Feasibility Study for a Sub-Regional Anticipatory Action Mechanism for Hurricanes in the Caribbean

Focusing on Antigua and Barbuda, Dominica, and Saint Kitts and Nevis

Prepared by

The Netherlands Red Cross' data and digital team, 510

With contributions and consultations from National Red Cross Societies, regional and national disaster management offices, regional and national meteorological agencies and humanitarian partners.

In partnership with

This project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement No 101073954

Acknowledgements

This work was financed by the PARATUS project, which has received funding from the European Union (EU)'s Horizon Europe research and innovation programme under grant agreement No 101073954. The study took place in collaboration with the French Red Cross' Regional Intervention Platform of the Americas-Caribbean (PIRAC) under the Ready 360°/3 Oceans programme, supported by Interreg Caraïbes, Agence Francaise de Développement (AFD), Foundation Compagnie Maritime d'Affrètement (CMA) and Compagnie Générale Maritime (CGM).

National Red Cross Societies, meteorological agencies, and disaster offices of Antigua and Barbuda, Saint Kitts and Nevis, and Dominica contributed information and perspectives. The World Food Programme (WFP) Dominica and the International Federation of Red Cross and Red Crescent Societies (IFRC) Latin America Disaster Response Emergency Fund (DREF) team co-facilitated workshops. Coordination by the IFRC's Caribbean Cluster helped align ongoing anticipatory action initiatives and integrate lessons learned into the feasibility study. The Caribbean Institute for Meteorology and Hydrology (CIMH) and the Caribbean Disaster Emergency Management Agency (CDEMA) offered technical feedback on forecasts and regional coordination mechanisms; and the European Commission and the European Centre for Medium-Range Weather Forecasts (ECMWF) Destination Earth team supported stakeholder engagement and review.

The authors of this report are:
Aklilu Teklesadik, Marc van den Homberg and Corina Markodimitraki.

With contributions from:
Mahée-Théa Viton, Jeremy Mouton, Lisette de Valk and Memory Kumbikano.

Special thanks to the National Red Cross Societies of Antigua and Barbuda, Dominica, and Saint Kitts and Nevis, as well as PIRAC for providing valuable feedback in preparation of this study.

Acronyms and Abbreviations

ABMS	Antigua and Barbuda Meteorological Services
ADRA	Adventist Disaster Relief Agency
AFD	Agence Francaise de Développement
CCRIF SPC	Caribbean Catastrophe Risk Insurance Facility – Segregated Portfolio Company
CDEMA	Caribbean Disaster Emergency Management Agency
CIMH	Caribbean Institute for Meteorology and Hydrology
CMA CGM	Foundation Compagnie Maritime d'Affrètement Compagnie Générale Maritime
CU	Coordinating Unit (CDEMA)
DDC	District Disaster Committee
DREF	Disaster Relief Emergency Fund
DRR	Disaster Risk Reduction
DRF	Disaster Risk Finance
DOMMET	Dominica Meteorological Service
ECMWF	European Centre for Medium-Range Weather Forecasts
EOC	Emergency Operations Centre
EPoA	Emergency Plan of Action
IFRC	International Federation of Red Cross and Red Crescent Societies
NDMD	Nevis Disaster Management Department
NDMC	Nevis Disaster Management Committee
NDC	National Disaster Committee
NDE	National Disaster Executive
NEMA	National Emergency Management Agency (Saint Kitts)
NHC	National Hurricane Center (U.S.)
NODS	National Office of Disaster Services (Antigua and Barbuda)
NGO	Non-Governmental Organization
NEOC	National Emergency Operations Centre
ODM	Office of Disaster Management (Dominica)
OECS	Organization of Eastern Caribbean States
PIRAC	Plateforme d'Intervention Régionale Amériques Caraïbes (French Red Cross)
RRM	Regional Response Mechanism (CDEMA)
SRFP	Sub-Regional Focal Point (CDEMA)
SIDS	Small Island Developing States
VCAs	Vulnerability and Capacity Assessments
WFP	World Food Programme
WMO	World Meteorological Organization

Table of contents

1. Executive Summary 5
2. Introduction 7
3. Framework for Anticipatory Action Feasibility Study 11
4. Methodology 15
5. Country Case Studies 17
   5.1 Saint Kitts and Nevis 18
      5.1.1 Context and Risk Assessment 19
      5.1.2 Institutional Landscape 20
      5.1.3 National Early Warning and Trigger Systems 24
      5.1.4 Pre-Defined Anticipatory Actions 25
      5.1.5 National Society Capacity and Institutionalization 26
   5.2 Antigua and Barbuda 27
      5.2.1 Context and Risk Assessment 28
      5.2.2 Institutional Landscape 29
      5.2.3 National Early Warning and Trigger Systems 30
      5.2.4 Pre-Defined Anticipatory Actions 31
      5.2.5 National Society Capacity and Institutionalization 32
   5.3 Dominica 33
      5.3.1 Context and Risk Assessment 34
      5.3.2 Institutional Landscape 35
      5.3.3 National Early Warning and Trigger Systems 37
      5.3.4 Pre-Defined Anticipatory Actions 38
      5.3.5 National Society Capacity and Institutionalization 39
6. Readiness of National Societies for Anticipatory Action 41
   44
   6.1 Assessment of National Societies 44
   6.2 Stakeholder Influence on Anticipatory Action Readiness 46
      6.2.1 Saint Kitts and Nevis 46
      6.2.2 Antigua and Barbuda 47

6.2.3 Dominica 48
6.2.4 Regional Stakeholders 49
7. Forecast Skill Assessment for Anticipatory Action Triggers 52
7.1 National Hurricane Center Forecast 52
7.2 Opportunity from AI-Based Weather Prediction Models 54
7.2.1 AIFS – AI/Integrated Forecasting System (ECMWF) 54
7.2.2 GraphCast (DeepMind/Google) 55
7.2.3 Aurora Forecasting (Microsoft Research) 55
7.3 Summary 56
8. Exploring a Regional Model for Anticipatory Action in the Caribbean 58
8.1 Country Risk Profiles and Implications for Early Action Protocol Design 60
8.2 Regional Early Action Protocol Governance 62
8.2.1 Protocol Ownership and Structure 63
8.2.2 Decision-Making 64
9. Bibliography 66

1. Executive Summary

This feasibility study explores the potential for implementing anticipatory action mechanism in the Eastern Caribbean, with a particular focus on Saint Kitts and Nevis, Dominica, and Antigua and Barbuda. Anticipatory action is an approach that enables humanitarian organizations, especially the Red Cross Red Crescent Movement, to act early and reduce the impact of disasters by leveraging scientific data, forecasts, and community knowledge. While anticipatory action has been successfully adopted in other regions around the world, the Caribbean remains underrepresented despite its high vulnerability to climate-related hazards such as hurricanes, floods, and rising sea levels.

The study uses a structured framework with five components: activation mechanisms (triggers), pre-agreed anticipatory actions, pre-arranged financing, integration with disaster risk governance, and National Society capacity. Desk research, stakeholder workshops, and diagnostic tools are used to assess each country's hazard profile, institutional arrangements, early warning systems, operational readiness, and financial mechanisms. Case studies outline existing practices and identify gaps in disaster preparedness. The report notes the presence of disaster preparedness and response expertise in the three countries, including initiatives such as multi-hazard risk assessments in Dominica and Antigua and Barbuda. Integration of anticipatory action into national disaster risk management plans remains limited.

Key findings highlight that National Red Cross Societies in all three countries possess robust local networks, logistical assets, and community engagement capabilities. However, operational anticipatory action frameworks and dedicated financial mechanisms are lacking. Forecasting capacity anchored by the U.S. National Hurricane Center (NHC) and supported by regional institutions such as the Caribbean Disaster Emergency Management Agency (CDEMA) and the Caribbean Institute for Meteorology and Hydrology (CIMH) is sufficient to serve as a trigger for Early Action Protocols, with emerging AI-based models offering additional promise for future enhancement.

The report recommends adopting a sub-regional Early Action Protocol model, coordinated through regional and national technical working groups, with a shared governance structure and country-specific annexes. This approach would pool expertise, harmonize triggers and actions, and ensure rapid, context-appropriate responses across the Eastern Caribbean. By formalizing anticipatory action through regional collaboration, National Societies can close critical gaps, mobilize resources, and protect vulnerable communities more effectively.

Ultimately, the proposed sub-regional anticipatory action mechanism aligns with both the specific context of the Caribbean and the lessons learned from anticipatory action implementation to date. Caribbean countries share common hazards, forecasting systems, and regional disaster coordination platforms such as the CDEMA and the CIMH. A sub-regional

approach therefore builds on these existing structures, avoids duplication, and addresses capacity gaps faced by smaller island states. By harmonizing triggers, financing, and coordination while allowing for country-specific implementation, it ensures that anticipatory action is both scalable and well-integrated into the region's disaster management architecture.

2. Introduction

In recent years, anticipation has become an integral component of humanitarian initiatives, particularly within the Red Cross Red Crescent Movement. Anticipatory action leverages forecasts generated by early warning systems to assess and prepare for potential hazards before they escalate into crises. By employing forecasting, scenario planning, and engaging communities, societies are empowered to respond proactively and make well-informed decisions that mitigate risks and lessen future impacts. Anticipatory action has evolved from decades of experience in disaster risk management, climate forecasting, and innovative humanitarian financing.

For the Red Cross Red Crescent Movement, anticipatory action provides a critical framework to protect lives and livelihoods by taking early, pre-emptive actions before a disaster strikes. These actions are driven by scientific data, early warning systems, local knowledge, and pre-agreed triggers paired with flexible, pre-arranged funding to ensure timely and targeted response. Anticipatory action involves activities implemented prior to a crisis, with the objective of minimizing or preventing its negative effects. These interventions are time-sensitive, ideally carried out after a forecast but before a hazard directly affects communities. Common examples include cash transfers, pre-positioning supplies, or activating preparedness plans, increasingly linked with social protection systems.

The International Federation of the Red Cross and Red Crescent Societies (IFRC) and its National Societies, along with the Food and Agriculture Organisation (FAO), World Food Programme (WFP), United Nations Office for the Coordination of Humanitarian Affairs (OCHA), the START Network, and other humanitarian agencies, have made significant progress in advancing anticipatory action initiatives worldwide, with notable achievements in Africa and Asia. By 2022, Early Action Protocols encompassed more than 7 million people across 35 countries, supported by USD 138 million in pre-arranged funding mobilized globally (Anticipatory Action in 2022: A Global Overview, 2023).

However, National Societies with limited capacities, particularly those operating in small island nations such as those in the Caribbean, continue to be underrepresented in the implementation of anticipatory action frameworks. The need for such mechanisms in the Caribbean is especially urgent, given the region's high exposure to climate-related risks such as hurricanes, floods, and sea-level rise. For instance, Hurricane Ivan in 2004 caused damage equivalent to 200% of Grenada's Gross Domestic Product (GDP) (IMF). Hurricane Maria in 2017 diminished 226% of Dominica's GDP (UNDP). On average, storms in the Caribbean wipe out 17% of annual GDP, with Dominica experiencing losses of up to 74% of GDP in particularly severe years. Beyond economic tolls, the human cost of these storms is devastating. Between 1963 and 2017, the Caribbean experienced 324 disasters, resulting in more than 250,000 deaths and affecting over 24 million people (UNDP). Individual storms also confirm the grim trend: Hurricane Georges in 1998 left 615 fatalities and displaced around 500,000 people across multiple islands, while Hurricane Maria in

2017 killed approximately 3,059 people, making it the deadliest cyclone in recent Caribbean history (UNDP). These extreme impacts where hurricanes can erase one or two entire years' worth of economic output highlight the critical need for anticipatory action tools in the Caribbean. Despite this vulnerability, only a handful of countries currently operate formal anticipatory action frameworks, examples being the Dominican Republic and Guatemala (hurricanes), and Honduras (multiple hazards).

The Caribbean demonstrates strong experience and institutional capacity in disaster preparedness and response at both national and regional levels. Most countries have established national disaster management plans, and National Red Cross Societies play an active role through technical committees and coordination mechanisms. In Saint Kitts and Nevis, the National Disaster Management Act and National Disaster Plan formally authorize the Saint Kitts and Nevis Red Cross Society as a member of the National Disaster Committee, the highest policymaking and coordination body during emergencies. In Antigua and Barbuda, the Antigua and Barbuda Red Cross holds recognized auxiliary status in law: established as an independent National Society in 1983 by Act of Parliament, it is officially acknowledged as a partner to the government in disaster preparedness and response. In Dominica, the Dominica Red Cross Society has contributed to the drafting of the Comprehensive Disaster Management Bill, reflecting its formal consultative role in shaping national disaster legislation. At the regional level, the Caribbean Disaster Emergency Management Agency (CDEMA) plays a central role in coordinating preparedness, response, and recovery across member states, drawing on decades of operational experience in managing hurricanes, floods, and other hazards (CDEMA 2020). This network demonstrates that the region has strong expertise in disaster risk management and a robust foundation for scaling new approaches.

Despite this capacity, a persistent gap remains in disaster financing for preparedness and early action. Traditional humanitarian funding often arrives only after disaster strikes, leaving communities exposed during a critical window of time when pre-emptive measures could save lives and reduce losses. Early warning systems remain only partially integrated into national disaster risk management frameworks, limiting their role to issuing alerts rather than enabling action. For example, in Antigua and Barbuda, the national meteorological service issues formal tropical cyclone watches, warnings, and alert statements. The National Office of Disaster Services designates public shelters (49 for the 2025 season) under the Disaster Management Act (National Office of Disaster Services (NODS) 2025). These measures demonstrate strong government commitment; however, gaps persist especially in financing for household preparedness, shelter retrofitting and supplies, accessible transport and services for vulnerable groups which limits communities' ability to act on those warnings.

Bridging this financing and planning gap presents a clear opportunity. By embedding anticipatory action into disaster management strategies, small island nations in the Caribbean could unlock

pre-arranged funding, trigger early interventions, and ensure faster, more targeted responses. Doing so would not only strengthen existing preparedness capacities but also reduce the economic and human costs of increasingly frequent and severe climate-related disasters. A recent study coordinated by the French Development Agency (AFD) and the Organization of Eastern Caribbean States (OECS) in the framework of the Adapt Action programme, has highlighted the promise of anticipatory action in both the Caribbean and the Pacific (Wilkinson et al. 2021). The scoping study outlines a framework and joint work plan aimed at enhancing disaster preparedness in the Caribbean by linking early impact forecasts with pre-arranged actions and funding. It emphasizes how forecast-based early action could significantly reduce both humanitarian impacts and economic losses from extreme weather events.

The Red Cross Red Crescent Movement is uniquely positioned to bridge this gap. Through their recognized role in national disaster management plans, embedded within communities and guided by the principles of humanity, neutrality, and impartiality, National Societies can serve as frontline actors in implementing and scaling up anticipatory action in the three countries. By linking forecasts, regional coordination mechanisms, and early actions with pre-arranged financing and local response plans, these National Societies can help reduce the impact of climate related disasters on communities.

In line with IFRC guidance, this feasibility study assesses the case for establishing an anticipatory action mechanism in the Eastern Caribbean, focusing on Saint Kitts and Nevis, Dominica, and Antigua and Barbuda. In addition to country-level options, it tests the feasibility of a sub-regional framework that could pool capacity across borders. Because these countries share similar hurricane exposure, vulnerability profiles, and disaster-management institutions, a coordinated approach is both practical and strategic. The report deepens understanding of anticipatory action in this context, examining regional and national systems, institutional arrangements, and the enabling conditions for implementation. Drawing on consultations with local and regional stakeholders and targeted case studies of the three countries, it identifies key opportunities and constraints, and offers practical recommendations to build locally led, sub-regionally coordinated, and sustainable anticipatory action systems.

Why Anticipatory Action in the Eastern Caribbean

- **Global momentum**: Anticipatory protocols cover 7M+ people in 35 countries with USD 138M pre-arranged funding (Anticipation Hub 2022).
- **Severe impacts**: Hurricane Ivan (2004) cost ~200% of Grenada's GDP; Hurricane Maria (2017) cost ~226% of Dominica's GDP; 1963–2017: 324 disasters, 250k+ deaths, 24M+ affected across the Caribbean.
- **Existing capacity**: National disaster plans, active Red Cross roles, and CDEMA regional coordination; in Antigua and Barbuda, formal cyclone warnings and 49 public shelters designated for the 2025 season.

- **Persistent gaps**: Limited financing for preparedness/early action; early warning systems often stop at alerts rather than enabling household action—especially for vulnerable groups.
- **Opportunity**: A subregional anticipatory action mechanism for Saint Kitts and Nevis, Dominica, and Antigua and Barbuda to pool capacity and financing for faster, targeted early action.

3. Framework for Anticipatory Action Feasibility Study

Anticipatory action is a practical, life-saving approach that complements humanitarian response by enabling pre-emptive measures before hazards become disasters. To ensure that anticipatory action is effective and context-appropriate, this feasibility study applies a structured analytical framework built around three essential building blocks: Activation Mechanisms (Triggers), Pre-Agreed Anticipatory Actions, and Pre-Arranged Financing supported by two cross-cutting lenses on Disaster Risk Governance and National Society Capacity. The framework is applied to Saint Kitts and Nevis, Antigua and Barbuda, and Dominica, while also testing a subregional anticipatory action plan option that can pool capacity across borders.

Activation Mechanism – Triggers

Definition. Triggers are pre-defined, evidence-based thresholds (e.g., cyclone wind speed, rainfall intensity, surge levels) derived from scientific forecasting and/or community risk monitoring that determine when anticipatory action mechanism is activated.

Design principles. Triggers must be:

- **Locally relevant and inclusive**, drawing on formal early warning systems and traditional/local knowledge.
- **Scientifically robust and operationally feasible**, calibrated to local hazard profiles and lead times.
- **Pre-agreed** with communities, government, and humanitarian partners to ensure ownership, clarity of roles, and accountability.
- **Time-bound and actionable**, enabling National Societies to act within the short window before impact.

