CCRIF

CARIBBEAN CATASTROPHE
RISK INSURANCE FACILITY

A Natural Catastrophe Risk Insurance Mechanism for the Caribbean

A Collection of Papers and Articles

November 2009

Design and Layout: Sustainability Managers, Corporate Communications Consultant, CCRIF
Printed by: MAPCO Printers Limited, Kingston, Jamaica

CCRIF: A Natural Catastrophe Risk Insurance Mechanism for the Caribbean

A Collection of Technical Papers and Articles

Published by:

Caribbean Catastrophe Risk Insurance Facility
3rd Floor Harbour Place, 103 South Church Street
P.O. Box 2171, George Town, KY1 - 1105
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CCRIF

CARIBBEAN CATASTROPHE RISK INSURANCE FACILITY

Vision Statement

CCRIF will be a key partner with the Caribbean region in its disaster risk management strategies to support long term sustainable development goals.

Mission Statement

Our Mission is to serve Caribbean governments and their communities in reducing the economic impact of natural catastrophes. We provide immediate liquidity through a range of affordable insurance products in a way that is financially responsible and responsive to their needs.

The CCRIF is the first multi-country risk pool in the world, and is also the first insurance instrument to successfully develop a parametric policy backed by both traditional and capital markets. It is a regional catastrophe fund for Caribbean governments designed to limit the financial impact of devastating hurricanes and earthquakes to Caribbean governments by quickly providing financial liquidity when a policy is triggered. During 2008/09 the CCRIF paid out approximately US$6.3M to the Turks and Caicos Islands in the aftermath of Hurricane Ike.

Members

Sixteen governments are currently members of the fund: Anguilla, Antigua & Barbuda, Bahamas, Barbados, Belize, Bermuda, Cayman Islands, Dominica, Grenada, Haiti, Jamaica, St. Kitts & Nevis, St. Lucia, St. Vincent & the Grenadines, Trinidad & Tobago and the Turks & Caicos Islands.

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Message from the Chairman, Mr. Milo Pearson

I am very pleased to introduce the Caribbean Catastrophe Risk Insurance Facility's (CCRIF) first publication of technical papers and articles. This publication is divided into two parts – section one presents useful background information on CCRIF – its types of coverage, members, policy initiatives, and vision and mission statements. In the second part, we present to you four technical papers about CCRIF. These papers will enable the reader to better understand catastrophe risk transfer facilities and their contribution as a key disaster risk management tool.

We recognise that natural hazards which can lead to natural disasters have dire consequences for economic activities, infrastructure, human welfare and natural resources management. Throughout the Caribbean, natural disasters have consistently affected community livelihood systems as well as the productive sectors and industries such as agriculture, manufacturing and tourism. Climate change is likely to increase the incidence of natural disasters by causing extreme weather events to occur with greater intensity and more frequently.

The CCRIF model, as an innovative risk transfer option, can be included in disaster risk management strategies for countries vulnerable to hurricanes, earthquakes and other natural catastrophe events, and can be a critical component of a country's climate change adaptation framework.

The papers presented here provide an analysis of CCRIF to date and its benefits. Within the wider discussions on adaptation to climate change, the papers highlight why CCRIF is the only working model of a multi-national and parametric-based catastrophe risk pool and why it should be considered a viable template for expansion and/or replication globally.

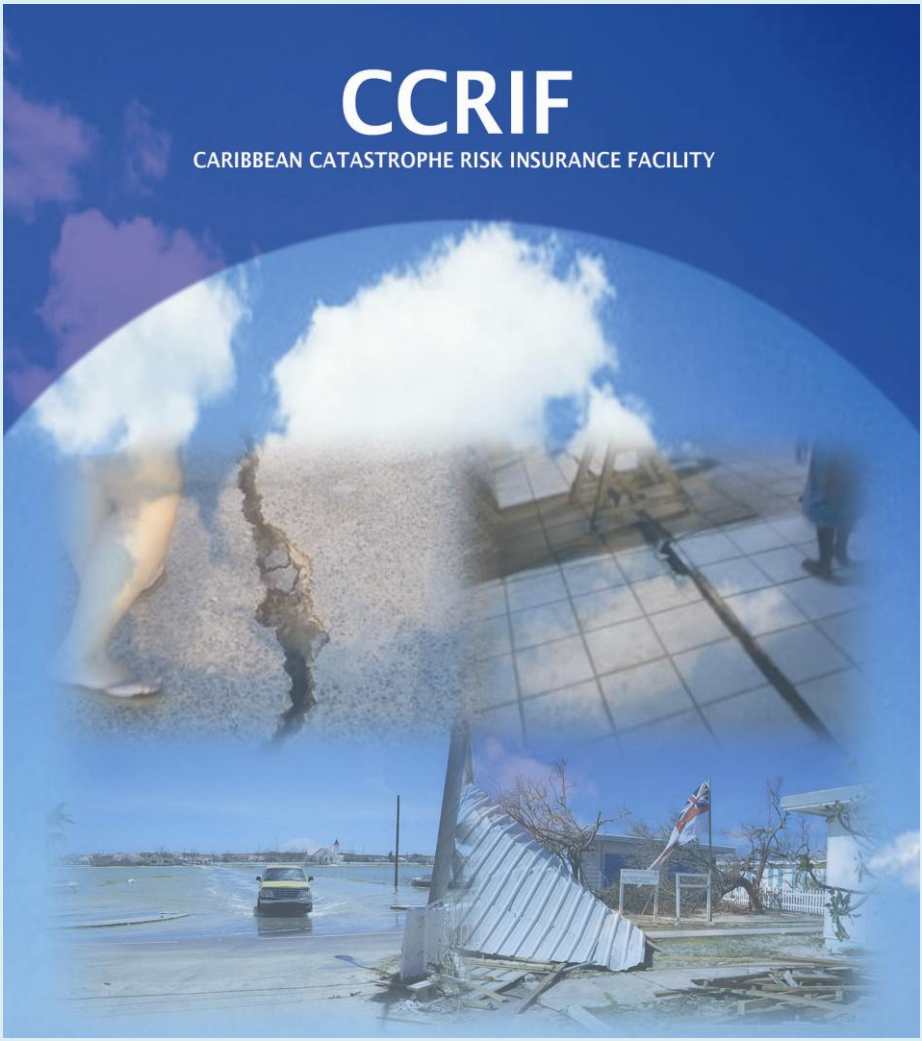
As a novel idea nurtured by Caribbean governments into a successful and globally unique risk transfer solution, CCRIF shows how risk transfer instruments can be a key part of a country's risk management framework. Through the pooling of capital into a collective reserve and spreading of risks geographically, the Facility provides extremely cost-efficient coverage options for its participants against extreme natural events.

CCRIF issues parametric insurance policies, which use modelled hazard parameters as a basis for loss estimation and payment. Parametric policies enable very rapid payouts, providing governments with liquidity to help with immediate post disaster recovery as well as medium term rebuilding efforts. Parametric policies also differ from traditional insurance in that they limit any potential 'moral hazard', where there is less incentive to implement risk reduction activities because of the presence of insurance coverage. Parametric solutions with risk-based pricing work hand in hand with other risk management tools, fully rewarding risk reduction actions.

The publication of this booklet is timely, in light of the upcoming United Nations Climate Change Conference in Copenhagen in December 2009. CCRIF provides a starting point for discussions on the implementation of risk transfer solutions as part of the overall climate change adaptation framework.

We feel that this booklet will be particularly useful to all governments, national disaster coordinators, finance and planning officials, meteorological and other scientific agencies, research institutions, students and regional and international organisations, as they participate in the creation and implementation of comprehensive disaster management frameworks towards the sustainable prosperity of our planet.

Table of Contents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CARIBBEAN CATASTROPHE RISK INSURANCE FACILITY

SECTION 1:

BACKGROUND INFORMATION

CARIBBEAN CATASTROPHE RISK INSURANCE FACILITY

About CCRIF

CCRIF is the first multi-country risk pool in the world, and is also the first insurance instrument to successfully develop parametric policies backed by both traditional and capital markets. It is a regional catastrophe fund for Caribbean governments designed to limit the financial impact of devastating hurricanes and earthquakes by quickly providing financial liquidity when a policy is triggered.

In September 2004, following the passage of Hurricane Ivan through the Caribbean region, the Caribbean Community (CARICOM) Heads of Government held an emergency meeting to discuss critical issues surrounding the need for the provision of catastrophe risk insurance for its members. Consequently, CARICOM resolved to take action and approached the World Bank for assistance to design and implement a cost-effective risk transfer programme for member governments. This marked the beginning of what would become the Caribbean Catastrophe Risk Insurance Facility.

CCRIF can comfortably pay losses for a 1 in 1,000-year series of catastrophe events

CCRIF policies have a high per-event deductible (1 in 15-year loss for hurricanes, 1 in 20-year for earthquakes) and an annual coverage limit. Pricing is calculated as a function of the pure risk (expected annual loss) on each contract. Coverage is designed to cover short term revenue shortfall (c.f. Business Interruption), NOT infrastructure, indirect social costs etc.

CCRIF's policies do not obviate the need for Caribbean

governments to continue to invest in mitigation activities and in other financing mechanisms to cover relatively small losses that occur more frequently such as flash floods, tropical storms and heavy rainfall. CCRIF provides a cost-effective solution to one part of the larger comprehensive disaster management (CDM) process and will continue to support other aspects of CDM in the region in partnership with both international and regional institutions and its member Governments.

CCRIF Members

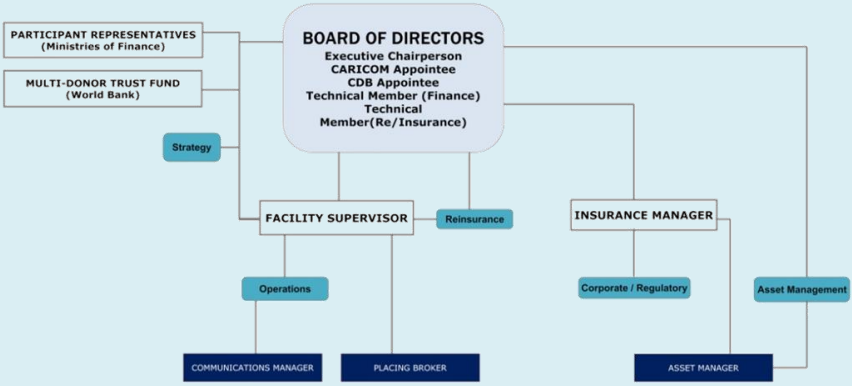
Sixteen governments are currently members of the fund:

- Anguilla
- Antigua & Barbuda
- Bahamas
- Barbados
- Belize
- Bermuda
- Cayman Islands
- Dominica
- Grenada
- Haiti
- Jamaica
- St. Kitts & Nevis
- St. Lucia
- St. Vincent & the Grenadines
- Trinidad & Tobago
- Turks & Caicos Islands

Structure of CCRIF

CCRIF's operations are laid out in an Operations Manual and are executed by a number of service-provider companies:

- Facility Supervisor
- Insurance Manager
- Placing Broker
- Asset Manager
- Communications Manager



Policy Initiatives

On the policy side, CCRIF continues to evolve and to focus its efforts in helping to meet the needs of its constituency. To that end, substantial resources have been committed to the following initiatives:

Excess Rainfall Product – CCRIF is pursuing the development of an excess rainfall product (to be launched in early 2010) aimed at helping to mitigate the economic consequences of major rainfall events in the region. The rainfall product is of particular interest in the agriculture sector, where index insurance is seen as a potential solution to achieving cost-effective insurance programmes for the region's agricultural industry since traditional insurance products are either too expensive for most farmers or require unsustainable government subsidies. The excess rainfall product will utilise a modelled rainfall index developed within CCRIF's second-generation modelling framework. This programme will be the first of its kind in the world.

Parametric Insurance for Electrical Utility Services – In collaboration with the Caribbean Electrical Utility Services Corporation, CCRIF is working towards developing a programme to provide parametric hurricane coverage to electrical utilities in the region to enable cost-effective protection of their highly vulnerable overhead transmission and distribution systems.

Climate Change –The ever-changing risks of climate variability and the extremes associated with climate change threaten to undermine the economic base and, by extension, the social viability and sustainability of the Caribbean region. CCRIF has become involved in supporting the utilisation of financial tools as part of disaster risk management strategies within its member states. This is part of a broader regional strategy designed to support critical adaptation initiatives targeted at reducing the disproportionately high burden created by climate change on Caribbean countries. Similarly, CCRIF's contribution to global discussions on the use of insurance mechanisms to address some of the risks posed by climate change, as part of the negotiation process leading up to 15th meeting of the UN Conference of the Parties in Copenhagen (COP15) and the resulting post-Kyoto climate change treaty, is aimed at enhancing adaptation strategies to assist the mitigation of future impact of climate change.

CCRIF Vision and Mission Statements

Vision Statement

CCRIF will be a key partner with the Caribbean region in its disaster risk management strategies to support long term sustainable development goals.

Mission Statement

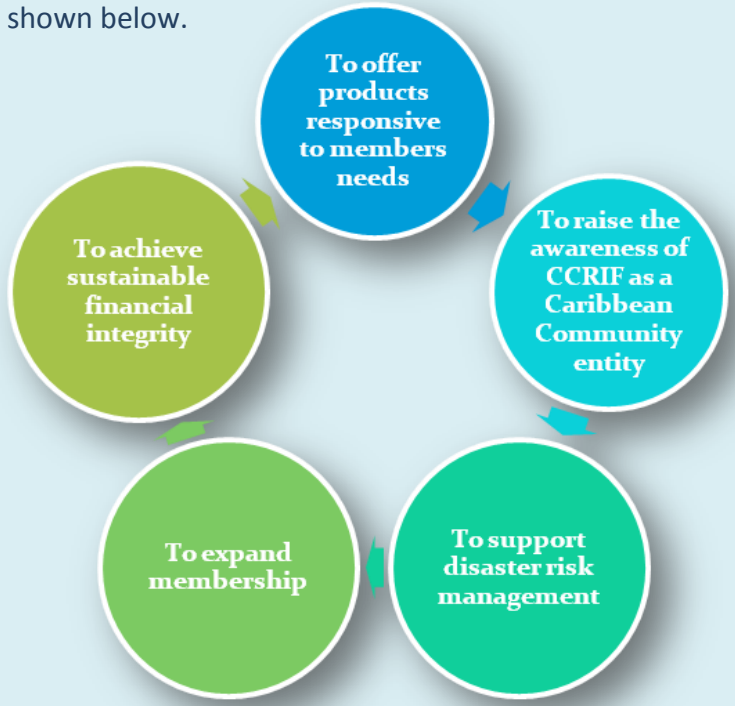
Our Mission is to serve Caribbean governments and their communities in reducing the economic impact of natural catastrophes. We provide immediate liquidity through a range of affordable insurance products in a way that is financially responsible and responsive to their needs.

