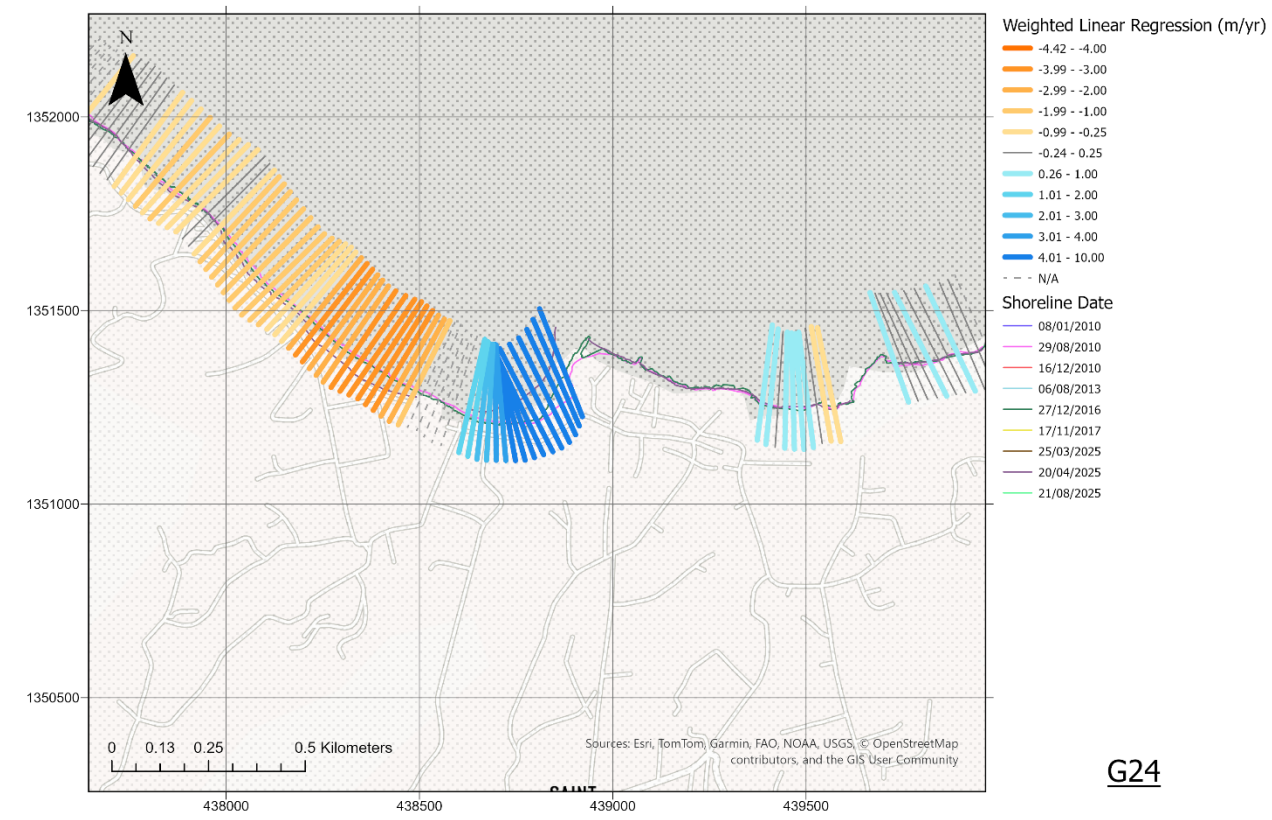
(ii) Impact of Hurricane Beryl on shorelines: Hurricane Beryl caused abrupt shoreline erosion in St Patrick, with 90% of the measured locations retreating as a result of hurricane waves. Nine months post-hurricane, the shoreline response was still dominated by erosional trends.

On Carriacou and Petite Martinique, the picture was different. There, post-hurricane beaches tended to advance in most locations, which is probably due to deposition of large volumes of debris and coral fragments from the extensive shallow reefs landing on the coast (Figure 4 and Figure 5). However, the mean shoreline advance of 2.9 m just after the hurricane reverted to slight erosion (mean retreat of -0.4 m) 7.5 months later. The most recent shorelines from six Carriacou beaches in March 2026 (20-months post-hurricane), also showed erosion dominance.

