CariCOF 2019-20 Dry Season - Seasonal Forecast Training Workshop
Port-of-Spain, Trinidad, Trinidad and Tobago

25th – 26th November, 2019

Workshop Report

The 2019-20 Dry Season pre-CariCOF forecasters' training was held on November 25th and 26th in Port-of-Spain, Trinidad, Trinidad and Tobago, ahead of the Forum held on November 27th and the Climate change in the Caribbean – strengthening the science to services interface on November 28th and 29th. The CariCOF, including the training workshop, was organised by the Caribbean Institute for Meteorology and Hydrology (CIMH) and hosted by the Trinidad and Tobago Meteorological Services (TTMS). The training workshop was facilitated by Dr. Cédric Van Meerbeeck, Dr. Teddy Allen and Mr. Adrian Trotman 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 the International Research Institute for Climate and Society (IRI) – who joined remotely – and Mr. Steven Fuhrman the U.S. National Oceanic and Atmospheric Administration (NOAA). It was made possible through CREWS Programme, with financial support from the World Meteorological Organization (WMO). The agenda is found in **Appendix 1**.

Rather than introducing a new training item to the team of climate forecasters within the CariCOF, this training workshop would serve as a reinforcement and updating some of the forecasting knowledge and skills Caribbean NMHSs had acquired through the CariCOF to date. The topics of the agenda for day 1 of the workshop were compiled by means of polling across the participating NMHSs on priorities for retraining. To that end, Dr. Van Meerbeeck and Dr. Allen had requested feedback ahead of the planning of the workshop. The results of the poll are given in the Table below:

	Verification	CCA modes	Validation	Exceedance	Specific forecasts	Communication	CAROGEN	Calculation of dry spells
Grenada	1	1	1					
Jamaica	1		1					
Dominica	1			1				
St. Lucia	1				1			
Cayman Islands	1					1		
Trinidad & Tobago	1	1	1		1			
Curaçao	1				1		1	
Suriname		1			1	1		
Belize	1	1			1			
St. Vincent & the Grenadines		1						
Guyana	1							1
Antigua & Barbuda	1	1						

Nearly invariably, the NMHSs requested retraining in forecast verification procedures, with retraining on understanding canonical correlation analysis (CCA – incl. CCA modes) being the second most popular choice. While hindcast validation was only the fourth most popular topic, bundling topics forecast verification, understanding canonical correlation analysis (incl. CCA modes) and hindcast validation into one training day would offer a practical solution, as all three topics required solely the use of the Climate Predictability Tool (CPT) developed and maintained by the IRI, with Dr. Mason being one of the world's foremost scientists with respect to climate outlook forum type climate forecast verification. Hence, the decision was made to focus day 1 of the training on those topics. It should be noted that, even though there was no space for re-training in exceedance forecasts or other specific forecasts, the use of CAROGEN for producing forecasts, or the calculation of dry spells at this time. However, those topics will be kept as potential priorities for retraining into the future in the context of CariCOF.

Day 1: Monday November 25th, 2018 – Understanding Canonical Correlation Analysis as a statistical prediction method, verification of climate forecasts in CPT

After a word of welcome from the Trinidad and Tobago Meteorological Service by Mr. Kenneth Kerr and opening remarks by Mr. Adrian Trotman (CIMH), the training workshop's objectives were introduced by Dr. Cédric Van Meerbeeck. Dr. Van Meerbeeck mentioned that the first half day would be largely dedicated to understanding CCA as facilitated by the CIMH, followed by a presentation by NOAA offering an update to the RCC-Washington's work on developing and delivering sub-seasonal forecast products for the Caribbean still before lunch break. The afternoon's sessions would be facilitated by Dr. Mason with the assistance of CIMH trainers.

In the first technical session, Dr. Van Meerbeeck explained the basics of statistical, linear regression models in climate prediction, including simple linear regression, multiple linear regression, Principle Components Regression (PCR) and CCA. To help with the interpretation of PCR and CCA using PCR, Dr. Allen then explained in practical terms the basics of principal components, empirical orthogonal functions and modes that are used in PCR and are currently used in CCA (when producing forecasts using CPT).

After the morning break, Dr. Van Meerbeeck and Dr. Allen demonstrated briefly the procedures to use CCA in CPT to produce hindcast models and seasonal forecasts in the style of those produced by the CariCOF. Shortly thereafter, trainees participated in a hands-on training exercise, whereby examples of some concepts on the interpretation of CCA were elucidated, explained and discussed.

Then Mr. Fuhrman took the workshop participants through an overview of the activities of the RCC-Washington, including their current range of operational climate forecast products and other services such as training. With respect to the forecast products, Mr. Fuhrman paid particular attention to seasonal, monthly and sub-seasonal forecasts covering the Caribbean region.

After the lunch break, Dr. Mason joined the workshop remotely. The session began with a re-introduction into hindcast model validation and seasonal forecast verification, with a particular focus on the most

useful/practical validation and verification scores, including scores such as the Goodness Index, the ROC score and the hit (skills score). He ended the presentation by recommending the use of the ROC and 2AFC scores as the most practical measures of hindcast model quality. Since this was repetition and reinforcement of previously acquired knowledge for all represented NMHSs – albeit new material for some trainees –, Dr. Van Meerbeeck then briefly took the workshop participants to a demonstration of where to find the validation information when building hindcast models in CPT.

Recalling previous training efforts on forecast verification using CPT, Dr. Mason reintroduced the basics of forecast verification in CPT, including looking at different diagrams, scores and skill maps. He focused on Ranked Hits diagrams, ROC diagrams, the Weather Roulette – profits and cumulative profits diagrams. The former two are common presentation formats to highlight the quality of RCOF type climate forecasts, while the weather roulette offers a simplistic visualisation of the potential value of forecasts.

The final, brief session of the day, facilitated by Dr. Mason, provided an overview of CPT version 16, of which some of the major new functionalities are the reading in of sub-seasonal input data and the replacement of missing monthly values before integrating into seasonal averages or totals.

Day 2: Wednesday May 22nd, 2019 – CPT upgrades and preparation of the 2019 Wet/Hurricane season climate outlooks

As revealed by research on user stakeholder needs and as experienced by NMHSs, clear communication of forecasts is paramount, but still largely perceived to be a difficult task by forecasters. Not only the language of communication, but also the very interpretation of some of the operational climate outlook products offered by the CariCOF and the Caribbean RCC remained a stumbling block to the forecasters. In a renewed effort to improve the interpretation and communication of forecasts, the morning of day two was reserved for these topics, of which it is the intention that they become recurrent training topics across successive pre-CariCOF training workshops.

The first session was facilitated by Dr. Van Meerbeeck, who reintroduced the participants with an evolving, effective presentation structure/outline for climate outlooks in a RCOF/NCOF setting. The premise is that the information contained within climate forecasts can much better be grasped by a non-technical specialist audience when presented in the form of a story line, somewhat similar to a newspaper article. The argument was made that the story line should be structured such that the audience understands the context of the forecasts. Critical to proper contextualisation of forecasts are (i) drawing the picture of recent impactful climate events and what drove their occurrence, as well as, the latest climate conditions; (ii) providing an overview of what characterises the upcoming period in a typical year and mentioning how drivers of climate events may change the expected patterns in the upcoming period in the current year; (iii) assessing in a simple way how well previous forecasts performed, to increase the credibility of the forecasts and visualise the uncertainties of climate forecasts; and (iv) stating potential, general implications of the expected climate conditions to help inform sectoral stakeholders on potential sector impacts and planning/mitigation/response actions to be taken.

This presentation was followed by a Q&A session, as well as, a quick polling of NMHS's ways of presenting outlooks to their national public.

After the morning break, Mr. Trotman and Dr. Van Meerbeeck facilitated a session that focused on the correct interpretation of the drought information provided by the Caribbean RCC, as well as, the information contained in the CariCOF's regional and national drought alert maps. Several common misconceptions among the participants were tackled, including the target period of the alert maps, the setup of the forecasts and the interpretation of suggested alert levels, among others.

In the final morning session, the CIMH facilitators took the participants through a climate information products interpretation exercise which had four objectives:

1. to utilise the range of CariCOF's operational and experimental products, navigate the Caribbean Regional Climate Centre's web page, and annex CAROGEN online portal to find authoritative early warning information;
2. to interpret and message out information from the products relevant to agriculture and water during the dry season;
3. to identify product interpretation challenges;
4. to provide recommendations for product improvement.

In that session, particular attention was put into distilling implications from monitoring, climatology and forecast information products made available on the Caribbean RCC's web page rcc.cimh.edu.bb. The session concluded with Dr. Allen and Dr. Van Meerbeeck noting that, given that capacity of NMHSs in the interpretation, presentation and effective communication of climate outlooks has not as yet reached the level of procedural capacity of NMHSs in the production of climate forecasts. Hence, it was suggested that such interpretation and communication exercises should become regular content of the pre-CariCOF training workshops.

