Terms of reference

Development of a database of ground rainfall data for CCRIF SPC and implementation of a web platform for real time data exchange.

1.0 Background

In 2007, the Caribbean Catastrophe Risk Insurance Facility (CCRIF) was formed as the first multi-country risk pool in the world, and was the first insurance instrument to successfully develop parametric policies backed by both traditional and capital markets. It was initially designed as a regional catastrophe fund for Caribbean governments to limit the financial impact of devastating hurricanes and earthquakes by quickly providing financial liquidity when a policy is triggered. CCRIF was developed under the technical leadership of the World Bank and with a grant from the Government of Japan. It was capitalized through contributions to a multi-donor Trust Fund by the Government of Canada, the European Union, the World Bank, the governments of the United Kingdom and France, the Caribbean Development Bank and the governments of Ireland and Bermuda, as well as through membership fees paid by participating governments.

In 2014, the facility was restructured into a segregated portfolio company (SPC) to facilitate expansion into new products and geographic areas and is now named CCRIF SPC. The new structure, in which products are offered through a number of segregated portfolios, allows for total segregation of risk. In April 2015, CCRIF SPC signed an MOU with COSEFIN - the Council of Ministers of Finance of Central America, Panama and the Dominican Republic - to enable Central American countries to formally join the facility. The expansion to Central America and the Caribbean is supported through the World Bank administered Central America and Caribbean Catastrophe Risk Insurance Program Multi-Donor Trust Fund (MDTF) established for that purpose. The MDTF channels resources from various donors, including: Canada, through the Department of Foreign Affairs, Trade and Development, the United States, through the Department of the Treasury; the European Union, through the European Commission, and Germany through the Federal Ministry for Economic Cooperation and Development.

Funding under the Program has been allocated to: (i) expand the services and membership of CCRIF SPC through a recipient-executed Project implemented by CCRIF SPC. The Central America and Caribbean Catastrophe Risk Insurance Project (P149670) was approved by the Regional Vice President for Latin America and the Caribbean on June 30, 2015**.** The Project is implemented by CCRIF SPC (CCRIF Segregated Portfolio Company, formerly the Caribbean Catastrophe Risk Insurance Facility). The Project development objective is to improve affordability of high-quality sovereign catastrophe risk transfer associated with earthquakes and climate-related events for CCRIF participating countries. The expansion of membership into Central America has the potential to diversify the risk portfolio, improve access to reinsurance markets hence reduce the cost of risk transfer, allowing these benefits to be passed on to its members. The peer review of the actuarial soundness of CCRIF SPC's loss assessment models for Central America and the Caribbean will be financed with grant funding from the Central America and Caribbean Catastrophe Risk Insurance Project (P149670).

CCRIF SPC is registered in the Cayman Islands with a board of directors which is responsible for governance and the strategic direction of the company and a chief executive officer with responsibility for managing the company on a day to day basis. It operates as a virtual organization, supported by a network of service providers covering the areas of risk management, risk modelling, captive management, reinsurance, reinsurance brokerage, asset management, technical assistance, and corporate communications and information technology. CCRIF SPC offers earthquake, tropical cyclone and excess rainfall policies to Caribbean and Central American governments. CCRIF SPC helps to mitigate the short-term cash flow problems small developing economies suffer after major natural disasters. CCRIF SPC's parametric insurance mechanism allows it to provide rapid payouts to help members finance their initial disaster response and maintain basic government functions after a catastrophic event.

Nineteen Caribbean govern are currently members of the facility: Anguilla, Antigua & Barbuda, Bahamas, Barbados, Belize, Bermuda, British Virgin Islands, Cayman Islands, Dominica, Grenada, Haiti, Jamaica, Montserrat, St. Kitts & Nevis, Saint Lucia, Saint Vincent & the Grenadines, Saint Vincent, Sint Maarten, Trinidad & Tobago and Turks & Caicos Islands. Nicaragua is the first Central American government to become a CCRIF SPC member.

CCRIF SPC's sustainability relies on certain key factors:

- Continuing operations with the capacity to fund payouts, within the agreed timeframe, while maintaining adequate capital and reserves
- Ability to attract members by offering relevant products with competitive pricing while at all times reinforcing the objectives and limitations of parametric insurance coverage
- Supporting the membership with technical assistance and ensuring a close working relationship with members that value the need for parametric insurance coverage in light of more frequent and severe natural disasters.

The XSR product makes use of several state-of-the-art tools, which allows estimating accurately the daily precipitation over the region. These include:

- Rainfall estimates from satellite images elaborated by the NOAA (National Oceanic and Atmospheric Administration).
- Rainfall estimates provided by the Weather Research and Forecast (WRF) numerical weather prediction (NWP) model developed at the National Center for Atmospheric Research (NCAR) and initialized by a global climate model called GFS-FNL (Global Forecast System, Final) developed at the National Centers for Environmental Prediction (NCEP).

The combination of these products has so far proven to be an efficient way of estimating the occurrence and intensity of damaging events. In 2016 and 2017, 178 rainfall events were detected by the model, out of which 86 were on CCRIF member countries. Among these, XSR identified 13 loss events with no payout (i.e., damaging events whose economic losses were lower than the minimum threshold established by the insurance policy condition to trigger a payout) and 13 triggering events with an associated payout.

2.0 Objectives

Positive performance of the current XSR model notwithstanding, CCRIF is considering an upgrade of it to include new available techniques and datasets. After consultations with the stakeholders, CCRIF is considering explicitly considering the inclusion in the model of measured ground rainfall data among the tools used to estimate the daily precipitation amount within the excess rainfall risk modelling process. This upgrade has two objectives:

a) Improving the reliability of the model results;
b) Strengthening the collaboration between CCRIF and key stakeholders, such as national and international meteo-hydrological institutions.

3.0 Scope of Works

This assignment seeks to develop a database of ground rainfall measurements for Caribbean and Central American countries as well as to implement a web platform for real-time data exchange. A ground rainfall measurement is defined as a measure of the rainfall recorded by ground instruments such as rain gauges and/or radar. As an example, several meteorological agencies operate rain gauge networks in the area, such as the Caribbean Institute of Meteorology and Hydrology (CIMH) and national meteorological offices. The ground data to be integrated within the XSR model needs to meet certain requirements:

- The data need to be available preferably since 1998 (i.e., it has to cover at least the same historical period used by the XSR model to assess the rainfall risk and compute the policy parameters).
- Real-time data must be consistent with historical data.
- The data need to be available in real time or in near-real time (i.e., preferably within 48h but at most with 3 to 4 days of delay).
- The meteorological network(s) from which data are obtained must have high reliability and quality control standards.

The assignment is composed of the following points:

Component 1 a) Data collection;

Component 1 b) Development of a historical geo-database;

Component 2 Web platform development. Component 2 will be undertaken by the Consultant only if there is a determination by CCRIF that it is feasible to include the data into the XSR model based on the requirements outlined above

Assignment Countries

CARIBBEAN: Anguilla, Antigua and Barbuda, Barbados, Belize, Cayman Islands, Dominica, Grenada, Haiti, Jamaica, St. Kitts and Nevis, Saint Lucia, St. Vincent and the Grenadines, The Bahamas, Trinidad & Tobago, the Turks and Caicos Islands plus the British Virgin Islands, Montserrat, and Sint Maarten

COSEFIN: Nicaragua, Panama, Honduras, Costa Rica, Dominican Republic, Guatemala, El Salvador

4.0 Services

Component 1a): data collection

Objectives

The main objectives of this component are:

- To identify the main potential meteorological data providers in the countries of study and to engage with them within the framework of the XSR modelling process.
- To assess the compatibility of the available products/data with the XSR model requirements.
- To collect all the available historical precipitation rain gauges and radar data from all the available sources.

Activities

The main activities of this component are:

- Engagement with local and international hydro-met ground data providers, including oral/written communications and/or meetings.
- Analysis of the characteristics of the available databases. Parameters such as the length of the records, the presence of data gaps, the reliability and quality of the data, the spatial coverage, etc., need be assessed.
- Analysis of the suitability of the available datasets within the framework of the XSR model. In particular, the aspects to be analysed include: historical data availability compared to the historical period previously used to assess long-term risk with XSR; real-time data availability; data consistency and homogeneity in space and time; general reliability of the data and the data provider.

Key actions

Key actions will include, but should not be limited to:

- Identification of existing meteorological, climatological and hydrological agencies operating in the countries of study and that might represent a potential data provider.
- Engagement with such agencies to establish a link between them and CCRIF and to facilitate the transfer of data.
- Collection of all historical rainfall databases, both rain gauge and radar, from the agencies identified as above under the first bullet point.
- Analysis of the data collected to assess their suitability for integration in XSR.

Expected output

1. A collection of historical rainfall databases. This collection should include georeferenced information about station location, duration of the historical period, completeness of the record and other relevant characteristics of the datasets.

2. A technical report and supporting GIS information created for the purpose of describing in an organized and systematic fashion the available databases and their suitability for the purposes of the XSR model.

Component 1 b): Historical geo-database

Objectives

The main objective of this component is:

- Organizing the collected precipitation data in the countries of study within a historical geo-database
- For quality control and quality assessment purposes, comparison with relevant projects and data sources for the region (e.g. CHARIM, GSOD) should be performed.

Activities

The main activities of this component are:

- Organisation of the data obtained in Component 1 according to a homogeneous format. This activity will include format conversion (from the original format to the output format) and data homogenisation.
- Data gap filling, if necessary, using spatial/temporal interpolation techniques and/or geostatistical approaches.
- Develop an approach that ensures sustainability of data availability from the identified sources, considering CCRIF's requirements on the speed of availability and format of the data. This process should include recommendations on an outreach program to actively involve the identified institutions in the project.

Key actions

Key actions will include, but should not be limited to:

- Based on the assessment carried out in Component 1, one or more datasets/data providers for each country will be chosen to be integrated into the final historical database of ground data and into the real time operation of the web platform (Component 3).
- The selected data will be processed and, eventually, the gaps will be filled using spatial interpolation techniques.
- Automatic routines will be set up to process, homogenise, assimilate and upload the data.

Expected output

1. Organised and homogenised database of historical rainfall values, both from rain gauges and radar, for all the countries of the assignment, including metadata.
2. A technical report detailing the methodology used to analyse, homogenise and process the data.

Component 2: web platform development

Objectives

The main objectives of this component are:

- To set up a real-time data assimilation and processing tool.
- To develop an operational web tool to be used as a storage and exchange platform between the rainfall data assimilation processing tool and the XSR model for near real time operations and historical rainfall data.
- To test the operability of the application in various scenarios for each one of the countries of study.

Activities

The main activities of this component are:

- Implementation of the necessary routines to assimilate the data in real time and to upload them to the web platform.
- Setting up a web tool/platform for data exchange. The nature of this platform is to be tailored on the needs of the XSR model. Setting up an application programming interface (API) is required to ensure a smooth interaction with the XSR model.
- Key automation of data acquisition, through long-term partnerships with data providers.
- Coordinating the integration of the web platform with the current CCRIF's monitoring framework, through communication and interaction with CCRIF's Risk Management Specialist. The platform should be flexible enough to be able to be eventually incorporated into CCRIF's monitoring framework.
- Uploading the historical rainfall database and making it easily accessible to XSR developers and users.
- Testing the robustness and operability of the application by performing tests for each one of the countries of study to assess the reliability and accuracy of the procedure and the criticalities that may arise once it becomes operational. Emphasis should be put on rare events (within 100-year return period).

Key actions

Key actions will include, but should not be limited to:

- Development of a web tool for data exchange from data providers to CCRIF.
- Stress-testing of the model under extreme event scenarios.

Expected output

1. A web-based platform/application for the exchange of information with the XSR model, especially focused to near-real time operations.
2. A technical report and supporting GIS information created for the purpose describing in an organized and systematic fashion the developed tool.

Data formats and requirements

With respect to this data, the inception phase of the project should establish the definition of data management guidelines inducing all file formats and metadata standards. The minimum requirements to be followed for all geospatial (GIS) data are:

Metadata: Detailed documentation needs to be provided for each data set. This metadata must include description, source, contact, date, accuracy, restrictions. A description of attributes needs to be provided for vector and tabular data sets. Spatial data must include details of projection.

Vector data: Geospatial vector data must be converted into a standard OGC format or well-known format. This list includes, but is not limited to, shape file, KML, GML, WKT. Additional formats may be used with approval. Where possible, styling information should be provided in SLD format. All files must include projection parameters.

Raster data: Geospatial raster data must be converted into a standard OGC or well-known format. This list includes, but is not limited to, geoTiff, JPEG, JPEG2000, ERDAS img, ArcInfo ASCII or Binary grid, MrSid. Additional formats may be used with approval. Where possible, styling information should be provided in SLD format. All files must include projection parameters.

Tabular data: Tabular data must be converted into a readily accessible or well-known format. This list includes, but is not limited to, CSV, tab delimited text file, or spreadsheet. Additional formats may be used with approval.

Media/method of transfer: All data sets must be transferred on permanent media such as a CD/DVD disk. Very large data sets, too large for CDs and DVDs, may be provided on a hard drive or solid-state drive.

4.0 Resources and reporting

The Consultant is expected to have developed/managed large precipitation datasets (and/or other meteorological variables). The Consultant will have a good knowledge of rain gauge networks in the region and expertise on automatic data retrieval and delivery. The Consultant will have advanced analytical skills, hydrological and/or meteorological expertise, project management skills, excellent presentation skills and the ability to develop strong relationships with key counterparts and other contractors on this project. Project management skills are considered critical, for the timely delivery of products, and the overall coordination of experts with different areas of expertise.

The Consultant team will include experts in weather data collection, real-time monitoring, GIS and Web GIS development. The Consultant will closely interact and report to the CCRIF team that will accept the deliverables. The Consultant is encouraged to appoint a focal or contact person who can be competently consulted on this undertaking on a regular basis.

The Consultant will closely interact with the developer of the XSR model to ensure consistency between the assignment outputs and the needs of the model. This interaction is considered a key step to achieve a successful implementation of the project, given that the outcome of this project will then need to be efficiently integrated into the XSR model, potentially before the 2019-2020 policy year, which begins in June 2019.

5.0 Requirements

One of the lead Firm team members is expected to fulfil the role of Team Leader, to be the chief communication partner for CCRIF and other external parties, to coordinate and manage the implementation of the assignment including all necessary personnel deployment, purchases, and project administration, to supervise the work of all team members and guide them as necessary, to carry out those tasks for which no professional specialist will be deployed, to manage the dialog and interface with primary counterparts and the World Bank, to compile and submit the deliverables stated in this terms of reference and ensure quality control and timely delivery of all deliverables.

The suggested team composition includes:

- Team Leader (10+ years in hydrological or meteorological field).
- Meteorologist/Hydrologist expert (PhD).
- GIS and WebGIS expert.

The firm must demonstrate the following:

- Team members with excellent analytical skills, and ability to prepare professional narrative reports summarizing observations and conclusions in English and
- Experience and knowledge of the Central America and the Caribbean context.

6.0 Timetable

It is expected that the work will be carried out within a period of 5 months following the date of the award of the contract. The Consultant is expected to conduct a one-day meeting in Washington, DC or in the Central America / Caribbean region during the course of this project to present and discuss the status, progress and challenges of the assignment. In addition, as mentioned earlier, training sessions on outputs for CCRIF should be arranged, based on feedback from CCRIF and agreed during the inception phase. The specific dates for deliverables will be agreed by contract. Delays are justified if caused by the proven tardiness in receiving the requested information from the target countries.

Schedule for Completion of Outputs

Outputs	Completion date
Component 1 a): data collection 1. Collection of historical rainfall databases 2. Report	Within 3 months of contract signing
Component 1 b): data processing 1. Homogenised historical rainfall database 2. Report	Within 4 months of contract signing
Component 2): web platform development 1. Web platform 2. Report	Within 5 months of contract signing, and based on the feasibility finding of Competent 1) and b)