Feasibility focus. The study assesses data availability and reliability (national meteorological/hydrological services and regional providers), lead times, institutional roles, and interoperability across the three countries to judge whether meaningful, harmonized triggers are possible at national and subregional levels.

Pre-Agreed Anticipatory Actions

Definition. Clearly defined actions, validated with stakeholders in advance, that measurably reduce expected impacts once a trigger is reached (e.g., providing cash assistance, pre-positioning essential supplies, activating community preparedness plans, deploying mobile health teams). Where appropriate, actions should link to social protection systems.

Alignment criteria

- **Community priorities and needs**, determined through participatory assessments and vulnerability and capacity analyses (VCA).
- **The auxiliary role of National Societies**, ensuring coordination with government disaster management systems and regional actors.
- **Existing humanitarian mandates**, making sure actions are principled, neutral, and inclusive.
- **Timeliness and feasibility**, able to be implemented within hours to days of a trigger being reached.

Feasibility focus. The study reviews the readiness of National Red Cross Society branches and partners to carry out anticipatory actions, considering logistics, human resources, access, and appropriateness. It explores where subregional arrangements (e.g. surge teams) could improve speed and coverage.

Pre-Arranged Financing

Timely action depends on financial resources that are secured and ready to be disbursed as soon as triggers are met. This can take many forms, such as an anticipatory action pillar of the International Federation of Red Cross and Red Crescent Societies (IFRC)'s Disaster Relief Emergency Fund (DREF), contingency funds, insurance-based schemes, or partnerships with donors for rapid release of funds. Pre-arranged financing should:

- Be reliable and flexible, enabling swift action without bureaucratic delays.
- Be linked to National Society contingency plans and Early Action Protocols
- Include clear governance and accountability structures, ensuring transparency and effectiveness.
- Support both immediate needs and long-term resilience, such as community-level preparedness capacity.

Feasibility focus. All National Red Cross and Red Crescent Societies have access to the funding mechanism through the Anticipatory Action pillar of the DREF (IFRC 2022). This mechanism gives access to financial support prior to disasters, either through an approved Early Action Protocol or via the imminent DREF, ensuring timely and efficient resource mobilization. Consequently, it is not necessary to apply a financial feasibility lens when assessing feasibility for anticipatory action. However, the feasibility study will still examine the existence of national and regional financial mechanisms that may support anticipatory action.

Integration with Disaster Risk Governance

The sustainability and effectiveness of anticipatory action rely on its integration into existing disaster risk management systems. To be sustainable, anticipatory action must be embedded

within both National Society strategies and broader national disaster risk management frameworks, promoting institutional coherence and coordination.

This feasibility study uses a **governance lens** to assess how anticipatory action can be institutionalized in current structures, including:

- Policy and legislative contexts for disaster risk management and early warning
- The mandate of the National Red Cross Society
- Coordination among humanitarian, governmental, and scientific actors
- Opportunities for integration into contingency planning, financing, and sectoral policies

By treating governance as essential, the study identifies ways that anticipatory action can become a routine part of disaster preparedness and response, strengthening a National Society's auxiliary role and building national resilience.

Capacity of National Society

The effectiveness of anticipatory action is influenced by the institutional preparedness of each National Society. The ability of the National Society to implement measures is a significant factor in establishing and carrying out Early Action Protocols. The feasibility study includes an additional analytical lens focused on institutional capacity, evaluating organizational readiness, technical expertise, resource availability, and coordination structures within the National Societies in each country.

For capacity assessment, key areas included:

- The human and technical abilities of National Society staff and volunteers for timely anticipatory actions.
- The presence of internal systems and protocols, such as contingency plans and Standard Operating Procedures (SOPs).
- Partnerships and coordination with government, scientific, and humanitarian bodies.
- Logistic strengths, such as supply chains, communications, and reach to at-risk communities.

Applying this institutional capacity perspective to the feasibility study ensures that recommendations are both technically viable and aligned with National Societies' operational realities.

Regional Coordination Mechanisms

Beyond assessing national-level feasibility for anticipatory action, the primary objective of this framework is to evaluate the potential for a subregional approach among the three Eastern Caribbean countries. Their geographic proximity, common exposure to hazards, and interlinked institutional frameworks present significant opportunities to enhance efficiency and impact

through collaborative efforts. Accordingly, the feasibility study analyzes whether adequate regional coordination mechanisms currently exist, or could be developed, to support core elements of anticipatory action—such as unified triggering protocols, technical working groups, governance structures, and cross-border surge support. This perspective informs whether consolidating expertise, standardizing procedures, and jointly mobilizing resources at the subregional level is both technically and institutionally feasible, and if such mechanisms can provide added value compared to exclusively national anticipatory action systems.

The framework's five pillars—activation mechanisms (triggers), pre-agreed anticipatory actions, pre-arranged financing, integration with governance structures, institutional capacity, and regional coordination—provide a structured method for evaluating the feasibility of sub-regional anticipatory action for Saint Kitts and Nevis, Antigua and Barbuda, and Dominica. Using a methodology based on this framework, the study examines whether key components are established and identifies areas for further development, aiming to ensure that anticipatory action systems are effective and appropriately adapted to each country and the regional context.

4. Methodology

The framework for anticipatory action feasibility studies, detailed in chapter three, is utilized to assess the readiness for implementing anticipatory action in three target countries: Antigua and Barbuda, Saint Kitts and Nevis, and Dominica. This framework is organized around five core pillars: Activation Mechanism (Triggers), Pre-Agreed Anticipatory Actions, Pre-Arranged Financing, Integration with Disaster Risk Governance, and Capacity of National Societies. This structure aligns with the guidelines provided by the International Federation of Red Cross and Red Crescent Societies (IFRC) for anticipatory action feasibility assessments, offering a systematic basis for evaluating the potential to operationalize anticipatory action across different national contexts. To implement this framework, the study follows a mixed-methods approach that combines desktop research, in-country stakeholder workshops, and a structured assessment using the IFRC Anticipatory Action Readiness Checklist tool. This methodology allows for the capturing of both institutional capabilities and contextual realities, ensuring that findings are grounded in evidence and local perspectives.

Comprehensive desktop research built a baseline understanding of the disaster risk management and anticipatory action landscape in each country. This phase involved reviewing national disaster risk management plans and policies to identify institutional arrangements and possible entry points for anticipatory action. An analysis of regional strategies and governance frameworks was conducted to ensure alignment with regional disaster risk management strategies, as well as a review of existing Early Action Protocols and past feasibility studies, especially those led by the Red Cross Red Crescent Movement, UN agencies, and other humanitarian partners. Peer-reviewed literature and scientific research were also examined to incorporate best practices and strengthen the evidence base. This initial phase helped map the status of anticipatory action systems in the selected countries and informed the design and focus of subsequent field engagement.

Following the desk review, in-country workshops with key national stakeholders aimed to validate preliminary findings, gather local insights, and assess feasibility across all five pillars of the framework. Participants included representatives from National Red Cross Societies, national disaster management offices, meteorological and scientific institutions, and a range of humanitarian and regional actors. The sessions were participatory in nature and focused on critical areas such as the availability and accessibility of early warning systems, the relevance and readiness of planned early actions, the presence and structure of pre-arranged financing mechanisms, and the coordination and governance frameworks related to disaster risk management. A key component of these discussions involved assessing the institutional capacity of National Societies in terms of human resources, technical expertise, operational protocols, logistics, and partnerships.

To strengthen the assessment of institutional capacity, the IFRC's Feasibility Study Toolkit was used. This tool offered a standardized method to evaluate the ability of each National Society to implement time-sensitive anticipatory actions. The assessment covered several aspects, including the availability of planning instruments such as contingency plans and Early Action Protocols, the strength of logistics and information systems, mechanisms for coordination and community engagement, and the mobilization of staff and volunteers. National Societies' positioning to work with government bodies and other humanitarian actors in the anticipatory action space was also examined. This institutional lens ensured that recommendations were grounded in the actual capacity and mandate of each National Society.

Each country workshop concluded with a group discussion and synthesis session. During these sessions, stakeholders reviewed key findings together and co-developed recommendations for advancing anticipatory action in their national context. These sessions helped reinforce local ownership and alignment across sectors.

By combining structured literature review, local stakeholder engagement and IFRC diagnostic tools, this study is a context-specific analysis of anticipatory action readiness in the three countries. The approach reflects the Red Cross Red Crescent Movement's commitment to locally driven solutions, community engagement, and sustainable humanitarian practice. The results offer a strong foundation for designing anticipatory action frameworks that are both operationally feasible and tailored to each country's specific risks and capacities.

5. Country Case Studies

Antigua and Barbuda, Saint Kitts and Nevis, and Dominica were preselected by the French Red Cross' Regional Intervention Platform of the Americas-Caribbean (PIRAC) as part of the 3 Oceans Programme, an initiative that strengthens humanitarian preparedness and resilience in island nations across the Caribbean, Indian Ocean, and South Pacific. Within this framework, the anticipatory action feasibility methodology is applied to assess how these countries can better prepare for and respond to the growing risks associated with climate change and natural hazards. The analysis considers six interlinked dimensions: the hazard landscape and its impacts on vulnerable groups; the institutional frameworks that govern disaster risk management; the reliability of early warning systems and the design of pre-agreed triggers for action; the readiness of national and regional institutions to operationalize anticipatory measures; the feasibility and local relevance of pre-defined early actions; and the financial and governance mechanisms that enable rapid, coordinated, and predictable interventions. This structured approach provides a comprehensive picture of each country's readiness for anticipatory action while situating the findings within broader regional priorities for resilience and risk reduction.

5.1 Saint Kitts and Nevis

Saint Kitts and Nevis, the smallest sovereign state in the Western Hemisphere, shares the climate and disaster risks faced by its Eastern Caribbean neighbors, with its limited land area and coastal concentration of assets amplifying vulnerability to climate extremes. The federation spans 261 km² across two volcanic islands. Both islands are mountainous, with Mount Liamuiga (the highest point) reaching 1,156 m. The climate is tropical, with high humidity and average annual rainfall near 2,400 mm.

Youth volunteers from the Saint Kitts and Nevis Red Cross Society participate in a beach cleanup at Jessups Beach in Nevis, August 2023. © Saint Kitts and Nevis Red Cross Society

Quick facts

- **Population:** ~54,000 (2023).
- **Area & topography:** 261 km² across two volcanic islands with mountainous interiors; highest point Mount Liamuiga at 1,156 m.
- **Climate:** Tropical savanna on Saint Kitts and tropical monsoon on Nevis; ~2,400 mm annual rainfall; high humidity.
- **Economy:** Transitioned from sugar to tourism, agriculture, light manufacturing, and financial services.

- **Main risks:** Hurricanes, droughts, heatwaves, and sea-level rise; rapid increase in extreme hot days linked to climate change.

5.1.1 Context and Risk Assessment

Saint Kitts and Nevis, like other small island developing states (SIDS) in the Eastern Caribbean, is increasingly exposed to the impacts of climate change, particularly rising temperatures, hurricanes, and droughts. Recent climate risk analysis conducted by Stimson Center, in collaboration with the government of Saint Kitts and Nevis, highlights the scale of these challenges: between 1971 and 2018, the federation experienced an increase of approximately 30 additional hot days per decade, the fastest rate recorded among Eastern Caribbean countries. This trend poses serious implications for human health, agriculture, water security, and the tourism sector, which underpins the national economy. Combined with rising sea levels and coastal exposure, these climatic shifts place disproportionate strain on the country's limited land area and resources.

Hurricane Georges (1998) and Hurricane Lenny (1999) stand out as two of the most destructive storms to impact Saint Kitts and Nevis in the past three decades. In September 1998, Hurricane Georges made direct landfall as a powerful Category 4 storm, delivering sustained winds of around 115 mph and leaving catastrophic damage in its wake. Approximately 80–85% of houses were damaged, with 20–25% completely destroyed. Electricity and communications were severely disrupted, and half of the sugar crop was lost. Critical infrastructure, including the airport's terminal and control tower, suffered extensive damage, and the overall economic toll was staggering—estimated at nearly twice the country's GDP, with losses of about US $484 million and five fatalities recorded. Just a year later, in November 1999, Hurricane Lenny compounded the federation's vulnerability when powerful 20-foot waves surged inland by as much as 600 feet. The storm destroyed 46 homes, damaged over 300 others, triggered mudslides, and caused widespread structural and agricultural losses, with damages amounting to an additional US $41.4 million.

While Hurricanes Georges and Lenny caused visible physical damage across the islands, Hurricane Hugo (1989) is noted for its ongoing emotional and psychological effects, particularly among older populations (Saint Kitts and Nevis Red Cross Society). Although it occurred a decade earlier, the experiences of Hugo continue to be remembered within the community. Many elderly people recount their experiences during that period, indicating significant long-term emotional impacts. This situation demonstrates that the consequences of disasters can extend beyond immediate physical damage, emphasizing the importance of psychosocial support programmes both in post-disaster recovery and as a proactive measure to strengthen community resilience against more frequent climate-related events.

In the years since, Saint Kitts and Nevis has continued to face significant weather-related events. Hurricane Earl (2010) passed near the islands, bringing strong winds and heavy rainfall and leading to infrastructural damage. Hurricane Irma (2017) did not make direct landfall, but the storm's proximity resulted in tropical storm conditions across the islands. Tropical Storm Ernesto (2024) made landfall near Sandy Point Town with wind speeds up to 98 km/h, classified as a tropical storm. Powerlines and trees collapsed, while workers needed to clear roads of debris after Ernesto passed by. The National Emergency Management Agency (NEMA) of Saint Kitts advised residents to stay off roads and potentially unstable ground. Preliminary damage due to Ernesto across the island was estimated at US $780,000.

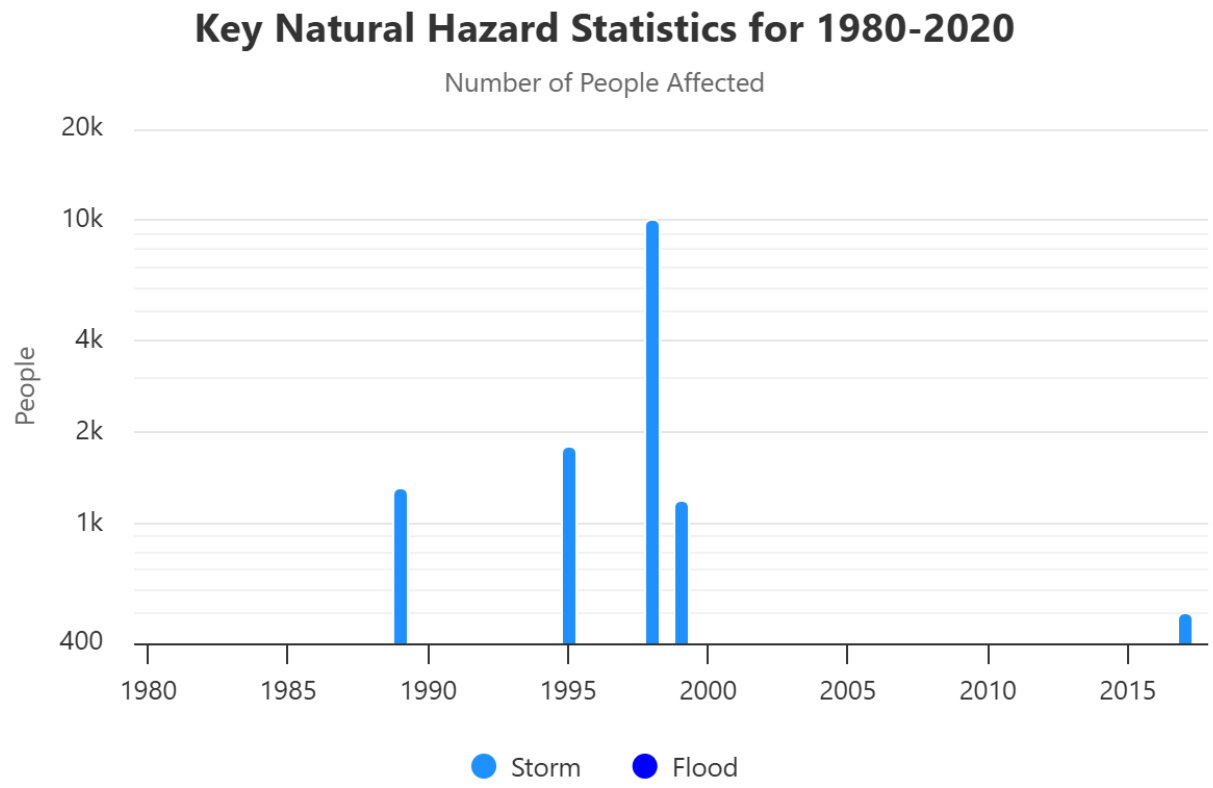


Figure 1 Most frequent natural hazards and their impact on the associated population in Saint Kitts and Nevis. Source: World Bank Climate Change Knowledge Portal (World Bank, n.d.)

5.1.2 Institutional Landscape

The disaster risk management system in Saint Kitts and Nevis is anchored in the NEMA on Saint Kitts and the Nevis Disaster Management Department (NDMD), supported by the National Disaster Committee (NDC) and a series of specialized sub-committees. Both islands operate under the National Disaster Management Act (1998), with the 2013 National Disaster Plan serving as the overarching framework. The plan sets out a multi-hazard approach, covering preparedness, mitigation, response, and recovery, and is aligned with the regional

Comprehensive Disaster Management Strategy of the Caribbean Disaster Emergency Management Agency (CDEMA).

