Dutch Disaster Risk Reduction and Surge Support (DRRS) Programme – Desk Study OECS, Grenada (2025)

Context

"The Eastern Caribbean's coastal zones are at the frontline of climate impacts—rising sea levels, accelerating coastal erosion, and intensifying storm surges threaten ecosystems, infrastructure and livelihoods. Hurricane intensity in the Eastern Caribbean has increased by more than 10% over the past decade, with coastal erosion rates up to 1–2 m/year in some Grenadian shorelines. (OECS)"

As climate impact is growing OECS and its member states are exploring ways to adapt. So far this has been challenging as "fragmented data systems and uneven technical capacity across Member States impede timely, evidence-based decision making for Integrated Coastal Zone Management (ICZM). (OECS)"

They have identified the need for a regional geospatial platform (Digital Earth Caribbean (DEC)), to bridge these gaps by integrating multi source Earth Observation (EO) data into a unified, scalable dashboard tailored to Small Island Developing States (SIDS) vulnerabilities and would like to pilot this in Grenada. In Grenada there is an opportunity as Grenada's new National Adaptation Plan is due for revision in early 2026 (DEC should inform this process) and there is already some relevant data available.

The DEC should "facilitate advanced coastline analysis, and flood plain analysis, enabling timely and data-driven decisions to address coastal changes" and include a "coastal vulnerability dashboard" (OECS).

Objective

The objective of this assignment is twofold:

- 1. "To assess whether the requested support effectively addresses the most urgent challenges—that is, whether the development of Digital Earth Caribbean (DEC) represents the most appropriate way forward; and
- 2. To determine the next steps, i.e., to scope how the Disaster Risk Reduction & Surge Support (DRRS) Programme can best contribute within its mandate. (RVO)"

To reach these objectives the following activities have been requested:

a) "Review the OECS request and existing initiatives to see how the proposed Digital Earth Caribbean (DEC) project adds value, fits with current efforts, and helps address the most urgent climate-related coastal problems.

- b) **Inventory existing data platforms**—such as those hosted by Copernicus, Deltares, NASA, and others—that provide various environmental data sets. Discuss the rationale for DEC's existence alongside these initiatives, and explore whether and how they can be integrated.
- c) **Map key actors and follow-up possibilities,** including potential financing sources and partnerships, to identify opportunities for collaboration and resource mobilization within the regional context, ensuring DEC's sustainability and scalability.
- d) Formulate a blueprint outlining the essential components, indicative costs, and steps necessary for the development and successful deployment of DEC. This should also define the potential role and contribution of a DRRS intervention in supporting these elements.
- e) **Provide advice on the scope, required expertise, and modality** for a potential DRRS team deployment that would effectively support DEC's development, including reasons why this undertaking cannot be directly marketed. (RVO)

Existing related initiatives

The following initiatives have been identified in collaboration with OECS:

Initiative	Who is involved?	Timing	Relation			
National						
National Adaptation Plan (NAP)	Lead: Ministry of Climate Resilience, the Environment & Renewable Energy (MCRE&RE), Grenada's GCF National Designated Authority (NDA). Recent revision work supported by the Global Water Partnership-Caribbean (GWP-C) / NAP Global Network.		DEC outputs will feed directly into the evidence base for coastal resilience priorities.			
Finalization and operationalization of the National Ocean Policy and Strategic Action Plan	Led by the Ministry of the Blue Economy & Marine Affairs; the policy framework is national (2020–2035).	Policy adopted Dec 2021 for the period 2020–2035; active operationalization steps underway (e.g., Grenada chaired the new regional Ocean Coordination Mechanism in May 2025).	DEC would provide vital spatial data and monitoring capacity to support this implementation.			
Integrated Coastal Zone Management (ICZM) Policy	Lead: Environment Division/MCRE&RE and the CZMU Unit; policy development supported by GIZ programmes (ICCAS & CATS).	Policy adopted Nov 2015; the ICZM Act No. 8 of 2019 provides the legal/institutional framework for implementation.	Emphasizes spatial planning, hazard mapping, and data- driven decision-making for coastal development.			
Establishment of a Coastal Zone	Mandated under the ICZM Act (2019); the Unit (with a Director) and a Coastal Management &	Established in law in 2019;	DEC can directly strengthen the technical foundation			