CCRIF Aims and Strategic Goals

The Caribbean Catastrophe Risk Insurance Facility has three main aims. These are:

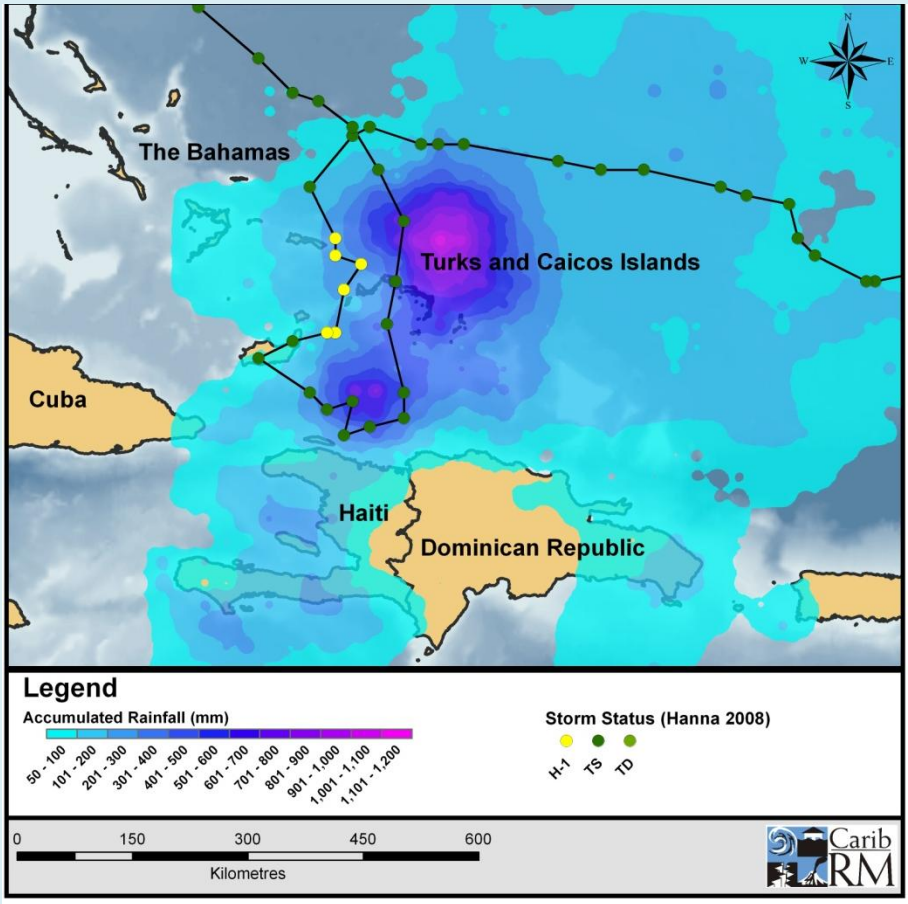
- To cover the post-disaster liquidity gap faced by governments between immediate emergency aid and long-term redevelopment assistance
- To enable governments to receive money quickly, with the payout calculated completely objectively
- To minimise the burden of governments to provide exposure information prior to coverage being initiated and loss information after a disaster

The organisation has five strategic goals developed at the organisation's first strategic retreat held in early 2009. These goals are shown below.



SECTION 2:

TECHNICAL PAPERS



Hurricane Hanna, accumulated rainfall (mm)
Source: Track data from NOAA-NHC and rainfall data from TRMM

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Section 2

- **Natural Catastrophe Risk Insurance Mechanisms for Asia and the Pacific: The CCRIF as A Technical Model**

  by Simon Young & Milo Pearson

- **Innovative Risk Transfer Options as Adaptation Strategies to Growing Hydro-meteorological Risks in the Caribbean Basin**

  by Simon Young & Ekhosuehi Iyahen

- **CCRIF Briefing Document: Climate Change and Caribbean Economies: Implications, Adaptation and Risk Management**

  by Ekhosuehi Iyahen & Simon Young

- **The Cayman Islands Experience with the Caribbean Catastrophe Risk Insurance Facility**

  by Michael A. Nixon

About the Authors

Milo Pearson

Mr. Milo Pearson is currently the Chairman of the Board of CCRIF. He has over 35 years of insurance experience and has created two landmark organisations that have had an important and lasting impact on insurance industry in California: the California Earthquake Authority and the Rate Regulation Division of the California Department of Insurance. As a senior partner of Insurance Solutions Group, Pearson specialises in regulatory and catastrophe related issues. He is also the executive director for the Pacific Association of Domestic Insurance Companies, an industry trade association.

Dr. Simon Young

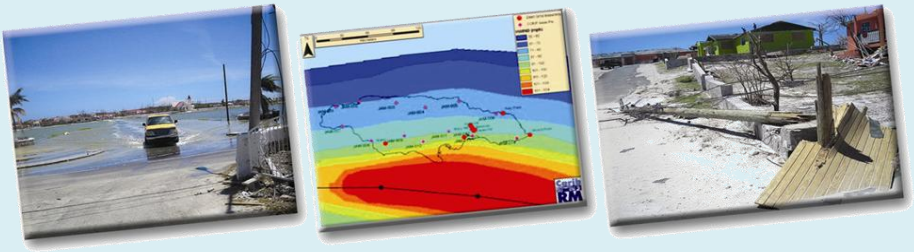
Dr. Simon Young is the CEO of Caribbean Risk Managers Ltd (CaribRM). CaribRM currently serves as Facility Supervisor of CCRIF - the lead operational and risk management role within the Facility. He has an academic research background in geohazards and has worked extensively in Europe and the Americas. Dr. Young has served clients in both the public and private sectors throughout the Caribbean, including the Organisation of American States, the Pan-American Health Organisation, the Inter-American Institute for Global Change, the World Bank, numerous regional Governments, and local and regional quasi-government institutions including CDERA and UWI among others.

Ekhosuehi Iyahen

Ms. Ekhosuehi Iyahen is currently a Project Development Officer at CaribRM. A Graduate of the London School of Economics and Political Science in 2008, she completed her dissertation in *"Environmental Risk-Transfer Instruments - Risk Pooling and Securitisation as an Adaptation Strategy to Natural Hazards in Small Island Developing States: An Evaluation of the Emergence of the Caribbean Catastrophe Risk Insurance Facility (CCRIF)"*.

Michael Nixon

Mr. Michael Nixon is currently the Senior Assistant Financial Secretary, Finance and Economics for the Cayman Islands Government. He has been coordinating the Cayman Islands Government's (CIG) association with CCRIF since its inception, and has also been leading the CIG team looking at holistic financial risk management in the aftermath of the huge economic impacts felt in the Cayman Islands from Hurricane Ivan in 2004. He is therefore uniquely positioned to provide a client's perspective on CCRIF and its role in sovereign catastrophe risk management.



Natural Catastrophe Risk Insurance Mechanisms for Asia and the Pacific: The CCRIF as a Technical Model

by Simon Young & Milo Pearson

This paper, written by Simon Young and Milo Pearson, was presented at an Asian Development Bank Conference held 4–5 November 2008 in Tokyo, Japan.

The conference brought together over 250 representatives from ADB member-countries, officials from Japan's Ministry of Finance, the World Bank Group and other donors, academicians and representatives from global insurers, reinsurers, and other financial intermediaries. The paper was presented at a workshop co-sponsored by the World Bank, which focused on development of a catastrophe risk transfer mechanism for the Pacific Islands region.

Participants discussed new developments amid the need for quick action due to global warming and in light of the development community's recognition of the importance of proactive disaster risk management.

Introduction

The Caribbean region comprises a large number of small states with developing economies prone to both of the two main global catastrophe hazards, earthquakes and tropical cyclones (known in the wider Atlantic Basin as hurricanes.) In these small states, single catastrophes can have a disproportionate effect on both the national and regional economies. Development is largely concentrated in coastal areas which are generally flat; these areas have relatively high exposure to hydro-meteorological hazards (particularly flooding) and to earthquake shaking (due to the nature of the soil/rock in these areas.) This fact, and the increasing impact of global climate change and sea-level rise on the frequency, intensity and potential impact of hydro-meteorological hazards, makes the adequate consideration of catastrophe hazards an important priority for governments in their pursuit of sustainable development.

The Caribbean Catastrophe Risk Insurance Facility (CCRIF) came about as the direct result of Caribbean governments' consideration of their exposure to catastrophe hazards, as vividly demonstrated in the summer of 2004 when Hurricane Ivan crossed the Caribbean Sea, causing major damage in Grenada, Jamaica and the Cayman Islands. In both Grenada and Cayman, the total economic impact was almost double the annual GDP, highlighting the need for sophisticated and global risk management tools to mitigate regional impacts and finance recovery. At a special meeting of the heads of government of the members of the regional political body, CARICOM (the Caribbean Community, a group of 15 full and 5 associate members of the Anglophone Caribbean plus Haiti and Suriname), to consider actions after Ivan, a formal request was made to the World Bank to assist in development of a government insurance program. The World Bank had previously led a project aimed at solving similar problems in the wake of

high reinsurance pricing in the early 1990s, but the government insurance scheme element of that project was never implemented.

In light of the request from CARICOM, the World Bank sought funding for a project to develop an insurance solution for Caribbean governments. The Japanese government agreed to provide the necessary funding (just under US$2 million), and the World Bank prepared the overall concept notes and initiated a tender process for consultants to execute the project during 2005. The Bank drew extensively on its experience in Grenada, where the major unfunded exposure was identified as being in the 1 to 6 months after Ivan's impact, when immediate post-disaster aid had ceased long-term redevelopment aid was yet to come. During that time, Grenada's treasury had great difficulty meeting its debt payments and paying its civil servants, income having dried to a trickle due to Ivan's impact on business activity. The World Bank's insurance solution for the CARICOM governments was thus designed to be able to pay quickly and to try to cover this current account shortfall at premium rates the governments could afford within already very tight budgetary constraints.

Parametric insurance was thus selected as the vehicle for the CCRIF's catastrophe cover. There are three main reasons for its selection:

- Payouts can be calculated and made very quickly because loss adjusters do not have to be relied on to estimate damage which can take months, or years;
- Calculation of payouts is totally objective, based on a few simple input parameters published widely in the public domain from the globally-mandated body responsible for estimating those particular parameters, and a set of formulae which form part of the policy; and
- The risk, which drives policy pricing, is uniformly defined (i.e., there is no subjectivity in the definition of the risk.)

Development Phase

Development of CCRIF was executed through the Caribbean Catastrophe Risk Insurance Initiative, coordinated by the World Bank's Latin American & Caribbean Department, Sustainable Development Division. Due to constraints on use of the Japanese government funds pledged to support the initiative, the project executing agency selected was the Jamaica Social Investment Fund (JSIF), a Jamaican government vehicle for managing development projects in Jamaica. Partly as a result of this selection, the Jamaican government became the leading CARICOM supporter of the initiative.

Development was undertaken through two main contracts which were tendered internationally; one contract covered risk modelling and the other covered development of the operational and financial strategy of the facility and selling of policies to CARICOM member states. Various other, smaller, contracts were executed under the development funding to assist with peripheral aspects of the project and with oversight. The risk modelling company, EQECAT, a division of ABS Consulting, was awarded the risk modelling contract. A consortium led by Caribbean re/insurance intermediary, CGM Group, and including two boutique hazard/risk assessment companies, GeoSY Ltd and Kinetic Analysis Corporation, was awarded the operations and financial strategy development contract.

Risk Modelling

The risk modelling exercise was designed to create a Caribbean-specific risk model for hurricane and earthquake hazards, which could then be used to generate government-related losses for a large set of stochastic events. These losses could then be used to construct a loss profile for each island (in the form of a loss exceedance curve) and also per-event, per island losses so that facility aggregate loss exceedance curves could also be

generated.

The second part of the modelling process was to produce a parametric index for each country which could reasonably replicate the modelled loss exceedance curve based only on totally objective and publicly-available hazard data for a particular event.

Loss Model

The CCRIF loss model was based on EQECAT's existing and proprietary hurricane and earthquake hazard models and stochastic event sets. However, new data had to be generated to represent the exposure of the government to these hazardous events. Exposure data needed to take into account physical buildings, infrastructure and additional costs of operating (e.g. emergency relief) as well as the secondary effects of reduced revenue due to lower business activity (including tourism arrivals, which are a key component of many of the CARICOM governments.)

EQECAT commissioned a specialist Geographical Information Systems (GIS) Unit at the University of the West Indies to undertake a data-gathering exercise for all 20 of the countries the model covered. The aim of the exercise was to gather data which could be used as a basis for creating an exposure profile for each government. Unfortunately, much of the required data was unavailable, meaning that many proxies had to be used. A second major barrier was the lack of verification data available to help establish proxy relationships and to help validate the model outputs.

Parametric Index Development

Once the loss model was completed, EQECAT used its proprietary stochastic event set to generate loss exceedance curves for each of the 20 islands and for each of the two perils to be covered. As part of the process, they also produced event

losses across all covered territories.

EQECAT then generated a template parametric index formula and, based on the individual country loss exceedance curves, produced the two constants (alpha and beta), needed to solve the parametric equations, for each country. The indexing had to strike a balance between producing a relatively simple parametric formulation and reproducing the underlying loss exceedance curve. In order to assist in this process, CCRIF directed EQECAT to focus on fitting the curve best at about the 100-year return period.

The loss modelling and indexing process enables CCRIF to use a parameter of the hazard as a proxy for a loss, rather than the actual loss. The principal of indemnity (the covered party enduring a loss) still holds, but instead of the loss being measured on the ground after an event, the loss is estimated using a series of formulae based in turn on catastrophe risk modelling as described above.

Use of Parametric Index for Event Loss Estimation and Claims Settlement

The implementation of the parametric policy formulation by CCRIF is relatively straightforward and is described below. The two key components to the process are that it can be completed rapidly and that it is absolutely objective and replicable using public-domain data and the index formulae provided in each parametric policy.