The institutional framework is highly structured. At the federal level, the National Disaster Executive (NDE) oversees planning and response through ten national disaster sub-committees managing areas such as medical services, utilities, environment, shelter management, foreign assistance, search and rescue, and damage assessments. On Nevis, the Nevis Disaster Management Committee (NDMC), chaired by the Premier, mirrors this structure with its own sub-committees for shelter management, medical and health services, utilities and transport, public information, tourism, and environmental pollution, ensuring island-specific needs are addressed. Both NEMA and NDMD operate Emergency Operations Centres (EOCs) that are activated during crises to coordinate operations.

Non-governmental organizations play a formal role in this landscape. The Saint Kitts and Nevis Red Cross Society is recognized in both the National and Nevis Plans as a core partner. The Adventist Disaster Relief Agency (ADRA), Lions, Rotary, the Christian Council, and youth organizations support preparedness and relief. The Amateur Radio Society contributes to emergency communications, while the Chamber of Commerce and private sector actors provide resources and logistics support.

The Saint Kitts and Nevis Red Cross Society is one of the most significant non-governmental actors in the country's disaster risk management framework and is formally recognized in both the National Disaster Plan (2013) and the Nevis Disaster Management Plan (NEMA 2013). It plays a multi-faceted role that bridges government systems and community resilience.

The National Society participates in several official sub-committees, including shelter management, medical and health services, land search and rescue, and emergency supplies. Within these structures, it provides trained volunteers for first aid, relief distribution, and psychosocial support, while also contributing to the management and staffing of emergency shelters. The Saint Kitts and Nevis Red Cross Society works in partnership with the Ministry of Health to ensure shelter health services, and with the Housing and Shelter Sub-Committee on identifying and maintaining safe shelter facilities.

Beyond response, the National Society contributes significantly to preparedness and capacity-building. It delivers first aid training in schools and communities, supports public information campaigns, and conducts vulnerability and capacity assessments (VCAs) that inform local and national planning. The Saint Kitts and Nevis Red Cross Society also works with District Disaster Committees (DDCs) to strengthen grassroots preparedness and emergency drills. In collaboration with the International Federation of Red Cross and Red Crescent Societies (IFRC), it mobilizes technical and financial resources when national capacities are overwhelmed, providing a critical humanitarian safety net.

By combining formal roles within the state disaster risk management system with its own community-based network, the National Society ensures that disaster management in Saint Kitts and Nevis extends beyond government agencies to reach households and vulnerable groups, reinforcing resilience at all levels.

At the community level, DDCs on both islands link the national framework to grassroots preparedness. They work closely with NDMD, NEMA, and partners like the Saint Kitts and Nevis Red Cross Society to ensure early warning dissemination, shelter readiness, and community drills. This decentralized arrangement ensures that initial disaster response begins at the district level before national resources are fully mobilized.

Despite the structured framework, challenges persist. The dual governance system can cause duplication between NEMA and NDMD, and both agencies face constraints in financial and technical resources. Coordination across multiple committees and agencies is uneven at times, particularly in recovery phases. Finally, while the legal framework empowers authorities to enforce building standards and evacuation orders, enforcement of land-use planning, building codes and environmental protections remain weak, leaving vulnerabilities unaddressed.

In Saint Kitts and Nevis, NEMA has the legal mandate to declare a state of emergency during disasters, triggering the activation of the National Emergency Operations Centre (NEOC) for coordinated response. At the regional level, the CDEMA provides support, particularly in mobilizing and channeling external resources, though its operational role is engaged only upon request or invitation. During the Atlantic hurricane season, a daily 1:00 p.m. coordination call is convened whenever a storm threatens the region, enabling national and regional actors to share updates and synchronize preparedness measures. While the CDEMA participates by invitation, its involvement is critical for facilitating rapid access to regional assets and international assistance. On the ground, the **Saint Kitts and Nevis Red Cross Society works hand in hand with NEMA and NDMD** in preparedness, relief distribution, and shelter management, ensuring that both community-level response and regional support mechanisms are effectively integrated into the national disaster management framework.

Logistics and Warehousing

Logistics and warehousing are part of Saint Kitts and Nevis' approach to disaster response. The Saint Kitts and Nevis Red Cross Society operates warehouses on both islands, which store relief supplies such as blankets, hygiene kits, and shelter materials. These warehouses allow for the prompt distribution of assistance at the community level during emergencies, providing support until regional or international aid arrives.

In addition to the warehouses, the Nevis Disaster Management Plan (NEMA 2013) outlines several national and community-level logistics and storage arrangements that complement Saint Kitts and Nevis' disaster response.

- The Emergency Supplies Sub-Committee is mandated to identify and secure suitable buildings for the storage of emergency supplies such as food, clothing, building materials, and medical items. It is also responsible for establishing safe areas for non-perishable supplies, managing central warehouses, and creating distribution centres for bulk relief goods. This includes arranging for transportation of items to and from warehouses, staffing for packaging and distribution, and ensuring adequate security of storage facilities.
- The Chamber of Commerce plays a role in the private sector contribution to logistics, with responsibilities to identify and provide warehousing space and ensure the availability of essential emergency supplies (building materials, food, water, equipment, tarpaulins, and medical supplies).
- Faith-based and humanitarian organizations also contribute: ADRA maintains a dedicated warehouse for relief supplies and coordinates with government to optimize distribution during emergencies.

These national arrangements ensure that Nevis has pre-designated storage sites and logistics partners to support relief operations. By combining government coordination, private sector warehousing, and NGO-managed stocks, the system strengthens local capacity to manage the receipt, storage, and distribution of relief supplies until additional regional assistance arrives.

At the regional level, the CDEMA operates a network of sub-regional warehouses in Antigua and Barbuda, Barbados, Jamaica, and Trinidad and Tobago. These facilities are embedded in the CDEMA's Regional Response Mechanism (RRM) and maintain essential first-response items, including food, water, medical supplies, shelter materials, and search and rescue equipment. Each warehouse is managed by a Sub-Regional Focal Point (SRFP), which acts as CDEMA's frontline in disaster response. Antigua and Barbuda, as the Eastern SRFP, is directly responsible for supporting Saint Kitts and Nevis, managing the Antigua-based warehouse and coordinating with the CDEMA Coordinating Unit (CU) and other SRFPs across the region.

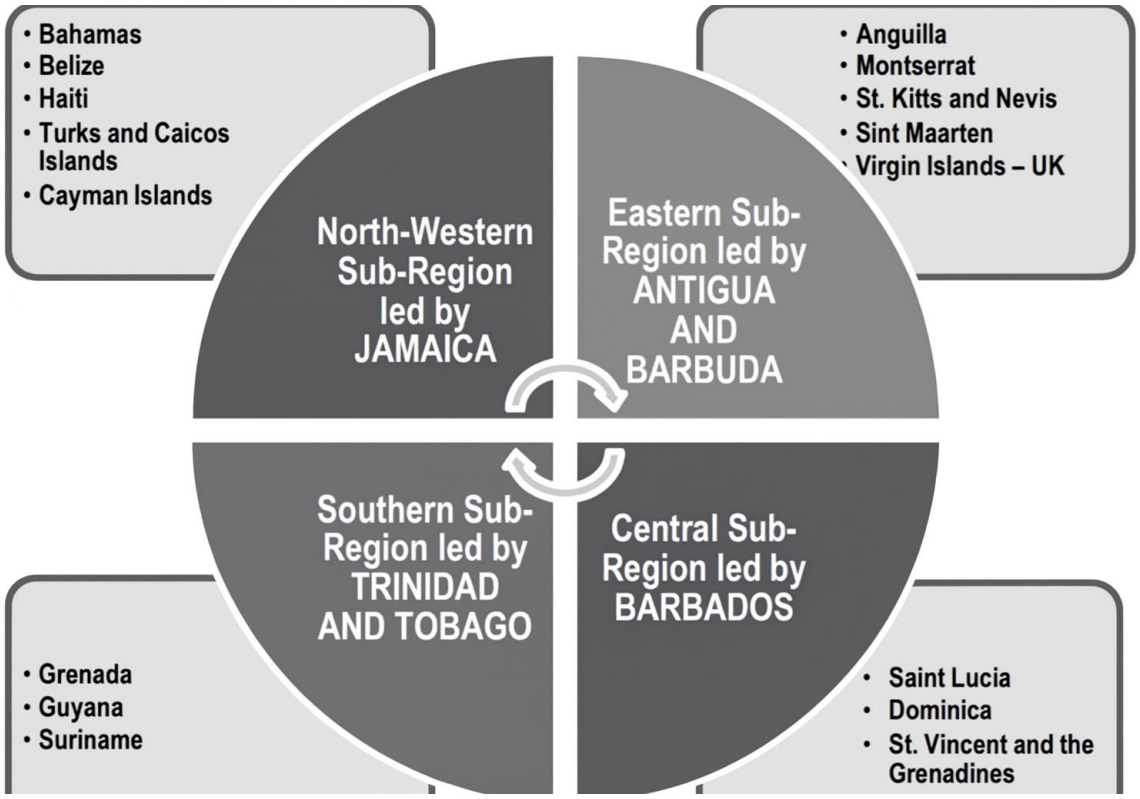


Figure 2 The four sub-regional disaster emergency response operational units — Jamaica, Antigua and Barbuda, Barbados, and Trinidad and Tobago — provide coordinated disaster response support across CDEMA participating states (CDEMA 2016)

Other actors also operate warehouses at the regional level: the French Red Cross' Regional Intervention Platform of the Americas-Caribbean (PIRAC) operates warehouses in Martinique, Guadeloupe and French Guiana, while the UN operates Humanitarian Response Depots in Panama.

Overall, the logistics and warehousing arrangements demonstrate that Saint Kitts and Nevis possesses a solid foundation for prepositioning activities, which are essential for anticipatory action. The established storage and rapid deployment capabilities at both the national and regional levels enable authorities and humanitarian partners to act proactively, ensuring that critical relief supplies can be delivered to affected communities before and immediately after disasters strike. This capacity not only supports swift emergency response, but also strengthens the federation's ability to implement anticipatory measures that minimize disaster impacts and enhance overall resilience.

5.1.3 National Early Warning and Trigger Systems

The hydro-meteorological forecast system in Saint Kitts and Nevis is an essential part of the national disaster risk management framework, given the federation's high vulnerability to

hurricanes, tropical storms, heavy rainfall, flooding, drought, and other climate-related hazards. Forecasting responsibility lies primarily with the Antigua and Barbuda Meteorological Services (ABMS), which serves as the official provider of meteorological forecasts and warnings for Saint Kitts and Nevis. ABMS operates as part of the regional meteorological network under the Caribbean Meteorological Organization (CMO) and coordinates closely with international bodies such as the U.S. National Hurricane Center (NHC) for tropical cyclone advisories.

In practice, the Saint Kitts Meteorological Office, based at Robert L. Bradshaw International Airport, functions as a relay point for data collection and communication but does not issue independent forecasts. Instead, forecasts and warnings from ABMS are transmitted to NEMA on Saint Kitts and the NDMD on Nevis, which integrate this information into preparedness, early warning dissemination, and emergency response systems. **During the active hurricane season, NEMA receives forecast updates twice daily from the ABMS,** with additional special bulletins issued whenever a system poses a direct threat to the federation. Both NEMA and NDMD ensure that these forecasts are rapidly conveyed to the NEOC, DDCs, line ministries, and the public. The forecast system is embedded in a regional and international support network, including the Caribbean Institute for Meteorology and Hydrology (CIMH) and the World Meteorological Organization (WMO). This allows Saint Kitts and Nevis to access seasonal outlooks, climate modeling, and drought monitoring products, complementing real-time warnings from ABMS. Community level dissemination remains critical. Once ABMS issues a warning, NEMA and NDMD activate communication channels through radio, television, SMS alerts, and social media, while the Saint Kitts and Nevis Red Cross Society and DDCs ensure that the most vulnerable communities receive and act upon the information.

Overall, the hydro-meteorological forecast landscape in Saint Kitts and Nevis is characterized by a reliance on Antigua and Barbuda for official forecasting, strong integration with regional and international systems, and national-level dissemination through NEMA, NDMD, and community actors such as the Saint Kitts and Nevis Red Cross Society, making it a vital but dependent pillar of resilience.

5.1.4 Pre-Defined Anticipatory Actions

Globally, countries such as Fiji, Mozambique, Madagascar, Guatemala, and the Philippines have implemented a wide range of anticipatory actions to reduce the impacts of tropical cyclones. These actions are typically triggered by forecast-based thresholds—such as predicted wind speeds or rainfall amounts—and supported by pre-arranged financing, allowing for the rapid deployment of aid before a cyclone makes landfall. In the Caribbean context, a 2022 feasibility study identified four primary anticipatory actions as most appropriate and cost-effective for the region (unpublished, 2022). These are designed to be “low-regret,” meaning they are still

beneficial and relatively low-cost even if the storm's impact is less severe than forecasted or does not make landfall at all (Wilkinson et al. 2021).

While the term anticipatory action is not explicitly used in Saint Kitts and Nevis' disaster plans, several measures align closely with this approach. The National Disaster Plan and the Nevis Disaster Management Plan emphasize the importance of pre-positioning relief supplies, maintaining and inspecting emergency shelters, and ensuring that DDCs are activated ahead of expected impacts. They also outline the early dissemination of warnings through radio, telephone, and community networks, backed by regular testing of communication systems during the hurricane season. In addition, the plans call for stockpiling of food, water, and medical supplies, readiness of emergency services, and mobilization of key sub-committees—such as those for public information, shelter, and logistics—once forecasts indicate a credible threat. Together, these provisions represent the foundations of an early action framework, even if not formally described as such.

As a twin-island federation with exposed coastlines and small urban centres, Saint Kitts and Nevis would benefit from formally integrating anticipatory action into its disaster risk management framework. An anticipatory action tool would enable the Saint Kitts and Nevis Red Cross Society to strengthen existing disaster management plans by addressing critical gaps and implementing proactive measures. These include ensuring rapid access to aid through pre-positioned supplies and regional logistics support, fostering strong community coordination through DDCs, and promoting household-level resilience such as securing assets and developing safe evacuation plans for vulnerable groups.

5.1.5 National Society and Institutionalization

The Saint Kitts and Nevis Red Cross Society, formally recognized under the 1985 Red Cross Act as an auxiliary to the government, has an established organizational structure with branches on both islands that enable it to maintain a local presence within communities. Its work is supported by a dedicated volunteer base that plays a central role in preparedness and response, strengthened through training opportunities and systems for volunteer engagement and retention. Operationally, the National Society contributes significantly to national disaster management through its warehouses with pre-positioned supplies on both islands, as well as its collaboration with NEMA and NDMD during emergency operations, ensuring that relief can be mobilized quickly in times of crisis. The Saint Kitts and Nevis Red Cross Society also maintains a full-time staff member who serves as the focal point for anticipatory action. These capacities position the National Society as a vital partner in disaster preparedness and response. With its local presence, volunteer networks, and logistics capacity, the Saint Kitts and Nevis Red Cross Society is well-placed to integrate and operationalize Early Action Protocols, ensuring earlier mobilization and more effective support to at-risk communities.

5.2 Antigua and Barbuda

Antigua and Barbuda, a twin-island state in the Eastern Caribbean, faces many of the same climate and disaster risks as its regional neighbors, with its low-lying coastal settlements and limited land area heightening vulnerability to hurricanes, storm surge, and sea level rise. The country covers 442 km², with Antigua characterized by rolling limestone and volcanic hills, and Barbuda largely flat and coral-based, rising to just 38 m at its highest point. The tropical maritime climate brings warm temperatures year-round, with average rainfall between 1,000–1,500 mm, though distribution is highly variable and the islands are prone to droughts as well as intense rainfall events during the hurricane season.

Antigua and Barbuda Red Cross volunteers hand a tarpaulin to a person at risk ahead of Hurricane Maria, September 2017. © Giovanni Zambello / IFRC

Quick Facts

- **Population:** ~93,000 (2023).
- **Area & topography:** 442 km²; Antigua has rolling limestone and volcanic hills; Barbuda is low-lying and coral-based. Highest point: Boggy Peak / Mount Obama (402 m).

- **Climate:** Tropical maritime; ~1,000–1,500 mm annual rainfall; prone to droughts and intense rainfall during hurricane season.
- **Economy:** Dominated by tourism; supplemented by financial services, agriculture (fruits, vegetables, livestock), and fisheries.
- **Main risks:** Hurricanes, storm surge, droughts, coastal flooding, and sea-level rise; climate change is increasing the frequency of extreme weather events.

5.2.1 Context and Risk Assessment

Antigua and Barbuda, a low-lying twin-island country in the northeast Caribbean, is experiencing mounting climate pressures in the form of rising temperatures and sea levels, more intense hurricanes, and recurrent drought. Recent regional analyses show a sustained increase in extremely hot days and longer dry spells, straining water security, agriculture, and public health. With the economy heavily reliant on tourism and much of the population and critical assets concentrated along the coast, even moderate climatic shifts have outsized consequences for infrastructure, livelihoods, and ecosystems. Sea-level rise further amplifies risk, leaving Barbuda's flat terrain and Antigua's densely developed shorelines especially exposed to inundation and storm surge.

Several major storms in recent decades highlight the country's acute vulnerability. Hurricane Luis (1995) struck as a Category 4 storm, causing catastrophic damage across Antigua, destroying or damaging 90% of homes, crippling infrastructure, and inflicting damages estimated at over US $350 million—well above the country's GDP at the time. Just six years later, Hurricane Lenny (1999) battered Antigua and Barbuda with destructive waves and flooding, damaging coastal roads and infrastructure, and compounding long-term recovery challenges. More recently, Hurricane Irma (2017) devastated Barbuda when it made landfall as a Category 5 storm with sustained winds of 185 mph. The hurricane destroyed an estimated 95% of buildings on the island, forcing the complete evacuation of Barbuda's population to Antigua and causing damages exceeding US $220 million. Recovery was slow and highlighted the challenges of responding to extreme events with limited land, resources, and institutional capacity. In 2020, Hurricane Gonzalo brought additional heavy rains and winds, while recurrent drought episodes have threatened food and water security.