Management Unit (CZMU)	Ocean Governance Committee) operates under the responsible ministry (now Blue Economy/MCRE&RE).	2020s (CZMU now developing Marine Spatial Planning (MSP) tools to manage competing coastal uses).	
Digital Transformation Strategy	Government of Grenada / Ministry of ICT under the Caribbean Digital Transformation Project (CARDTP); high-level ICT leadership by the Prime Minister (CARICOM lead on ICT)	Flagship "big digital transformation programme" launched 15 Mar 2023; ongoing nationa and regional ICT actions highlighted in 2025 (CANTO, Throne Speech).	Advancing national geospatial infrastructure and open ldata systems.
Ecosystem-Based Adaptation (EbA) projects	Government (MCRE&RE, Forestry & National Parks) with GIZ/UNDP ICCAS, UNEP coastal EbA, The Nature Conservancy (AWE), and GEF Small Grants Programme partners.	Multiple waves: ICCAS (2012–2019); UNEP coastal EbA & TNC AWE continuing; climate-smart/agro-ecosystem and community projects ongoing through 2025.	monitoring, and evaluation
Climate Resilient Water Sector in Grenada (<u>G-CREWS,</u> <u>GCF FP059)</u>	Ministry of Finance (MoF) with implementation execution by National Water and Sewerage Authority (NAWASA). A Water Resource Management Unit (WRMU) is being established. Support by GIZ.	Under implementation (2019–2025/26)	High-value synergies with DEC on hydromet and hazards
Grenada Blue Growth Coastal Master Plan & Marin Spatial Planning (MSP)	Government of Grenada with World Bank & OECS under the Caribbean Regional Oceanscape eProject (CROP). Support by the Netherlands.	>2016 long-term vision for sustainable development	Spatial planning framework for sustainable blue economy development and marine resource management that could benefit from DEC
Maritime Economy Plan	Government of Grenada (Ministry of Sport, Culture and the Arts, Fisheries and Cooperatives) funded by UK Government (under the Commonwealth Marine Economies (CME) Programme)	Alignment with Grenada's National Ocean Policy (2020 to 2035).	Aligns ocean governance with economic diversification and climate resilience

	Grenada's NDA: MCRE&RE	Readiness support since	DEC aligns with data
Green Climate Fund	Delivery/support: GIZ (e.g.,	2017; GCF's updated 2024-	systems and monitoring
(GCF) Readiness and	"Getting Grenada GCF-Ready"),	2027 Readiness strategy	requirements.
	Grenada Development Bank	adopted; 2025	
(e.g., OECS resilience	(GDB) and regional partners	private-sector readiness	
projects)	(including OECS)	activity led by GDB	
r -J/		underway.	

IDB Compete Caribbean Pillar 2 technical support	Compete Caribbean Partnership Facility (CCPF) led by IDB with the UK FCDO and Government of Canada; Government of	Prior support to Grenada 2018–2021 and 2019–2024 (TES) with continuing technical assistance under	•
	Grenada as counterpart.	Compete Caribbean+.	as an enabling data
			layer for
			implementation
	CARICOM, OECS, UNEP,	2025 onwards	Regional governance
Ocean Coordination	ProCaribe+		platform for integrated
Mechanism (OCM)			ocean management and
for the Wider			blue economy
Caribbean			coordination
	OECS, Conservation	2025 onwards	Focus on blue carbon,
OECS-Conservation	International		ecosystem restoration,
<u>International</u>			and financing for
<u>Partnership</u>			nature-based solutions.

As can be concluded from above table there are many ongoing initiatives to which the proposed Digital Earth Caribbean (DEC) project adds value. These initiatives are recent and ongoing meaning the DEC fits with current efforts.