Recommendations

The **ShoreSecure** project provided GNSS and drone equipment, training (to government, NGOs and two communities (St Patrick, Carriacou and Petite Martinique), an open-source shoreline analysis framework that can be updated and maintained with future shorelines, and a baseline for shoreline change patterns based on results from satellites and limited historical records. It made six important recommendations for the future:

1. Recognising the strong community uptake, expand training to other interested coastal communities. This will empower local communities with knowledge of their evolving coast and how to adapt, whilst simultaneously providing reliable evidence to the National Shoreline Change Database for policy and coastal management.
2. Encourage the sharing of beach survey skills, especially with young people, to promote STEM career opportunities, help the wider community adopt new technologies and improve the evidence base. In particular, consider the potential for high schools and colleges to engage student projects in data collection and analysis.
3. Set up a process that allows local suitably qualified communities and NGOs to access the GNSS survey equipment for beach monitoring.
4. As the official owner of shoreline data, the GoG should consider how data will be stored and made accessible, both within government (i.e., across ministries) and to the public (i.e., researchers, school projects, community groups etc.). Accessible data makes for robust decision making.
5. Given the provision of new, easy-to-use GNSS equipment that yields high-quality results, we recommend the development of a formal monitoring plan, that would be supplemented by NGO/community results and trigger enhanced monitoring in areas of specific interest (e.g., where homes, infrastructure or livelihoods are at risk). In such cases, the supplied drone equipment and software should be considered for detailed 3D beach topography (i.e., not just the shoreline) and beach volumes.



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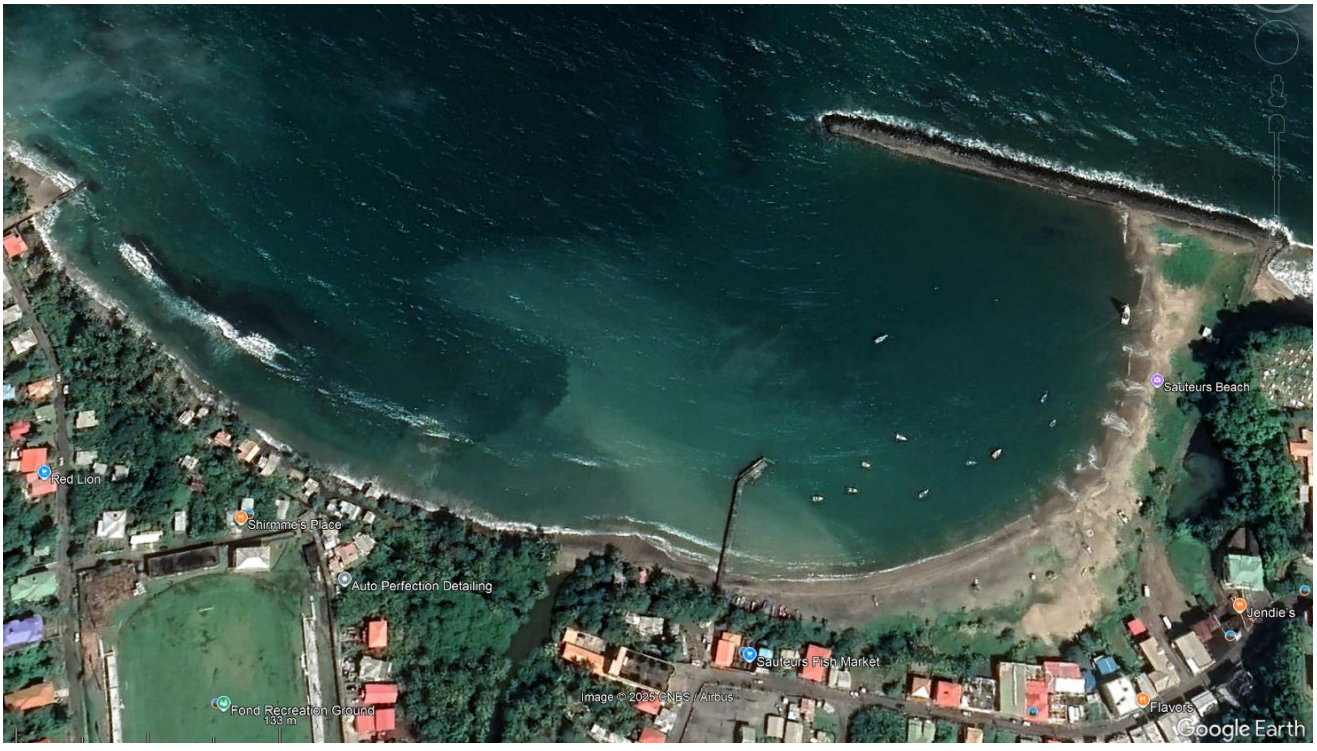

