CariCOF 2018 Wet/Hurricane Season - Seasonal Forecast Training Workshop
Christ Church, Barbados

22ᵗʰ – 23ᵗʰ May, 2018

Workshop Report

WORKSHOP REPORT

The 2018 Wet/Hurricane Season pre-CariCOF forecasters' training was held on May 22ⁿᵈ and 23ʳᵈ in Christ Church, Barbados, ahead of the Forum held on May 24-25. The CariCOF, including the training workshop, was facilitated by the WMO Caribbean Regional Climate Centre (Caribbean RCC) at the Caribbean Institute for Meteorology and Hydrology (CIMH), the International Research Institute for Climate and Society (IRI) and the U.S. National Oceanic and Atmospheric Administration (NOAA). It was made possible through a number of projects that focus on climate capacity building in the Caribbean region. The workshop received financial support from the from (i) the Inter-American Bank (IDB), through its Climate Investment Funds (CIF) under the Pilot Program for Climate Resilience (PPCR) executed by the University of the West Indies (UWI) – Mona Campus; (ii) the United States Agency for International Development through its Office of U.S. Foreign Disaster Assistance (OFDA); and (iii) the World Meteorological Organization (WMO).

Day 1: Tuesday May 22th, 2018 – Towards sub-seasonal forecasting in the Caribbean

After a word of welcome from the Deputy Director of the Barbados Meteorological Services, Mr. Clairmont Williams, and opening remarks by Mr. Adrian Trotman (CIMH), the training workshop's objectives were introduced by Dr. Cédric Van Meerbeeck (CIMH). Since 2012 and up until 2017, most pre-CariCOF training workshops focused on capacity building in the art of seasonal forecasting at the time scales of 3-12 months. Since the 2017 Dry Season pre-CariCOF training in November 2017, a new timescale was introduced as a next step in working towards providing the region with seamless climate prediction information across climate timescales. Those timescales run from weather (hours to 1 or 2 weeks) all the way to climate change (multiple decades). The newly introduced timescale was the so-called subseasonal timescale, spanning 2 to 4 weeks. Between this subseasonal timescale, and the timescales addressed to this point by the CariCOF, some room remains for seasonal forecasting at the shorter end of the scale, namely 1-month forecasts. Hence, the objectives of this workshop were:

1. To gain a basic understanding of sub-seasonal forecasts and the Seasonal to Sub-seasonal (S2S) Project
2. Based on the current state of operational S2S products and their limitations, to start working towards a roadmap to start working towards delivery of operational S2S early warning information by CIMH and/or the NMHSs.

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3. Explore the limits of seasonal forecasting, by producing monthly forecasts of event occurrence (e.g. heatwaves)

After this introduction, Dr. Simon Mason and Dr. Teddy Allen made the first presentation, entitled "Sub-seasonal forecasting: Sources of predictability" also co-authored by Dr. Ángel Muñoz (IRI). Their presentation started by explaining why the predictability of weather and climate conditions varies among the different climate timescales. Generally, the longer the duration or lead time, the less predictable (with the exception of climate change), but this decrease in predictability can be somewhat compensated by reducing the geographic and temporal detail at which the assessments are done for each of the longer timescales, going from local and sub-daily at the weather timescale to continental and 30 years at the climate change scale. The rationale is that, in general, larger and longer lasting patterns are more predictable than short and local variations.

A few examples were given: it is possible to forecast the passage of a set of showers on a particular day for a given island 3 days from now (weather forecast), but the accuracy of such a forecast decreases to essentially nil after 10-15 days. Instead, at the subseasonal timescale, it may be possible at times to forecast a higher likelihood of extreme weather at some point within the timeframe of week 3 or 4 from now within a set of Caribbean islands. But that would be hardly possible 3 months from now. Then, at the seasonal timescale, it is, at times, possible to forecast a higher frequency of bouts of heavy showers (wet spells) during 1 or 3 months than usual for that time of year for instance in a sub-region of the Caribbean, but such a forecast would not likely have any useful skill beyond a year from the time of forecast.

Dr. Mason then went on to illustrate how predictions at different timescales are bound by different levels of skill depending on latitude. 3-day forecasts of hot spells showing good skill in many parts of the extra-tropics, but weak to moderate in the tropics. By comparison, at the seasonal timescale, the skill of temperature and rainfall predictions over land areas is good to very good and weak to fair, respectively, in the tropics, but mostly weak and poor, respectively, outside the tropics. The main reason for this dichotomy, is that skill at the weather timescale typically comes from atmospheric initial conditions, which over land areas generally are better observed outside the tropics, with the added feature that atmospheric dynamics are easier to predict outside the tropics as well. By contrast, at the seasonal timescale, the skill of predictions mainly comes from boundary conditions, such as ocean temperatures. Because the upper level of the oceans contain far more energy than the atmosphere, exchange of excess heat with the atmosphere takes much longer time, meaning some features of ocean dynamics vary predictably at the seasonal timescale. This is especially so in the tropics, where most of the global heat of the upper ocean is stored.