The proposed DEC helps addressing the most urgent climate-related coastal problems. Besides providing a solution to the "fragmented data systems and uneven technical capacity" challenges, already mentioned, the meeting with OECS (18-09-'25) helped clarifying that DEC would address some other key concerns:

- The need for a full cycle DRM approach: mitigation/prevention, preparedness, response, recover; For mitigation/prevention proper data to plan and base decisions on is key. The lack of a reliable and complete source of data makes the current DRM practises opportunistic and often related to response and recovery. OECS wishes to move from a reactive approach towards a more proactive approach. As various sources confirm it's often more cost effective to act in the mitigation/prevention and preparedness part of the DRM cycle.
- Donor response after disasters (e.g. after hurricane Beryl in 2024) is currently not as effective as
 desired; there are many duplications in efforts and the approach is sometimes uncoordinated and
 scattered. The DEC can inform and structure these approaches significantly.
- IFI's are overwhelmed with project ideas but these ideas often lack proper justification. Grenada and many of the other SIDS struggle to develop solid proposals that can easily be adopted by the IFI's. The DEC will accommodate these processes.
- All islands deal with the same limitations, so a joint effort would support many.

Inventory existing data platforms

Open-source data and platforms are frequently used for analyses of risks and justification of investments. Depending on the data this is sometimes comparable to 'driving without glasses' especially at lower scales (implementation level). By applying this approach, risks and thus investments can be significantly overestimated, meaning justification and decision making becomes more

complex. Especially in combination with overly conservative planning and design caused by incomplete/ inaccurate data. At the same time there also the flipside where underestimations (which happens as well) can potentially even a be bigger threat as measures will not address the actual risks. The above illustrates that platforms need to be developed on actual needs and user requirement though a 'co-design' process.

Platform	Strengths	Limitations
Copernicus (EU Earth Observation Programme)	Free, open EO data (Sentinel missions)Global coverage, frequent updates	 Raw/semi-processed data; requires technical expertise No SIDS-specific hazard analytics No decision-support tools
Digital Earth Africa	Cloud-based, harmonized EO datasetsDashboards for land/water monitoring	Africa-focused; not tailored for CaribbeanLimited to pre-defined productsNo ICZM or policy integration
Deltares AquaMonitor	 Global shoreline change and surface water dynamics monitoring using satellite imagery. Provides long-term historical trends (since the 1980s) for coastal morphology and inland water bodies. 	 Primarily retrospective analysis, no recent or real time updates Global scale; lacks local calibration for small islands No integration with socio-economic or hazard data; focuses only on physical shoreline/water changes. Requires technical interpretation Visualization only, no predictive modelling
NASA Earthdata / Giovanni	Extensive global datasets(climate, ocean, land)Free and validated	Technical interface; steep learning curveData latency for some productsNo Caribbean-specific hazard analytics
Caribbean Risk Information System (CRIS)	- Regional hazard and risk data - Supports DRM planning	Limited to hazard layersNo predictive analytics or decision- support features
Regional Environmental Monitoring Data Portal (REMDAP)	- OECS-led clearinghouse for environmental indicators - Supports MEA reporting and policy tracking.	- Static indicators; lacks real-time updates - No integrated modelling or scenario tools
Caribbean Marine Atlas (CMA2)	- Regional geospatial platform for marine environment & ICZM - Supports ocean governance and CLME+ SAP monitoring.	 Static datasets; limited real-time analytics; Geared toward experts, not decision-makers.
Caribbean Coastal Data Centre (CCDC)	Archives coral reef, seagrass, mangrove, and water quality data for >30 Caribbean countries.	Historical datasets; limited visualization and no automated analytics.
Caribbean Data Portal (SpatialAgent)	Aggregates marine, climate, and socio-economic datasets; links to global EO sources.	Fragmented, not tailored for DOECS/members decision-making; lacks integrated workflows.

Caribbean Ocean and Aquaculture Sustainability Facility (COAST) Dashboard	Parametric insurance and fisheries risk data for Caribbean states.	Narrow scope (fisheries risk); not a full coastal vulnerability or hazard platform.
Caribbean Climate Outlook Forum (CariCOF)	Seasonal climate forecasts and drought outlooks for the Caribbean.	Focused on climate outlooks; no integration with coastal hazard or flood modelling.
Caribbean GeoNode (hosted by CDEMA)	Open-source geospatial data repository for DRM and hazard mapping.	Fragmented datasets; no advanced analytics or decision-support workflows.
Caribbean Blue Economy Data Hub (under UBEC)	Economic and marine spatial data for blue economy planning.	Early-stage; limited environmental hazard integration; not yet operational in all OECS states.