Figure 1: Sauteurs shoreline change rate (m/yr) between 2010 and 2025 (top) and November 2022 satellite image highlighting the accreting (blue) and eroding (red) frontages, and housing at risk.

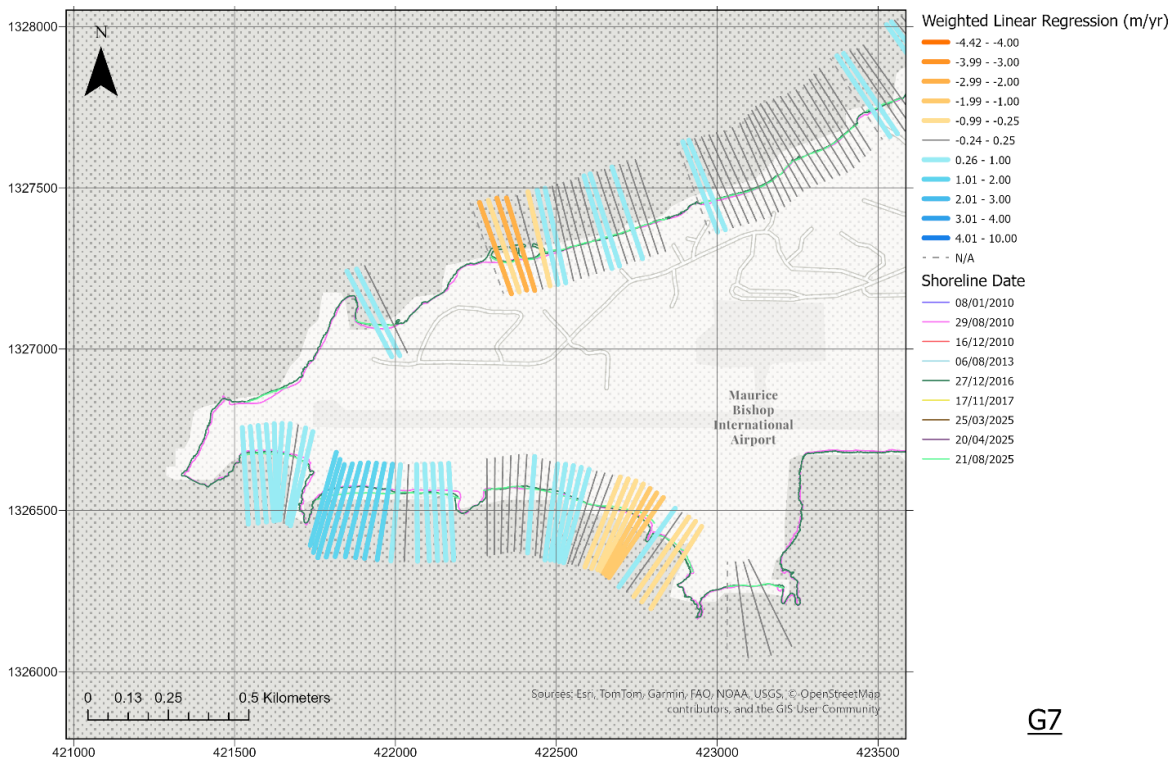

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Figure 2: Top: Airport region WLR (m/yr) between 2010 and 2025. Bottom: Google Earth images of the outfall / groyne structure, to the south of Maurice Bishop Airport. Arrows mark eroding frontage that may affect the structure and ultimately the ponds, and dashed red lines mark a linear ridge between the groyne/outfall and the ponds, which is possibly a buried pipeline.