For tropical cyclone events, the wind speed estimated on the ground is used as the proxy for loss, and payouts are made against the loss calculated using this proxy. In order to effectively average wind speed over a large area such that it serves as a reasonable proxy for losses across the same large area, distinct measuring points are used, each one representing the economic value of the area that particular measuring point

represents. The measuring points are weighted to give greater value to points representing greater government economic value, so a country's capital and major economic centers will have a greater weight than rural undeveloped areas.

In the calculation of the parametric equations, the effective loss (using wind speed as a proxy) is calculated separately for each measuring point and then aggregated across the entire country. The value of the wind speed used as a proxy for loss at each measuring point is calculated using a set of formulae provided within the policy document. In order to achieve total objectivity and transparency, a simplified version of the best-established relationship of wind speed to distance away from the eye in a hurricane (the Holland wind model) is used by CCRIF. This formula links the central peak wind speed of a hurricane, its forward speed and the distance and direction from the eye to the measuring point (all derived from information published every 6 hours by the US National Hurricane Center, NHC, the World Meteorological Organisation (WMO)'s regional reporting agency for tropical cyclones), as well as the radius to maximum winds (RMW), which is fixed at 23 km for CCRIF, to re-create the peak one-minute sustained wind speed at the measuring point. That wind speed is converted to a gust wind speed by using a fixed uplift factor and by including a site-specific friction factor (wind slows slightly due to friction over land, the type of land cover affecting the amount of slowing.)

For earthquake events, the calculation requires earthquake location and magnitude information from the global seismic data centre operated by the US Geological Survey (USGS) to determine the level of shaking at the same measuring points as used for hurricanes. The level of shaking is then converted to an index value using the country-specific parametric equations; the index value is directly equivalent to the expected government impact loss.

For both earthquakes and hurricanes, a preliminary calculation is made immediately after an event, but the final calculation is made 14 days after an event to ensure that the best information is available from the reporting agencies.

If the index value calculated for an event in a particular country falls above the attachment point (which is the equivalent of a deductible) for that country then a payment is made. The amount of total payments to a country in a policy year is limited by the exhaustion point of the coverage, selected by each country individually. The payment in any given event is made based on a sliding scale relative to the scale of the loss and with upper and lower limits at the exhaustion and attachment points respectively.

Risk Financing, Operations and Outreach

The risk financing and operational strategy development project was designed to provide the tools and analysis required to present and implement a risk financing program, develop the operational framework for the facility, and lead the marketing and selling of policies to the CARICOM countries.

Risk Financing

One of the major challenges in developing a risk financing strategy was the lack of certainty about:

- The number of CARICOM countries who would participate and at what level of premium/coverage;
- The amount of donor support that might be pledged to provide initial claims-paying capacity; and
- The appetite and pricing that might be available in the global reinsurance markets.

Given that none of these variables was going to be fixed until immediately prior to the facility's launch, the finance team developed a sophisticated Dynamic Financial Analysis (DFA)

model which could be used to test the wide range of input parameters to the CCRIF business model, providing survivability and balance-sheet metrics for a 10-year forward-looking time period. The DFA was developed by and for CCRIF, but is based on a public-domain DFA model framework developed at the University of Illinois. The CCRIF team was supported in the DFA development by Pinnacle Actuarial Services, a specialist catastrophe risk actuarial consultant.

The DFA included the ability to adjust the input portfolio, reinsurance pricing model and initial capitalisation as well as a host of other variables. It also utilised Monte Carlo simulation so that uncertainty in input variables could be properly modelled. Outputs from hundreds of runs of the DFA with different input parameters were compiled and analysed, providing a broad overview of the range of outcomes which the CCRIF, once operational, could face.

As more information became known and input variables could be better constrained, the range of DFA outcomes narrowed. In particular, the range of reinsurance pricing that might be relevant and the amount of reinsurance that would be required became better-constrained in the two to three months prior to the 1 June 2007 launch of the facility, enabling final pricing of the policies to be set. The pricing was necessarily conservative due to lack of firm knowledge about country participation levels.

As part of the risk financing strategy development, investigations were made into the value of alternative risk transfer solutions. During early 2007, traditional reinsurance market capacity was more than adequate for the needs of CCRIF and pricing was also generally easing. Early contact with the traditional reinsurance markets also indicated a strong interest in the CCRIF concept. However, given the long-term sustainability goals of CCRIF, the team continued to pursue ART options, particularly in conjunction with the World Bank Treasury.

Operational Framework

Much discussion was focused on the overall operational framework for the CCRIF. Given the goals of bringing parametric insurance solutions to governments at the lowest cost possible, it was paramount that any operational structure be minimalist and flexible. A "bricks and mortar" facility with permanent staff was discarded as being too costly and inflexible. A second solution, to piggy-back on an existing institution, was also discarded due to the inability of the team to find appropriate synergies with any existing entity.

CCRIF thus followed a third path that of a stand-alone "virtual" entity with a series of sub-contracted companies acting as the facility's staff. This approach requires that operational procedures are comprehensively documented and strictly adhered-to, and to this end an operational manual was developed.

The section on governance and operations below describes in detail the working structure of the CCRIF.

Outreach

The CCRIF team undertook a comprehensive outreach programme in advance of and alongside the "selling" of CCRIF policies to the CARICOM countries. The outreach strategy included two one-day technical workshops introducing the general concepts of the CCRIF and parametric insurance, briefings for Heads of Government and Finance Ministers at CARICOM meetings, a high-level donor conference at the World Bank, a technical meeting with potential reinsurance partners in London, and various one-on-one meetings with individual country technocrats. Further to this, the CGM-led consortium assigned a number of team members to lead outreach with two or three specific countries each, in order to build relationships and ensure that enquiries were addressed and problems solved quickly.

Lessons Learned

- Exposure data of the type readily available in the USA and other developed nations and upon which the risk modelling was designed to rely, was limited to non-existent in the Caribbean region. It is important that the modeller utilise local experts to help find and develop exposure data from local government sources. Without adequate data, assumptions must be made by the modelling firm which may, or may not, be accurate. Further, CCRIF would recommend that should data be limited, the potential program, along with local governments, should develop and maintain the appropriate data in a repository which would be used to update the model.

- Storm surge should be explicitly included in the tropical cyclone model; also, consideration should be given to include some form of excess rainfall coverage as well. In addition to earthquake, the current CCRIF policy only covers wind-driven damage from tropical cyclones. In the year and a half that CCRIF has been in existence, it has been demonstrated on a number of occasions that a major loss component from cyclonic systems in the Caribbean is from flooding generated by excess rainfall. Should a regional program decide to offer wind driven coverage only, it will be important to make certain that its participants are clear that damage from storm surge and excess rainfall is not covered.

- CCRIF would recommend the development of at least two models, one model from a well known modelling firm and another model developed within the region (or at least including a substantial component of regional scientific and engineering input.) This will allow for greater flexibility in decision-making regarding the use of the modelling data. The index loss model used by CCRIF

relies on proprietary research and therefore requires the commissioning of new and extensive modelling in order to add hazards and member governments to the facility.

Implementation Phase

The CCRIF project evolved from development to implementation early in 2007, with a deadline to have policies come into force by the start of the hurricane season in the Caribbean, 1 June. Although the development phase had delivered a template design and all of the technical information required for the facility to become operational, a number of challenges remained. Among the main challenges were the design of a suitable ownership and governance structure, putting together a set of service providers to run the operations of the facility, raising funds with which to capitalize the facility, securing support from the international reinsurance markets, and persuading a critical mass of Caribbean governments to purchase policies. This section describes critical elements of these main challenges and how they were overcome.

Organisational and Governance Structure

CCRIF was formed as a "captive" insurance company in the offshore jurisdiction of the Cayman Islands. The Cayman Islands was selected as the jurisdiction following a due-diligence exercise which evaluated multiple criteria including cost and reputation. A Trust was formed for the sole purpose of holding 100% of the shares of the company (Caribbean Catastrophe Risk Insurance Facility Ltd.), with a Trust Deed defining the purposes of CCRIF. A trustee was appointed to ensure that the legal conditions of the Trust Deed are met, and an Enforcer was also appointed to arbitrate between CCRIF and the trustee in case of any dispute.

Currently, CCRIF has a board of directors comprising five persons. Initially, an interim board of three persons was

appointed by CCRIF project team after consideration of a number of candidates. That board was expanded to five after appointment of nominees from CARICOM (to represent the participants) and the Caribbean Development Bank (CDB, to represent the donors, see below). That expanded board approved adjustments to CCRIF's governance structure early in 2008 so that the full board would comprise five persons as follows:

- One member from CARICOM (representing the participating countries)
- One member from the CDB (representing the donor countries)
- One member who is an expert in finance
- One member who is an expert in insurance/reinsurance
- Executive Chairperson (appointed by the other four board members)

The following is a very brief description of the duties and responsibilities of the board of directors and the operational areas of CCRIF.

Board of Directors: Sets and approves CCRIF policy, develops and implements strategic plans and sets the vision for the future of the organisation while maintaining its survivability by being fiscally responsible.

Facility Supervisor: Responsible for all front-office operations including modelling, risk transfer, pricing, dynamic financial analysis, claims and marketing.

Captive Manager: Responsible for all back-office operations including corporate secretary, accounting, audit management and regulatory liaison.

Asset Manager: Responsible for investing CCRIF capital in accordance to the CCRIF investment guidelines.

Reinsurance Broker: Responsible for implementing the risk transfer strategy developed by the Facility Supervisor.

Financial Structure

The capitalisation and risk transfer polices of CCRIF are predicated on achieving a satisfactory balance between the cost of coverage to participating countries and the long-term survivability of the facility. CCRIF has developed and utilises its own dynamic financial analysis system, which allows for deep insights into the complexities of catastrophe risk financing. This in-house analysis is supported by independent input from the Reinsurance Broker and is overseen by the Cayman Islands Monetary Authority (CIMA) in their capacity as regulator. While CCRIF is not rated by any of the commercial rating agencies, many of the same tools are used in analysing and drawing conclusions on the survivability of the facility.

Policy Pricing and Coverage

Pricing of policies is based upon a constant multiple of the pure risk (average annualised loss, AAL) of each country's coverage. This was the simplest way of ensuring that there was no cross-subsidisation of premiums between the individual members of the pool. The actual multiple used was based upon the results of many runs of the DFA model (as described above), with built-in premium reduction over the first few years of CCRIF's existence to bring the premium multiple to a level that is the lowest possible while maintaining sustainability in the long term.

Selection of coverage characteristics was done by each country individually. Three variables were open for negotiation, each limited in some way to ensure that the coverage characteristics fell within those which were operationally and financially sound from CCRIF's perspective. The three variables (decided separately for each peril) were:

Attachment point: Essentially the per-event deductible on the policy, stated in parametric index units (equivalent to $ loss amount) but generally decided-upon by governments on a return-period basis. The attachment point return period was limited to between a 1 in 20 year and a 1 in 50 year event for both perils in the first policy year. The lower limit on the tropical cyclone policy attachment point was reduced to 1 in 15 years for the 2008/09 policy year.

Exhaustion point: Essentially the annual aggregate limit on the policy stated in parametric index units (equivalent to $ loss amount) but generally decided-upon by governments on a return-period basis. The exhaustion point return period is limited to between a 1 in 50 year and a 1 in 150 year event for both perils.

Ceding percentage: The amount of the risk between the attachment and exhaustion points that is being transferred to CCRIF.

In reality, the final variable, ceding percentage, was not directly selected by each country. Instead, the attachment and exhaustion point of the required coverage was decided, along with the total annual premium that each country wished to pay for coverage (split between the two perils). CCRIF then used the final premium cost to calculate the ceding percentage (and thus coverage limit) for each country.

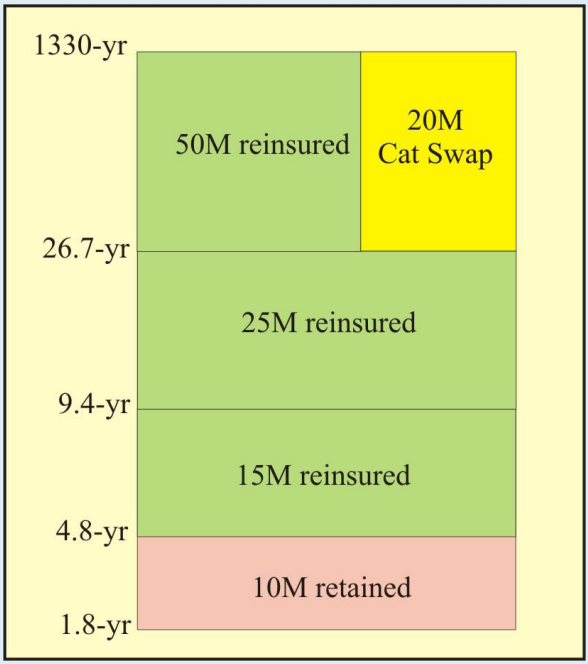
Capitalisation

Capitalisation of the facility occurred directly via a levy, or participation fee, charged to each country wishing to purchase a policy from CCRIF. The one-off participation fee was of an amount equivalent to the annual premium paid by a country, and is required to be maintained at the level or each year's annual premium payment (so if coverage is increased such that the annual premium increases for a given country, a top-up of

the participation fee is required.) Further claims-paying capacity and operational costs are provided by a CCRIF Multi-donor Trust Fund, held at the World Bank and into which a number of donors placed funds (totaling about US$50 million to date.)

Reinsurance

In order to boost its claims-paying capacity above the value of its assets and underwriting income, CCRIF purchases reinsurance from the international reinsurance markets (primarily located in London, continental Europe, Bermuda and the US.) CCRIF placed its reinsurance coverage for 2007/08 of US$110 million immediately prior to the inception of CCRIF insurance policies on 1 June 2007. All coverage precisely matches the underlying insurance coverage offered to CCRIF Participants, and there were therefore no changes through the year.



CCRIF's 2007/08 risk transfer structure, with return period of each layer shown

The Figure at right shows the final reinsurance structure for the 2007/08 policy period. CCRIF retains the bottom US$10 million, with US$110 million of reinsurance sitting above that. Munich Re took the dominant share of the traditional reinsurance program for 2007/08, with Paris Re and Hiscox, a Lloyd's of London Syndicate, supporting. US$20 million of the top layer of risk was

placed into the capital markets via a risk swap between CCRIF and the World Bank Treasury, the first time such an instrument has been used to transfer risk from a national cat pool.