At the sub-seasonal timescale, there are also some features of the climate system that behave somewhat predictably, for instance the Madden-Julian Oscillation (MJO), which is the main source in the tropics. Dr. Mason then introduced the well-established sources of climate predictability at the sub-seasonal timescale. Dr. Allen then elaborated on the MJO by illustrating its climate dynamics and impacts on precipitation anomalies in tropical South America. He further pinpointed that phases of the El Niño Southern Oscillation
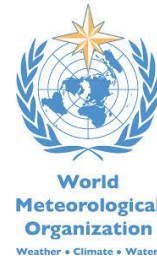
(ENSO), which is an important factor controlling seasonal rainfall anomalies, and the MJO can overlap and modulate the overall seasonal to sub-seasonal variability.

The subsequent presentation was made by Ms. Sarah Diouf (NOAA) on "Subseasonal forecasting - Current and envisaged range of products from the United States of America Regional Climate Centre (USRCC)". As a follow-on presentation to one she had made at the 2017 Dry Season pre-CariCOF training workshop, she updated the audience on the latest developments of the USRCC in demonstration phase with respect to ongoing experimental sub-seasonal forecasting activities which aim at building a portfolio of operational products specifically for the Caribbean, Mexico and Central America.

In the range of potential operational products are week 1 and week 2 precipitation, temperature and wind forecasts made with the GFS and GEFS ensemble models; calibrated and non-calibrated week 3-4 precipitation and temperature forecasts run with the CFSv2 model; monthly forecasts of sea surface temperatures, precipitation and 2m temperature from the seven North American Multi-Model Ensemble as well as the ensemble mean. Furthermore, the range of experimental tailored sub-seasonal forecast products currently investigated include (1) heatwave days based on NOAA's Heat Index and the 90th percentile of the daily maximum temperature; (2) dry spells, wet spells, very wet spells and extreme wet spells, following the CariCOF definition of spells.

Ms. Diouf then presented preliminary results of a predictability case study of heatwave days using a heat index of 38°C as baseline. The model was able to reproduce the location and, to some extent, the likely duration of a known heatwave in a week 1 forecast. However, much work needs to be done to investigate predictability of the mentioned climate events for weeks 3-4. This type of investigation was proposed as the next activities to be undertaken by the USRCC in demonstration phase in the months leading up to the next pre-CariCOF training workshop.

The subsequent presentation and annex session by Mr. Pierre-Honoré Kamsu-Tamo, entitled "Demonstration of sub-seasonal forecast products" provided a broad overview of the WMO and World Climate Research Programme (WCRP) Seasonal-to-Sub-seasonal (S2S) Project and its database of operational sub-seasonal prediction products. The aims of the S2S Project are:

1. To improve forecast skill and understanding on the sub-seasonal to seasonal timescale with special emphasis on high-impact weather events;
2. To promote the initiative's uptake by operational centres and exploitation by the applications community;
3. To capitalize on the expertise of the weather and climate research communities to address issues of importance to the Global Framework for Climate Services.

Reference was made to several portals that contain S2S output, including the S2S Project website s2sprediction.net , the European Centre for Medium-Range Weather Forecasts (ECMWF)'s data portal

apps.ecmwf.int/datasets/data/s2s/ , the China Meteorological Administration's S2S Archiving Data Center s2s.cma.cn/index , and the IRI's data library iridl.columbia.edu . Besides the introduction, a hands-on session spanning the end of the morning and the first afternoon session taught participants where to access the information stored in the S2S database and in the IRI's data library/map room. Exercises in the IRI data library included finding datasets; making sub-selections of datasets given a certain tailoring requirement using a GUI interface found in the Map Room, but also by means of a tutorial on scripting language to make selections based on command lines; and downloading data. The session concluded with a quick demonstration of data visualisation in the GrADS open access geo-data visualisation software.

The last two sessions of the day consisted of discussions in which recommendations were made to NOAA with respect to (i) the kind of sub-seasonal prediction products of interest to Caribbean NMHSs involved in the CariCOF, (ii) current limitations of operational seasonal-to-sub-seasonal prediction information, and (iii) more tailored sub-seasonal prediction information products. In essence, the current path proposed by the USRCC was encouraged, which is to further research the predictability of climate events in weeks 3 and 4 using the CFSv2 model. Results from this research were deemed critical to the further development of a capacity building agenda for the CariCOF, which could then focus on downscaling the information products in which the USRCC has enough confidence (i.e. useable skill). The R&D and training activities tied to the capacity building effort within CariCOF would then be rolled out subsequently. However, to start filling the time gap between weather forecasts, and the current range of seasonal forecasts, it was agreed that the CariCOF would start producing a set of experimental monthly forecasts of extreme event frequency, e.g. heatwaves.