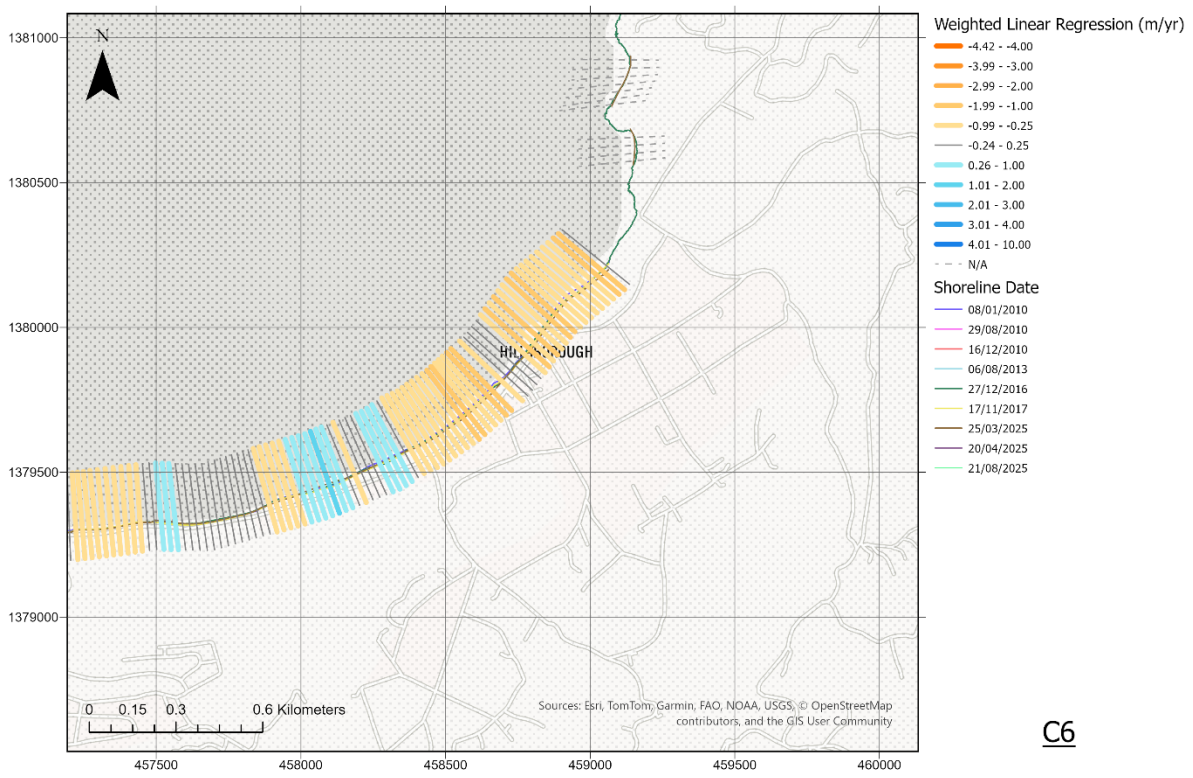

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Figure 3: Hillsborough Bay, WLR rate between 2010 – 2024.

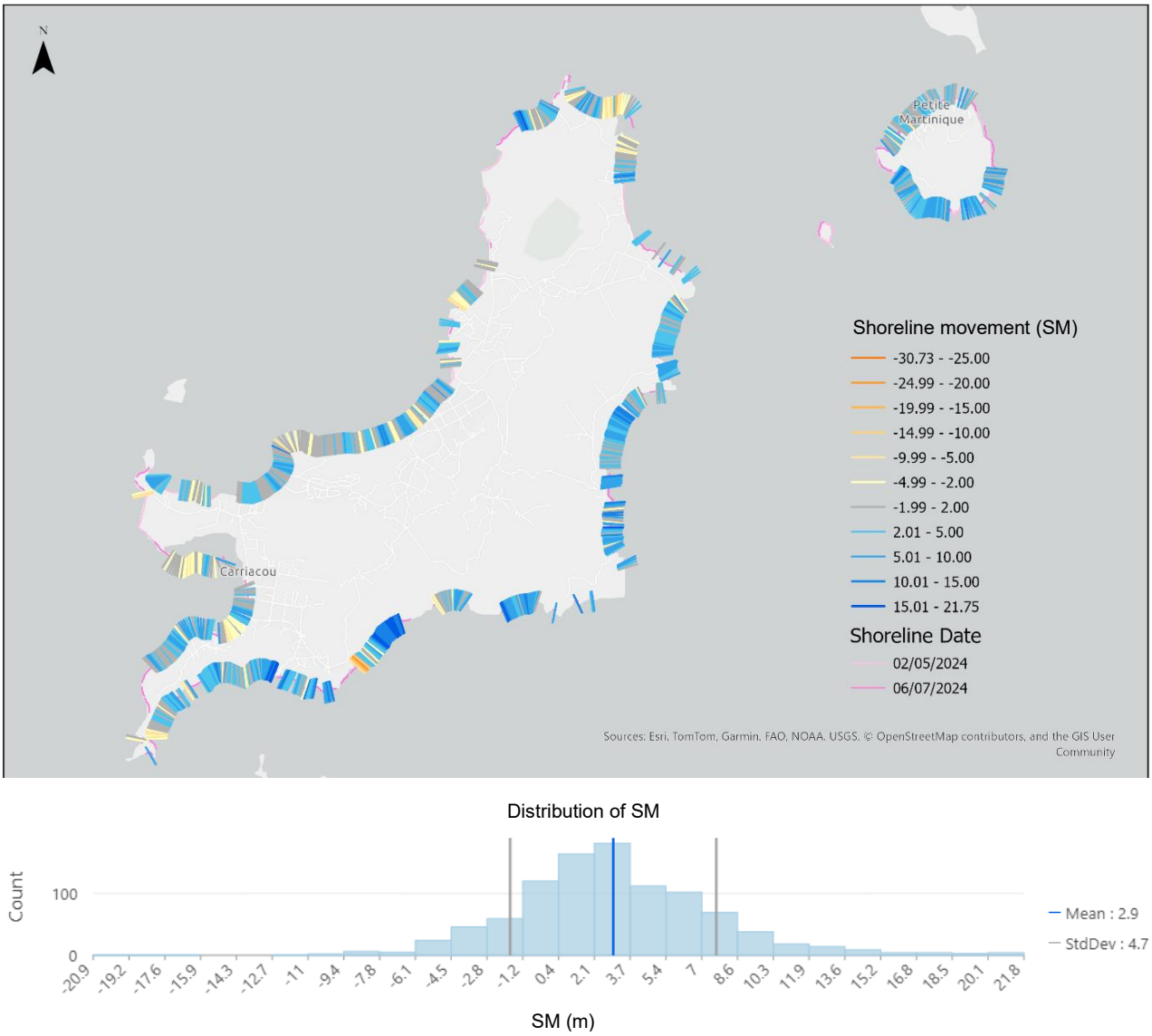

Figure 4: Carriacou and Petite Martinique Shoreline Movement (m) between 02/05/2024 and 06/07/2024 – 5 days post Hurricane Beryl.

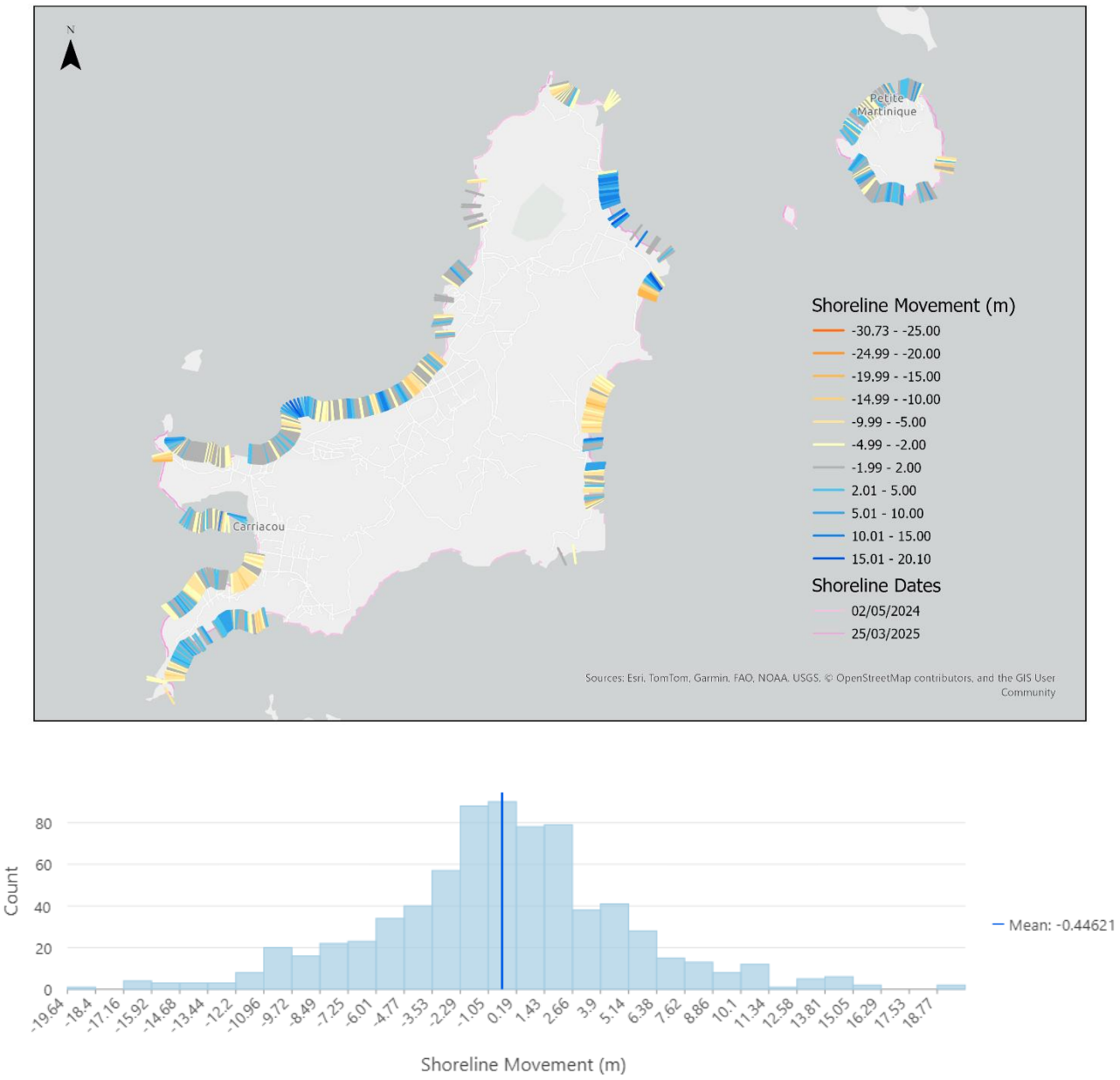

Figure 5: Carriacou and Petite Martinique Shoreline Movement (m) between 02/05/2024 and 25/03/2025 – 7.5 months post Hurricane Beryl.

Sustainable Blue Economies Technical Assistance Platform

The SBE Technical Assistance Platform enables Small Island Developing States (SIDS) to request specialist assistance from a partnership of UK marine science and management organisations to co-develop the evidence, tools and capacity for climate resilient, equitable sustainable and sustainable blue economies.

The Platform will achieve this through strengthened ocean management, blue economic development and nature-based solutions, with the aim of reducing poverty and vulnerability, strengthening livelihoods, building economic and climate resilience, and promoting equitable development pathways.

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