Why the DEC approach adds value to the above platforms/solutions

- Holistic data ecosystem: Combines EO, in-situ, socio-economic, and hazard data in one platform, including difficult areas to get data in the coastal and nearshore zones.
- Fresh & on-demand insights: Monitoring, near-real-time updates and scenario modelling for coastal hazards, ability to request relevant insights
- Al-enabled & low barrier: Automated analytics, intuitive dashboards, and natural language queries.
- Decision-support focus: Tailored tools for ICZM, NAP revision, and disaster risk reduction—not just data layers.
- Scalable & regional: designed for OECS/Grenada but adaptable across SIDS.

Besides platforms we have also looked into publicly available data sources for Grenada to understand from where a potential DRRS initiative would have to be started.

Data type	Sources	Notes
Satellite Imagery	- Sentinel-1 & Sentinel-2	Good for shoreline change, land cover, vegetation health; needs processing for
3 ,	(Copernicus) - Landsat (USGS/NASA)	actionable insights.
	- Commercial satellite	actionable maights.
	imagery	
-	- SRTM DEM (NASA)	DEM resolution often too coarse for local
Topography & Bathymetry	- GEBCO global bathymetry	flood modelling; bathymetry incomplete
	- Some LiDAR surveys	for nearshore zones.
	(Grenada coastal areas,	
	project-based)	
Coastal Erosion & Shoreline Change	- Historical shoreline datasets from ICZM projects	Fragmented, not consistently updated; slacks predictive analytics.
	- AquaMonitor (Deltares)	
	global water change	
	detection	

Hydrometeorological Data	 Rainfall & temperature from Grenada Met Office G-CREWS project hydrology data NOAA climate datasets 	Sparse station network; limited real-time integration.
Marine & Coastal Ecosystems	- Coral reef, seagrass, mangrove maps (Caribbean Coastal Data Centre, UNEP- WCMC) - Reef Check & AGRRA surveys	<u> </u>
Socio-economic & Exposure Data	Census data (Grenada CSO)World Bank & OECS socio-economic indicators	Needs integration with hazard layers for vulnerability/risk analysis.
Hazard & Risk Layers	- CRIS (CDEMA) hazard maps - GCF project risk assessments (e.g., G- CREWS) - Historical hurricane tracks (NOAA)	Often PDF-based; not machine-readable or dynamic.
Policy & Planning Layers	- ICZM zones - Marine Spatial Plans (CROP) - Protected areas (UNEP-WCMC WDPA)	Exists but scattered across agencies; no unified geospatial platform.

With regard to the data we can conclude that:

- Fragmentation: Data exists but is siloed across agencies and projects.
- Timeliness: Many datasets are static or outdated; lack near-real-time updates.
- Accessibility: Most require technical expertise; not user-friendly for decision-makers.
- Integration: No single platform combines physical, ecological, and socio-economic data for actionable insights.

Re-usability of existing data

While Grenada and the wider OECS region already hold valuable datasets—such as satellite imagery (Sentinel, Landsat), shoreline change records, ICZM zoning layers, and hazard maps—their current usability is limited by fragmentation, inconsistent formats, and lack of integration into decision—making workflows. Many datasets are static, project-specific, or locked in PDFs, making them difficult to update or combine with socio-economic and hazard information.

Digital Earth Caribbean (DEC) should maximize the re-use of these existing assets by:

- Exploring, aggregating and harmonizing legacy datasets into a single geospatial framework.
- Applying (Al-driven) analytics to transform raw data into actionable insights.
- Using historical data for trend analysis and modelling.
- Embedding decision-support tools so that existing data informs ICZM, NAP revisions, and disaster risk reduction strategies.

This approach ensures that prior investments in data collection are not lost but leveraged as the foundation for a dynamic, future-ready platform.

Key actors and follow-up possibilities

The following funding sources have been listed in collaboration with the OECS:

Initiative	Who	Relation	Type of Funding; (Investments and / or TA)	Timing (if relevant
Small Grants Programme and Adaptation Fund	GEF	Community-level pilots (e.g., local data capture, citizen science, coastal monitoring micro- projects) that feed into DEC	TA + Small grant	Rolling country windows; annual calls
Green Climate Fund (GCF)		DEC aligns with data systems and monitoring requirements, so needed to fund e.g., OECS resilience projects.	Investments + TA	Project cycles/ Rolling, concept → proposal windows 1–2×/yr
GCCA+ Caribbean,	European Union	Funds climate services and information platforms.	TA & Pilot grants	Issued via regional calls- typically multi-year envelopes
World Bank's Caribbean Regional Resilience Building Facility	World Bank	Relevant for scaling DEC beyond Grenada	Primarily TA	Programmatic, aligned to WB regional calendars
Dutch bilateral mechanisms	Dutch Government (RVO etc)	Including the Blue Deal Programme and Partners for Water, which can enhance technical engagement and facilitate replication across OECS states		Competitive calls (annual or bi- annual)
CDB Climate Action / Environmental Sustainability windows	Caribbean Development Bank	Regional development finance; possible co- finance for DEC-enabled resilience projects		Project cycle; align with CDB country strategy windows
IDB Lab / IDB Climate	Inter-American Development Bank Group	Innovation grants + concessional windows for data platforms, GovTech, and climate services	TA + Pilot/Scale Investments	Thematic calls; country programming cycles

CAF – Development Bank of Latin America	CAF	Regional public-sector climate resilience and digital public infrastructure	Investments + TA	Country dialogue; rolling with periodic calls
AMEXCID / Mexican cooperation	Government of Mexico (AMEXCID; possible INEGI technical coop)	South-South cooperation; technical support on geospatial standards and data governance	TA (incl. in-kind) + limited pilot grants	Call-based / bilateral MoUs; plan jointly with Mexico counterparts
GEO Secretariat / GEO	GEO	In-kind/mini-grants, coordination, standards alignment; amplifies DEC as a GEO regional exemplar	TA (incl. in-kind)	Programmatic; tie to annual GEO Work Programme cycles
Caribbean Blue Economy Financing (Caribbean BLUEFin Project)	Caribbean Biodiversity Fund (CBF), UNEP, GEF	for blue economy and	pilots/ demonstration projects	Calls for proposal through National Conservation Trust Funds during 2023–2028 implementation period
Regional Platform for Catalyzing Resilience and Climate Action	CARICOM, GCF, Caribbean Development Bank	Mobilizes large-scale climate finance for resilience projects across the Caribbean, including Grenada	TA + seed funding for "proof-of- concept" interventions	Calls for proposals through CARICOM or CDB/secretariat, platform just started Jun 2025
Unleashing the Blue Economy of the Caribbean (<u>UBEC</u>)	OECS and WB	Supports blue economy MSMEs, governance, and infrastructure investment in Grenada and other OECS states.		Investments through regular WB concessional finance procedure, Series of Projects (SOP) over 5 to 15- year horizon with Phase 1 ongoing (2022–2027)
Eastern Caribbean Climate Adaptation Enhancement Package	OECS, UNDP, GEF, CARICOM	Strengthens NDC implementation and climate-resilient policies, including EbA approaches	TA + Investment co-financing	Through national coordination if aligned with national climate strategies
Infrastructure for Resilient Island States (IRIS)	CDRI (Coalition for disaster resilient infrastructure)	global expertise, funding, technical support, research opportunities, innovative solutions, and international best practices	TA (funding + in kind)	Competitive grant application in 1-2 rounds / year

As can be concluded from the above list, there are many ongoing DFI's, programs and projects active in the Caribbean which can be tapped for funding, both for initial investments as well as technical assistance. So, there is no lack of potential funding sources. A potential DRRS mission could help to finetune and match available funding sources based on an initial scope, roadmap and identification of

investment needs. In doing so, it would be logical to focus first on those financiers and programs with whom the OECS already has an ongoing engagement and/or is in design / project preparation phase for new programs or projects.

From the meeting with the OECS it was learned that (i) it is the intention that the DEC will be hosted by the OECS through the Caribbean Geospatial Institute (CGI) (ii) The DEC and CGI would be hosted in Grenada, as there is clear political support in Grenada for this initiative. Such an institutional setting would greatly support the financial and institutional sustainability of the DEC and offer opportunities for further scaling to other islands within the OECS. It however also has implications for the financing and funding options of the DEC:

- **Initial investments** of setting up the DEC will likely need to be capital grant funded, as OECS will not be in a position to incur concessional debt, since this can only be incurred by a sovereign state.
- Through the OECS interview it was also learned that OECS member countries' national budgets are constrained, making it unlikely that this could be a viable financing source for the initial investments
- For **recurring operation and maintenance expenditures**, it could be explored to have these funded through the OECS budget, funded through existing member state contributions. This would greatly secure the financial and institutional sustainability of the DEC, as it will tap into an existing financing mechanism and would secure full coverage of the O&M expenditures. A potential DRRS could provide assistance in working out such a funding approach.