After the lunch break, a presentation made by the ESSA team – a consultancy team contracted by the intra-ACP EU funded CDB NDRM Programme on sustainable tourism – provided an overview of the their research into the effect of intra- and extra- regional climate on Caribbean tourism arrivals as contained in an upcoming technical report. The goal of the feasibility study was to determine the need for and the potential benefits regarding the development and use of operational Tourism-Climate Indices (TCIs). After presenting their methodological approach, the presenters detailed their most important findings on the statistical association (i.e. correlation) between climate variables and tourism arrivals from the USA and Canada. The overall conclusion was that the most feasible option for a Weather -Driven Tourism Demand model is to focus on the Winter Market. A small part of their research focused on evaluating the effectiveness of the quarterly Tourism Climatic Bulletin (TCB) as a tourism-climate information package for tourism businesses and policymakers offered by the Caribbean Tourism Organization, the Caribbean Hotel and Tourism Association and the CIMH. Recommendations were made regarding further research into the development of TCIs for the Caribbean, as well as, in relation to the format, content, dissemination and overall concept of the TCB.

Finally, after ESSA's presentation, the last half day of the training workshop was largely dedicated to preparation of the seasonal climate outlooks to be presented at the Forum to a range of user stakeholders the next day, as is customary within CariCOF. In this session, draft regional outlooks were reviewed and discussed by all participants under the guidance of Dr. Allen, who was assisted by Dr. Van Meerbeeck.

APPENDIX 1 – Workshop Agenda

CariCOF 2019-20 Dry Season - Seasonal Forecast Training Workshop
Port of Spain, Trinidad, Trinidad and Tobago
25th – 26th November, 2019

Workshop Agenda

Day 1: Monday November 25th, 2018 – Understanding Canonical Correlation Analysis as a statistical prediction method, verification of climate forecasts in CPT

09:00 – 09:15 Welcome and Opening Remarks (TTMS, CIMH)

09:15 – 09:30 Workshop Objectives (Cedric Van Meerbeeck, CIMH)

09:30 – 10:00 CCA – The basics of regression models (Cedric Van Meerbeeck, CIMH)

10:00 – 10:15 CCA – understanding principal components, EOFs, modes (Teddy Allen and Cedric Van Meerbeeck, CIMH)

10:15 – 10:30 *Break*

10:30 – 11:00 CCA – understanding hindcast models in CPT (Cedric Van Meerbeeck and Teddy Allen, CIMH)

11:00 – 11:45 CCA – understanding hindcast models in CPT (hands-on)

11:45 – 12:15 Operational seasonal to sub-seasonal climate products and services provided by RCC-Washington (Steven Fuhrman, NOAA)

12:15 – 13:30 *Lunch (provided)*

13:30 – 14:00 Hindcast model validation and forecast verification – Goodness Indices, ROC and hit (skill) score (Simon Mason, IRI)

14:00 – 14:30 Hindcast validation in CPT (Cedric Van Meerbeeck, CIMH)

14:30 – 14:50 Forecast verification – assessing the quality of global forecasts (Simon Mason, IRI)

14:50 – 15:10 Forecast verification – assessing the quality of global forecasts – hands-on (Simon Mason, IRI, and Cedric Van Meerbeeck, CIMH)

15:10 – 15:25 *Break*

15:25 – 15:55 Forecast verification – verifying national forecasts using hit (skill) score and ROC (Simon Mason, IRI)

15:55 – 16:45 Forecast verification – verifying national forecasts in CPT (Simon Mason, IRI)

16:45 – 17:00 CPT 16 – an update on new features and functionalities (Simon Mason, IRI)

Day 2: Tuesday November 26th, 2019 – Interpretation and presentation of climate outlooks, 2019-20 Dry Season CariCOF climate outlooks

09:00 – 10:00 Presenting climate outlooks – necessary components and presentation structure (Cedric Van Meerbeeck, CIMH)

10:00 – 10:15 Presenting climate outlooks – taking stock: (how) do the different countries present climate outlooks? (*All*)

10:15 – 10:30 *Break*

10:30 – 11:00 Presenting climate outlooks – are we really interpreting the drought information correctly? (Adrian Trotman & Cedric Van Meerbeeck, CIMH)

11:00 – 12:15 Presenting climate outlooks – distilling implications from monitoring, climatology and forecast information (Cedric Van Meerbeeck, CIMH)

12:15 – 13:30 *Lunch (provided)*

13:30 – 14:15 Results of the sustainable tourism project (ESSA)

14:15 – 15:15 Preparing the 2019-20 Dry Season climate outlooks – all

15:15 – 15:30 *Break*

15:30 – 16:45 Preparing the 2019-20 Dry Season climate outlooks – reaching a consensus

16:45 – 17:00 Closing Remarks (Adrian Trotman, CIMH)

END OF WORKSHOP