Caribbean Climate Outlook Forum – (CariCOF) Report

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Pegasus Hotel, Kingston Jamaica

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The Caribbean Climate Outlook Forum (CariCOF) was organised by the Caribbean Institute for Meteorology and Hydrology (CIMH) and hosted by the Jamaica Meteorological Services. This CariCOF, which focuses on the upcoming wet/hurricane season, was attended by personnel from Meteorological Services and stakeholder groups from climate sensitive sectors in the Caribbean; representing agriculture and food security, water resources management, disaster risk management, and health. Participants were also present from Central America, and for the first time from the Pacific islands of Tonga and Fiji. Other participants were from the International Research Institute for Climate and Society (IRI) and the University of Arizona, who were leading in another climate activity to follow CariCOF focussing on Integrating Climate Information and Decision Processes for Regional Climate Resilience, under the International Research Applications Program (IRAP) programme. *(See Appendix A for a list of Institutions represented)*

Mr. Adrian Trotman, Chief of Applied Meteorology and Climatology, CIMH gave a brief welcome before Mr. Evan Thompson, Deputy Director of the Jamaica Meteorological Services gave his brief remarks. Mr. Trotman stated that this forum followed on the heels of two days of rigorous climate outlook training. He indicated that this forum will see the addition of two new products to the outlook: temperature and drought (a major climate impact in the Caribbean). Mr. Trotman is hopeful that these products will become a joint collaboration between CariCOF, as the precipitation outlook, and that there can also be fruitful collaboration with Central America. He is hopeful a Flood Risk Outlook product could be added at the 2015 Wet/hurricane season forum.

In his speech, Mr. Thompson apologized for the absence of the Director of the Jamaica Meteorological Service. He duly recognizes the importance of climate variability and change issues in Jamaica as well as and the wider Caribbean region.

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Presentations

The Year 2013 in the Caribbean, a retrospective (Mr. Trotman, CIMH)

In his presentation, Mr. Trotman paid particular attention on the 2013 wet/hurricane season. The forecast was for an above normal rainfall and tropical cyclone activity, which did not come to fruition, particularly with the Accumulated Cyclone Energy (ACE) index being only 39% of the long-term median and was the lowest observed since the 1994 season. No major hurricanes formed for the season, though the number of named tropical cyclones (14) were above the average by 2. With normal to above normal rainfall being the most likely scenario across the Caribbean basin for the June to November season, many parts of the Caribbean experienced below normal rainfall as illustrated by the displayed Standardised Precipitation Index (SPI) maps.

Though SSTs for a more active hurricane season were realised, other conditions were not as favourable. These include above average upper-level convergence and greater shear. The 2013 conditions have to be further studied, as it is believed that other factors were involved in such a low energy season.

In general, the CariCOF forecast for the first half of 2013 was better than the second half. Mr. Trotman hopes that we continue to learn from the 2013 experience in the future.

Mr Trotman also spoke about the fact that drought is a major factor in the Caribbean region at present, as well as his hopes for the continued participation of Central America with CariCOF. He also stressed on the importance for continued development and use of products after participants return to their respective countries.

Hurricane Season Climate Outlook (Rainfall, temperature, Hurricanes) – Sheryl Etienne-LeBlanc, St. Martin Meteorological Service

Participants representing some 24 countries, along with the CIMH contributed to the production of the outlook products for the wet/hurricane season for 2014. These statistical climate outlooks were produced using output from global models in the Climate Predictability Tool (CPT).

Mrs Leblanc in her presentation stated that the main driver of the Caribbean climate is the Sea Surface Temperature (SST) and the El Niño Southern Oscillation (ENSO). She indicated that the forecast is for cooler than normal Atlantic (in some areas) and warmer Pacific (neutral to El Niño phase) SSTs. In summary, the conditions that would influence rainfall and tropical cyclone development were presented as:

- El Niñ0 - Neutral to weak El Nino ENSO conditions by August - September 2014; Wind Shear - Stronger than normal wind shear reducing the number and intensity of storms across Atlantic Basin.
- Trades winds - Strong trade winds and increases the atmospheric stability across the Atlantic (Limiting intensification of waves)
- Sea Surface temperatures (SST) - Cooler than normal Tropical Atlantic (at the end of April SSTs over the northern Atlantic were -0.3^{o}C (Climate Prediction Centre, NOAA)

The various presented outlooks were as follows:

June to August (JJA) Precipitation Outlook

- Normal to below normal precipitation over Western to Eastern Caribbean, with greatest probability of below normal (40% - 45% probability)
- Normal to above normal precipitation over Guyana, with greatest probability of above normal (40%)
- No clear signals over Cuba, the Bahamas, Suriname and French Guiana.

September to November (SON) Precipitation Outlook

- Normal to below normal precipitation over Northern to Eastern Caribbean, with greatest probability of below normal (40% - 45% probability)
- No signal over Belize, the Bahamas, with only slightly better than average chance for normal to below normal over the Guianas

June to August (JJA) Temperature Outlook

- Normal to above normal temperatures from the Leeward Islands across the Greater Antilles to Belize, with greatest probability of above normal (45%)
- Normal to below normal temperatures in the vicinity of the ABC islands, with greatest probability of below normal (40 %)
- There was no clear signal in the remainder of the Caribbean

Hurricane (tropical cyclone) Outlook

The 2014 hurricane season will likely be an average to below average year with:

- Eight (8) to thirteen (13) named tropical storms (TS)
- Three (3) to six (6) hurricanes
- One (1) to two (2) major hurricanes (above category 3)
- El Niño
    - Neutral to weak by August-September. If this is so, then we would see reduced TS activity
- Land-fall probability
    - One (1) major hurricane above category 5, (Gray et al)
    - One storm, no hurricanes (Tropical Storm Risk forecast)

Mrs. Le Blanc cautioned that having an El Niño does not mean that we should not expect any TS activity as we could clearly look back in our history and see the devastating Hurricanes/weather systems that ravaged the region during an El Niño period. For example, Hurricane Ivan on 2004 was devastating in an El Niño year.

Discussion

During the discussion the question to the stakeholders was:

"What does this forecast mean to you?"

Question/Comment: Gail Drakes (Caribbean Disaster Emergency Management Agency, CDEMA)

- Ms. Drakes expressed her concern that the Caribbean will be experiencing drought and it is not being highlighted in the current forecast.

Response: Dr. Cedric Van Meerbeeck (Climatologist, CIMH)

- There will be more tailored forecasts looking at drought, which will be presented later in the forum.

Question/Comment: Jeremy Collymore (Researcher, University of the West Indies)

- What is the skill of your forecast? How do you consider climate variability?

Response: Dr. Cedric Van Meerbeeck (Climatologist, CIMH)

- The forecast have 70% accuracy.
- We find that long term trends are exceeded in the Caribbean for temperature, thus we make sure that our climatology is quite recent.

Question/Comment: Elizabeth Johnson (IICA, Jamaica)

- 2014 is the year for water management in Jamaica where we look at ways to use water more effectively with farmers. Is it an overall trend for the Caribbean? Are we becoming drier? We need to know this so as to select the best methods for water harvesting.

Response: Dr. Cedric Van Meerbeeck (Climatologist, CIMH)

- What we have observed is an increase in extreme precipitation events but no overall reduction in precipitation.
- Increasing temperatures, however, gives rise to water loss thus enhancing the experience of drought.
- Towards the end of the century the region is expected to see a 20% reduction in precipitation.

Response: Adrian Trotman, CIMH

- It takes particular training and skills to convert products to tailored information, as like for the agriculture sector. This is however, the next step. CIMH is also focussed on developing a communication strategy for weather and climate information.

Question/Comment: Jeremy Collymore (Researcher, University of the West Indies)

- Has found that in the Eastern Caribbean at the end of the hurricane season and into the next season extreme events are becoming a regular feature of our landscape.

Response: Dr. Cedric Van Meerbeeck (Climatologist, CIMH)

- Mr. Meerbeeck challenged Mr. Collymore to look into climate data and observe if these events are indeed becoming more frequent or rather if it is the impacts that are more frequent. This is since impacts are not sole physically dependent, but dependent on other social and environmental factors, such as land use.

Caribbean Climate Impacts Database – Shelly-Ann Cox, CIMH

Ms. Cox made a presentation on the Caribbean Climate Impacts Database (CCID), which is a web-based tool that can provide evidence based information to inform decision making. It is a database, in development, that would gather information on impacts of events related to high water availability and excessive rainfall (leading to droughts and dry spells, and floods), heatwaves, tropical cyclones that affect vital sectors of the Caribbean such as water resources, agriculture and health, and which can lead to disasters. The historical data would be accessed from the platform in the form of tables, graphs or charts.

The main benefits of the CCID were identified as:

- Supporting the provision evidence-based information for decision-making
- Improving the efficiency and effectiveness of the sustainable planning, mitigation and adaptation
- Contributing to reducing vulnerability to climate related hazards
- Supporting regional growth resilient to climate risk.
- Promoting impacts and vulnerability research and assessments.

Impacts will be reported to the CCID from various sources that include, the print and electronic media, disaster management agencies, national authorities (e.g. water, forestry, environemt etc), online reports that can be accessed through the RSS Feed Crawler that generates web searches, and the general public through managed crowd sourcing.

Skit: "Things Brown at Coronation Market"

This skit was written and produced by Ms. Shelly-Ann Cox of CIMH. It depicts the effects of the changing climate with hotter and drier days impacting on food production. "Things Brown at Coronation Market" also assesses and creates awareness of products produced by CIMH and CariCOF, which can be helpful not only to the farmer, but also for those in other sectors.

The cast consisted of:

- Farmer Brown (farmer) by Desmond Jones of Jamaica Meteorological Service
- Mother Sally (livestock farmer) by Jacqualine Spence of Jamaica Meteorological Service
- Storm (Disaster Manager) by Lisa Kirton-Reed of CIMH
- Climo (Climatologist) by Glenroy Brown of Jamaica Meteorological Service
- Doc (Chief Medical Officer) by Shontelle Stoute of CIMH
- Hydro (Water Resources Manager) by Shelly-Ann Cox of CIMH

The skit can be obtained and viewed at https://vimeo.com/96862464.

Break-out Groups: Sectoral use and population of CCID

Below is the table with information collected from stakeholders on the CCID.

Table 1: Feedback on CCID by Stakeholders

Sector	Population of Database	User Access	Impact Reporting	Additional Remarks
Agriculture	(1) Incidence of flooding/drought. (2) Real-time forecast/outlook. (3) Best practices of reduce loss of crops and/or livestock. (4) Record of bush fires (5) Outbreak of pests /diseases (6) Length and number of dry spells (7) Geospatial analyses	(1) Open for research institutes, government and/or statutory bodies. (2) Available @ a fee for the private sector (subscription-based	Low rainfall & higher temperature over the next few months can only have a negative impact on the region: (1) Lower crop yield. (2) More pests and diseases (3) Higher temperature can lead to heat stress for livestock (4) Greater demand for irrigation. (5) Need to implement mulching	(1) Reporting mechanism for validation (ability to post pictures and/or videos. (2) Incorporation of GIS
Health & Environment	(1) Outbreak of diseases considering spatial parameters (2) Monitoring of vectors (3) Cost of the drought event (4) Coral bleaching (5) Water quality data (6) Chemicals or contaminates such as chlorine (7) Air quality data/air borne particulate	(1) Medical planners (2) Water resource agencies (3) Public (in a format that's understandable (4) Media	(1) Outbreak/spread of diseases (2) Heat stress – vulnerable demography (3) Loss crop yield which can result in food shortage	(1) Heat stress has a link to mental illness. (2) Low rivers can result in stagnant water that enhances mosquito breeding. (3) Need for data sharing policies (4) Integration of input from the private sector
Disaster Management	(1) Graphs (2) Separate drivers from impact (3) Data on the national level for activate community plans (4) Industry-focused products such as products geared for the fishing and/or farming communities	(1) Public	(1) Water supply shortage (2) Inability to distribute water adequately (3) Contamination of water supply due to excessive extraction of groundwater	(1) Products should be tailored for the specific sectors
Water Resource Management	(1) Graph (2) Areas prone to floods (3) Pictures from the public (4) SPI data (5) Sanitation sites	(1) Water resource management (2) Public (pay system for the private sector) (3) Free for research/universities (4)	(1) Possible increase in water bill due to the decrease in rain (2) Need to invest in desalination plants (3) Lowering of water levels especially where underground water is harvested	(1) Archiving is watershed data (2)

Standardized Precipitation Index (SPI) forecasting as a tool to support Drought Early Warning in the Caribbean and Central America – Dr. Cedric Van Meerbeeck, CIMH

Dr. Van Meerbeeck stated that the SPI[3] drought forecasting product he is presenting is a collaboration between CariCOF and the Central America COF (FCAC). He informed participants of the existing Caribbean Drought and Precipitation Monitoring Network (CDPMN) which currently monitors rainfall using SPI and Deciles (popularised by Australia) particular for the detection of drought, and when combined with precipitation outlooks can provide some insight into the development, extension or termination of droughts, as was the case in 2009-2010 (the most recent significant drought event in the Caribbean. He reminded that this particular event was felt mainly because the latter half of the 2009 wet/hurricane season had below-average rainfall thus by early 2010 the impact were already being severe, suggesting cumulative effects. The presenter also informed that the 2009 to 2010 event had a return period of at least 20 – 25 years

Dr. Van Meerbeeck suggested that to inform Drought Early Warning (DEW), that outlooks should be:

- Reliable - forecast probabilities correspond well with observed frequencies
- Timely
- In a language that is easily under stood
- Salient - forecast must relate to an outcome of direct interest to the user
- Sharp - assigned probabilities are high enough for effective sectoral resources allocation
- Cost-effective and sustainable - requiring guaranteed continuity of operations in the face of frequent understaffing and limited funding

In his presentation, Dr Van Meerbeeck suggested that using actual observation from previous months, the persistence would make drought outlook information more meaningful. He illustrated this by making a hindcast of the 2009 to 2010 drought in the Caribbean. He showed that a six month SPI for the period October 2009 to March 2010 made at the end of December 2009/beginning of January 2010 (therefore using the actual observation from October to December 2009), gave very good results with respect to the forecasted likely severity levels and the potential impacts that SPI implies, when compared with what actually happened in the region. Since drought is a creeping phenomenon with slow, but potentially harsh socio-economic impacts, the potential severity of impacts by the end of a period would be even more closely projected with the actual observations.

Other recommended considerations as elaborated by Dr. Van Meerbeeck:

In the wet season, sufficient rain falls over the territories so as not to cause drought impacts, even when rainfall is a bit lower than usual. Only severely dry conditions (or worse) would cause significant impacts to our economic sectors, in particular agriculture and water resource management. Thus, Questions to ask when dealing with DEW:

[3] The SPI, developed by T.B. Mckee, N.J. Doesken and J. Kleist (McKee et al. 1993) of Colorado State University is an index that, if used carefully, can provide early warning of an extended drought period and aid in assessing drought severity. It can also provide similar information at the other end of the spectrum- extremely high precipitation. SPI is basically a representation of rainfall in units of standard deviation. Positive values indicate greater than median rainfall; negative values indicate less than median rainfall.

- What are the regions of concern?
- What concerns should you have beyond the wet/hurricane season?
- What time-scale (lead time) is most appropriate?

Drought outlook for 2014 wet/hurricane season

- Interest in moderately dry or worse
- Severely dry is more associated with impacts on the respective sectors than moderately dry
- Severely dry event (based on June-July-August and September-October-November runs) has a return period of 16 years

Three questions were addressed following this presentation:

Question: With the tools we have what is the impact of drought for the hurricane season?

Response: Chance of moderately and worst conditions by August 2014 and severe by Aug 2014 except for French Guiana. Impactful drought is unlikely for the eastern Caribbean.

Question: where is drought imminent?

Response: French Guiana, no - A probability of normal to above normal rainfall.

Question: Is there any concern beyond wet/ hurricane season?

Response: If El Niño continues our entire wet season will be drier than usual

Simulation Exercise: Using the SPI outlook to brief the public on anticipated drought

Table 2 below shows the results of a simulation exercise using the SPI outlook to brief the public on an anticipated drought. Participants were selected to be members of the media and representatives of the various sectors.

Table 2: Results of the drought simulation exercise

Sector	Media conference
Health	(1) A need to store and conserve water (2) Concern over mosquito-borne diseases (3) Monitoring of the mosquito index
Water Management	(1) Conserve water (2) Possible rationing of water by the authority (3) A need for the implementation of household practices such as washing vehicles with buckets rather than hose, brushing your teeth with a cup of water to avoid running taps, etc.
Disaster Management	Be prepared!
Agriculture	(1) Conservation practices on farms (2) Increase storage capacity (3) Mulching (4) Farmers hotline for updates on the weather/climatic conditions

Climate information at sub-seasonal scale: Dr. Andrew Robertson, IRI

Dr. Robertson's presentation focussed mainly on (i) Sub-seasonal scale information relevant to applications and (ii) The new WWRP/WCRP Sub-seasonal to Seasonal (S2S) Prediction Project. This involves collaboration between the World Weather Research Program (WWRP) and World Climate Research Program (WCRP), as the sub-seasonal time scale is somewhere intermediate between the two. For many sectors, the frequency of precipitation (or number of rainfall days) is more important than accumulative or seasonal rainfall. Also important is the onset day/date of the monsoon/rainy season for sectors such as agriculture. There is some degree of predictability for both these characteristics. Dr. Robertson continued by indicating that less effort has been placed on this timescale in the past, but because of the importance of the information to many sectors, the new WWRP/WCRP joint research project has the goal to improve forecasts and understanding on this S2S scale, and promote uptake by operational centres and use by the applications community. There will be emphasis on coordinated research on predictability and modelling.

Dr Robertson provided a greater background of the S2S Prediction project by informing that it has five sub projects on (i) Madden Julian Oscillation, (ii) Monsoon, (iii) Africa, (iv) Extremes, and (v) Verification, with a focus in each project on research, modelling, and needs and applications. The outputs feed into a S2S database of daily data from real-time forecasts and hindcasts. He further

- Sub-seasonal lead time range from about 2 – 3 weeks
- The outlook uses Global Circulation Model (GCM) input
- Sub-seasonal real-time operational forecast models can be obtained from NCEP (National Centers for Environmental Prediction) website http://www.ncep.noaa.gov/
- Sub-seasonal scale models can use statistical models such as CPT to obtain an output.

The filling of information at the sub-seasonal timescale will provide a suite of information that better serves decision-making, planning and preparedness such that:

- (Get Ready) - With seasonal forecasts, the more mid-range (sub-seasonal) and short term (weather) forecasts would be more closely monitored, contingency plans could be updated, communities sensitised, volunteers trained, and early warning systems enabled;
- (Set) - The mid-range forecasts would initiate monitoring of short term forecasts, mobilise assessment teams, alert volunteers, warn communities, commence preparation at the local scale,
- (G0) – The short range forecasts would facilitate deployment of assessment team, mobilise assessment teams, distribute information for communities (for example to evacuate, if necessary)

Way forward and technical development leading up to the next CARICOF

In Summarising and providing a way forward Mr. Trotman expressed his pleasure at how the forum went, with keen participation, with interest in both the old and new products, particularly the drought outlook product. He welcomed the discussions and recommendations from both plenary and working groups. H also identified further activity for the future that would include:

- Further collaboration between CariCOF and the FCAC in the development, tailoring, and streamlining of SPI (drought) outlook.
- Building capacity in to develop other products such as for flood risk potential and sub-seasonal forecasting
- Developing more sector-tailored products
- Working towards having a Dry Season version of the CariCOF later in 2014

In closing, Mr. Trotman thanked all for their participation, particularly those from outside the region from Central America and The Pacific. He wished those leaving the following day safe travelling, while reminding those staying on of work still left to done during the following two days under the International Research Applications Program (IRAP) through a related workshop in Kingston.

Appendix A

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