Day 2: Wednesday May 23th, 2018 – Monthly forecasts, 2018 wet/hurricane season climate outlooks

With the decision made to build capacity within Caribbean NMHSs to provide monthly forecasts of heatwaves, the agenda was set for the morning session.

After a few words of caution on the limitations of monthly forecasts in terms of sources of predictability and linked forecast skill given by Dr. Mason and Dr. Van Meerbeeck, a demonstration was made of what could constitute a monthly heatwave frequency forecast. Essentially, the technique is very similar to that of the three-monthly heatwave days forecasts already provided in experimental form by the Caribbean RCC for the CariCOF, and for which training was provided on previous occasions by the Caribbean RCC and the IRI. Hence, a brief session was sufficient as a means of demonstration. Dr. Van Meerbeeck then continued by providing a hands-on exercise for all participants to produce a monthly heatwave days forecast using the Climate Predictability Tool (CPT), which has become the standard tool for climate forecasting in the CariCOF, and which has evolved to accommodate some of the requested functionality by the CariCOF over the years.

The last session of the training workshop, as has become customary for pre-CariCOF Forum forecasters' training workshops, concerned the preparation and review of all CariCOF outlook products for the 2018 wet/hurricane season, such that a consensus is reached between all climate forecasters within the

Collaborators:

Caribbean NMHSs and CIMH. The outlooks were summarised in a presentation that follows the template for RCOF/NCOF (National Climate Outlook Forum) type climate outlooks developed by CIMH. In view of the debilitating impact of the 2017 Hurricanes Irma and Maria to a large number of Caribbean Territories, a review was given by Ms. Diouf of the skill of NOAA's 2017 Atlantic Hurricane Season (tropical cyclone activity) forecasts, so as to re-emphasise the usefulness of such in supporting regional preparedness. The two major conclusions from the presentation were that (1) the 2017 outlooks were successful in predicting the extremely active Hurricane season; and (2) the skill level of NOAA's official hurricane season forecasts are good, especially that of the updated outlooks issued in August.

Day 1: Tuesday May 22th, 2018 – Towards sub-seasonal forecasting in the Caribbean

09:00 – 09:10   Welcome – Opening Remarks (Barbados Meteorological Service; Adrian Trotman, CIMH)

09:10 – 09:20   Workshop Objectives (Cedric Van Meerbeeck, CIMH)

09:20 – 10:00   Sub-seasonal forecasting – an introduction to the S2S Project and how sub-seasonal forecasting fits within weather and seasonal forecasting,

10:00 – 10:20   Sub-seasonal forecasting – sources of predictability (Simon Mason, IRI)

10:20 – 10:35   *Break*

10:35 – 11:15   Sub-seasonal forecasting – current and envisaged range of products from the US Regional Climate Center (Sarah Diouf, NOAA) and from the S2S database (Pierre-Honoré Kamsu-Tamo, NOAA)

11:15 – 12:15   Demonstration of sub-seasonal forecast products – a hands-on website navigation (Pierre-Honore Kamsu-Tamo, NOAA)

12:15 – 13:30   *Lunch (provided)*

13:30 – 15:00   Visualisation of sub-seasonal forecast products in GRADS and the IRI Map Room (Pierre-Honore Kamsu-Tamo, NOAA)

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15:00 – 15:30   Current limitations of S2S forecasting – a guided discussion (Simon Mason, IRI; Sarah Diouf and Pierre-Honore Kamsu-Tamo, NOAA; Cedric Van Meerbeeck, CIMH)

15:30 – 15:45   *Break*

15:45 – 16:30   Seasonal to Sub-seasonal forecasting in the Caribbean – towards a roadmap (Cedric Van Meerbeeck and Adrian Trotman, CIMH; Simon Mason, IRI; Sarah Diouf, NOAA)

16:30   Day's conclusion

Day 2: Wednesday May 23th, 2018 – Monthly forecasts, 2018 wet/hurricane season climate outlooks

09:00 – 09:20   Monthly climate forecasts – the limit of seasonal forecasting (Simon Mason, IRI)

09:20 – 10:15   Monthly forecasts in CPT – a demonstration of heatwave forecasts (Cedric Van Meerbeeck, CIMH)

10:15 – 10:30   *Break*

10:30 – 12:15   Monthly forecasts in CPT – hands-on exercises on heatwaves, wet days and/or exceedance forecasts (Wazita Scott and Cedric Van Meerbeeck, CIMH)

12:15 – 13:30   *Lunch (provided)*

13:30 – 15:15   Preparing the 2018 Wet/Hurricane Season climate outlooks – all

15:15 – 15:30   *Break*

15:30 – 16:30   Preparing the 2018 Wet/Hurricane Season climate outlooks – reaching a consensus

16:30 – 17:00   Hurricane Season Forecasts for 2018 (Wazita Scott and Cedric Van Meerbeeck, CIMH; Sarah Diouf, NOAA)

4:45 – 5:00   Closing Remarks (Adrian Trotman, CIMH)

END OF WORKSHOP

Collaborators: