CariCOF 2024 Wet/Hurricane Season - Seasonal Forecast Training Workshop
Georgetown, Guyana

21st – 22nd May, 2024

WORKSHOP REPORT

The 2024 Wet/Hurricane Season pre-CariCOF forecasters' training was held on May 21st and 22nd in Georgetown, Guyana ahead of the Forum held on May 23rd and 24th. The CariCOF, including the training workshop, was organised by the Caribbean Institute for Meteorology and Hydrology (CIMH) and hosted by the Guyana Hydrometeorological Service.

The training workshop was facilitated by Dr. Cédric Van Meerbeeck, Dr. Teddy Allen, Dr. Wazita Scott of the World Meteorological Organization (WMO) Caribbean Regional Climate Centre (Caribbean RCC) at the Caribbean Institute for Meteorology and Hydrology (CIMH); Dr. Simon Mason of Columbia University in New York's International Research Institute for Climate and Society (IRI); Mr. Jemar Greaves, ClimSA Caribbean CAROGEN consultant.

The workshop was made possible through two Intra-ACP projects, namely the Empowering Caribbean Action for Climate and Health programme and the ClimSA Caribbean project as part of the Climate Services and Applications Programme (ClimSA), both funded through the European Union. Further received financial support stemmed from the World Meteorological Organization (WMO) and the US National Oceanic and Atmospheric Administration (NOAA). The agenda is found in **Appendix I**.

Day 1: Tuesday May 21st, 2024 – Prediction of heat for early warning + finalisation of CariCOF climate outlooks

The workshop participants were warmly welcomed by the Dr. Garvin Cummings, director, Guyana Hydrometeorological Service, while opening remarks were given by Mr. Trotman, head of the Caribbean RCC, CIMH. After this, Dr. Van Meerbeeck of the CIMH provided a brief background to the work that spurred the sessions in this training workshop, followed by the workshop objectives and an overview of the workshop agenda. The remainder of the morning was dedicated to ongoing efforts to define, characterize, monitor and predict excess heat and heatwaves for regional early warning purposes.

During the first technical session, a presentation was given by Dr. Van Meerbeeck about the components of the CariCOF Heat Outlooks as the premier seasonal heat early warning product for the Caribbean region. He explained that the Heat Outlooks start by providing a qualitative overview of the range of expected heat impacts on human health (incl. public health, occupational health, well-being), agriculture and food security (incl. livestock and poultry, crop agriculture, fisheries, forestry), tourism (incl. heat adaptation of tourism facilities and diving operations), energy (incl. electricity production, consumption and cooling demand), water (incl. availability in terms of quantity and quality, consumption), disaster risk management (incl. risk types and levels, impacts on DRM operations), child care and education (incl. impacts on learning ability, child protection). The next section reflects the heat seasonality in the region, including the timing of the Cool and Heat Seasons and transition months in between. Then, the seasonal temperature forecasts are presented, followed by seasonal forecasts of heatwave day counts and, finally, historical and forecasted heat impact potential.

Then, Dr. Mason, Chief Climate Scientist, IRI presented the recent work of the WMO in defining and characterizing heatwaves and recommended heat indices for early warning. For the first time, the WMO formally defined 'Extreme heat' as excess heat defined with respect to the local and annual climatology, 'Warm spell' as excess heat defined with respect to the local but not the annual climatology, and, importantly, 'Heatwave' as the local cumulative excess heat during a sequence of unusually hot days and nights. He went on to specify defining heatwave characteristics and properties. Dr. Mason then drew the attention of the participants to different ways of measuring excess heat, namely through temperature indicators, thermal indices, heatwave intensity indices, and metrics.

After the morning's health break, Dr. Allen, Asst. Climatologist, CIMH made a presentation that focused on visualising spatial differences in excess heat during the 2023 and the early part of the 2024 Heat Seasons. The innovative visualisations can help to assess just how unusual or extreme the ongoing night-time and daytime temperatures may be. Graphics were clearly showing the extreme nature of the 2023 and 2024 Heat Seasons, as well as the much warmer than usual 2023-24 Cool Season, as well as highlighting the similarities and stark contrasts between different locations, even on one island. Then, Dr. Van Meerbeeck made a presentation about the historical seasonality of heat extremes across the different parts of the Caribbean Region. This included statistics hot days and nights, uncomfortably hot days and nights and hot and humid days.

The final part of the morning session on heat early warning was spent on a demonstration of seasonal heat forecast production using the IRI's Climate Predictability Tool (CPT), which was largely developed and is

maintained and regularly upgraded by Dr. Mason. Dr. Mason, Dr. Scott and Dr. Van Meerbeeck facilitated this demonstration.

After lunch, a (chronologically) regular part of the pre-CariCOF training workshops was facilitated by Dr. Allen with support from Dr. Van Meerbeeck, namely producing, presenting and consensus-building on the climate outlooks to be presented at the CariCOF Forum. Dr. Allen led the presentation and consensus-building of the CariCOF's 2024-25 Wet/Hurricane Season climate outlooks, including seasonal monitoring and forecasting information products, but also of global monitoring and forecasting products, such as seasonal forecasts from the WMO Global Producing Centres, the IRI, the Copernicus Climate Change Service and the Asia Pacific Climate Center. Among the presented CariCOF technical outlook products were the precipitation and temperature outlook maps, the drought outlook, the wet days and wet spells outlook, the dry spells outlook, the Heat Outlook, the flash flood potential outlook and the CIMH's 2024 Atlantic Hurricane Season Activity Outlook.