A potential DRRS could further provide assistance in building a business case of the DEC, to demonstrate added value to the OECS member states which would justify their contribution and to explore potential additional commercial revenues through the sale of data.

Blueprint DEC

In the request to RVO it was stated that the DEC should "facilitate advanced coastline analysis, and flood plain analysis, enabling timely and data-driven decisions to address coastal changes" and include a "coastal vulnerability dashboard.

After the meeting with OECS, OECS shared a concept note with the DRRS team elaborating the objectives of the DEC and on the creation of a Caribbean Geospatial Institute (CGI).

The concept note clarifies that the overarching goals are bigger: "a coordinated, regional initiative to unlock the value of EO data and technologies in support of climate resilience, disaster risk reduction, sustainable development, and digital transformation." "DEC will be CGI's flagship digital infrastructure for EO data access, modelling, and visualization with the following implementation plan:

1. <u>Year 1</u>: Stakeholder engagement, needs assessment, governance model development, prototype launch.

- 2. <u>Year 2</u>: Launch of DEC with decision-ready EO products (e.g., coastal monitoring, land-use change, disaster response mapping).
- 3. Years 3-5: Expansion of datasets, Al-powered analytics, integration with global EO platforms."

As can be derived from the above the DEC is a long-term development and not clearly pre-defined yet. The platform could even be a continuous initiative that will grow over time. The exact content and capabilities for different phases of its development will need to be established together with the stakeholders involved (needs assessment). That will also provide the information needed to provide a more detailed timeline and budget.

A spark for future direction:

The proposed Digital Earth Caribbean (DEC) represents more than a data repository—it is envisioned as a holistic, AI-enabled decision-support ecosystem tailored to the unique vulnerabilities, risks and policy needs of Small Island Developing States (SIDS). In addition to the OECS objective of advanced coastline/floodplain analyses and a coastal vulnerability dashboard, DEC will integrate lessons from existing initiatives, while addressing their limitations of fragmentation, technical complexity, and lack of contextualization for Caribbean realities.

DEC will bridge critical data gaps—from high-resolution coastal topography/bathymetry to ecosystem mapping and valuation—by combining Earth Observation, in-situ measurements, modelling and socio-economic datasets into a single, user-friendly platform. Unlike static portals, DEC will deliver fresh, on-demand insights and analytics, to support scenario planning and risk-informed investment decisions. Most importantly, it will be co-designed with end users, ensuring that outputs align with national adaptation priorities, ICZM policies, and disaster risk reduction workflows. This approach transforms data into actionable intelligence, enabling OECS member states to move from reactive responses to proactive, climate-resilient planning.

The concept notes do already provide an initial roadmap of steps to take and ingredients to consider. A potential DRRS initiative would be a first piece of the puzzle that should kickstart further developments. The DEC concept note outlines a pre-phase initiative DEC scope that was estimated at USD 250-400K that aims to design a sustainable, demand-driven framework for DEC. It includes developing a business case, strategic roadmap, stakeholder engagement plan, governance model, and prototype infrastructure. The initiative addresses institutional coordination, political buy-in, capacity gaps, financing strategies, and technical interoperability. Expected outputs include a five-year work plan, stakeholder report, governance recommendations, and a functioning prototype showcasing EO applications for regional priorities.

The DRRS budget does not cover initiatives budgeted at USD 250-400K but it could cover meaningful aspects of the wishes above. In the meeting with OECS it was stated that the most important first step for OECS would be to have a proof-of-concept DEC that can show some of the capabilities the full DEC would have. So, the proof-of-concept should have at least one feature of interest (e.g floods, coastal erosion etc). This to show people the power of what geodata can do to support their DRM

challenges. The proof-of-concept DEC would enable OECS and Grenada to create the buy-in for the next steps first scaling up to multiple features for Grenada after which more member states should be added.

For the DRRS program it will be important to understand the enabling environment for further scale up. The concept notes and above inventory show many multiple entry points for further development and scaling. A potential DRRS initiative should make this more tangible.

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