These events illustrate not only Antigua and Barbuda's high exposure to climate extremes, but also the disproportionate social and economic toll such hazards inflict on small island states. Strengthening anticipatory action, disaster preparedness, and climate adaptation is therefore critical to safeguarding lives, livelihoods, and the national economy.

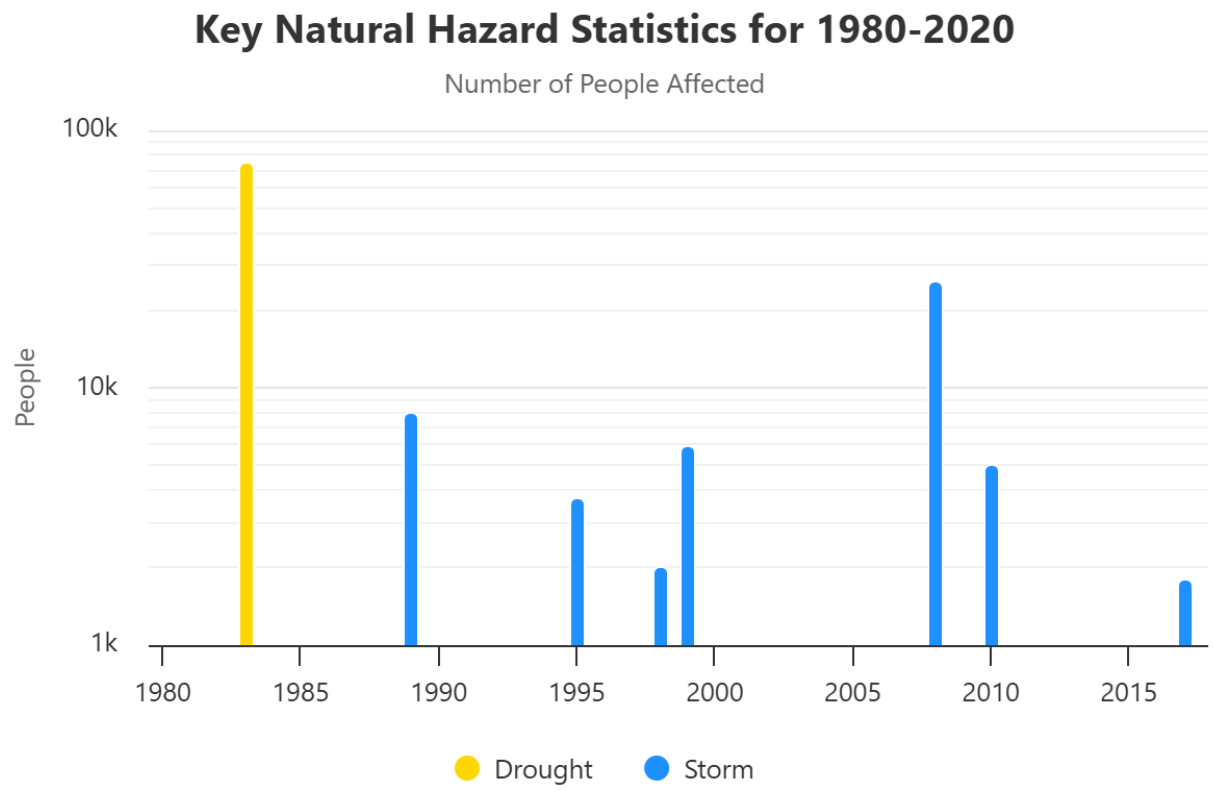


Figure 3 Most frequent natural hazards and associated population impacts in Antigua and Barbuda. Source: World Bank Climate Change Knowledge Portal.

5.2.2 Institutional Landscape

The institutional landscape of disaster risk management in Antigua and Barbuda is structured around the National Office of Disaster Services (NODS), which operates under the Ministry of Legal Affairs, Public Safety, and Labour. NODS serves as the country's lead agency for preparedness, response, and coordination, and is guided by the National Disaster Act of 1987 and related policy frameworks that mandate comprehensive disaster risk management across sectors. NODS also has the mandate to declare a state of emergency, acting on the advice of the Meteorological Service when extreme weather or other hazards pose a threat. A central mechanism for emergency coordination is the National Emergency Operations Centre (NEOC), which is activated during crises to bring together representatives from line ministries, security services, and key partners such as the Antigua and Barbuda Red Cross.

Disaster risk management in Antigua and Barbuda follows a multi-sectoral approach, engaging government agencies, utilities, community groups, and civil society organizations. The Antigua and Barbuda Red Cross plays a vital role in preparedness, community outreach, and relief distribution, complementing the work of NODS. The government also collaborates closely with regional and international partners, most notably the CDEMA, which coordinates regional

support and manages the sub-regional warehouse in Antigua. This facility is stocked with relief supplies and forms part of the CDEMA's RRM, positioning Antigua as a logistical hub for the Eastern Caribbean.

At community level, DDCs provide localized preparedness and response capacity, supported by training and public awareness programmes. However, limitations remain in terms of resources, enforcement of building codes, and coordination across institutions, which can reduce the effectiveness of disaster response. A notable challenge lies in the disconnect between early warning and early action. When hurricane warnings are issued by the disaster management authorities, they are often not accompanied by financial or material support for communities, leaving households to act based on their own limited means. This expectation can undermine the effectiveness of warnings, as vulnerable groups may lack the resources to evacuate, secure property, or prepare adequately, despite being fully aware of the risks. Financial and human resource constraints therefore continue to hinder long-term resilience building and the translation of warnings into timely protective action.

Despite these challenges, Antigua and Barbuda has made strides in mainstreaming disaster risk management into development planning, particularly in climate adaptation, coastal zone management, and housing. With continued investment in institutional capacity, better integration of community-based approaches, and stronger enforcement of legal instruments, the country is well-positioned to enhance resilience against hurricanes, floods, droughts, and other climate-related hazards.

5.2.3 National Early Warning and Trigger Systems

ABMS plays a pivotal role in the country's disaster risk management system and serves as a regional forecasting centre for the Eastern Caribbean. In addition to providing national services, ABMS issues forecasts and warnings for Saint Kitts and Nevis, the British Virgin Islands, Montserrat, and Anguilla, making it a key hub for hydro-meteorological information across the sub-region.

For hurricanes, ABMS coordinates closely with the NHC. Under this system, NHC—working in coordination with ABMS—issues a hurricane watch 48 hours in advance of possible storm conditions and a warning 36 hours prior to expected impacts. Forecast updates are released every three hours, ensuring continuous monitoring and communication of risk. Where necessary, NHC has the authority to downgrade warnings or watches in line with its established criteria, without requiring further consultation, streamlining the process and avoiding delays.

According to ABMS, forecast skill for hurricanes and droughts is considered strong, making it reliable for anticipatory action planning and activation. However, forecast capacity for flooding

remains limited, leaving gaps in early warning for one of the country's more frequent and disruptive hazards. While the agency acknowledges a shortage of staff given its regional responsibilities, its collaboration with NHC provides a strong operational base that ensures continuity and reliability of hurricane forecasting. ABMS also highlighted a risk related to its strong dependence on the NHC. In addition, geopolitical changes and shifts in U.S. government policy create uncertainty regarding continued access to hurricane forecasts.

5.2.4 Pre-Defined Anticipatory Actions

While the term *anticipatory action* is not explicitly used in Antigua and Barbuda's disaster planning, several measures already align with this approach. The **National Hurricane Plan** and the wider disaster management framework, coordinated by NODS, emphasize the pre-positioning of relief supplies, preparation and inspection of emergency shelters, and the activation of community disaster management committees ahead of an expected storm.

Early dissemination of warnings is also a central feature, making use of radio, SMS, and community networks, supported by seasonal drills and communication system testing. In addition, plans call for stockpiling of essential items such as food, water and medical supplies, ensuring the readiness of first responders, and mobilizing functional sub-committees, including those for public information, health, shelter, and logistics, once a credible threat is identified.

However, important gaps remain. During evacuations, the Antigua and Barbuda Red Cross is typically called on to provide support in emergency shelters, but these requests often come late, making it difficult to deliver adequate and timely assistance. Likewise, early warning messages disseminated by the meteorological office generally expect communities to act using their own means, without sufficient structured support for the most vulnerable. These are areas where the Antigua and Barbuda Red Cross could add significant value by applying an **Early Action Protocol**, ensuring that shelter support, relief distribution, and community mobilization begin *before* a storm strikes, rather than after.

As a small island state with vulnerable coastlines, critical tourism infrastructure, and dependence on external supply chains, Antigua and Barbuda would benefit from formally integrating anticipatory action within its disaster management framework. An anticipatory action-oriented approach would strengthen current plans by enabling:

- Rapid access to aid through pre-positioned supplies.
- Stronger coordination at the community level through disaster committees.
- Household-level resilience measures, such as securing assets and preparing evacuation plans for vulnerable groups.

- Timely planning of deployment of Antigua and Barbuda Red Cross teams to evacuate at-risk communities.

Together, these measures would help minimize disaster impacts and safeguard both lives and livelihoods in advance of hurricanes.

5.2.5 National Society Capacity and Institutionalization

The Antigua and Barbuda Red Cross, formally recognized as an auxiliary to the public authorities, has an established organizational structure with its headquarters in St. John's and active networks across both islands. The National Society is supported by more than 200 trained volunteers, who are mobilized through a clear coordination mechanism that includes regular monthly update meetings to strengthen readiness and engagement.

Operationally, the Antigua and Barbuda Red Cross maintains warehouses in both Antigua and Barbuda, where pre-positioned relief stocks are managed to ensure rapid response when disasters occur. The National Society collaborates closely with the NODS during preparedness and response operations. However, coordination and communication remain a challenge at times. For example, during evacuations, the Antigua and Barbuda Red Cross is responsible for providing first aid and psychosocial support in emergency shelters, yet requests to coordinate this work are often received at the last minute, limiting the effectiveness of the support. Beyond its formal role in national disaster management, the National Society also coordinates with religious groups and community networks to enhance outreach and response capacity, ensuring assistance reaches vulnerable populations more effectively.

Together, these capacities position the Antigua and Barbuda Red Cross as a critical partner in disaster preparedness and response. With its volunteer base, logistics assets, and community partnerships, the National Society is well-placed to operationalize Early Action Protocols, ensuring that support is mobilized earlier and more effectively to protect lives and livelihoods.

5.3 Dominica

Dominica, known as the “Nature Island” of the Caribbean, is highly exposed to natural hazards due to its rugged mountainous terrain, extensive river systems, and coastal settlements concentrated in low-lying areas. Covering 751 km², the island is characterized by steep volcanic slopes, dense forests, and limited flat land, which heightens risks of landslides, flooding, and coastal impacts during tropical cyclones. Its tropical maritime climate brings high rainfall year-round, averaging 1,500–7,500 mm depending on elevation, with the eastern windward slopes receiving some of the highest totals in the region. This abundance of rainfall supports lush ecosystems, but also makes Dominica one of the most hazard-prone Caribbean islands.

After tropical storm Philippe, the Dominica Red Cross Society conducts assessments and distributes cleaning kits to support affected households, October 2023. © Dominica Red Cross Society

Quick Facts

- **Population:** ~72,000 (2023).
- **Area & Topography:** 751 km²; mountainous volcanic island with peaks over 1,400 m (Morne Diablotins 1,447 m); numerous rivers and steep valleys.
- **Climate:** Tropical maritime; high annual rainfall (1,500–7,500 mm); prone to hurricanes, floods, and landslides.

- **Economy:** Historically reliant on agriculture (bananas, root crops, citrus), increasingly diversified into tourism and services; heavily impacted by disasters.
- **Main Risks:** Hurricanes, storm surge, landslides, river flooding, coastal flooding, volcanic hazards; climate change amplifying storm intensity and rainfall extremes.

5.3.1 Context and Risk Assessment

Dominica faces some of the most severe disaster risks in the Caribbean, with climate change intensifying vulnerabilities. Its steep topography, fragile soils, and dense settlement along coasts and rivers make it highly susceptible to flooding, landslides, and wind damage during storms. Dominica is also exposed to earthquakes and volcanic activity, alongside floods, landslides, and hurricanes. Independent risk benchmarking underscores this exposure: Germanwatch's Global Climate Risk Index (2010) ranked Dominica 25th of 150 countries for climate-related exposure and 55th by losses (9.62% of GDP) based on 1998–2007 events, reflecting the compounding effects of rising sea levels, storm surge, and stronger hurricanes (climateknowledgeportal.worldbank.org).

Looking ahead, the World Bank's climate knowledge portal notes that while future tropical cyclone frequency remains uncertain, storm intensity is likely to increase as oceans and atmosphere warm, heightening the risk of extreme winds and rainfall. At the same time, rising sea levels amplify coastal flooding and surge hazards for low-lying communities and critical infrastructure.

Disaster history illustrates these risks:

- Hurricane David (1979): Category 5; ~75% of homes destroyed; 56 deaths; economy devastated.
- Tropical Storm Erika (2015): Catastrophic flooding and landslides; US $483 million in damage (~90% of GDP).
- Hurricane Maria (2017): Category 5; ~90% of buildings damaged or destroyed; island-wide power collapse; ~US $1.3 billion in losses (~226% of GDP).

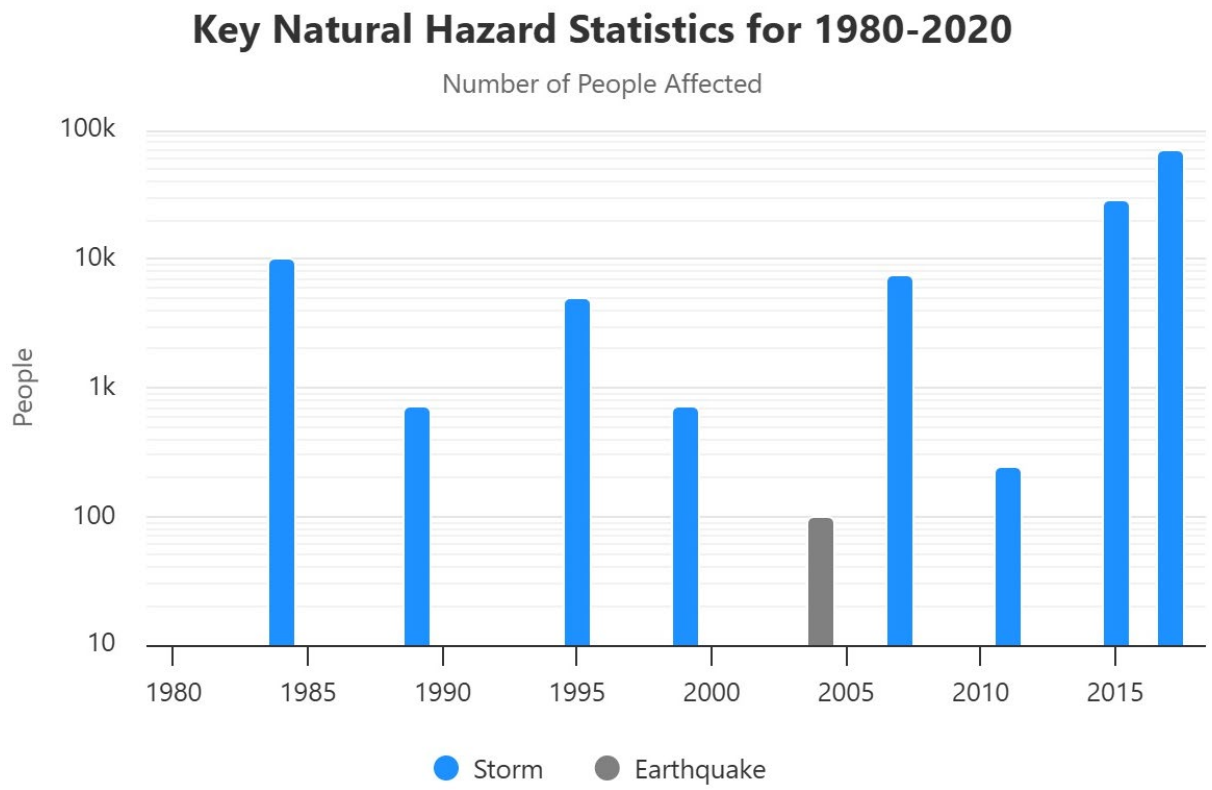


Figure 4 Most frequent natural hazards and associated population impacts in Dominica. Source: World Bank Climate Change Knowledge Portal.

These events illustrate how a single storm can erase decades of development gains. Ongoing hazards include frequent landslides, flash floods, and episodic droughts, threatening agriculture, water supply, and livelihoods. The combination of topographic exposure, sea level rise, and potentially stronger cyclones reinforces the need to couple early warning with financed, pre-planned early action to protect the most vulnerable.

5.3.2 Institutional Landscape

Disaster management in Dominica involves a governance and coordination framework that includes government agencies, non-governmental organizations, the private sector, and community volunteers. The National Emergency Planning Organization (NEPO) functions as the central body responsible for overseeing disaster management activities. The NEPO Advisory Committee, led by the Prime Minister, sets national disaster policies and supervises preparedness and response. The National Emergency Executive Committee (NEEC) turns these policies into action, meeting regularly to develop guidelines and coordinate national disaster response.

The Office of Disaster Management (ODM) acts as the principal coordinating agency, led by the National Disaster Coordinator. The ODM is tasked with planning, preparedness, public education, training, and providing both administrative and logistical support across the disaster management sector. During emergencies, the National Emergency Operations Centre (NEOC) is activated to centralize decision-making, facilitate information sharing, and manage operational command. The NEOC is staffed by specialized officers covering operations, logistics, communications, and public information, ensuring a cohesive response.