Day 2: Wednesday May 22nd, 2024 – Towards CAROGEN v2 + sub-seasonal heat forecasts

The second day of the training workshop had two focal themes: (i) the ongoing upgrade of CAROGEN to version 2, the key online platform for automation of seasonal (and, soon, also subseasonal) forecasts run with CPT at the national and regional levels for the Caribbean; (ii) introducing the NMHSs and CIMH staff to the production of simple, sub-seasonal heat forecasts in CPT.

Participants had first been introduced to the development of CAROGEN version 2 six months prior during the 2023-24 Dry Season CariCOF Training Workshop by the ClimSA Caribbean project's CAROGEN consultant, Mr. Greaves. On the second morning of the 2024 Wet/Hurricane Season CariCOF Training Workshop, Mr. Greaves and Dr. Scott – who also plays a key role in developing CAROGEN v2 –, presented on the status of the upgrade and plans for the coming months. Overall, the aim is to have a first release in another six months' time at the 2024-25 Dry Season CariCOF Training Workshop.

CAROGEN v2 will be an upgraded system that expands on the work currently done using the CARicof Outlook GENerator (CAROGEN v1) which has been in use since 2017, was developed and is maintained by the CIMH. Version 2 will enhance the user experience and expand on CAROGEN's functionality in multiple ways. Most importantly,

(1) it will integrate an API designed to further enhance automation from the user perspective while reducing efforts to set up the system on a monthly basis;

(2) it will be designed to enable sub-seasonal forecasting;

(3) it will expand on the number of seasonal forecast products to encompass the entire current range of CariCOF forecasts, as well as enable the easy development and integration of seasonal forecast products of choice to be developed in future;

(4) it will enable automated regional seasonal forecast verification using WMO recommended verification metrics.

After the morning's health break, participants were introduced to how meteorological data need to be prepared for the purposes of making sub-seasonal forecasts using CPT, followed by a demonstration of running sub-seasonal temperature and heat extremes forecasts in CPT 18. Then, after the lunch break, a hands-on exercise session ensued, where all participants were able to run their first sub-seasonal heat forecasts and try out the purpose-built new features of CPT 18.

To maximise the time spent on these exercises, it was decided that the afternoon's health break would be a working break, during which Dr. Scott, Dr. Van Meerbeeck and Mr. Greaves facilitated the final session of the workshop. That session was geared at collecting initial feedback regarding the development and functionality of CAROGEN v2. Given that some feedback was already gathered and recommendations already made during the morning session, this session featured an abridged discussion on the next steps required to work towards finalising the development of CAROGEN v2.

Dr. Van Meerbeeck concluded the workshop by thanking the participants, facilitators and sponsors.

APPENDIX I: Workshop Agenda

Day 1: Tuesday May 21st, 2024 – Prediction of heat for early warning + finalisation of CariCOF climate outlooks

09:00 – 09:20 Opening and welcome remarks (Guyana Hydrometeorological Services; Adrian Trotman, CIMH)

09:20 – 09:30 Workshop objectives (Cedric Van Meerbeeck, CIMH)

09:30 – 09:45 Components of the CariCOF heat outlooks – a refresher (Cedric, CIMH)

09:45 – 10:15 WMO's next generation of recommended heat indices for early warning (Simon Mason, IRI)

10:15 – 10:30 *Break*

10:30 – 10:55 Spatial variability in the diurnal timing of peak heat (Teddy Allen, CIMH)

10:55 – 11:15 Seasonality and spatial distribution of extreme heat and heatwaves across the Caribbean (Cedric, CIMH)

11:15 – 12:15 Producing seasonal heat forecasts – a demo (Simon, IRI; Wazita, Cedric, CIMH)

12:15 – 13:30 *Lunch (provided)*

13:30 – 15:00 Preparing the 2024 Wet/Hurricane Season climate outlooks (Teddy Allen and Cedric, CIMH)

15:00 – 15:15 *Break*

15:15 – 16:00 Preparing the 2024 Wet/Hurricane Season climate outlooks (Teddy and Cedric, CIMH)

Day 2: Wednesday May 22nd, 2024 – Towards CAROGEN v2 + sub-seasonal heat forecasts

09:00 – 10:15 Towards CAROGEN version 2 (Jemar Greaves, Wazita Scott and Cedric, CIMH)

10:15 – 10:30 *Break*

10:30 – 12:15 Producing sub-seasonal heat forecasts using a WMO recommended heatwave index – data preparation and how to in CPT18 (Simon, IRI; Wazita, Cedric, CIMH)

12:15 – 13:30 *Lunch (provided)*

13:30 – 14:45 Producing a sub-seasonal forecast for temperature and heat extremes – hands-on

14:45 – 15:00 *Break*

15:00 – 15:45 Gathering initial feedback on CAROGEN v2 (Jemar, Wazita, CIMH)

15:45 – 16:00 Closing Remarks (Adrian, CIMH)

END OF WORKSHOP

Learning objectives for the training workshop:

1. Learn why it is important to know when heat exposure peaks in different parts of the Caribbean.
2. Learn about the latest developments in heat indices for early warning and apply them to seasonal forecasting.
3. Learn and provide feedback on the ongoing development of CAROGEN v2.
4. Learn to use CPT 18 to make weeks 2 or 3-4 predictions of
   a) the number of days above a given threshold across Caribbean stations;
   b) temperature anomalies across Caribbean stations;
   c) heatwave occurrence across Caribbean stations.