Terms of reference for the Peer Review of the Runoff Model 1.0

1. Background

In 2007, the Caribbean Catastrophe Risk Insurance Facility 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 born 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

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 offers earthquake, tropical cyclone and excess rainfall policies to Caribbean and Central American governments. CCRIF helps to mitigate the short-term cash flow problems small developing economies suffer after major natural disasters. CCRIF'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 governments 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, Sint Maarten, Trinidad & Tobago and Turks & Caicos Islands. Nicaragua is the first Central American government to become a CCRIF SPC member, Panama, Guatemala and Honduras have since joined the facility.

CCRIF'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 at attracting 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.

CCRIF's products require careful design of the policy terms and conditions as well as precise and robust models. In 2016, CCRIF implemented a new Excess Rainfall Loss model (XSR 2.0) which computes the country aggregated losses due to excess rainfall on a daily basis and, when the excess rainfall exceeds a threshold level on a sufficiently large portion of a country, it computes the losses and the insurance payout according to pre-defined policy parameters. The model has been updated to XSR 3.0 in the 2023/24 policy year.
The XSR product makes use of several state-of-the-art tools, which allows estimating accurately the daily precipitation over the region. These include:

- CMORPH (CPC MORPHing technique), which produces global precipitation analyses at very high spatial and temporal resolution. This technique uses precipitation estimates that have been derived from low orbiter satellite microwave observations exclusively, and whose features are transported via spatial propagation information that is obtained entirely from geostationary satellite IR data.
- IMERG (Integrated Multi-satellitE Retrievals for GPM) dataset has also been included in the latest version of XSR among the precipitation datasets used in the hazard module.
- Rainfall estimates provided by four different configurations of 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 and accurate way of estimating the occurrence and intensity of damaging events.

The XSR policy product offered by CCRIF is designed to assess pluvial flood risk and it is particularly efficient in countries with a size and a geomorphology that make hydrological processes not extremely relevant in the generation of extreme flood events. In 2023 CCRIF decided to integrate the XSR product with a runoff model, aiming at providing coverage against fluvial flood. The Runoff model has been initially developed for a pilot study in Guyana and Suriname, since these two CARICOM countries are not covered by catastrophe insurance coverage and are not yet members of CCRIF. The product will thereafter be developed for other member countries, as appropriate.

2. Objectives

The accumulated rainfall amount during an event can be considered as a good prediction of loss only in those countries/territories characterized by relatively small catchments, such as the Caribbean countries. In larger countries such as Suriname, Guyana and Central America countries, the main hydrological processes (soil infiltration, surface overland flow) cannot be neglected because the contribution of the runoff from the upslope catchment area is much greater than the contribution of rainfall on the single grid cell. In these countries losses can also be caused by fluvial flood, i.e., water flowing over the river's banks. For these reasons, CCRIF has undertaken the development of a runoff model, able to simulate riverine floods. It should be noted that this model,

while capturing the essential parts of a flood, is not assumed to be a full flood model including flood protection measures, but rather a model calculating potential inundation areas. Therefore, this model accounts for the hydrological and hydraulic processes to determine the overland water depth accumulated after/during an event. In addition, a vulnerability module that converts the water depth into direct losses to the exposed assets and a financial module that defines the policy parameters, have been developed for the two pilot countries. Finally, the exposure module has already been developed for all the CCRIF member countries and most of the countries targeted for joining CCRIF in future. However, some adjustments to the exposure module are required to adapt its spatial resolution to be consistent with the resolution of the Runoff model.

The Runoff model is more appropriate for Guyana and Suriname compared with the XSR 3.0 model that underpins the current excess rainfall product, given the exposure to rainfall runoff from large rivers flowing through South America.

In future, the Central American countries and Belize can also benefit from the runoff product as would the large CARICOM members such as Jamaica, Haiti and Trinidad could also be potential candidates, as well as the Dominican Republic.

3. Scope of the Assignment

The Runoff model (RO 1.0) for Guyana and Suriname has been developed for CCRIF by a company referred to herein as "the developer" and CCRIF is searching for a Consultant ("Peer Reviewer") qualified on the subject to perform the peer review.

The expected services from a successful Peer Reviewer are the following:

1. ***Read the Model Development Proposal***. CCRIF will provide the Peer Reviewer the Terms of Reference used to procure the model development.

2. ***Read the Model Documentation***. CCRIF will provide the Peer Reviewer information necessary for the peer review. The documentation may consist of, but is not limited to, the following items:
    a. The technical documentation produced by the developer to describe the work performed to develop the model
    b. A presentation by the authors about the model
    c. Maps with findings
    d. Other support material produced by CCRIF

3. ***Interaction with the model developer.*** The Peer Reviewer is expected to interact with the developer via electronic mail and other means for clarifications. If the interactions occur via electronic mail, the Peer Reviewer will copy a designated person at CCRIF. If the interactions occur via phone, before the call the Peer Reviewer will notify the designated CCRIF person so that he/she can elect whether to participate or not in the call. CCRIF will provide the Peer Reviewer with the name and email address of the point of contact at in the developer team to whom he/she can address any such request.

4. ***Interaction with CCRIF*.** The Peer Reviewer is expected to interact with the Senior Risk Management Specialist at CCRIF regarding the Peer Review. Although the Peer Reviewer will not have direct access to the developer's catastrophe models, he/she may ask the Senior Risk Management Specialist to carry out specific analyses with the developer's models and to report back the model output. The CCRIF Senior Specialist may also provide the Peer Reviewer with comments about the peer review findings.

5. ***Reporting.*** The Peer Reviewer is expected to deliver two reports:

    a. A concise letter report of five or fewer pages with an executive summary of the findings. This concise report will be used by CCRIF to interact with insurance regulators, primary insurance companies and customers. Therefore, this letter report will include the primary findings of the review with emphasis on the positive ones.
    b. A report for internal use of CCRIF, where all the findings are reported at the level of detail necessary for the developer to implement any ameliorating actions in the successive release of the catastrophe risk model. This report will be shared at CCRIF's discretion. This report should contain either an endorsement of the runoff model or, if the case, notes for further future improvements.

Before receiving any such material, the Peer Reviewer will be required to sign a Non-Disclosure Agreement with the model developer.

4. Requirements

- Ph.D. degree in Meteorology and/or Hydrology or an equivalent and suitable qualification.
- At least 5 years of experience in flood hazard and risk modeling.
- Knowledge of and experience on all the risk assessment components (hazard, exposure and vulnerability). Knowledge of probability and statistics.
- Excellent analytical skills.
- Good oral and written communication abilities in English.

Time Schedule and proposed Fees

The assignment will start upon execution of the contract, and it is expected to need not more than 10 working days. The deliverables are due not later than September 20, 2024. Delays are justified if caused by the tardiness in receiving the requested information or results of the model runs by either the developer or CCRIF.