Disaster management in Dominica is further structured through sectoral task forces operating under the NEEC. These task forces address specific areas such as health services, food and general supplies, emergency shelters, transportation, communications, welfare, damage assessment, search and rescue, public information, and the protection of records, utilities, economic stability, national security, and environmental protection. At the local level, the country is divided into seven districts, each with its own District Emergency Committee (DEC) and District Emergency Operations Centre (DEOC). These entities ensure preparedness and response at the community level and serve as vital links between national structures and grassroots organizations. Community Emergency Committees (CECs) operate at the village level to manage shelter, food aid, welfare, and initial relief operations.

Effective logistics and supply chain management are central to Dominica's disaster response capabilities. The Food and General Supplies Task Force is responsible for securing storage facilities, maintaining inventories, establishing distribution centres, and organizing the packaging and delivery of relief items to ensure equitable distribution. The Welfare Task Force oversees needs assessments, the distribution of food and clothing, and the coordination of care for vulnerable populations, working closely with organizations such as the Dominica Red Cross Society and district committees.

The private sector, particularly through the Dominica Association of Industry and Commerce (DAIC), plays a crucial role in monitoring critical supplies, identifying warehouses, and ensuring the availability of emergency stocks. Service clubs such as the Lions, Rotary, Jaycees, Kiwanis, Scouts, and Guides contribute significantly by supporting evacuation, shelter management, relief distribution, and warehousing activities (NEPO, 2001). The Dominica Red Cross Society is instrumental in providing relief supplies, logistics support, tracking incoming aid, and coordinating volunteers. Both the ODM and NEOC employ dedicated logistics officers to manage the requisition, storage, transport, and distribution of relief supplies.

Dominica's disaster management framework is further strengthened by its regional linkages. The country coordinates closely with the CDEMA, leveraging regional response mechanisms, warehouses, and specialized teams for surge capacity.

Despite this robust framework, Dominica faces several challenges, including heavy reliance on voluntary organizations and NGOs for warehousing and logistics support, the need to continuously update databases and preposition supplies, and the logistical difficulties posed by the island's terrain and limited transport corridors, especially in reaching remote communities.

Within this institutional landscape, the Dominica Red Cross Society occupies a pivotal role. Fully integrated into the NEPO framework, the National Society is represented on the NEPO Advisory Committee and actively participates in NEEC task forces, particularly those focused on welfare, relief supplies, shelter, and public health. Operationally, the Dominica Red Cross Society collaborates with the Food and General Supplies Task Force to receive, store, and distribute emergency supplies, and works with the Welfare Task Force to support vulnerable groups and provide psychosocial assistance. The organization also provides staff and volunteers to assist with warehousing, packaging, and transportation of relief items at both national and district levels.

At the community level, National Society representatives are embedded within district and community emergency committees, contributing to needs assessments, first aid, shelter management, and grassroots relief distribution. Their close collaboration with village councils, churches, and other voluntary organizations enhances the effectiveness of local disaster response. As a member of the Red Cross Red Crescent Movement, the Dominica Red Cross Society can rapidly mobilize external relief supplies, technical teams, and funding in coordination with NEPO and ODM. This position enables the National Society to serve as a bridge between government structures, local communities, and international humanitarian assistance, with particular strengths in logistics, welfare, and relief distribution.

5.3.3 National Early Warning and Trigger Systems

The Dominica Meteorological Service (DOMMET) is the national authority for weather and climate services, providing monitoring, forecasts, warnings, and response information in coordination with the ODM. Its responsibility has evolved from airport-focused operations to a full hydrometeorological service, though staffing and data-management capacity remain constrained. For tropical cyclones, DOMMET references official advisories and watch/warning guidance from the NHC (RSMC Miami). Hurricane watches are generally issued approximately 48 hours prior to the expected landfall of a tropical storm, with warnings typically provided around 36 hours in advance. Within the framework of the WMO's Severe Weather Forecasting Programme (SWFP–Caribbean), the Regional Forecast Support Facility (RFSF) at Météo-France Martinique offers operational regional support, supplemented by additional products from both global and regional centres.

According to information collected during the workshop, DOMMET utilizes a high-resolution rainfall forecasting system called Sistema de Pronóstico Inmediato (SisPI). This is a Weather Research & Forecasting (WRF)-based model, which was developed with technical support from Cuba's Instituto de Meteorología de Cuba (INSMET). DOMMET also accesses guidance on WRF from CIMH, and works with Météo-France Application of the Research and on the short-term Mesoscale (AROME) Caribbean products to supplement local analysis with higher-resolution forecasts. The CIMH's WRF provides mesoscale outputs for the Caribbean, updated at least daily and twice daily during hurricane season, for forecasters across the region. Météo-France AROME Caribbean fields, such as CARAIB0025 (~0.025° grid, hourly), are distributed via regional channels linked to the RFSF. Regional collaborations with the NHC, the RFSF, as well as high-resolution model guidance, all facilitate monitoring throughout the hurricane season.

Based on DOMMET's assessment, forecasting capacity for hurricanes—including wind, and surge—and seasonal outlooks is relatively robust. However, there are challenges in accurately predicting riverine flooding and landslides due to limited local hydrological modeling, complex terrain, and resource constraints.

While early warning messages are generally timely, converting forecasts into effective proactive measures remains a gap—particularly for the most vulnerable households—because alerts are not always accompanied by dedicated funding, logistics, or pre-arranged finance to activate assistance.

5.3.4 Pre-Defined Anticipatory Actions

Dominica's disaster plans do not explicitly use the term *anticipatory action*, but several existing measures align well with this approach. The Dominica Red Cross Society and government frameworks emphasize pre-positioning relief supplies and emergency kits, identifying and inspecting shelters ahead of the hurricane season, activating disaster committees, and stockpiling of essentials like food, water, and medical supplies. Additionally, early warnings are disseminated widely through radio, SMS, and community networks to ensure timely awareness across affected areas.

A notable innovation that reflects anticipatory thinking is the Cash Transfer Programme launched after Hurricane Maria. Nearly 2,000 bank cards were distributed across more than 30 communities, allowing families to withdraw cash from ATMs and make purchases in supermarkets. This approach empowered recipients to address their own needs with dignity and supported local markets. Given that the necessary systems and trained personnel are now in place, this cash mechanism could be adapted into a formal anticipatory action tool. Instead of delivering relief after impact, it could proactively enable vulnerable households to meet their

essential needs before a predicted hazard strikes, such as purchasing food, water, or shelter materials.

Incorporating this kind of anticipatory cash distribution alongside traditional measures like shelter readiness and supply pre-positioning would enhance the country's resilience. By acting before hazards hit, Dominica can reduce humanitarian needs, streamline recovery, and safeguard both lives and livelihoods more effectively.

5.3.5 National Society Capacity and Institutionalization

The Dominica Red Cross Society, established in 1983 and formally recognized as an auxiliary to the public authorities, has continued to strengthen its institutional base and community outreach. In 2023, the National Society operated with a staff complement of seven, including one officer from the government's National Employment Programme, and expanded its reach to 11 branches across the island supported by approximately 350 active volunteers. This network of branches and volunteers forms the backbone of the Dominica Red Cross Society's grassroots presence, enabling it to deliver preparedness, training, and disaster response at the community level. Importantly, the country's disaster risk management framework gives the National Society a clear mandate to act independently within the national system, enabling it to mobilize resources quickly and serve as a trusted first responder.

The Dominica Red Cross Society undertook a review of its 2023–2024 Strategic Plan to refine priorities and set the foundation for the forthcoming 2025–2030 Strategic Plan. Governance and accountability were also reinforced through a comprehensive review and adoption of the updated Statutes at the 2023 Annual General Meeting. At the operational level, contingency plans, including those developed by branches, are reviewed and updated prior to each hurricane season to enhance emergency response preparedness. The National Society maintains logistical resources to support relief transportation and medical assistance. Warehouses and branch offices are supplied with pre-positioned relief items, and annual inventory checks ensure that supplies are available for deployment.

Funding during the year came primarily from donors, IFRC, and partner National Societies. Notably, the Netherlands Red Cross provided support to enhance the Dominica Red Cross Society's first aid programme as part of a sustainability strategy. This included the introduction of a Wilderness and Adventure First Aid course, and a marketing campaign using radio, television, social media, and billboard advertising to raise visibility for both first aid training and ambulance services.

The National Society also regularly demonstrates its operational capacity in response to localized disasters. When communities are affected by storms, floods, or other emergencies, the Dominica

Red Cross Society carries out vulnerability and capacity assessments and distributes essential relief items such as cleaning and hygiene kits, solar lights, and tools to support recovery. It works in collaboration with local authorities to ensure that households receive additional assistance, including shelter materials, financial support, or other items not directly provided by the National Society. These efforts help to meet immediate needs and contribute to longer-term community resilience.

With its island-wide branch network, trained volunteer base, dedicated staff, updated contingency planning, improved governance, and enhanced logistics and funding mechanisms, the Dominica Red Cross Society is well positioned to institutionalize Early Action Protocols. By engaging in earlier shelter deployment, pre-distribution of relief kits, and rapid volunteer mobilization, the National Society can strengthen its role in protecting vulnerable households and ensuring that communities are better prepared before hazards strike.

6. Readiness of National Societies for Anticipatory Action

The International Federation of Red Cross and Red Crescent Societies (IFRC)'s anticipatory action team has developed a structured assessment tool to evaluate the readiness and capacity of National Societies to implement anticipatory action by collecting information across multiple dimensions. Building on this broader framework, the American Red Cross created a Readiness Index, which streamlines the approach into three readiness levels based on baseline and annual data collection. At the Basic Readiness Level (1.0–1.9), a National Society lacks interpretable forecasting models, has no anticipatory action plans or funding streams in place, and demonstrates minimal capacity to implement early actions. The Intermediate Readiness Level (2.0–2.9) reflects partial access and capacity, with at least one anticipatory action plan or funding source established and some ability to implement early actions at a subnational level. At the Advanced Readiness Level (3.0), National Societies can interpret forecasting models for all relevant hazards, maintain comprehensive anticipatory action plans and sustainable funding mechanisms, and have the capacity to implement early actions at scale.

This feasibility study primarily relies on the Readiness Index for readiness assessment. Additional data include indicators not fully covered by the tool but relevant to the assessment, such as the auxiliary role and mandates of National Societies, disaster risk management laws and strategies, and coordination mechanisms with Red Cross Red Crescent Movement partners and government authorities.

The assessment was carried out through an in-country workshop with participation from representatives of the National Societies. During the workshop, each question in the Readiness Index tool was reviewed collaboratively, and the National Societies answered based on self-assessment and local experience. The responses were analyzed to assess readiness in forecasting, early action, and financing (figures 5-7). This method aims to represent the capacities and viewpoints of the National Societies.

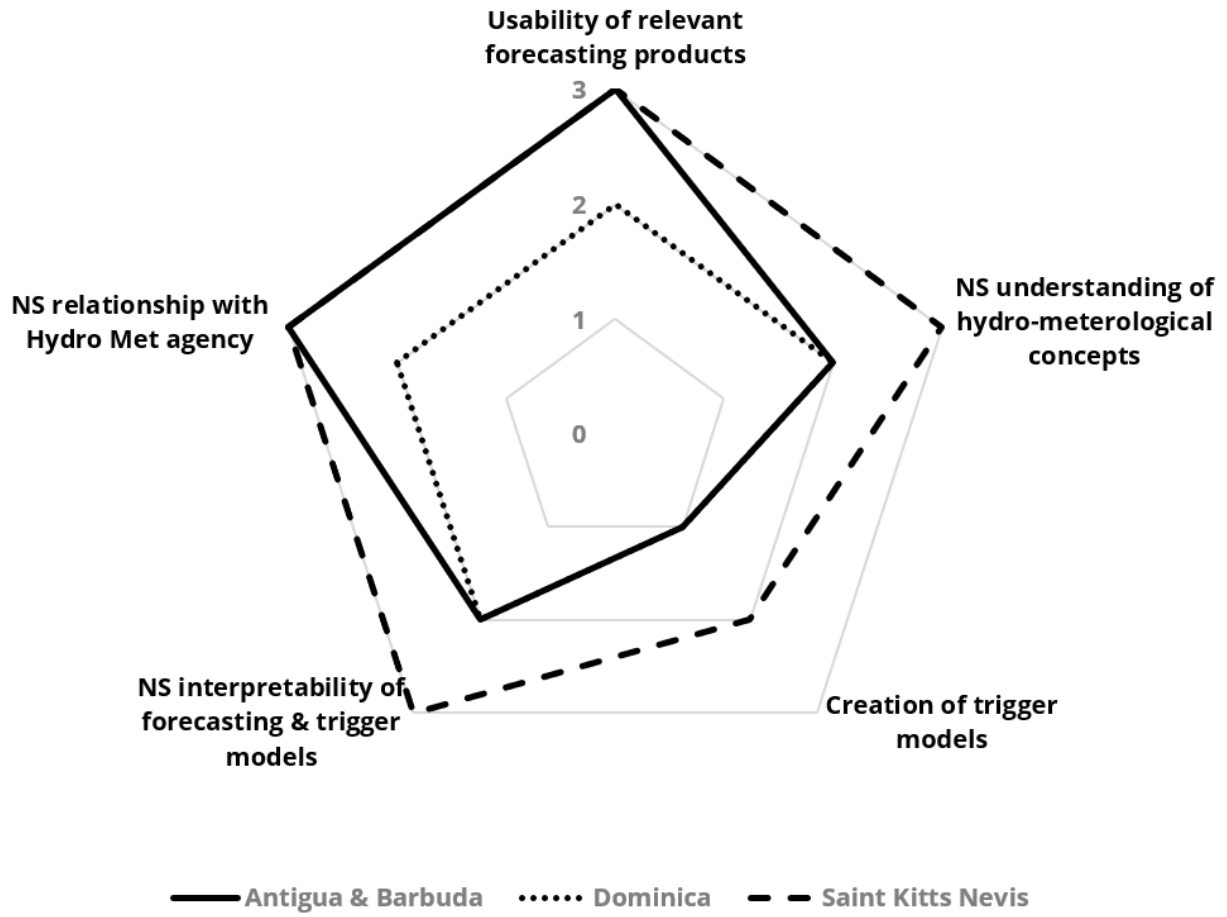


Figure 5 Readiness index in National Society capacity to interpret and develop forecasting and trigger models — Results of self-assessments conducted by the National Red Cross Societies in the three countries

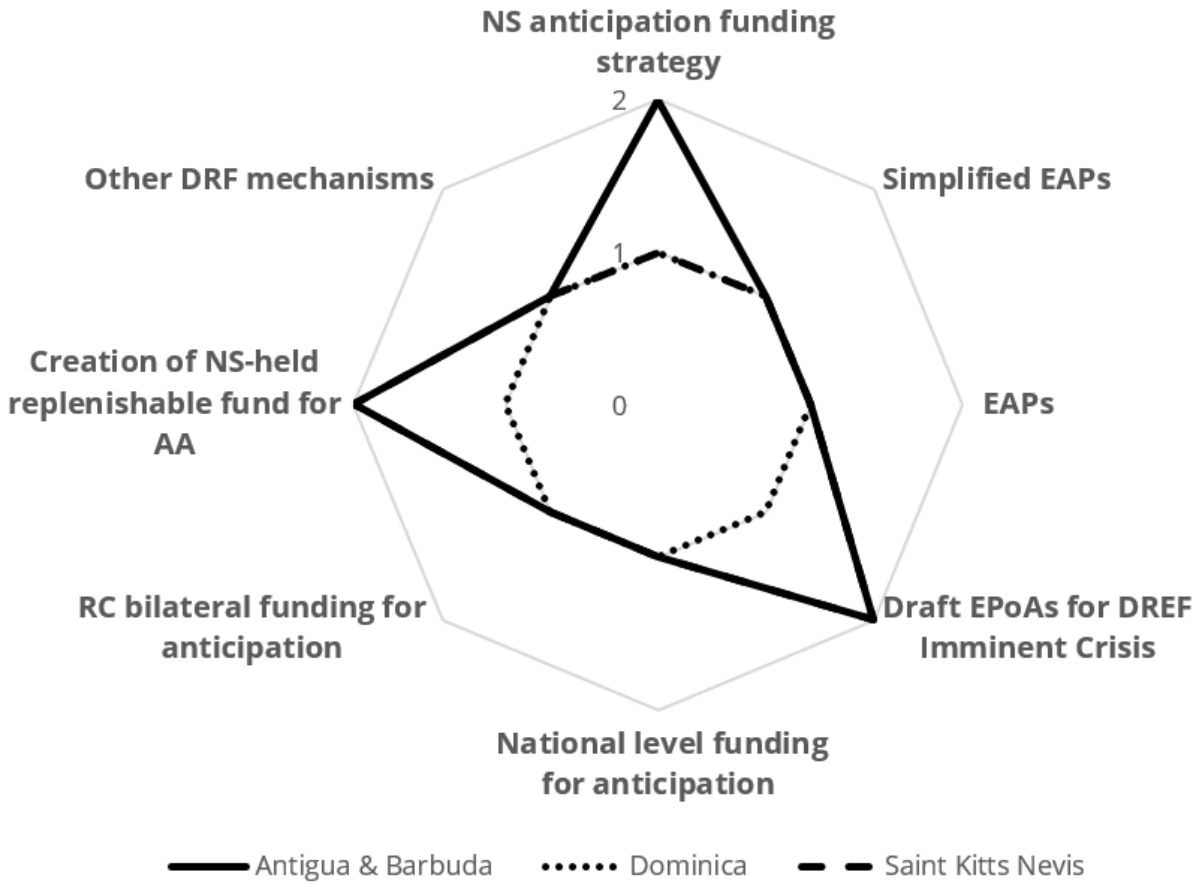


Figure 6 Readiness index in National Society access to anticipation funding streams — Results of self-assessments conducted by the National Red Cross Societies in the three countries