Financial Security

CCRIF can currently survive a series of loss events with a less than one in ten thousand chance of occurring in any given year. Due to planned premium reductions, the level of security drops somewhat through the course of the 10-year forward modelling. However, the lowest projected survivability for CCRIF in the 10-year modelled period is about a one in three thousand chance of claims exceeding capacity (and thus defaulting on its obligations) in any one year.

Although direct comparisons are difficult, such survivability levels, when compared to other national catastrophe pools and to rating agency criteria, are much better than average. For example, the Taiwanese earthquake pool has a survivability of about 1 in 240 years and the Turkish quake pools currently stands at 1 in 150 years with plans for an increase to 1 in 200 years.

Lessons Learned

- CCRIF held two workshops and several other high-level briefings during the development and implementation phases. These workshops were a valuable marketing tool (to encourage countries to join the facility) and they were geared toward the technical experts within the country. Because of the nature and complexity of the parametric product, how the coverage is to be determined and the risk profile of individual countries, CCRIF would recommend that additional workshops would be beneficial for potential participants, including one workshop specifically for government decision makers (i.e., political leaders rather than technocrats.) We would also encourage that the disaster management

community be specifically addressed as a critical stakeholder.

- Communication is critical for all stakeholders, particularly potential participants. In addition to the Facility Supervisor, Captive Manager, Reinsurance Broker and Asset Manager, it is important to have communication experts on contract to help craft the message to all stakeholders. Communication experts (an individual or firm) should be on board prior to launch of the program.

- Strong consideration should be given to utilizing a local (regional) firm for marketing and communication with governments.

After Implementation: Further Developments

As with any new and complex organisation, operational changes and adjustments will occur for some time. This has been the case with CCRIF during its first year and a half. Hurricane Dean occurred within three months of the launch of CCRIF and generated damage to several of CCRIF's participating countries. While the damage was certainly severe in some areas, it was not widespread enough in any one of the participating countries to trigger their catastrophe coverage. The board of directors and staff felt that Hurricane Dean provided an excellent opportunity to review CCRIF's mission and response.

To that end and following widespread consultation and analysis, CCRIF staff recommended to the board of directors several changes in contract, coverage and price. The changes were effective at the renewal of the annual policies on 1 June 2008:

- A lower deductible option was offered to CCRIF members for hurricane coverage only. Members could reduce their attachment point (deductible) from a 1 in 20 year event to a 1 in 15 year event.
- Maximum coverage limit available to each country for

each peril was increased from US$50 to US$100 million.
- Policy premium rate was reduced by 10%.
- A minimum payout equal to the annual premium paid by the participant for that peril was implemented should a policy reach the attachment point.
- Finalisation of parametric calculations and thus claims settlement timeframes were reduced from 28 days to 14 days.

Once annual renewals were successfully completed on 1 June 2008, CCRIF re-focused again towards research and development in a number of areas:

New Modelling Framework

A new hurricane and earthquake risk model commissioned for CCRIF will be tested in late 2008, with its phased introduction as an option to existing policy holders and as a necessity for any new non-CARICOM members planned for 2009.

The new approach is one of modelled loss instead of index parametric, on which all current policies are based (as previously described.) This means that the new policy will be able to reduce the basis risk in the parametric loss estimates by modelling each loss as it happens, rather than reducing the loss estimation methodology to a series of simple equations. Furthermore, the new model will use the best definition available of the entire hurricane wind and storm surge field for wind policies and earthquake shaking field for earthquake cover to drive its loss model. Instead of being estimated only at distinct measuring points, the new model estimates the level of hazard and consequent loss for every 1km grid square of an island's territory. The losses are then added up across the country to find the total country-wide loss.

The new CCRIF modelling framework, developed by Kinetic Analysis Corporation (KAC), is based on public domain research

and is easily modified to provide a modelled loss framework for various other hazards and loss types. The new KAC model will allow the facility to form the foundation for a wide variety of policy formulations, some of which are further discussed below.

Flood/Excess Rainfall Coverage

Providing access to excess rainfall coverage for CCRIF member governments has been a high priority for the facility. Unfortunately, true flood insurance is technically challenging to develop. Existing ground saturation at the time of an event, topography, development of historical data are only some of the variables to consider for the project; all measurements which are notoriously difficult to obtain and therefore model.

Still, the need for the policy is clear and CCRIF has partnered with the Caribbean Institute of Meteorology and Hydrology (CIMH) to conduct a feasibility study in order to create a methodology for execution of a CCRIF rainfall/flood product. The results of that study, if favorable, will guide CCRIF in the development of the new policy which would become available in time for the June 2009 renewals alongside existing wind and earthquake policies.

Extreme Weather Monitoring Network

One of the most critical necessities for offering an excess rainfall product is the availability of reliable rainfall measurements at adequate density. A second pre-requisite is availability of verifiable historical data which is required to get the risk properly priced in the reinsurance market. To help address both of these issues, CCRIF has signed a Memorandum of Understanding with the CIMH to support the development of an extreme weather monitoring network which will record extreme rainfall and wind events and act as the verification network for CCRIF parametric policies. CIMH is near completion of a test instrument package and funding will be sought to fully test and then roll-out that instrument package into a region-wide network.

Agriculture Insurance

In response to requests from member governments, CCRIF continues to closely monitor developments in agriculture risk management and stands ready to support governments in the transfer of parametric risk from the agriculture sector. The World Bank is currently responding to a request from the Jamaican government through funding of a project to develop a risk management framework for the agriculture sector, and it is hoped that parametric insurance products will be developed for farmers in Jamaica and then the wider Caribbean. Parametric policies would need to have a primary underwriter either in the state or private sector, but CCRIF would be able to assist in the onward transfer of risk to the international markets at best cost.

Power Distribution Systems

CARILEC, the association of Caribbean electrical utility companies, has approached CCRIF about developing a parametric solution for insuring transmission and distribution systems against catastrophic losses due to hurricanes; these systems are usually not insured due to the prohibitive costs in the open market. Pooling of such risks as well as a parametric framework would make such coverage much more affordable. Caribbean governments continue to hold equity interest or fully own most of the CARILEC utilities and also recognise the vital role that rapid repair of electrical distributions systems play in post disaster recovery. CCRIF has agreed to focus some of its research and development efforts on this initiative, which will be ongoing through the next 12 to 18 months.

Real-Time Impact Modelling and Risk Mapping

CCRIF launched its real-time impact modelling product developed by KAC using the same modelling framework as for the soon to be introduced CCRIF loss modelling product. The facility plans to further develop this real-time impact mapping system especially in conjunction with the KAC modelled-loss policy formulation. In addition to this initiative, CCRIF is working closely with the World Bank on a regional risk mapping project funded using the Global Fund for Disaster Risk Reduction (GFDRR) which will be primarily executed by the University of the West Indies.

New Members

CCRIF continues a dialogue with a number of governments who have expressed an interest in the CCRIF model. However, these discussions are at an early stage, and no firm commitments have been made by either party.

Lessons Learned

The following are the lessons learned by CCRIF during one and a half years of operations.

- The Hurricane Dean aftermath reflected the importance of effective communication with stakeholders and the public which can help to manage expectations. Other events, leading to both triggering and non-triggering of coverage, have solidified the view that communications will play a vital ongoing role in the successful continuation of CCRIF.

- The identification of CCRIF by members and other potential client governments as a sound and stable financial institution has led to the belief that CCRIF can help in a wide variety of risk management problems facing small developing states. While we believe the CCRIF model has great value, it only addresses a small niche in the required risk management toolkit. As research and development leads to new products, additional small niches will be addressed. However, there is a need to closely monitor and manage expectations, particularly with regard to the view that "insurance" will cover all of a country's losses, however small the annual premium payment. We also note the widely-held misperception that insurance can replace other budgetary tools for any losses due to natural events, however frequent the event.

CCRIF – A MODEL FOR THE FUTURE?

There are approximately two dozen catastrophe pooling funds existing in the world. CCRIF is by far the most unique. It is multi-national; it provides catastrophe coverage for governments for their short-term liquidity needs; does not insure individual policyholders and offers a parametric policy rather than the traditional indemnity coverage.

With certain adjustments, we believe that CCRIF can serve as a template for other areas of the world, meeting the needs of governments with similar exposures. This technical paper has provided the reader with detailed information about CCRIF, the feasibility studies through implementation and the data developed and used to make critical decisions along the way. Just as important, however, this paper also includes the lessons learned by the project staff, current staff and the board of directors during the past 3 years. These lessons can and should be a valuable tool to those who are considering similar catastrophe risk pooling mechanisms.

Innovative Risk Transfer Options as Adaptation Strategies to Growing Hydro-meteorological Risks in the Caribbean Basin

by Simon Young & Ekhosuehi Iyahen

This paper, written by Simon Young and Ekhosuehi Iyahen, is featured in the publication, Climate Sense, which was launched at the World Climate Conference 3 (WCC-3) on August 31, 2009.

In the article, CCRIF is described as an innovative risk transfer option that can be included in adaptation strategies for small island states vulnerable to hurricanes and earthquakes. The article explains that CCRIF's recent development of its own catastrophe modelling platform – with the help of Kinetic Analysis Corporation– broadens the scope of potential financial instruments which could be made available for risk management and mitigation in both the public and private sectors.

Climate change is adding to the already severe and steadily worsening risk exposure of the Small Island Developing States (SIDS) of the Caribbean Basin. Exposed to severe hurricane hazards as well as extreme rainfall and related flood and landslide hazards, small islands have a relatively high length of coastline and a huge concentration of economic activity in coastal zones and/or the lower reaches of river valleys. This is due to the high and growing economic importance of tourism (dominantly coastal-based) and the great concentration of the population on coastal flats. The other main economic engine of the region, agriculture, is also, of course, highly exposed to hydro-meteorological hazards.

An added problem for small countries with small economies is the devastating effect that single-event catastrophes can have both on physical infrastructure and the socio-economic fabric of the country. The small economies of the region combined with existing physical vulnerabilities often results in an amplification effect on the impact of natural hazards on these countries. For example, Hurricane Ivan in 2004 caused almost 200% of annual GDP impact in each of two Caribbean islands, Grenada and the Cayman Islands, as well as significant damage in Jamaica. By contrast, Hurricane Katrina's impact in the US was less than 1% of annual US GDP and only about 30% of Louisiana's annual GDP (assuming half of the total economic impact was in Louisiana.)

Although much work remains to be done to fully understand the impacts of climate change on the Caribbean, a consensus is emerging that severe events will likely become both more frequent and more severe; this may hold for hurricanes as well as non-cyclonic rainfall events. Evidence provided by the 2007 Fourth Assessment Report of the Intergovernmental Panel on Climate Change provides overwhelming support of these changes occurring within the Caribbean. Similarly, predictions summarised in a position paper by the Caribbean Development

Bank (CDB) released in 2008 indicate that by the end of the century temperatures within the region would have risen between +1.4° to +3.2°C with a greater than 66% probability of an increase in hurricane intensity.

While these forecasts and predictions are useful, it is important to also recognise that the impact of climate change cannot be simply conceptualised or limited to being a possibility that might occur in the future. Its effects are already being directly felt within the Caribbean region. The rise in sea level and the increase in sea surface temperature already provide evidence of the increasing dangers being inflicted on these fragile environments and their economic and social landscape. The occurrence of sea level rise and the warming of oceans have a direct effect on wave and storm surge hazards independent of event frequency/severity changes and these are especially pronounced in the Caribbean where most of the population resides in close proximity to the coast.

Additionally, degradation of coral reefs as a result of coral bleaching due to higher sea temperatures has led to a reduction in the natural mitigation provided by reefs to coastal environments and in turn the surrounding coastal communities. The destructive impact of climate change on the coral reefs across the region has also resulted in irrevocable damage to the economic base of communities who rely heavily on the marine environment. The challenges created by climate change are therefore much more complex than simply changes in the physical environment within

these islands. The challenges are intrinsically tied to physical, social and economic vulnerabilities which place a disproportionate burden on these small island developing states.

There can be no dispute that the challenges created by climate change through its present manifestation and potential future impacts are daunting. However, the Caribbean is leading the world in the development of innovative risk transfer solutions for catastrophe exposure as part of an integrated risk management and climate change adaptation strategy. The development of the Caribbean Catastrophe Risk Insurance Facility (CCRIF) is an example of a macro scale initiative that can be regarded as a proactive and collective approach by regional governments to adapt to and mitigate the risks associated with their exposure to catastrophe hazards.

CCRIF is the first multi-country risk insurance pool. It is an example of an innovative risk transfer option in which a risk financing vehicle has been specifically designed to provide Caribbean governments with an efficient and cost effective method of pooling natural hazard risk exposures into a single better-diversified portfolio. The pooling of these risks facilitates effective access to the global reinsurance and capital markets. CCRIF currently issues parametric insurance policies, which use modelled hazard parameters as a basis for loss estimation and payment. Current hurricane policies are based on modelled wind speed at representative 'measuring points' which is then used as a proxy for government losses via an index developed by modelling company EQECAT. Parametric

The Caribbean is leading the world in the development of innovative risk transfer solutions for catastrophe exposure as part of an integrated risk management and climate change adaptation strategy.

policies enable very rapid payouts, providing governments with liquidity to help with immediate post-disaster recovery as well as medium-term rebuilding efforts.

The progress achieved in understanding the science behind meteorological events coupled with technological advances within the risk management and financial sector have facilitated the emergence of tools and mechanisms such as CCRIF and the development of supporting informational databases which allow Caribbean governments to better manage their climate related risks. CCRIF's recent development of its own cat-modelling platform via modelling company Kinetic Analysis Corporation (KAC) is a further refinement of the modelling capacity of the Facility and broadens the scope of potential financial instruments which could be made available for risk management and mitigation in both the public and private sectors. This new platform enables the use of either a hazard index or modelled-loss as the basis for parametric contracts. Its modular and highly scalable architecture enables plug-in of new hazard modules and a variety of exposure database formats (including gridded and point-data exposure.)

Prime Minister and Minister for Finance of Dominica, Hon. Roosevelt Skerrit accepts a cheque for US$528,021, the full amount the government received for the November 29, 2008 earthquake, from Dr. Simon Young, CEO of Caribbean Risk Managers Ltd, Facility Supervisor of CCRIF

In addition to the multi-hazard hurricane model (which includes surge and wave action loss generators), CCRIF and KAC, in partnership with the Caribbean Institute for Meteorology and Hydrology (CIMH), are developing a rainfall index aimed at representing flood impacts. The model will produce 6-hourly rainfall estimates for the Caribbean Basin based on the Global Forecast System (GFS) initialisation data run with topographic enhancement; this base rainfall accumulation will be aggregated at the basin level and weighted according to relative exposure within a basin to produce an extreme rainfall impact index.

The rainfall product is of particular interest in the agriculture sector, where index insurance is seen as a potential solution to achieving cost-effective insurance programmes for the region's agricultural industry. Climate change impacts on agricultural production will have greatest impact on those least able to cope, and traditional insurance products are either too expensive to most farmers or require unsustainable government subsidies. At the local scale, such index insurance solutions will, however, require significant enhancement of the hydro-meteorological measuring network. Although the lack of extreme event data provides a significant hurdle to developing and verifying index insurance products, this is not a problem faced by Caribbean countries alone. Instead it is a part of a wider global problem in which there has been a significant underinvestment in technical and institutional infrastructure related to climate monitoring networks, which are necessary to inform effective climate

The rainfall product is of particular interest in the agriculture sector, where index insurance is seen as a potential solution to achieving cost-effective insurance programmes for the region's agricultural industry.

change adaptation initiatives. The problem is particularly acute for extreme event monitoring.

Within the Caribbean the role of regional collective action in addressing these institutional deficiencies, while also developing and implementing national and regional climate change adaptation strategies, is critical. CCRIF's collaborative relationships with institutions such as CIMH, the Caribbean Disaster Emergency Response Agency (CDERA) and the University of the West Indies (UWI) are part of the collective approach required to assist the region as a whole and the individual nations within it. The initiative to develop a Caribbean Risk Atlas, led by UWI's Disaster Risk Reduction Centre in collaboration with national governments, CDERA, CCRIF and the World Bank and funded by the Global Facility for Disaster Reduction and Recovery, reinforces the role of close partnerships and alliances in effectively adapting to the complex impacts of climate change. The creation of a regional risk atlas will permit greater comparison and exchange of information between countries and this can be used to better guide risk mitigation and risk financing strategies which will benefit the individual countries most if they are collective in their nature.

CCRIF's collaborative relationships with institutions such as CIMH, the Caribbean Disaster Emergency Response Agency (CDERA) and the University of the West Indies (UWI) are part of the collective approach required to assist the region as a whole and the individual nations within it.

CCRIF's modelling platform, which is designed to enable testing of various future climate input datasets, and the substantial research already undertaken by KAC in this field could find potential applications within the risk atlas project, and would be especially relevant in informing the planning, policy formulation

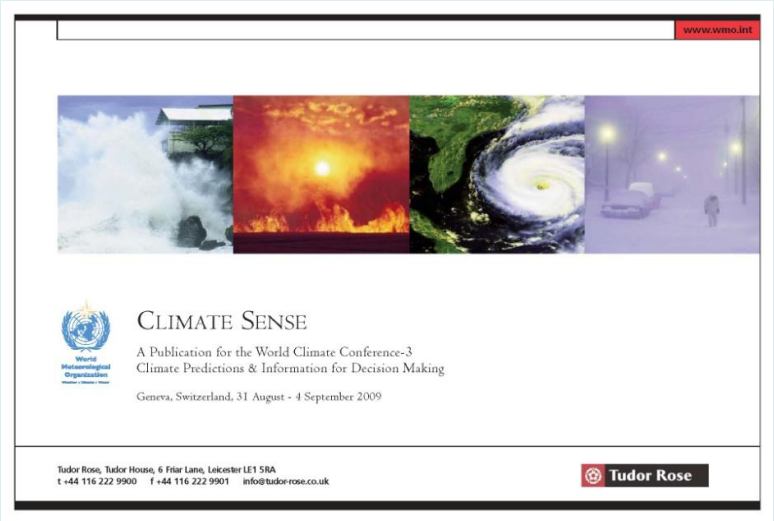
and decision making process within national and also regional institutions and governments. As climate model outputs increase in resolution, CCRIF hopes to utilise its in-house loss modelling capabilities to provide significant quantitative information to enhance discussions on economic loss aspects of the climate change debate which, in turn, will inform discussions on adaptation strategies and the role of insurance mechanisms in mitigating future impacts, particularly on small vulnerable states such as those in the Caribbean.

The scope for innovative risk transfer options as adaptation strategies to growing hydro-meteorological risks in the Caribbean Basin is therefore promising on a number of levels. It offers some measure of security for Caribbean countries through the provision of mechanisms and tools which can be harnessed to mitigate and adapt to the ever changing risks of climate variability and extremes associated with climate change. The potential of these mechanisms for developing countries is also especially relevant as they provide a means through which these countries can raise a reliable source of post-disaster funding for their recovery process in the occurrence of a catastrophe event, thereby reducing to some extent the disproportionally large economic and human burdens created by climate change.

But the role and utility of these instruments cannot be limited to the tangible benefits which they can provide in the immediate aftermath of a catastrophe event. Their benefits can also be expanded to include the investments which they facilitate in preventative initiatives and the adoption of holistic risk management programmes based on assessments of the vulnerability of these states. CCRIF intends to leverage its cross-departmental role to promote development of an explicit, high level 'Country Risk Officer' position to coordinate the holistic risk management strategy required both by individual countries and across regions in the face of growing hydro-meteorological, financial, health and social risks, many tied back to climate

change. Investments in the development of supporting technological and infrastructural capacities that build critical information databases that might not have previously existed, can also be powerful tools to inform wider policy and decision-making processes. These supporting investments can have benefits that go far beyond present day relief; indeed they are investments for the future security of the region.

Although useful and indeed also a necessary and integral part of a comprehensive disaster risk management process, risk transfer instruments are not a complete solution to the present and future risks created by climate change. Adaptation to and mitigation of the risks associated with growing hydro-meteorological hazards and vulnerabilities within the Caribbean Basin requires a multi-dimensional collective regional and domestic response of which risk transfer instruments can play a crucial role within a wider comprehensive process.



About the Climate Sense Publication

Climate Sense is a fully illustrated 250 page publication of the United Nations World Meteorological Organisation. It was launched in August 2009 and features 100 authors relating their work in weather, climate and water services at international, regional, national, municipal and local levels of activity. Their commentaries draw upon experiences around the world reflecting how people are using climate information to improve the security and sustainability of their lives. CCRIF supported the publication through a contribution and this allowed for the following four articles to be published:

"Innovative risk transfer options as adaptation strategies to growing hydro-meteorological risks in the Caribbean Basin" – by Simon Young and Ekhosuehi Iyahen, Caribbean Risk Managers Limited

"The Caribbean Drought and Precipitation Monitoring Network: the concept and its progress" – by Adrian Trotman, Anthony Moore and Shontelle Stoute, Caribbean Institute of Meteorology and Hydrology CIMH

"Strategic Planning in the Caribbean: the role of seasonal forecasts" – by Kim Whitehall, Margarette Mayers-Als and David Farrell, CIMH

"Feasibility Issues: mitigation and adaptation to climate change in the Caribbean" – Andrea Sealy

CCRIF Briefing Document: Climate Change and Caribbean Economies: Implications, Adaptation and Risk Management

by Simon Young & Ekhosuehi Iyahen

This paper, written by Simon Young and Ekhosuehi Iyahen, was presented as the CCRIF Chairman's contribution to a discussion session forming part of the Caribbean Development Bank (CDB) Board of Governors' meeting in the Turks & Caicos Islands in February 2009. The paper examined ways in which the region could implement best practice in sovereign risk management to further develop proactive management of natural hazards risks. It also explores the inter-linkages between many aspects of the region's risk landscape both at a national and regional level.

"As a strong supporter of risk mitigation as a way to achieve economic targets, the Caribbean Development Bank takes much interest in the effects that natural disasters can have on the sustainable development of the region," Warren Smith, Director of Finance and Corporate Planning at the CDB said. "The Caribbean's high exposure to hurricanes and other climate-related hazards, the specific natural and social conditions which many small island states operate within, as well as the increased loss tally due to natural disasters over the past 15 years, point to a continued need for climate change adaptation within a holistic sovereign risk management framework."

Implications

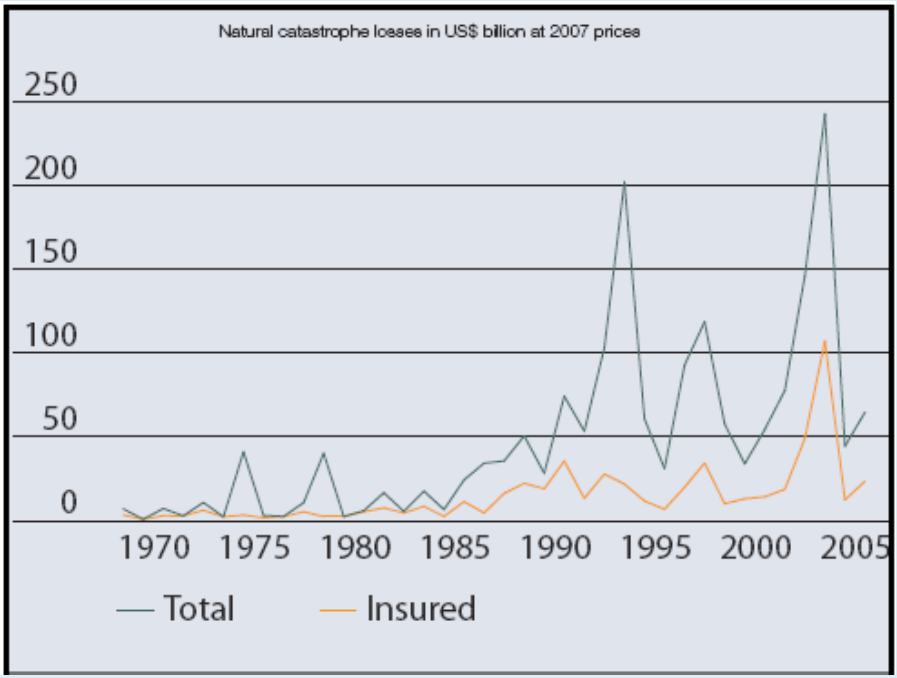
Although the islands of the Caribbean are marked by nuanced differences which define the social, economic and political fabric of each individual country, there are broad similarities which make the islands, as a collective, all vulnerable to the risks and impacts of climate change.

The fact that they all share similar economic and sustainable development challenges (consisting of low availability of resources, high debt, a small but rapidly growing population, remoteness, susceptibility to natural disasters, excessive dependence on imports and vulnerability to global developments) enhances their vulnerabilities and reduces their resilience to climate change, particularly via the associated sea-level rise and enhanced climate variability and occurrence of extreme natural events.

Beach erosion on a Caribbean beach

The implication and impact of climate change on these predominantly island nations are therefore not simply physical but inherently tied to their economic and social viability. The deterioration in coastal environments, for example through beach erosion and coral bleaching, will significantly affect local resources such as the fishing industry as well as directly impacting on the value of the tourism industry.

Sea-level rise will result in an increase in storm surge inundation area, flood water height and wave damage, in turn resulting in enhanced levels of erosion and specific event impacts which threaten vital infrastructure, settlements and facilities that support the livelihood of most Caribbean communities. The increasing devastation and losses caused by natural disasters in the Caribbean is similarly reflected on a global scale (Figure below), therefore highlight the increasing risk being created by climate change.

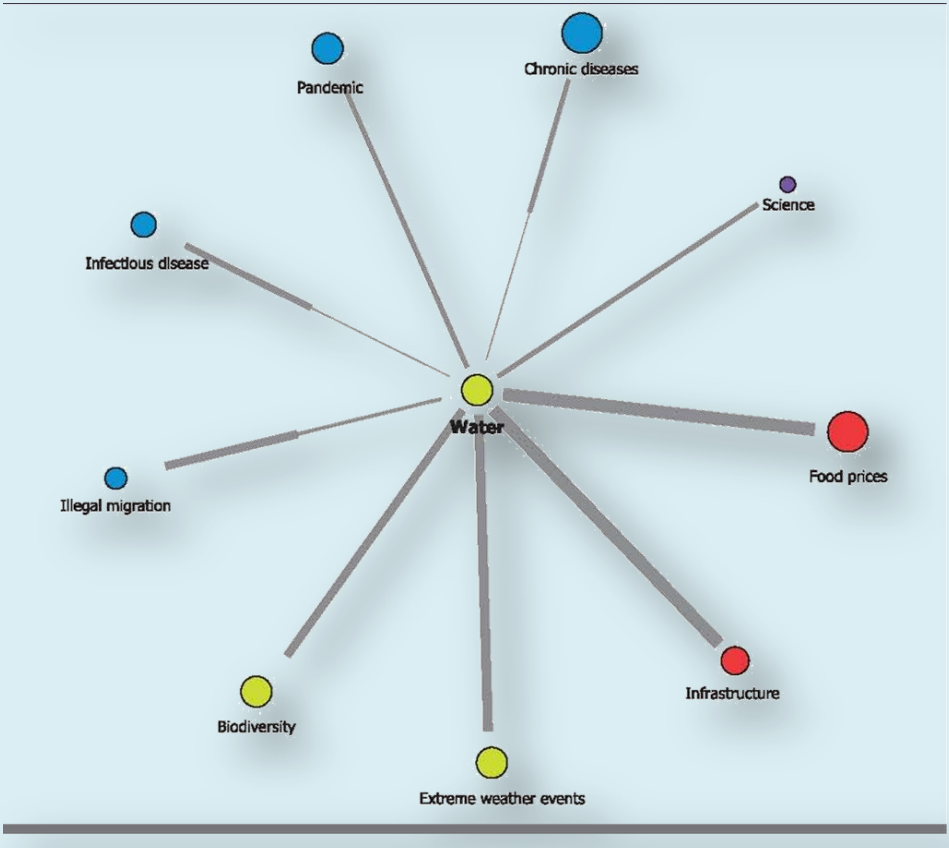


Increase in global losses from natural disasters - Data from Swiss Re

The reduction of potable water resources within small islands is yet another example of a threat that is not simply physical but could have potentially far reaching social, economic and political implications (See Figure *"Water as a Nexus of many Risks"*).

The concern about the future of Caribbean economies within the context of these risks posed by climate change is therefore a

legitimate one. It is not simply based on unfounded fears but born from experience with current patterns and consequences of climate variability, as well as from observational records and indeed also climate model projections. This is supported by the 4th Assessment Report of the IPCC (Intergovernmental Panel on Climate Change) which concludes that small islands, including those in the Caribbean, face some of the highest levels of threats and risks from climate change and hence should focus on enhancing their resilience and implementing appropriate adaptation measures as a matter of urgency (UN-IPCC 2007; Chapter 16, page 4).



Water as a nexus of many risks - from WEF: Global Risks 2009.

Adaptation

Adaptation to climate change is not a simple task. This is inherently due to the complex nature of climate change itself and the high level of uncertainty associated with understanding its true scope, intensity and impacts.

As climate change is a complex issue, effectively addressing adaptation will require a multi-faceted approach involving both mitigation and adaptation mechanisms and public and private sector involvement and cooperation. This portfolio of mechanisms could range from technological (e.g. sea defences), through to behavioural (e.g. altered food and recreational choices), to managerial (e.g. altered farm practices) and to policy (e.g. planning regulations). In fact, there is no clear picture of the limits to adaptation, or the cost, and this is partly because effective adaptation measures are highly dependent on specific geographical and climate risk factors as well as institutional, political and financial constraints.

Each of the islands of the Caribbean are simultaneously confronted with other social, political, economic and physical stresses which make adaptation an intrinsically challenging and complex task. This is because investment in essential adaptation and mitigatory measures will involve the reallocation of already scarce resources away from economic development and poverty alleviation, and will also add to already stifling debt burdens.

Although these constraints can limit the choices of adaptation options and their implementation (such as inadequate data and technical capacity, weak human and institutional capacity and limited financial resources), it becomes especially important that the harnessing of these mechanisms and the associated adaptation investments made must themselves be properly conceived and legitimately implemented.

Mal-adaptation, caused by an underestimation, overestimation or mis-estimation of the impact of climate change, can also be regarded as an added risk with far reaching consequences for the people of the Caribbean.

Within this context the role of risk management as a component used to inform the process of adaptation to the risks associated with climate change become especially relevant, important and even critical.

Risk Management

Apart from the risks created by climate change, Caribbean countries are also subject to a myriad of other risks. These risks oftentimes do not stop at individual island national borders but are part of a complex globally interconnected system. Similarly the risks associated with climate change are borderless. Adaptation to this compendium of risks places enormous pressure on regional governments who are charged with the responsibility of maintaining critical infrastructure while preserving lives and economic livelihoods under increasing budgetary constraints. Within this context prioritising risks and the actions necessary for effective adaptation becomes a point of concern.

Risk management is a process which governments can harness to determine their priorities in advance… and offers insight into opportunities and mechanisms which can be used to anticipate, adapt to and mitigate against present and future risks

Risk management is a process which governments can harness to determine their priorities in advance and in order where possible to minimise these risks. It involves a thorough examination of current situations as well as a constant awareness of the ever changing risk landscape and offers insight

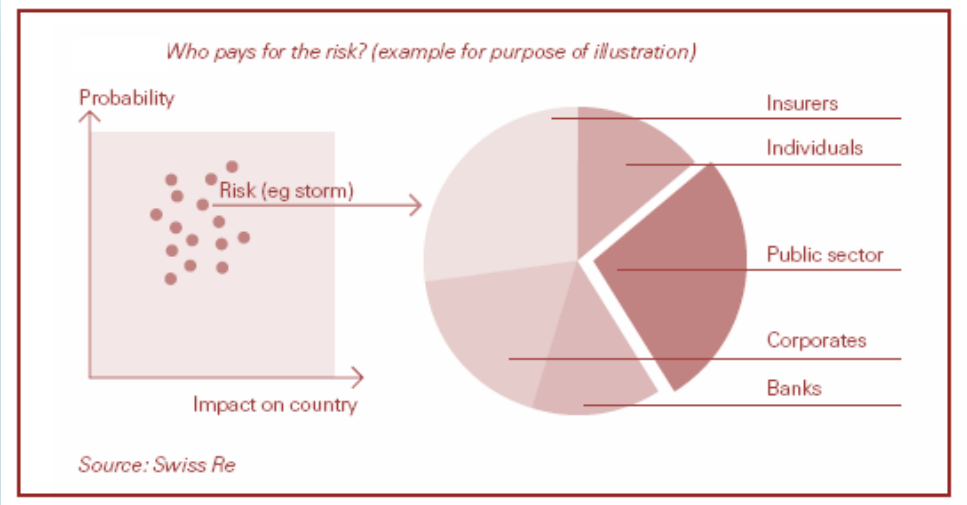
into opportunities and mechanisms which can be used to anticipate, adapt to and mitigate against present and future risks.

The knowledge gained from utilising the comprehensive identification and assessment of risk processes can provide valuable information that can then be presented to decision-makers, thereby offering them an appropriate platform upon which to make decisions about the optimal use of limited resources for adaptation.

It is important to also note that intrinsic to the risk management process is an appreciation of uncertainty. Uncertainty is a factor which is critical in a lot of the risks faced by Caribbean countries and by extension also the risks created or enhanced by climate change. The utilisation of statistical methods and models and the in-depth knowledge of insurers who have experience in quantifying and managing risk allows for these uncertainties to be limited to some extent, thereby providing a more solid base upon which to make decisions.

Through the risk management process, public and private efforts can therefore be better focused on those risks that cause either the greatest damage or occur the most frequently, with options being offered into the means or tools of implementation to prevent or mitigate these risks and how these can be spread across both the private, public and legal regulatory framework. Distribution of risk management efforts across the different sectors must be aligned with the relative impacts of each risk on that sector (e.g. Figure below.)

The utilisation of risk management as a tool to aid decision-making in an uncertain environment has the potential to greatly help the islands of the Caribbean to effectively adapt to the risks associated with climate change. The role of new initiatives such as CCRIF highlight some of the ways in which risk management tools have been and can be harnessed to adapt to the risks that result from climate change.



Example of the breakdown of economic costs for one risk; the distribution may be very different for each of the different risks a country and its people face, and will also vary with economic profile etc.

Case Study: CCRIF

CCRIF provides a working model of an innovative risk management mechanism that provides cost effective risk transfer as part of a holistic disaster risk management framework within the Caribbean. It is a regional fund for Caribbean governments designed to limit the financial impact of catastrophic hurricanes and earthquakes by quickly providing financial liquidity when a policy is triggered. CCRIF offers parametric policies backed by both traditional and capital markets.

The intense risk assessment processes involved in the CCRIF initiative involves the collection of information relating to catastrophe risk exposure to hurricanes and earthquakes. This in turn provides valuable data that can aid national governments and regional risk management institutions in understanding the extent of exposures which they face as a country. This helps governments to determine the level of coverage to purchase as well as aiding efforts in physical disaster risk reduction and avoidance, general disaster response and recovery planning, and long-term sustainable development planning.

Conclusions

Investing in adaptation initiatives that reduce the impact of climate change is absolutely essential for the future viability and sustainability of the economies of the Caribbean. Risk management and by extension the utilisation of risk management tools and mechanisms will be critical in ensuring that effective adaptation measures against climate change are made even within the context of constrained resources and budgetary pressures.

Investing in adaptation initiatives that reduce the impact of climate change is absolutely essential for the future viability and sustainability of the economies of the Caribbean.

The importance of comprehensively mapping and addressing the pronounced risk landscape within each individual Caribbean island as a result of climate change highlights the need for the mainstreaming of the risk management process within policy making, and the possibilities for the creation of a role for a 'Country Risk Officer' in the individual islands.

The Case for a Country Risk Officer

The case for this role can be made on a number of grounds involving several simple questions:

- Who evaluates the mix of prevention, preparation, response, recovery and risk transfer actions across different risks?
- Who takes responsibility for international coordination, as many catastrophes do not stop at the individual national border?

These questions underscore the importance of developing a systematic method of addressing these risks. They also underscore a need for Caribbean islands to find innovative ways of taking ownership of the risks in order to control the adverse conditions which they can create for the people of the Caribbean.

A Country Risk Officer would act as a central point of contact for the purposes of systematically managing a comprehensive multi-area risk portfolio that coordinates and builds upon the work already being carried out by governments.

Although some work is being undertaken at the local, corporate and even national level on mitigation and building awareness about climate change, adaptation and the role of risk management in the process, it is necessary that the appropriate exchange of information, expertise, governance and management structure is coordinated, in order to effectively address the current multifaceted risk scenarios faced by the islands.

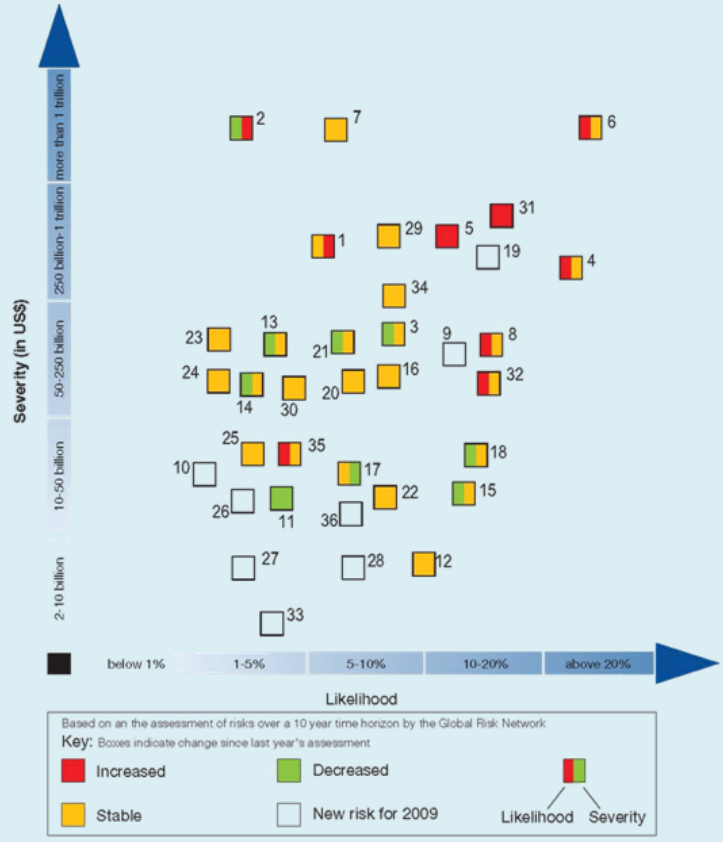
Within this context a Country Risk Officer would act as a central point of contact for the purposes of systematically managing a comprehensive multi-area risk portfolio that coordinates and

builds upon the work already being carried out by governments. Essential to this role will be creating a high degree of synergy between the various levels of government and administration, private-sector operations and the insurance industry. Improving the level of collaboration across the various sectors by actively engaging in the development of new partnerships involving the transfer of risks and financing of economic losses through the coordination of global efforts would be an essential component of effectively adapting to climate change.

The Figure opposite illustrates a fundamental tool of country (or regional/global) risk management; the mapping of the risks onto a severity/likelihood grid. The example provided is for the world economy, but the same principles can be applied at a country level, so identifying key priorities.

Without ownership of these risks and a systematic method of addressing the problems they create, adaptation will remain fragmented and the challenges created by climate change will continue to further dampen prospects of sustainable growth within the Caribbean.

Although risk management is not the complete solution to the problems being created for Caribbean people and economies by climate change, it does provide an important benchmark upon which more informed decisions can be made regarding investments in adaptation and mitigatory measures.



Source: World Economic Forum 2009

ECONOMIC

1 Food price volatility
2 Oil and gas price spike
3 Major fall in US$
4 Slowing Chinese economy (6%)
5 Fiscal crises
6 Asset price collapse
7 Retrenchment from globalization (developed)
8 Retrenchment from globalization (emerging)
9 Regulation cost
10 Underinvestment in infrastructure

GEOPOLITICAL

11 International terrorism
12 Collapse of NPT
13 US/Iran conflict
14 US/DPRK conflict
15 Afghanistan instability
16 Transnational crime and corruption
17 Israel-Palestine conflict
18 Violence in Iraq
19 Global governance gaps

ENVIRONMENTAL

20 Extreme climate change related weather
21 Droughts and desertification
22 Loss of freshwater
23 NatCat: Cyclone
24 NatCat: Earthquake
25 NatCat: Inland flooding
26 NatCat: Coastal flooding
27 Air pollution
28 Biodiversity loss

SOCIETAL

29 Pandemic
30 Infectious disease
31 Chronic disease
32 Liability regimes
33 Migration

TECHNOLOGICAL

34 CII breakdown
35 Emergence of nanotechnology risks
36 Data fraud/loss

The Cayman Islands Experience with the Caribbean Catastrophe Risk Insurance Facility

by Michael Nixon

This paper, written by Michael Nixon, provides an analysis of the experience of the Cayman Islands Government after the first year of operation of the Caribbean Catastrophe Risk Insurance Facility (CCRIF). The paper also highlights the Cayman Islands Government's awareness of the potential negative financial and macroeconomic impacts that a major natural catastrophe can have on the country and brings into focus that country's commitment to investigating and implementing appropriate mitigation measures to minimise these risks.

This paper, like the one written by Simon Young and Milo Pearson, "Natural Catastrophe Risk Insurance Mechanisms for Asia and the Pacific: The CCRIF as a Technical Model", was presented at an Asian Development Bank Conference held 4–5 November 2008 in Tokyo, Japan.

Introduction

This paper provides an analysis of the experience of the Cayman Islands Government (CIG) after the first year of operation of the Caribbean Catastrophe Risk Insurance Facility (CCRIF).

CCRIF is specifically designed to provide a cost effective and efficient method of pooling and transferring the financial risks associated with the major natural catastrophes of hurricanes and earthquakes which plague countries across the Caribbean region.

The Cayman Islands Government is acutely aware of the potential negative financial and macroeconomic impacts that a major natural catastrophe can have on the country and is committed to investigating and implementing appropriate mitigation measures to minimise these risks.

Cayman Islands – An Overview

The Cayman Islands consists of three islands, Grand Cayman, Cayman Brac and Little Cayman located in the Northwest Caribbean Sea approximately 150 miles south of Cuba and 167 miles northwest of Jamaica. Together the Islands have a total land area of approximately 100 square miles. The Islands are low lying with the highest point being 140 feet above sea level on Cayman Brac. The main Island of Grand Cayman is home to the capital George Town and has a maximum elevation of approximately 60 feet above sea level.

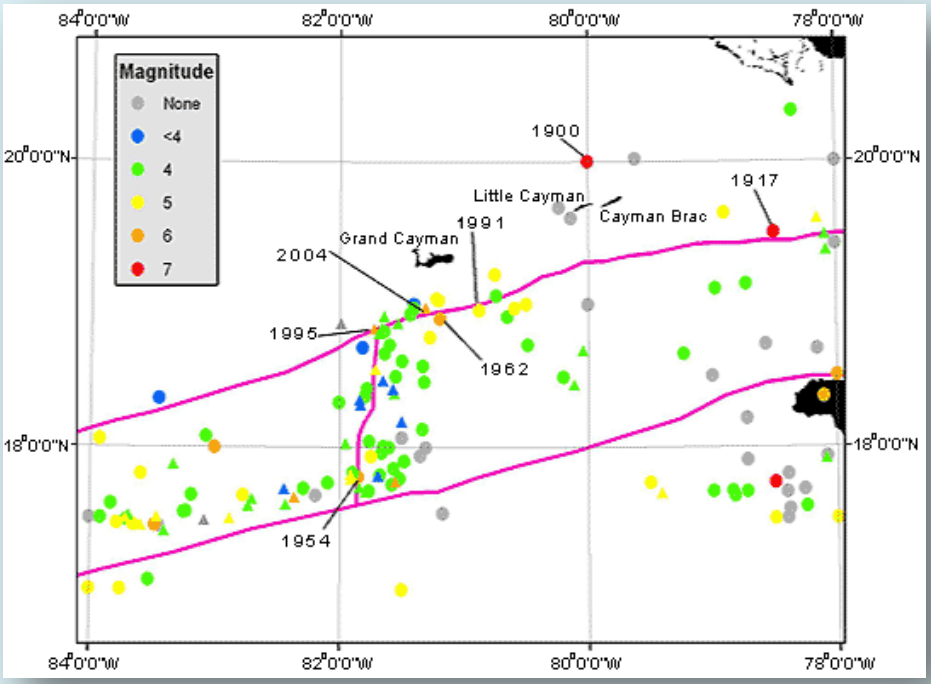
The islands are a British Overseas Territory with a population of approximately 53,000 people, of which approximately 95% reside on Grand Cayman. The economy is largely services based with a strong focus on Tourism and Financial Services.

Catastrophe Risk Exposures

Due to their geographic location, the Cayman Islands are susceptible to the catastrophic risks of earthquakes and hurricanes.

Earthquake Risks

The Cayman Islands lie near a fault zone where the Caribbean and North American tectonic plates meet. This transform zone is known to generate earthquakes which have occasionally affected the Cayman Islands and the potential for catastrophic earthquakes exists. The figure below shows historical earthquake activity in the Cayman region.



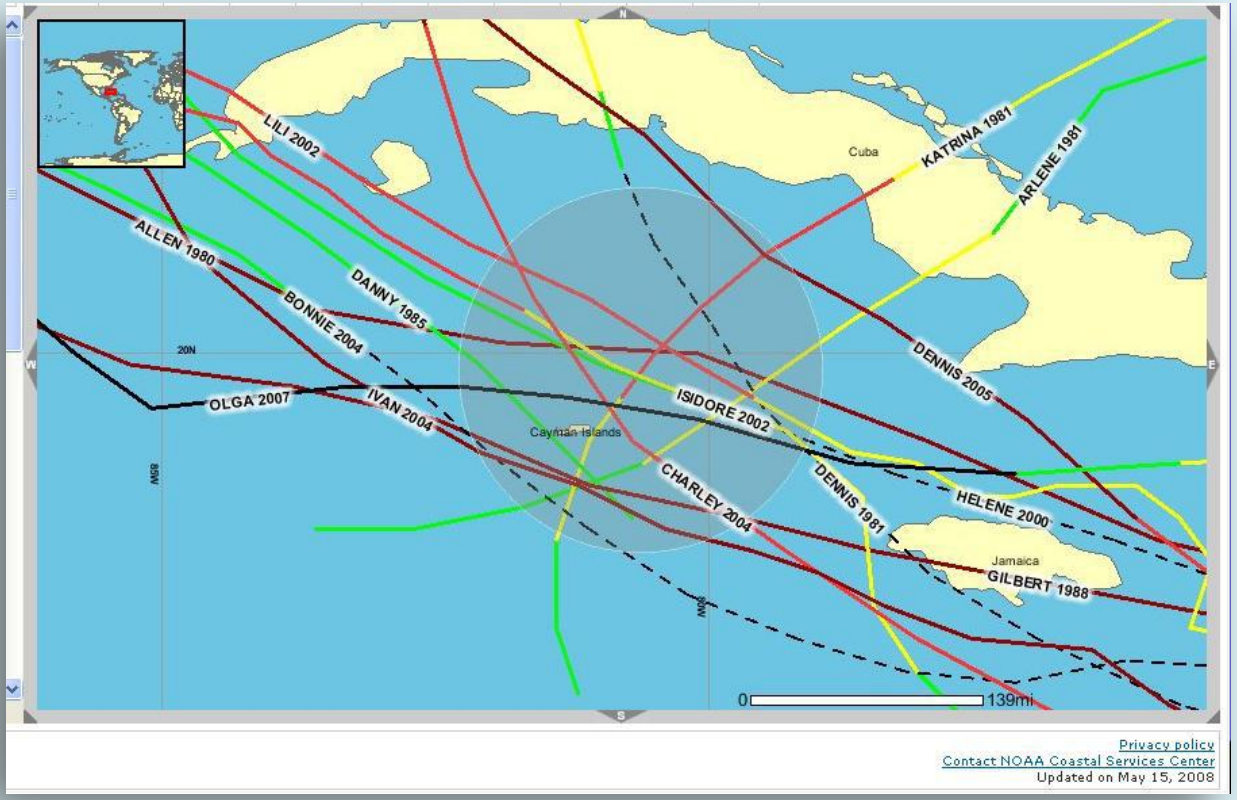
Historical Earthquake Activity in the Cayman Region

In recent history, the strongest earthquake occurred on 14 December 2004 when a magnitude 6.8 quake centered just 20 miles southwest of Grand Cayman shook the Islands. Fortunately this strong quake caused only very minor damage, but it did highlight the potential for the Islands to be severely affected by earthquakes. This potentially catastrophic event came just three short months after the Islands had been ravaged by Hurricane Ivan.

Hurricane Risks

The Northwestern Caribbean where the Cayman Islands are located is exposed to hurricanes and the Cayman Islands have been described by some as lying in "hurricane alley" given the high frequency with which storms have passed through the Cayman area. According to data compiled by the United States of America's, National Oceanic and Atmospheric Administration (NOAA), Coastal Services Center, the Cayman Islands have had many major hurricanes (category 3 or higher) pass within 100 miles during the past 30 years. See Figure below.

Over the past 30 years, the Cayman Islands have undergone rapid economic growth along with much development and construction of the country's built infrastructure such as tourism, commercial, government and residential buildings; road networks; water and sewerage infrastructure; ports and airports. These rapid developments along with the particular geography of the Islands have combined to put the Cayman Islands at great potential financial risk should they receive a direct hit from a major hurricane. On September 12, 2004 the Cayman Islands and in particular the main island of Grand Cayman was hit by Hurricane Ivan, a Category 4 hurricane which caused widespread damage on a scale that had not been experienced by the Islands in modern history. Hurricane Ivan resulted in two deaths and created losses estimated at US$3.4 billion4 or 183% of GDP for the Cayman Islands.



Occurrence of Category 3 or Higher Hurricanes in the Cayman Region between 1977 and 2007

Hurricane Ivan impacted every aspect of life in the Cayman Islands and the United Nations Economic Commission for Latin America and the Caribbean (ECLAC) team reported that the dollar amount of damage was the highest ever encountered by ECLAC. CIG's financial position deteriorated significantly, with the Government's forecast operating position moving from a small surplus of $0.5 million to an operating deficit of $36.7 million,6 the largest deficit in the country's history.

Financial Mitigation of Catastrophe Risks

The CIG is generally risk averse and conservative in managing its financial risks associated with catastrophe exposures using a combination of risk transfer, retention and reduction methodologies.

Insurance Programme

The CIG uses insurance to transfer financial risks where appropriate, and has operated a comprehensive property and liability risk insurance programme since the mid 1980's. This programme provides all-risk insurance coverage against physical loss of major Government buildings and assets. Currently the programme insures more than US$500 million in assets across the three Islands.

Even with an insurance programme of this size it is impossible to provide total financial risk transfer for CIG's assets. There is a considerable value of assets which are not currently insurable including roads, seawalls, docks and piers.

In addition to assets there are other large uninsurable financial risks such as removal and disposal of debris, provision of emergency relief services, emergency housing assistance and other such social responsibilities that the CIG would be called upon to assist with in the aftermath of a hurricane or an earthquake.

National Disaster Fund

In addition to its insurance programme, the CIG established a National Disaster Fund (NDF) on the 4 November 1999 for the purpose of providing the Government with the financial resources necessary to fund emergency response and recovery efforts following a major disaster. The NDF is funded through specific annual allocations in CIG's annual budget process. At 30 June 2004 the fund had a balance of US$3.01 million.

Performance of Financial Mitigation Methods

Following the passage of hurricane Ivan in September 2004, the CIG's existing financial risk transfer mechanisms were fully tested.

Due to the high value of claims from the public and private sectors arising from hurricane Ivan, the CIG's property insurance provider was unable to meet both its obligations arising from the Government's insurance claim (approximately US$120 million) and those emanating from private sector claims as well. As a result, CIG settled its claim for substantially less. Subsequent changes were made to the CIG insurance programme to diversify its base of insurance and remove it from direct competition with the local market. These changes improved the overall quality of the programme and have significantly reduced the likelihood of non-payment of a valid insurance claim.

In addition to calling on its property insurance policies, the CIG withdrew US$2.989 million from The National Disaster Fund to pay for emergency relief and emergency house repairs for displaced and uninsured residents. The value of the claims on Government for social relief assistance far exceeded the amount in the fund and it was clear that the current level of reserves and rates of contribution to the NDF was insufficient to meet the demands of a major disaster.

The experience of hurricane Ivan highlighted the fact that even though the CIG had in place financial risk transfer instruments it could not fully protect itself from the enormous financial risks that the country was exposed to following the occurrence of natural hazards. The consensus in the CIG at the time was that there was a real need for some other form of financial risk transfer to help bridge the gap between what was the perceived and real financial risk associated with hurricanes.

Launch of Regional Initiative

In September 2004, following the passage of hurricane Ivan through the Caribbean region, the Caribbean Community (CARICOM) Conference of Heads of Government held an emergency meeting to discuss critical issues surrounding the need for the provision of catastrophe risk insurance for its members. Consequently, CARICOM resolved to take action and approached the World Bank for assistance to conduct a feasibility study on an appropriate solution for the reduction and transfer of catastrophe financial risks. This marked the beginning of what would become the Caribbean Catastrophe Risk Insurance Facility.

The Cayman Islands Government, having just experienced a major hurricane event and the subsequent massive financial impact, welcomed this regional initiative and was very interested in exploring additional/alternative methods for mitigating the financial risks associated with such disasters. The CIG recognised the potential benefit that could be derived from having a well structured mechanism in place to mitigate the potentially crippling financial losses arising from natural catastrophes. These benefits would greatly improve the entire region's ability to recover from such exogenous shocks and allow countries to still pursue their planned economic and social development activities.

CIG participated in a number of technical regional meetings to discuss the various possible solutions to offer regional Governments better protection against the financial risks associated with natural hazards such as hurricanes and earthquakes.

Damage resulting from Hurricane Ivan's impact on Cayman in September 2004

During these discussions a broad range of issues were identified concerning the many types and levels of risk faced by countries in the region, including, storm surge flooding, flash flooding and mudslides. As a result of the discussions, it was determined that the majority of the natural hazard risks in the region could be traced to either hurricane or earthquake events and that initially, CCRIF would focus its efforts on developing a parametric solution for those specific risks.

After much debate and discussion among regional Governments, it was decided that full support should be given to for the establishment of the CCRIF.

Government Decision Making and Cost Benefit Analysis

Following the devastating financial impacts of Hurricane Ivan, the CIG had a strong desire and will to explore all available options to minimise the financial risks created by such natural hazards.

Review of Alternative Risk Transfer Options

In January 2005, prior to any involvement with the CCRIF, the CIG commissioned its insurance brokers to investigate possible alternative insurance solutions to fill the gap that had been identified between its existing financial risk mitigation mechanisms and the level of financial losses that the Islands experienced with Hurricane Ivan.

As part of this analysis, CIG initially explored other possible risk transfer options such as catastrophe bonds and parametric insurance policies. In the case of catastrophe bonds, these were ruled out as inappropriate for the Cayman Islands given their inherently high transaction costs; the poor match of such an instrument to the value and scale of the risks faced by CIG and lack of interest for this type of product within the CIG.

Parametric insurance contracts were also reviewed but were also deemed to be inappropriate for the CIG at the time as there was very limited market capacity and there were forecasts of high volatility for premium rates in comparison to traditional property insurance. In addition, a Cayman specific parametric insurance product would require an expensive setup in terms of the development of loss modeling, selection of appropriate triggers and contract development.

The CIG's internal review of these alternative risk transfer options was subsequently validated by the research and findings of the CCRIF team that was presented in a Paper entitled **"Initial**

Results of Preparation Work: Caribbean Catastrophic Risk Insurance Facility". That Paper was presented to interested Governments and donor agencies at a regional meeting held in Barbados on 13 October 2006.

At that important meeting, the full case for the CCRIF was set out and included a comprehensive discussion on the positive and negatives of the proposed CCRIF, its structure, funding and operations. The reports from this particular meeting were instrumental in guiding CIG's decision to join the CCRIF.

The Risk of Maintaining the Status Quo

One option considered by the CIG was the option of continuing its strategy of risk transfer via its existing insurance programme and National Disaster Fund without investing in any new risk transfer mechanisms. However this was quickly ruled out as a viable option as the CIG did not want to jeopardise the continued positive economic development of the Islands to this traditional approach given its known deficiencies in catastrophic events. In CIG's experience the traditional insurance solutions lacked the overarching capacity to adequately cope with the magnitude of the negative financial impacts stemming from a catastrophic natural disaster.

Fiscal Policy Considerations

A major factor in CIG's decision making centered on the relative affordability of CCRIF and the projected financial impact of the costs of premiums and membership fees on CIG's internal operation. As with any country, in the Cayman Islands there are a range of priorities which need to be addressed by the government and limited financial resources to adequately deal with them.

In 2005, the CIG commenced a large multi-year Capital Development Programme (CDP) which focused on the development of new and expanded infrastructure for the islands

with a focus on new schools, roads, and upgraded airport and port facilities. One of the main aims of the CDP is to improve the overall quality of the country's critical infrastructure and reduce where possible the potential damage and economic disruption of hurricanes and earthquakes. However it will take a few years before these projects are completed and these benefits realised.

In it's 2006/7 Budget the CIG presented a US$154.75 million CDP for that year to be funded by a combination of operating surpluses and borrowings. At the time, CIG was forecasting similar levels of capital spending over the next three financial years.

The financial requirements of CIG's CDP would likely mean that the Government would have a reduced financial capability to deal with any major disaster without severely disrupting its planned CDP. Recognising this situation, and the fact that it would take years to fully implement its CDP the CIG was eager to find a viable solution to transfer this financial risk.

Climate Change Considerations

Another factor which influenced CIG's decision making were the predictions from global and regional scientific and meteorological authorities which suggested that the earth's climate was entering a pattern which would likely generate more and stronger hurricanes in the North Atlantic Region which encompasses the Caribbean basin.

The 2007 Atlantic hurricane season forecast by the world renowned team of Klotzbach and Gray of the Colorado State University called for *"a very active hurricane season"* and *"Above average major hurricane landfall risk in the Caribbean"*. These forecasts were taken quite seriously by CIG officials and helped to reinforce the call for comprehensive catastrophe risk management.

The CCRIF Solution – Why it is Attractive?

CCRIF complemented the CIG's existing catastrophe related financial risk transfer strategies and fit nicely into its overall established policy of transferring financial risk where appropriate.

In terms of a financial risk transfer option, CCRIF has a number features which the CIG found to be highly desirable. These are described below.

Benefits of Risk Pooling

As discussed earlier, CIG's cost benefit analysis explored the costs for securing a risk transfer mechanism to cover the gap which existed between CIG's existing Insurance Programme and National Disaster Fund and resulted in findings that such a product was not readily available, would require extensive research and customisation and be prohibitively expensive.

CCRIF, by pooling risks from multiple countries would present a better risk profile to prospective insurance/reinsurance markets and likely receive rates that were significantly better than what the CIG could obtain on its own.

Pooling also has the added benefit of keeping premiums stable, as over time when the size of the funds in the pool grows the pool will be able to retain a greater portion of the risks it provides coverage for and purchase less reinsurance. This factor is particularly valuable when reinsurance markets harden and premiums for Caribbean catastrophe risk increase. Over the 2005 to 2007 period, the CIG had to cope with a significant increase in premium for the catastrophe risk element of its own property insurance programme.

Donor Support

CCRIF obtained the support of the World Bank and the Government of Japan very early on; this gave the project both the credibility and resources necessary to make it a success.

The proposed structure for CCRIF called for the base capital of the Facility to come from major international donor agencies and be managed by the World Bank. This feature added security, stability and viability to the Facility as it would encourage donor agencies to contribute to the Facility creating a strong core capital base which would put CCRIF in an optimal position to secure the best possible reinsurance rates.

Parametric Insurance Policy

The CCRIF's offer of a parametric insurance solution presented several benefits to CIG over traditional indemnity type insurance policies:

- Claims would be paid much faster as there was no need for a long detailed physical assessment and loss adjustment following an insured loss, this factor would also contribute to keeping the insurance premiums low

- The policy is not linked to damage occurring to a specific asset at a particular location. Instead the policy is triggered when certain conditions are met, either wind speed in the case of hurricanes or the intensity of ground shaking for earthquakes

- Substantial policy limits even during the first year of CCRIF provided some degree of comfort to participating countries as the projected payouts for a major catastrophe would be large enough to enable the affected Government to address their local needs

Improved Risk Exposure Data

As part of CCRIF, risk assessment and loss exposure analysis would be conducted by expert agencies providing valuable data to aid national and regional risk management institutions in fulfilling their mission. It was unlikely that these detailed studies would ever have been done by CIG or any of the individual member countries.

Promotes Regional Cooperation

CCRIF presented an excellent platform for regional Governments to unite and take concrete steps toward reducing the negative impact of these well known and particularly devastating risks. CCRIF encourages knowledge sharing among its member countries which can lead to solutions which best meet the needs of the countries it is designed to protect.

First Year of the CCRIF: Cayman Islands' Assessment

In May 2007, the CIG officially contracted with CCRIF for a parametric insurance policy providing coverage for up US$49.8 million for hurricane events and US$6.1 million for earthquake events. The Policy period covers one year beginning 1 June 2007; during this first year the Cayman Islands did not experience any significant events which triggered the policy for the islands. However, the islands were impacted by two reportable events, hurricane Dean in September 2007 and an earthquake in March 2008.

Overall, the CIG was satisfied with the performance of CCRIF in its first year of operation. The first year presented real challenges to the CIG in terms of exactly how the facility would perform and the level of understanding among key CIG policy makers. In reviewing our experience we believe that CCRIF definitely has its place in the Cayman Islands as part of an overall

strategy for the risk management of the financial risks associated with major catastrophe risks.

CCRIF is not a complete solution for these types of risks and should not be the only mitigation measure utilised by any country. The CIG recommends that any country approach this type of risk mitigation from multiple angles seeking first to reduce and avoid these risks where possible as well as utilising other appropriate risk transfer mechanisms.

Communication

CIG considers communication to be one of the most important aspects of CCRIF in its early phases and is satisfied with the level of communication and the overall quality of the information disseminated by CCRIF. CCRIF is a very technically complex instrument which can be difficult to explain to persons with little or no knowledge of insurance matters and it is therefore very important that the lines of communication be open and frank.

CCRIF engages its participating countries early on in the renewal phase of the policy year to obtain feedback from countries on possible changes to the programme. Also to assist with determining if changes to the level of coverage are necessary due to changes in the country's level of perceived risks, or changes to the fiscal, political or policy landscape.

Another very desirable feature of CCRIF is the monitoring of potential threats and provision of timely updates as soon as a covered event threatens one of the participating countries.

The CIG would like to see an annual meeting of the appropriate officials from the CCRIF member countries to discuss issues related to CCRIF coverage, share experiences and make joint recommendations for programme enhancements.

Experience of Hurricane Dean

During the 2007 policy year the Cayman Islands was affected by Hurricane Dean as it passed 168km south of the Islands on the 19 and 20th of August 2007. Hurricane Dean would be the first event under CCRIF that had the possibility of generating a claim, and there was much interest among participating countries to see if the policy would be triggered and if so, would it respond in the way that it was envisioned.

Prior to affecting the Cayman Islands, Dean affected other CCRIF countries including Dominica, Saint Lucia and Jamaica. Jamaica was the most heavily impacted, as the storm skirted the south coast of Jamaica causing a fair amount of damage particularly from the torrential rains which accompanied the storm. CIG paid particular attention to what was happening in Jamaica and the fact that its CCRIF policy was not triggered by hurricane Dean even though Jamaica suffered significant financial losses from that storm. There were calls in local and regional media which criticised CCRIF for not responding and providing Jamaica with a payout.

Post Dean internal CIG discussions revealed that there was some disappointment and confusion with CCRIF and why no payouts followed this storm. The issues centered on how it was possible for Hurricane Dean's winds to be well above the triggers for Cayman and Jamaica; both countries experienced financial losses yet there be no CCRIF payout.

When the CCRIF loss models were run to determine whether or not payouts were triggered the results showed that while Dean did have sustained winds strong enough to trigger the policy those winds did not actually extend over either country to the extent necessary to trigger the policy. For both Cayman and Jamaica this was validated by the fact that the actual wind speed recorded by the local meteorological authorities were also below the threshold required to trigger the CCRIF policy.

CCRIF provided the CIG with a Preliminary Event and Index Calculation Note on 21 August 2007 which provided details of the event and the calculations used to determine if the policy has been triggered and if so, what the payout would be. In the case of hurricane Dean, the Cayman Islands policy was not triggered therefore no payment was due to CIG.

While the CCRIF policy was not triggered, the Cayman Islands did suffer damage and the CIG incurred a substantial financial loss. Even though this damage was not catastrophic in nature or cost, the CIG did question its CCRIF policy limits and whether or not it was feasible to purchase a policy with a lower trigger threshold. The main concern for CIG was the potential financial losses that could result from multiple hits from low level hurricanes (category 1 or 2) or tropical storms during any given year. In CIG's estimation such a scenario could have a similar impact on the Cayman Islands as a single direct hit from a catastrophic hurricane such as Ivan in 2004.

Another area of concern for the CIG had to do with the minimum level of payout that would occur once a policy had been triggered. Under the terms of the 2007 CCRIF policy it was entirely possible for the Cayman Islands to be hit by a hurricane that would trigger the CCRIF policy and for the payout under the policy to be quite small.

After the brush with hurricane Dean, CIG requested CCRIF to run a series of hypothetical scenarios using the data from that storm. In one of those scenarios had Dean tracked 1 degree or 69 miles to the North of its actual track the center of the storm would have come within 30 miles of Grand Cayman, triggering the policy and generating a payout of just US$8,551. Under such a scenario the CIG has estimated that it would incur millions of dollars in financial losses, likely exceeding its annual policy premium. It would be difficult for CIG to justify its investment in CCRIF to the people of the Cayman Islands.

In another scenario, with the center of the hurricane passing just 15 miles south of Grand Cayman it would have triggered the CCRIF policy and generated a payout of US$36.5 million to CIG. Under this type of a scenario, the CIG could very easily justify the investment in CCRIF and would have access to the financial resources necessary to recover from such a major disaster.

CCRIF Programme Changes

In early 2008 CCRIF proposed a number of changes for the 2008/9 Policy year which took into account the experiences of its member countries during the initial policy year. The programme changes addressed most areas of major concern among countries and offered enhancements which we believe will help to support the long term commitment of countries to CCRIF and the facility's viability.

Coverage for Smaller Windstorms

The CIG supports the move to allow countries to purchase coverage for smaller windstorms from a 1 in 20 year event to a 1 in 15 year event. Due to the potential impact of multiple strikes by smaller storms and the often devastating impact of torrential rains accompanying such storms this enhancement will allow countries the opportunity to purchase a level of coverage which may more adequately cover the risks they face.

Increased Coverage Limits

Increasing the CCRIF policy limit from $50 million to $100 million is also supported as it will allow those countries which have greater financial risks to cover them. The CIG believes that this is particularly important as member countries become more aware of their exposures and are better able to quantify them they will have the option of increasing limits where necessary.

Increased Minimum Payout

An increased minimum payout is also supported by CIG and is considered to be of significant benefit to all of the CCRIF participating countries as it ensures an adequate payout once a country's policy has been triggered. As discussed above, this enhancement is viewed by CIG as being crucial to ensuring the long term commitment of participating countries.

Simplified Settlement Procedures

The 2008/9 Policy enhancements in this area were welcomed as they support the rapid settlement of claims and in particular smaller claims which are funded by retentions with the CCRIF. The quick settlement of claims was one of the strong advantages of the parametric insurance policies offered by CCRIF and the CIG strongly supports this enhancement.

Cayman Islands - Lessons from CCRIF

A catastrophe risk pooling product is inherently complex especially when trying to address the needs of multiple jurisdictions at once. Based on the experience of the Cayman Islands with the CCRIF, we can recommend the following to any territory or region considering a similar catastrophe risk transfer mechanism.

Understand your Risks

It is important to conduct the research studies (risk assessment and probable maximum loss) necessary to properly identify and quantify the risks which face the country. As part of the CCRIF, the CIG participated in a detailed catastrophe risk exposure analysis study which provided valuable information to the relevant decision makers on the extent of the exposures facing the country. The results of this study helped CIG with determining what level of coverage to purchase under the CCRIF. It also helped the CIG in directing its efforts in physical disaster risk reduction and avoidance as well as general disaster response and recovery planning.

Another important benefit of such studies is that the results will help to define a suitable structure and parameters for the risk transfer instrument. The data compiled should be updated periodically to capture changes in risk profiles.

Apply a Diversified Approach

The CCRIF or other similar financial risk transfer mechanism should not be viewed as a universal solution for all of the financial risks associated with exposure to natural catastrophe hazards. Instead it should be considered as one component of an overall country-specific catastrophe risk management strategy.

Countries should make the effort to explore other financial mitigation methods in conjunction with a catastrophe risk pool instrument as this will likely result in a more complete, robust, effective and efficient risk transfer.

The benefits that can arise from implementing physical mitigation measures to reduce possible losses from natural hazards should not be ignored. The Cayman Islands has undertaken a number of these measures including: improving the standard of construction; relocating certain facilities; building storm surge barriers and improving public education and awareness of possible natural hazards.

Conduct Territory-Specific Cost-Benefit Analysis

Every country considering a parametric type risk transfer mechanism needs to conduct their own internal cost benefit analysis to help it determine what level of coverage is appropriate for its circumstances.

The fiscal state of affairs is a crucial determining factor that must be appropriately analysed to determine whether the country is obtaining the best value for money. No country has unlimited

resources and the purchase of this type of product must be considered in the context of local priorities.

Create a Forum for Communication

It is crucial that there is clear and open communications between all parties when establishing a complex risk transfer solution similar to the CCRIF. Every partner has a voice and should have the opportunity to put forward thoughts on the table as common understanding of both the needs of the countries and what the selected solution can offer, are critical factors which will determine the overall success or failure of the initiative.

Communication is also critical to obtaining the necessary political and public support for this type of solution. It is important that elected officials be afforded full understanding of what they are committing to and what they can expect from a parametric insurance type product. It is critical that countries take the time to fully understand the selected risk transfer mechanism to avoid disappointment and to identify gaps in their individual plans.

Conclusion

CCRIF has allowed the Cayman Islands to secure an effective means of transferring some of the financial risks associated with their catastrophic risk exposures. It has also helped to highlight the need for active and comprehensive catastrophe risk management and encouraged decision makers to take firm steps to implementing appropriate solutions.

The CIG is committed to ensuring that CCRIF remains a viable entity and that it continues in its quest to provide innovative risk transfer mechanisms to regional countries and serves as an example for other countries and regions around the world.

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Published by:
Caribbean Catastrophe Risk Insurance Facility

November 2009