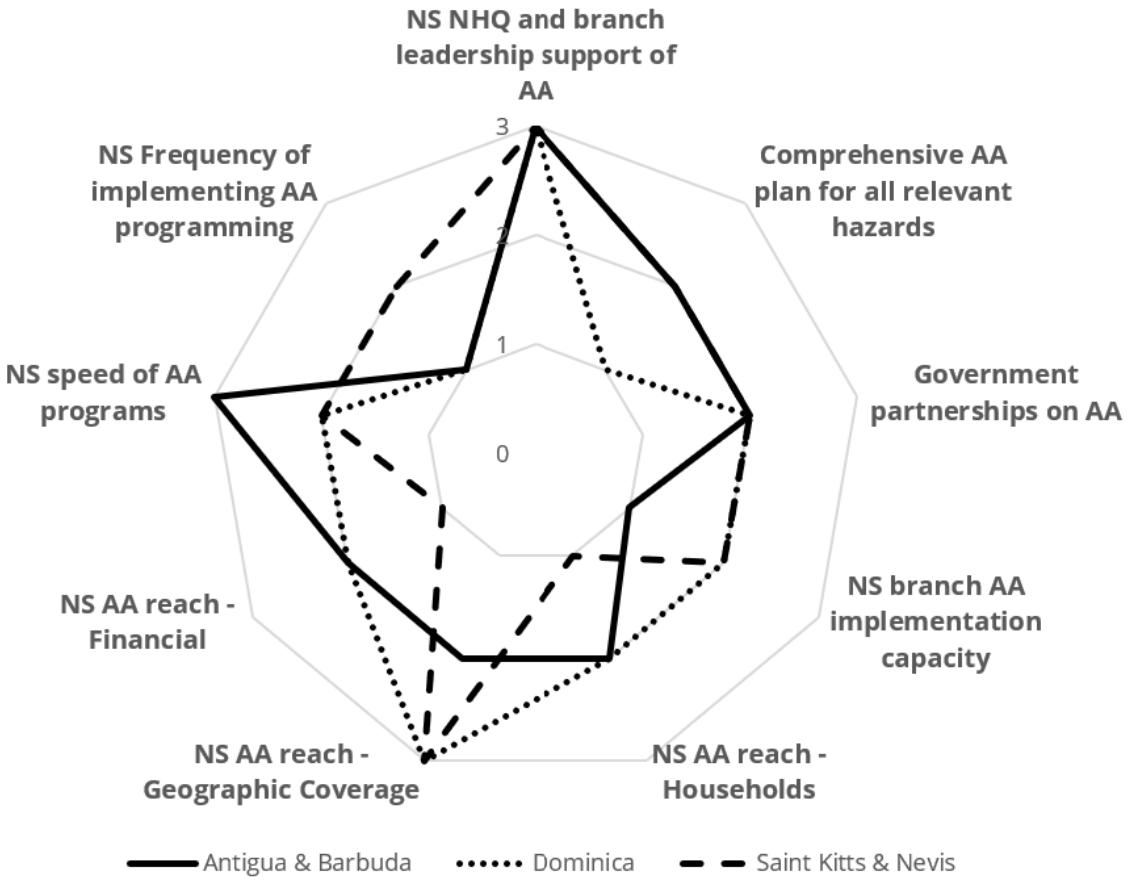


Figure 7 Readiness index in National Society capacity in speed and/or scale of early action programming — Results of self-assessments conducted by the National Red Cross Societies in the three countries

6.1 Assessment of National Societies' Anticipatory Action readiness

Informed by National Society self-assessment and joint review during the in-country workshop, the next section summarizes readiness across key dimensions, highlighting strengths to build on and priority gaps to address.

Saint Kitts and Nevis

The Anticipatory Action Readiness Index assessment for Saint Kitts and Nevis indicates that the National Society has knowledge of forecasting, with the ability to use and interpret forecasts and established links with the hydro-meteorological authority. Early action capacity is assessed as intermediate, while financing remains limited, with no mechanism in place to allocate funds based on early warning information. The National Society has technical readiness to anticipate events but faces constraints due to the lack of Standard Operating Procedures (SOPs) and pre-

arranged finance. To strengthen these capabilities, the National Society can formalize its current response processes within the National Emergency Operations Centre (NEOC) to develop an Early Action Protocol. The National Society's experience in EOC simulations, including participation in live activation drills with national stakeholders, will facilitate the transition from technical expertise to effective implementation of an Early Action Protocol. Additionally, this process provides an opportunity for the National Society to share valuable lessons learned with other National Societies during Early Action Protocol simulation exercises.

Antigua and Barbuda

Based on its self-evaluation using the Anticipatory Action Readiness Index, Antigua and Barbuda demonstrates an intermediate level of preparedness for anticipatory action. Forecasting capacity is relatively strong: forecasting products are used effectively, relationships with the hydro-meteorological service are mature, and core concepts are generally understood. The main challenge is low-level trigger interpretation, but close cooperation between the National Society and the Antigua and Barbuda Meteorological Services (ABMS) helps address this. A Memorandum of Understanding (MoU) with ABMS is also being prepared to further support the National Society. Financing is still basic, dedicated mechanisms for anticipatory action are not yet in place and early action capacity is uneven: leadership endorsement and operational speed are good, but branch-level execution and the regularity of programming are limited. These gaps don't mean the National Society can't implement anticipatory action; rather, they show where an Early Action Protocol can enhance its disaster risk management. A practical next step is to use the Met Office's expertise to develop an Early Action Protocol for a key hazard.

Dominica

According to the Anticipatory Action Readiness Index evaluation, Dominica's readiness profile is classified as basic to intermediate. The National Society is familiar with forecasting products and concepts, but trigger threshold development and interpretability are still low, and the financing environment for anticipatory action is minimal. On the implementation side, there is strong leadership support and solid geographic reach. In effect, the Dominica Red Cross Society has buy-in and reach but lacks the pre-arranged resources to act ahead of impact. There is an opportunity to translate available forecasting into a clear decision pathway by developing an Early Action Protocol for the highest-impact hazard. This will help strengthen the National Society’s disaster risk management capacity.

In all three countries, the lack of an operational anticipatory action framework and dedicated financial mechanisms, coupled with susceptibility to climate-related hazards, highlights a significant gap. Initiating the development of Early Action Protocols focused on a single priority hazard will support efforts to enhance the readiness index for anticipation within National Societies.

6.2 Stakeholder Influence on Anticipatory Action Readiness

This section identifies the national and regional stakeholders that shape anticipatory action readiness across forecasting, governance/mandates, communication, and early action implementation. The stakeholder mapping is based on a desk review of national disaster management plans and interviews conducted during in-country workshops. For each country, the table outlines each stakeholder's mandate, decision authority, interests, current stance, and the actions required to operationalize anticipatory action. This analysis is intended to help National Societies identify enablers, address coordination gaps, and prioritize engagement to strengthen readiness for implementation.

6.2.1 Saint Kitts and Nevis

This stakeholder mapping summarizes the institutions that determine anticipatory action readiness across forecasting, governance, communication, and last-mile delivery. Key actors are the Saint Kitts MET Office (forecasts/warnings), the National Emergency Management Agency (NEMA) on Saint Kitts and the Nevis Disaster Management Department (NDMD) for activation, and the NEOC for coordination. Community reach is enabled by district managers, vulnerable groups advocates, and faith/heritage groups, with regional support from the Caribbean Disaster Emergency Management Agency (CDEMA) and the Caribbean Institute for Meteorology and Hydrology (CIMH). Priority actions include formalizing data-sharing MoUs, embedding stakeholders in technical working groups for anticipatory action (AA TWG).

Stakeholder	Role/mandate	Power	Interest	Current stance	Recommended next steps	Risks
Saint Kitts MET office	Forecasts & warnings	High	High	Supportive	Data sharing MoU/Part of the sub-regional/national AA TWG	Competing priorities
NEMA	Declaration of emergency at national level	High	High	Supportive	Part of the sub regional AA TWG	
NDMD	Declaration of emergency on Nevis	High	High	Supportive	National AA TWG	
NEOC	Emergency coordination	Medium	High	Supportive		

Saint Kitts community leader representing disabled people	Access point to communities	High	?	?	National AA TWG
Saint Kitts Christian Council, St Christopher Heritage Society	Access point to communities	Medium	Medium	?	Inform
District managers (responsible for shelter coordination)	Implementation partners	Medium	High	Supportive	Part of the national AA TWG
CDEMA	Regional coord. & logistics	Medium	High	Supportive	Part of the sub-regional AA TWG
CIMH	Regional Forecasts	Medium	High	Supportive	Part of the sub-regional AA TWG

6.2.2 Antigua and Barbuda

This mapping identifies the stakeholder's readiness across forecasting, decision authority, communication, and implementation. The ABMS provides forecasts and warnings, while the National Office of Disaster Services (NODS) holds activation authority. Community Disaster Response Teams are central to last-mile delivery, complemented by regional partners (CDEMA, CIMH). Immediate priorities are to close communication gaps, establish MoUs for data sharing and coordination, and integrate all actors into the AA TWG.

Stakeholder	**Role/mandate**	**Power**	**Interest**	**Current stance**	**Recommended next steps**	**Risks**
ABMS	Forecasts & warnings	High	High	Supportive	Data sharing MoU/part of the sub-regional + national AA TWG	
NODS	Declaration of emergency	High	High	Supportive	MoU/part of the sub-regional + national AA TWG	Communication Gap
Community Disaster Response Teams in Antigua and Barbuda	Implementing partner	Mid	High	?	national AA TWG	
CDEMA	Regional coord. & logistics	Medium	High	Supportive	Part of the sub-regional AA TWG	
CIMH	Regional Forecasts	Medium	High	Supportive	Part of the sub-regional AA TWG	

6.2.3 Dominica

This mapping outlines the actors influencing readiness across forecasting, governance, communication, and early-action implementation. The Dominica Meteorological Service (DOMMET) leads forecasting and warnings, while the Office of Disaster Management (ODM) coordinates emergency management. District Emergency Committees and partners such as the World Food Programme (WFP) provide implementation capacity at community level; the CDEMA and the CIMH add regional coordination and forecast support. Key next steps are to strengthen ODM engagement, finalize MoUs and ensure stakeholders participation in the AA TWG.

Stakeholder	Role/mandate	Power	Interest	Current stance	Recommended next steps	Risks
DOMMET	Forecasts & warnings	High	High	Supportive	Data sharing MoU/part of the sub-regional + national AA TWG	Competing priorities
ODM	Emergency coordination	High	High	No engagement	MoU/part of the sub-regional + national AA TWG	Lack of coordination
Dominica District Emergency Committees	Implementing partners	High	High		national AA TWG	
WFP Dominica office	Implementing partners	High	High	Supportive	national AA TWG	
CDEMA	Regional coord. & logistics	Medium	High	Supportive	Part of the sub-regional AA TWG	
CIMH	Regional Forecasts	Medium	High	Supportive	Part of the sub-regional AA TWG	

6.2.4 Regional Stakeholders

In addition to national stakeholders, understanding and mapping regional stakeholders is crucial for ensuring a coordinated, effective, and sustainable anticipatory action design for the three countries. In small island state countries, regional organizations play a pivotal role in bridging the gaps between national efforts and global support, offering technical expertise, logistical frameworks, and harmonized strategies that no single country could achieve alone. By including regional stakeholders in the mapping process, the countries can leverage shared resources, standardize procedures, and promote collaboration that transforms early warning into timely, impactful early action. The key regional institutions whose mandates, networks, and capabilities are instrumental in operationalizing anticipatory action in Saint Kitts and Nevis, Antigua and Barbuda and Dominica are listed below.

The Caribbean Disaster Emergency Management Agency (CDEMA)

Regional coordination is critical for disaster response in the Caribbean. Over the past two decades, Caribbean governments have recognized that increasingly frequent and severe disasters undermine development by diverting scarce resources from long-term priorities to relief, rehabilitation, and reconstruction. This reality has accelerated a shift from ad-hoc response toward comprehensive disaster risk management and stronger regional coordination. Working together allows states to pool limited technical and logistical capacities, standardize operating procedures, share data and analysis, and present a unified counterpart to global institutions and donors. In short, regional coordination turns early warnings into earlier, better-resourced action, reducing losses and speeding recovery across multiple countries at once.

The CDEMA is the region’s institutional answer to this need for collective action. Collaboration in disaster risk management is embedded in the Caribbean integration project: the Treaty of Chaguaramas (1973) emphasizes functional cooperation, and the 2001 Revised Treaty (Article 6(i)) names enhanced functional cooperation as a core Caribbean Community and Common Market (CARICOM) objective. Building on these commitments, and amid mounting disaster impacts, the 2007 CARICOM Heads of Government declaration, *A Community for All: Declaration on Functional Cooperation*, endorses reorganizing regional arrangements and establishing the CDEMA as a critical institution for mitigating natural and human-made disasters within the region’s sustainable development agenda. Today, the CDEMA provides the backbone for regional coordination in disaster risk management: convening national authorities, aligning preparedness and response plans, mobilizing surge support and logistics across participating states, and enabling countries to collaborate meaningfully with global partners. By strengthening this shared architecture, CDEMA helps translate awareness and early warning into timely, coordinated action that protects lives and livelihoods across the Caribbean.

The CDEMA is a critical partner for anticipatory action, because it serves as the region's intergovernmental coordinator for disaster risk management, providing the mandate, legitimacy, and backbone systems needed to translate early warning into early action at scale and with government ownership. Through its role, CDEMA can integrate trigger thresholds and Early Action Protocols into national and regional disaster coordination mechanisms, ensuring actions are recognized and synchronized across government agencies. It also has the convening power to align forecast-based triggers, thresholds, and risk communication, while providing logistics frameworks, staging hubs, and customs pre-clearance that enable rapid deployment within short lead times. By strengthening information flows through access to regional forecast guidance and common operating pictures, the CDEMA helps target early actions to the most at-risk communities. In addition, it mobilizes resources by aligning regional and donor support with anticipatory financing tools, and institutionalizes anticipatory approaches through agreements, exercises, and after-action reviews, embedding them into comprehensive disaster risk management systems for sustainability.

Caribbean Institute for Meteorology and Hydrology (CIMH)

The CIMH is the region's technical hub for weather, climate and hydrology services. As the World Meteorological Organisation (WMO)'s designated regional climate centre for the Caribbean, the CIMH supports national meteorological and hydrological services with data, modeling, verification, training, and coordinated outlooks (e.g., through the Caribbean Climate Outlook Forum, drought and heat monitoring, and sector briefs). Its mandate and technical depth make it a natural partner for turning forecasts into decision-ready information across multiple hazards.

The CIMH is a critical partner for anticipatory action, as it provides the scientific and technical foundation for designing and activating evidence-based triggers. Through access to historical datasets, reforecasts, and forecast skill assessments, the CIMH supports trigger setting, monitoring, and activation processes. It strengthens capacity across national meteorological and disaster agencies by promoting standardized methods, training, and consistent advisories that reduce conflicting messages when thresholds are approached. The CIMH also facilitates data sharing and integration by brokering access to regional data streams and ensuring outputs feed into both government and National Red Cross Societies' systems, enabling coordinated decision-making. Its multi-hazard expertise extends anticipatory approaches beyond cyclones to floods, droughts, heat, and rainfall-related landslides, reflecting the realities faced by communities. At the regional level, the CIMH plays a vital role in aligning thresholds and risk communication across countries, ensuring harmonized approaches that are essential for sub-regional activation and cross-border operations.

Other Relevant Regional Stakeholders for Anticipatory Action

Beyond the CDEMA and the CIMH, several regional and UN organizations are involved in anticipatory action in the Caribbean. Early engagement with these actors supports the coordination of triggers, financing, logistics, and the delivery of assistance. For instance, WFP works on shock-responsive social protection, which aims to strengthen national and regional systems to respond to disasters, such as hurricanes and climate-related shocks. WFP collaborates with governments and regional bodies like the CDEMA to enhance the use of existing social protection mechanisms, such as cash assistance, to provide timely support to at-risk populations. Main activities include providing technical assistance in vulnerability analysis, supply chain management, disaster risk finance, and the implementation of digital tools to improve response efforts. These components contribute to the effective application of anticipatory action.

The Caribbean Catastrophe Risk Insurance Facility – Segregated Portfolio Company (CCRIF SPC) is a regional risk pool established in 2007 that provides parametric disaster-risk financing to Caribbean and Central American governments. It issues insurance payouts for events such as tropical cyclones, earthquakes, excess rainfall, fisheries shocks, or fluvial floods based on parametric triggers rather than on-site damage assessments. CCRIF SPC's use of parametric insurance addresses ex-ante financing requirements by providing liquidity immediately after qualifying events. The datasets and models employed by CCRIF can support anticipatory planning and may be relevant to exploring engagement opportunities with the organization.

7. Forecast Skill Assessment for Anticipatory Action Triggers

The design of anticipatory action for hurricanes relies on the availability of accurate and timely forecasts. Multiple agencies provide global and regional predictions, but their effectiveness depends on reliability, making verification necessary. This section examines forecast skill for anticipatory action in Saint Kitts and Nevis, Antigua and Barbuda and Dominica, focusing on products used by meteorological agencies in these countries.

7.1 National Hurricane Center Forecast

As noted in the institutional landscape section, the meteorological agencies in all three countries rely on forecasts provided by the U.S. National Hurricane Center (NHC). For the Atlantic basin, which includes the Eastern Caribbean, the NHC issues the official tropical cyclone forecasts and conducts rigorous verification of both its own products and major Numerical Weather Prediction (NWP) models. Findings from the NHC's verification programme provide detailed insight into forecast accuracy and model performance across lead times (Cangialosi 2022).

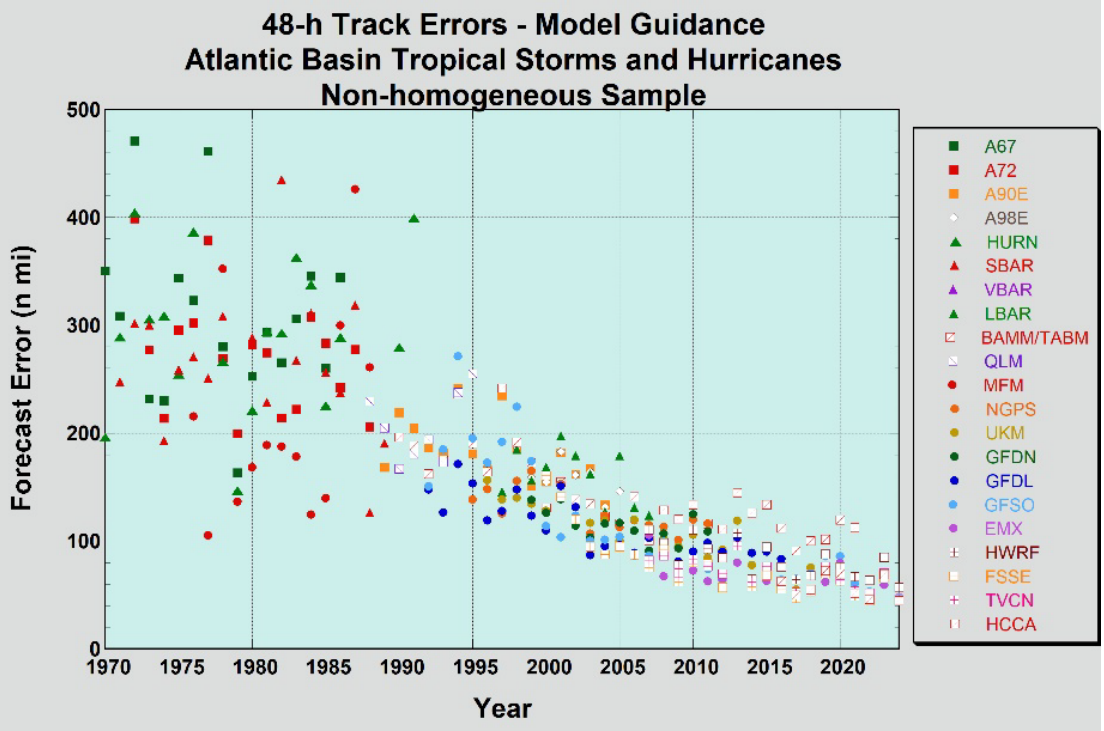


Figure 8 A non-homogeneous comparison of annual average model track errors for Atlantic basin tropical storms and hurricanes for the period 1970-2024. The skill of available forecast with 48h lead time indicates a track error of around 70 kilometers.

Analyses from the NHC show sustained gains in hurricane forecasting, with notable reductions in both intensity and track errors. Over the past 20 years, 24–72-hour track errors have fallen by about 75%, and 96–120-hour errors by about 60%.

Current forecast skill at 48 hours produces track errors of approximately 90 km—comparable to the entire width of nations such as Antigua and Barbuda or Saint Kitts and Nevis. Given that hurricane-force winds typically extend 45-90 km from the storm centre and tropical storm-force winds reach 280-370 km outward, these small islands nations fall entirely within potential impact zones even when storms pass at distances equal to the forecast error margin. A 48-hour forecast placing a hurricane track near these islands justifies Early Action Protocol activation, as even a "near-miss" at maximum forecast error distance would still impact the islands. **Therefore, the 48-hour forecast threshold provides sufficient confidence for triggering anticipatory action without risk of acting in vain.**

Actual impacts depend on storm size and asymmetry, so decisions should be guided by the latest NHC wind-radii and hazard products rather than distance to the centre alone. As a rule of thumb, hurricane-force winds (≥74 mph / 119 km/h) typically extend 25–50 nautical miles (nmi) (45–90 km) from the centre, while tropical-storm-force winds (≥39 mph / 63 km/h) often reach 150–200 nmi (280–370 km). In the Caribbean, small shifts in the forecast track can determine whether a country intersects the high-impact wind zone. A 40–50 nmi track error at 48 hours still lies within the average radius of hurricane-force winds precision sufficient to justify activating preparedness, mobilizing communities, and pre-positioning relief so early actions reduce risk before impacts occur.

Even though forecast skill continues to improve, challenges remain. Tropical cyclone genesis and rapid intensification remain major forecasting limitations for effective early warning systems. In the Atlantic basin, cyclogenesis is often delayed until disturbances encounter favorable environments, making it difficult to determine which tropical waves will evolve into significant threats (Kossin 2017; Wang et al. 2017). Rapid intensification can further complicate preparedness, as weak storms may strengthen into major hurricanes within 24–36 hours, compressing the available window for mobilizing resources and issuing timely warnings. Forecast skill for rapid intensification lags considerably behind that of track prediction, and shortcomings in anticipating sudden intensity changes can weaken confidence in early action frameworks. These scientific and operational gaps highlight the need for continued investment in forecast verification, the adoption of innovative modelling approaches including Artificial Intelligence (AI)-driven systems, and the development of anticipatory mechanisms capable of functioning under uncertainty with adaptable lead times.

7.2 Opportunity from AI-Based Weather Prediction Models

Recent advancements have enabled the use of AI forecasting tools to enhance weather prediction capabilities. AI is significantly transforming the field by delivering forecasts that are faster, more accurate, and less computationally intensive compared to traditional physics-based models. Whereas conventional methods depend on solving intricate mathematical equations related to fluid dynamics and thermodynamics, AI systems leverage extensive historical data to generate predictions within seconds. This capability supports rapid updates, improved local accuracy, and greater accessibility—benefits that are particularly vital for disaster-prone and data-limited regions such as the Caribbean. Next-generation models developed by leading organizations are demonstrating AI's potential to complement and augment traditional forecasting approaches. Notably, three prominent systems—the European Centre for Medium-Range Weather Forecasts (ECMWF)'s AI/Integrated Forecasting System (AIFS), Google DeepMind's GraphCast, and Microsoft Research's Aurora—now offer medium-range forecasts whose performance matches or surpasses that of standard numerical models across various metrics.

7.2.1 AIFS – AI/Integrated Forecasting System (ECMWF)

The AI/Integrated Forecasting System (AIFS) is ECMWF's flagship, data-driven counterpart to its physics-based Integrated Forecasting System (IFS). Built with a graph-neural-network encoder/decoder and a transformer core trained on ERA5 and operational analyses, AIFS is designed to emulate—and in many cases surpass—traditional NWP skill while running far more efficiently. Public descriptions and the technical paper report highly skilled forecasts across upper-air and surface variables as well as tropical-cyclone tracks.

ECMWF's newsletter presents headline verification where AIFS matches or exceeds IFS on standard metrics (e.g., Northern Hemisphere 500-hPa height ACC for 2022). ECMWF communications further note that AIFS delivers improvements on several measures, including tropical-cyclone track errors (up to ~20% better) in internal comparisons. Early user-focused verification also highlights strong overall performance with some precipitation caveats (e.g., bias at low rates in initial assessments), consistent with ongoing peer-reviewed evaluations that compare AIFS and IFS rain skill. In short: track and many synoptic-scale fields show competitive or better skill; precipitation and some regimes remain active areas of tuning. AIFS is now operational at ECMWF: the deterministic AIFS Single entered operations on 25 February 2025, and the AIFS-ENS ensemble became operational on 1 July 2025.

AIFS products are available alongside IFS on ECMWF OpenCharts and via open-data streams, with continued evolution planned (e.g., resolution upgrades) (ECMWF).

7.2.2 GraphCast (Google/DeepMind)

GraphCast (Google/DeepMind) is a global, AI-based weather model that learns from decades of reanalysis to predict hundreds of variables out to 10 days within minutes. The peer-reviewed Science paper and DeepMind's release note that GraphCast often matches or exceeds leading physics models at far lower computational cost.

In head-to-head tests, GraphCast outperformed ECMWF's high-resolution IFS (HRES) on ~90% of 1,380 verification metrics globally and showed lower tropical-cyclone track errors across multi-day leads; DeepMind also highlighted an early, stable landfall signal for Hurricane Lee about 9 days in advance. Independent coverage echoes these results, while noting known challenges around some extremes.

GraphCast is not an official operational forecast system at a national centre, but ECMWF runs it experimentally on OpenCharts (with verification panels alongside other AI models). The open-source code and pretrained weights enable third parties—and ECMWF's AI-models tooling—to run it; DeepMind's newer Weather Lab site also serves interactive AI forecasts.

7.2.3 Aurora Forecasting (Microsoft Research)

Aurora (Microsoft Research) is a large-scale, foundation AI model for weather and Earth-system prediction. Trained on >1 million hours of diverse meteorological and geophysical data, it uses a 3D transformer architecture to produce fast, high-resolution global forecasts and to tackle related tasks (air quality, ocean waves) via fine-tuning. The peer-reviewed Nature paper and Microsoft's technical materials position Aurora as a data-driven counterpart to traditional NWP that can deliver comparable or superior skill at a fraction of the computational cost.

Across extensive benchmarks, Aurora matches or outperforms operational systems on many 10-day weather metrics and delivers state-of-the-art tropical-cyclone (TC) track forecasts. The Nature study reports improvements spanning global weather, air quality, ocean waves, and high-resolution weather, at orders-of-magnitude lower compute. Public summaries highlight that Aurora beat seven forecasting centres on 5-day TC tracks in the 2022–2023 season and, in case studies, provided earlier/stabler track guidance (e.g., Typhoon Doksuri). Independent reporting also notes broad gains versus ECMWF HRES on most tested variables. As with other AI models, precipitation and certain extremes remain active areas for scrutiny and cross-validation with official hazard products.

Aurora is not an official operational forecast at a national or regional centre; it is a research model with open-source code and released weights, enabling third parties to run and fine-tune it (e.g., via WeatherBench2 initial conditions, with example notebooks for TC tracking). This makes

Aurora practically deployable by agencies or partners as a complement to official guidance, while formal operational adoption proceeds through further evaluation.

7.3 Summary

An assessment of the forecast landscape indicates that there is an opportunity to develop such a mechanism. The proposed approach would leverage the NHC's forecasts for its triggering mechanism, which have demonstrated substantial improvements in accuracy over recent decades. For example, the NHC's 48-hour track error now averages about 50 nmi (~90 km), providing a reliable basis for activating preparedness measures as a hurricane's forecast track approaches a location. In designing an anticipatory action system for Saint Kitts and Nevis, Antigua and Barbuda, and Dominica, it is advisable to use NHC forecasts and associated wind-radii/hazard products as the primary triggers. These remain the official and most rigorously used source by the respective national agencies in the three countries. A 48-hour window could be adopted for mobilizing communities and pre-positioning relief, as this timeframe reliably identifies areas at risk, while allowing for forecast uncertainties due to storm size and asymmetry.

Looking ahead, emerging AI-based weather prediction models offer promising opportunities to further strengthen Early Action Protocols. Systems such as ECMWF's AIFS, Google DeepMind's GraphCast, and Microsoft Research's Aurora have demonstrated the ability to deliver medium-range forecasts with skill comparable to or surpassing traditional numerical models, along with faster updates and improved computational efficiency. While these AI models are not yet operational tools at national centres, they are available for experimental use and could be incorporated through the Caribbean Institute for Meteorology and Hydrology (CIMH) as complementary resources for rapid local updates and scenario planning within a newly developed anticipatory framework.

In addition, the role of AI extends beyond enhancing forecast skill. Advances in data-driven modelling are also reshaping how decision-makers interact with forecasts and underlying data. Concepts such as ECMWF's Forecast-in-a-Box (ECMWF 2025) illustrate how trained AI models can be deployed locally and adapted to specific user contexts, while AI-enabled interfaces—including chatbots—offer the ability to generate customized impact assessments on demand. Together, these innovations signal a shift from static forecast products toward interactive, user-centred systems that provide context-specific insights in real time, thereby improving both the timeliness and relevance of early warning and response frameworks.

Furthermore, there are important opportunities to leverage international funding mechanisms that can accelerate improvements in forecasting and early warning capacity. Initiatives such as the European Union (EU)'s Global Gateway, the Systematic Observations Financing Facility (SOFF) and the Climate Risk and Early Warning Systems (CREWS) programme provide dedicated financial

and technical support that institutions like CIMH and national hydrometeorological agencies can tap into. Accessing these resources would not only strengthen forecasting infrastructure and data integration but also enhance the operationalization of "Early Warnings for All" by expanding coverage, improving timeliness and ensuring that vulnerable communities benefit from the most advanced science and tools available.

In summary, this study concludes there is enough forecast skill with 48-hour lead time that can be used for the development of an anticipatory action system for Saint Kitts and Nevis, Antigua and Barbuda and Dominica based on NHC forecasts for trigger thresholds. The prospect for improved forecasting is also strengthening, supported by emerging opportunities in data-driven models and international financing mechanisms that can further enhance early warning capacity.

8. Exploring a Regional Model for Anticipatory Action in the Caribbean

Effective implementation of anticipatory action requires strong coordination among national stakeholders, humanitarian organizations, and regional actors, both during the design of Early Action Protocols and throughout their operationalization. This ensures that triggers are well aligned with national priorities, early actions are complementary to existing response systems, and resources are used efficiently.

National agencies, including National Red Cross Societies across the small island nations of the Caribbean, often operate with limited human, financial and material capacity. While they are committed to advancing anticipatory action, the scale of resources required for effective design and implementation of Early Action Protocols can be challenging to sustain at the national level. A sub-regional approach for the development of Early Action Protocols therefore offers a more practical and impactful pathway by pooling expertise, strengthening coordination, and facilitating peer learning for more consistent and impactful implementation across multiple countries. Moreover, building on existing systems of cooperation and shared platforms is possible.

Caribbean nations already collaborate through established regional mechanisms for disaster risk reduction and forecasting, such as the Caribbean Disaster Emergency Management Agency (CDEMA) and the Caribbean Institute for Meteorology and Hydrology (CIMH). These platforms provide structured coordination, technical expertise, and data services that can be readily aligned with Early Action Protocols. Integrating anticipatory action into such regional mechanisms would not only enhance efficiency but also ensure coherence with existing response frameworks.

In addition, valuable experiences within individual National Societies can be leveraged to strengthen preparedness across the region. For example, the Saint Kitts and Nevis Red Cross Society regularly participates in simulation exercises designed to test the functionality of the National Emergency Operations Centre (NEOC). These exercises form part of the country's annual preparedness activities and involve all sub-committees of the National Disaster Risk Management Plan. As a result, they generate practical lessons on coordination, communication, and operational readiness that can be shared with other National Societies to enhance their own anticipatory action planning.

Forecasting and disaster management in the Caribbean are already organized in a sub-regional format. For instance, the Antigua and Barbuda Meteorological Service (ABMS) provides forecasting support to Saint Kitts and Nevis, while the CDEMA's sub-regional logistics warehouse in Antigua and Barbuda also serves Saint Kitts and Nevis. Similarly, Dominica receives support from the Barbados Meteorological Service and from the CDEMA's logistics hub located in Barbados.

Taken together, these arrangements indicate that a sub-regional approach to anticipatory action is both feasible and highly compatible with the region's existing disaster management architecture. Such an approach would promote stronger coordination and peer learning, while positioning anticipatory action as a natural extension of the well-established regional disaster response system.

In addition, lessons from the early years of anticipatory action implementation highlight a strong push toward harmonization at both national and regional levels. Experience has shown that anticipatory action works best when national stakeholders lead the process, while aligning with regional standards, data services, and coordination mechanisms. This combination ensures that activation is fast, consistent, and scalable across borders. In Latin America and the Caribbean, the Technical Group on Anticipatory Action (TGAA) was established by humanitarian and development partners to harmonize and scale anticipatory initiatives at the regional level. The TGAA complements national technical groups and aligns with global guidance directly addressing issues of duplication and uneven capacity among countries. In East Africa, the Intergovernmental Authority on Development (IGAD)'s Regional Roadmap for Anticipatory Action sets out a cohesive regional model that standardizes triggers, roles and data services, while embedding anticipatory action in member states' policies. Its explicit aim is to achieve a harmonized, coordinated, and scaled-up practice across the region. In Southern Africa, a multi-agency Regional Anticipatory Action Working Group (RAAWG) operates under a shared inter-agency roadmap, organized around four key pillars: coordination, information services, financing, and learning. This mechanism has proven effective in mobilizing resources and guiding action across multiple countries during regional hazards. In the Asia–Pacific region, a Regional Technical Working Group on Anticipatory Action facilitates cross-country knowledge sharing and the development of joint standards. Additionally, the Association of Southeast Asian Nations (ASEAN) has adopted a Framework on Anticipatory Action in Disaster Management, created with regional and global partners, to guide systematic integration across its member states.

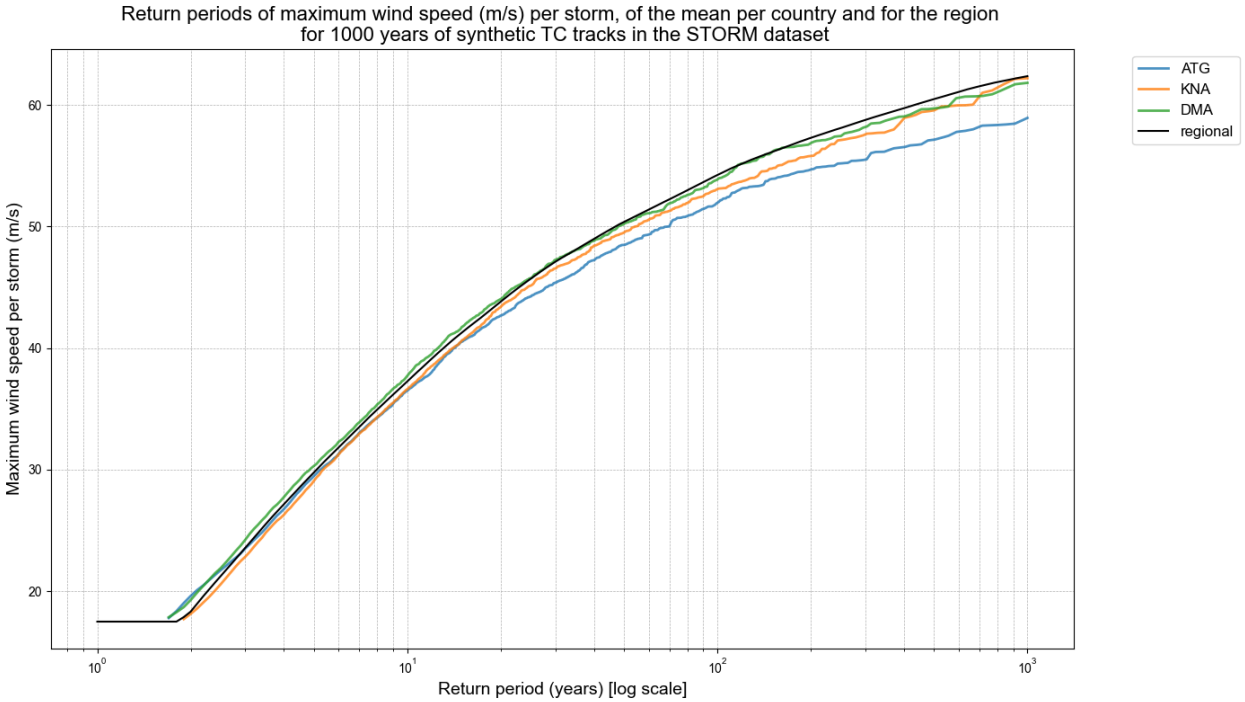
Taken together, these experiences demonstrate that a sub-regional Early Action Protocol approach for the Caribbean is not only feasible but highly strategic. It would build on lessons learned globally while leveraging the region's existing cooperation platforms, enabling anticipatory action to be implemented more effectively, consistently, and at scale.

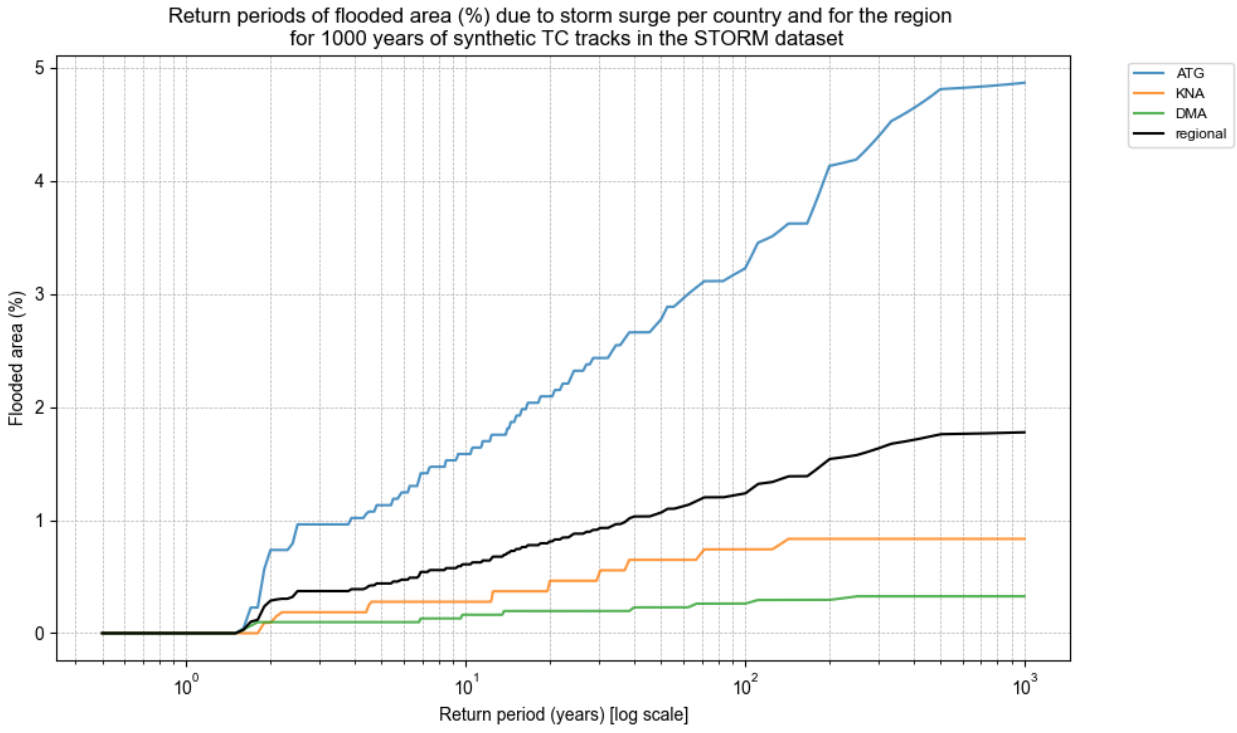
The following section proposes a potential governance framework to operationalize this sub-regional Early Action Protocol.

8.1 Country Risk Profiles and Implications for Early Action Protocol Design

For the potential trigger of the sub-regional Early Action Protocol, it is important to compare the risk profiles of the participating countries across different hazards. Insights from the literature review and in-country workshops highlight that wind hazard is the primary driver of damage during hurricanes in all three countries. However, in Dominica, rainfall associated with lower-category hurricanes events that may cause limited impact elsewhere often results in significant damage due to flooding and landslides. This distinction should be considered when defining anticipatory action triggers.

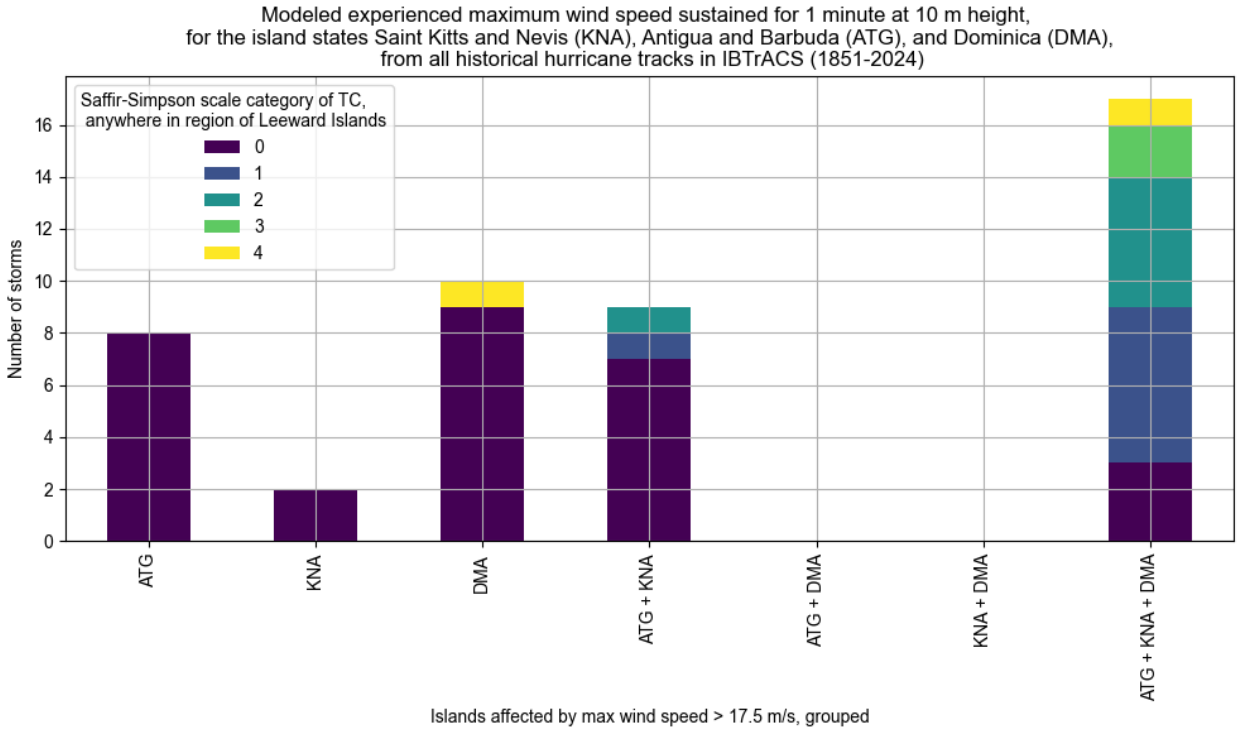
Another key question in the context of a sub-regional Early Action Protocol is the likelihood of triggering protocols simultaneously across all three countries. To explore this, historical data were analyzed using the Synthetic STORM dataset. Wind speed and storm surge levels were extracted per country with the Climate Risk and Adaptation Platform (CLIMADA)'s Python library, and hazard frequencies were plotted over time. These frequencies were then compared across the three countries and against the regional average for the Eastern Caribbean. The analysis indicates that the three countries share similar wind hazard risk profiles, which align closely with the regional average. This suggests that while national differences exist, wind-related hazard risk is broadly comparable across the sub-region. However, the storm surge risk profile differs significantly. Antigua and Barbuda face higher storm surge risk than both the regional average and the other two countries, while Dominica shows the lowest risk, and Saint Kitts also records relatively lower risk compared with the regional benchmark. Therefore, in addition to wind speed, storm surge induced by tropical cyclones should be explicitly considered in defining anticipatory action triggers for Antigua and Barbuda.





To better understand the likelihood of triggering sub-protocols simultaneously across all three countries, historical hurricane events in the Eastern Caribbean were analysed, focusing on how often storms made landfall in one, two, or all three countries. The analysis was carried out for

different hurricane categories. Using the International Best Track Archive for Climate Stewardship (IBTrACS) dataset (1851–present), the estimated maximum wind speed per storm was modeled for each island based on the Holland model. A threshold of 17.5 m/s was applied to determine whether a storm would have been experienced as significant on each island. The results demonstrate that 20 storms affected only one of the three states, 9 storms affected both Saint Kitts and Nevis and Antigua and Barbuda, and 17 storms impacted all three countries simultaneously (Lisette de Valk, MSc research).



The analysis indicates that there is roughly a 33% likelihood that all three countries could be simultaneously affected by a hurricane, highlighting the need for a sub-regional Early Action Protocol that carefully considers implications for activation and funding. Key questions include whether the full allocation would be released if only one island is impacted, how available funding would be divided if all three are affected at once, and how to manage cases where one island meets the trigger criteria and another follows shortly after. Addressing these different scenarios during the development of the sub-regional protocol will be essential to ensure clarity and fairness in both activation procedures and resource allocation.

8.2 Regional Early Action Protocol Governance

In the debriefing meetings following the in-country workshops, the three National Societies in Saint Kitts and Nevis, Dominica, and Antigua and Barbuda indicated their commitment to explore

a regional Early Action Protocol approach as a viable way forward. This section examines potential options for how the governance of such a regional Early Action Protocol could be organized. One option is a two-level governance model, divided between regional and national levels with clearly defined mandates. At the regional level, a governance committee would provide oversight, coordination, and technical guidance. This body would be responsible for validating regional triggers, ensuring consistency across countries, facilitating access to regional forecasting services, and aligning anticipatory actions with existing regional coordination mechanisms such as RCM CDEMA. It would also play a role in cross-country learning.

At the national level, National Red Cross Societies, working closely with government disaster management authorities and other stakeholders, would lead the implementation of early actions. Each country would contribute to a jointly owned regional protocol, but operate through country-specific annexes that define context-appropriate actions, roles, and resources. This ensures flexibility at the country level, while maintaining coherence under the regional framework.

8.2.1 Protocol Ownership and Structure

The regional Early Action Protocol will be governed through a shared ownership model, distinguishing between regional and national responsibilities. It will consist of **one core section** that defines the overarching regional framework, complemented by **three country-specific annexes**. These annexes will include each country's components of the Early Action Protocol such as budgeting, roles and responsibilities, implementation arrangements and planning, monitoring, evaluation, and reporting to ensure operational relevance at the national level while maintaining regional coherence.

Based on the International Federation of Red Cross and Red Crescent Societies (IFRC)'s Early Action Protocol template, an Early Action Protocol is composed of several key elements organized into different sections. For the proposed regional approach, these sections will be divided between the core protocol and the country-specific annexes. The core section of the regional Early Action Protocol establishes the overarching framework that is jointly owned across participating countries. It includes the risk analysis, the Early Action Protocol trigger, the standardized methodology for selecting actions, regional activation and stop mechanisms, as well as the common framework for monitoring, evaluation, accountability, and learning (MEAL). It also outlines the governance and endorsement arrangements that ensure coherence and accountability at the regional level. In contrast, the country annexes translate this framework into the national context. Each annex details the country-specific risk profile and intervention areas, selected early actions, and operational arrangements for implementation. They also include the National Society's capacity assessment, budgeting, logistics planning, and financial requirements.

Core Section (Regional Level)	Country Annexes (National Level)
1. Risk Analysis	1. Risk Analysis – country-specific details
2. Trigger (Monitoring)	2. Trigger Model – localized thresholds and intervention areas
3. Selection of Actions (methodology): Early Action Selection Process, Usefulness of actions if event does not occur, Feasibility (regional criteria)	3. Selection of Actions (national actions): Country-specific early actions, Feasibility analysis and stakeholder validation
4. Early Action Protocol Activation Process (regional mechanisms): Trigger activation system, Stop Mechanism (regional criteria)	4. Early Action Protocol Activation Process (national implementation): Early Action Implementation Process, Selection of Target Population
5. MEAL (regional framework and indicators)	5. MEAL – national reporting integrated into regional MEAL
6. Early Action Protocol Endorsement/Approval – regional endorsement with national validation	6. National Society Capacity
7. Hypothetical Activation Scenario: Presents a simulated activation	7. Finance & Logistics

8.2.2 Decision-Making

For streamlining decision making, this study suggests two Technical Working Groups (TWGs) at the regional and national levels to oversee the implementation of the sub-regional Early Action Protocol. The Regional TWG will include representatives from meteorological agencies, national disaster management authorities, National Red Cross Societies, and regional coordination bodies such as the CDEMA and the CIMH. This regional TWG will be responsible for the overall coordination and governance of the core section of the protocol, ensuring consistency across countries and alignment with regional response mechanisms. At the national level, a dedicated National TWG will be formed in each participating country. Membership will include the National Society and other key national stakeholders identified through stakeholder mapping. These groups will be tasked with overseeing the country-level implementation of the protocol, ensuring

that national annexes are operationalized effectively and in coordination with government-led disaster management structures.

Preparedness Fund: Anticipatory action preparedness budget will be accessible to all three National Societies to support seasonal planning, training, stockpiling, and simulations. Allocations will follow annual preparedness workplans pre endorsed by the TWG and approved by the IFRC validation committee.

Activation Fund: The Anticipatory Action Activation Fund will be allocated based on forecast data and pre-agreed regional trigger statements for the selected lead time. If the trigger, as defined in the main anticipatory action document, is reached at the specific lead time, all countries where the trigger threshold is met will receive the activation fund. This process is guided by the common risk and trigger model outlined in the core document. The release of funds will be expedited and directly channeled to the relevant National Societies to implement country-specific early actions guided by country specific annex.

Implementation and Oversight: National Societies will lead in-country implementation according to their country specific annexes.

Monitoring and Evaluation: Post-activation reviews will be implemented by National Societies according to their country-specific annexes. The sub-regional TWG will facilitate lesson learning from activations across the countries.

Coordination and Communication: National coordination mechanisms will be aligned with country-specific annexes. Regional coordination will be ensured by the sub-regional TWG.

9. Bibliography

Anticipation Hub. 2022. *ANTICIPATORY ACTION IN 2022 A GLOBAL OVERVIEW*.

Cangialosi, John P. 2022. *NATIONAL HURRICANE CENTER FORECAST VERIFICATION REPORT*.

CDEMA. 2020. *Building Disaster Resilience in the Caribbean Region: CDEMA Annual Report 2019–2020. Barbados: Caribbean Disaster Emergency Management Agency*.

ECMWF. 2025. "Forecast-in-a-Box: Portable AI Forecasting Workflows within the DestinE Digital Twin Engine." *Destination Earth*. https://destine.ecmwf.int/news/forecast-in-a-box-portable-ai-forecasting-workflows-within-the-destine-digital-twin-engine/.

IFRC. 2022. "Anticipatory Pillar of the IFRC-DREF | IFRC." January 21. https://www.ifrc.org/happening-now/emergencies/anticipatory-pillar-dref.

Kossin, James P. 2017. "Hurricane Intensification along United States Coast Suppressed during Active Hurricane Periods." *Nature* 541 (7637): 390–93. https://doi.org/10.1038/nature20783.

NEMA, NDMD. 2013. *The Nevis Disaster Management Plan*.

Red Cross Red Crescent Climate Center, Regional et al. 2022, F*orecast-based financing for hurricanes in the Eastern Caribbean: A feasibility study.* Unpublished.

NODS. 2025. *The National Office of Disaster Services (NODS) Announced the Designation of 49 Buildings across Antigua and Barbuda as Hurricane / Emergency Shelters for the 2025 Season.*

Wang, Chunzai, Xidong Wang, Robert H. Weisberg, and Michael L. Black. 2017. *Variability of Tropical Cyclone Rapid Intensification in the North Atlantic and Its Relationship with Climate Variations*. https://repository.library.noaa.gov/view/noaa/20197.

Wilkinson, Emily, Blandine Arvis, Janot Mendler de Suarez, et al. 2021. *Preparing for Extreme Weather in the Eastern Caribbean: What Role for Forecast-Based Early Action?* Working Paper / Overseas Development Institute 603. ODI.

World Bank. n.d. "Climate Change Knowledge Portal | Climate Change Knowledge Portal." Accessed September 24, 2025. https://climateknowledgeportal.worldbank.org/.