Early Warning Information Systems: An essential ingredient for Drought Management in the Caribbean

by

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Drought Early Warning Information Systems – Reducing Drought Risks in a Changing Climate
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Caribbean Institute for Meteorology and Hydrology

PRIMARY FUNCTIONS

• Train various categories of meteorological and hydrological personnel
• Operate as a centre of research in meteorology, hydrology and associated sciences
• Data collection, storage, & dissemination
• Maintain, repair, and calibrate meteorological & hydrological instruments
• Advise regional governments on matters related to meteorology & hydrology
• Provide consulting services to industry

An arm of the Caribbean Meteorological Organisation
Rainfall in the Caribbean

- Characterized by a wet and a dry season...
- …except northern Guyana with two wet and two dry seasons associated with ITCZ
- At least 70 to over 80% of the rainfall occurs during the wet season
- Large seasonal, interannual and inter-decadal variability...
- …associated with ENSO, Pacific-Atlantic, SST and SLP anomalies and gradients, NAO and CLLJ
- Rainfall also cyclical – 50 to 60 years
Why concerns over drought?

Wet season rainfall as a percentage of annual rainfall (Enfield and Alfaro, 1999).

Seasonal Impacts - Droughts are particularly due to extensive and intense dry seasons.

Moving 10 year averages of rainfall at Edgecumbe, Barbados (Burton 1995).

Impacts potentially more severe during drier phases.

Future dryer and warmer regime likely to increase frequency of drought episodes.
Types of Drought

Source: NDMC, Nebraska
Response
Caribbean Drought and Precipitation Monitoring Network (CDPMN)

• CDPMN launched under Caribbean Water Initiative CARIWIN in January 2009 expected to be fully operational by the end of 2010
• Goal of CARIWIN is to increase the capacity of the Caribbean countries to deliver equitable and sustainable IWRM by
  • Implemented jointly by McGill University, CIMH and 3 partner countries (Grenada, Jamaica, Guyana)
  • Driven by impacts from previous droughts, such as in 1997-98
CDPMN on two scales

- Caribbean Basin Monitoring
- Country-level Monitoring
• Precipitation status monitored using a number of indices

• Final precipitation status determined, by consensus, by a network of persons from different sectors, institutions and communities embracing the diversity in definitions and impacts of drought

• Short term and seasonal rainfall forecasts to provide a projection of future drought (1 - 6 months possible)
Caribbean Basin Monitoring
Caribbean SPI and Deciles

Region dominated by seas surface so rainfall monitoring at this scale
Country Level Monitoring Examples

Found to be the more difficult to implement.........Why?
Region was facing drought during latter part of 2009 rainy season linked with El Niño.

Just months after launch of CDPMN...

...and a year before CDPMN was meant to be operational...

...but CPDMN was mobilised to provide information and advice to regional governments.
2009-2010 Drought 2

- Began during the 2009 rainy season (in particular the month of October)
- Stations in Trinidad, Grenada, St. Vincent, Barbados, St. Lucia, Dominica Jamaica, recorded their lowest ever February rainfall totals
- Stations in Anguilla, Grenada, Trinidad, Dominica and St. Vincent recorded their lowest ever 3 month (January to March)
- Stations recorded their lowest six month (October 2009 to March 2010) totals. These included stations in Tobago, Grenada, Barbados, St. Vincent, St. Lucia and Guyana
- Over 24 years of record at Point Saline Airport in Grenada, 2009 lowest annual total
Crops and livestock
- President of Guyana allocated US $1.3 million to bring relief to farmers of Region 2, costing government US $16,000.00 per day to operate pumps and conduct other works in this region.
- Farmers became so desperate that they were forced to pump salt water to about 150 acres of rice lands knowing the grave consequences of such actions.
- Banana exports from Dominica were approximately 43% lower in first 11 weeks of 2010.
- In St. Vincent and the Grenadines, agricultural production was reduced to 20%. The resilient farms were the ones that utilised greenhouse facilities and irrigation systems.
- In Antigua and Barbuda, where the 2010 onion crop was expected to be about 500,000 kg, 25 percent of it was lost, whilst about 30 percent of the Tomato crop which was estimated to total 250,000 kg was lost.
- In Trinidad disease of cattle.
2009-2010 Drought 4
Impacts 2

• **Food Prices**
  - In St. Vincent and the Grenadines, prices of tomatoes were $2.35 per pound in February. In March the prices rose to $6.00 per pound.
  - Trinidad and Tobago expressed concerns over rising inflation rates with a significant food prices component. Food prices increased 6.9% in March compared with 6.3% in February and 2.7% in January. An increase in the price of fruit in March 2010 by 60.8 per cent.
  - An increase in the price of fruit in March 2010 by 60.8 per cent.

• **Bush Fires** - the same scarce commodity – water – has then to be used to reduce the risks to limb and property
  - In Dominica, attended to 160 fires (mainly bush fires) for the 1st quarter of 2010, which was more than for the entire year 2009, which was about 103
  - 150% increase in the amount of bush fires reported.
  - In St. Vincent and the Grenadines, seven different farms reported the destruction of at least two acres of crops.

• **Land degradation** – flooding and landslides after drought, particularly where there was denudation of slopes from fires can be a concern.
2009-2010 Drought 5
Impacts 3

• **Water Resources**
  - Antigua and Barbuda: the Potswork Reservoir, the largest surface water impoundment on the island (22% of annual water supply derived from surface water sources) was all but dry by March 2010.
  - Guyana: water level at the East Demerara Water Conservancy dropped significantly below the designated safe level for irrigation – 53.50GD – forced to pump rather than by gravity – **INCREASED ENERGY CONSUMPTION**. Hinterlands, hand pumps became inoperable due to low well levels, areas that relied solely on rainwater were out of water, with reported increases incidences of diarrhea attributable to use of unsafe water – **HEALTH CONCERNS**
  - Jamaica: **rapid storage depletion** in the two largest surface water storage systems on the island Mona Reservoir (40% capacity) and Hermitage Dam (34% capacity)
  - St. Lucia: February 23rd NEMO declared a national water-related emergency
  - Barbados, low enough water levels in that prompted **Stage 1 of its Drought Management Plan** urging population to exhibit good water use habits and voluntary conservation measures.
2009-2010 Drought 6  
Impacts 4

Average wet season production of water versus production during the 2009 wet season in Grenada

<table>
<thead>
<tr>
<th>PLANT</th>
<th>AVG. WET PRODUCTION (Gals./day (gpd))</th>
<th>AVG. PRODUCTION, 2009 Gals./day (gpd)</th>
<th>% REDUCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annandale</td>
<td>2,000,000</td>
<td>1,600,000</td>
<td>20.0</td>
</tr>
<tr>
<td>Mardigras</td>
<td>167,000</td>
<td>100,000</td>
<td>40.1</td>
</tr>
<tr>
<td>Les Avocats</td>
<td>430,000</td>
<td>282,300</td>
<td>34.3</td>
</tr>
<tr>
<td>Mamma Cannes</td>
<td>310,000</td>
<td>240,000</td>
<td>23.0</td>
</tr>
<tr>
<td>Concord</td>
<td>300,000</td>
<td>298,000</td>
<td>-0.7</td>
</tr>
<tr>
<td>Vendomme</td>
<td>450,000</td>
<td>240,000</td>
<td>46.7</td>
</tr>
<tr>
<td>Mt. Horne</td>
<td>210,000</td>
<td>210,000</td>
<td>0.0</td>
</tr>
<tr>
<td>Mirabeau</td>
<td>700,000</td>
<td>280,000</td>
<td>60.0</td>
</tr>
</tbody>
</table>

Yet water was barged from Grenada to Carriacou, its dependent.
Energy

In St. Vincent and the Grenadines, hydro power contribution to total electricity production fell in Jan 2010 to 8.17%. In Jan 2009 it was 28.12% and Jan 2008 it was 17.35%. In February 2010 it fell to 12.01% from 28.69% in Feb 2009. In Feb 2008 it was 21.30%.

The decline in hydro-electricity resulted in an increased use of diesel resulting in a higher fuel surcharge. However, this surcharge was significantly offset by lower diesel prices.
Recommendations for Water Resources Management

- Data and integrated analysis and decision making is critical in identifying the onset of droughts. Member States are:
  - Urged to ensure that data collection networks and associated instrumentation are calibrated and are functioning effectively and efficiently.
  - Encouraged to ensure that data collected from such networks are made available to national and regional institutions to support broad range investigations including drought analysis and the impacts of drought on water resources and sectors sensitive to water availability.
  - Encouraged to ensure that appropriate technical capacity to support decision making in the water resources sector and related sectors is available in national institutions.
  - Urged to utilize appropriate resources in Regional Institutions. Regional Institutions are urged to include in their research and development activities the development of early warning systems and appropriate indicators to support Member States in their planning and adaptation strategies. In this regards, Member States are encouraged to renew their various commitments to important activities of regional institutions.
Recommendations for Water Resources Management

• Given the potential for increased droughts in the future due to the combined effects of climate change and climate variability (e.g., ENSO, NAO/SLP, CLLJ), Member States are urged to perform comprehensive reviews of their water resources to ensure that clear regulations and policies related to Action Plans to be implemented under drought conditions are clearly articulated and that the necessaries competencies to activate the actions are in place. In this regard, Member States should also ensure that water resources management and regulatory agencies are familiar with climate change and climate variability predictions for respective Member States and to ensure that this information is included in planning and design activities.
Recommendations for Water Resources Management

- Given the financial vulnerability of regional small economies to droughts and related low water availability and the fact that such events may become more intense and extreme in the future, Member States are encouraged to consider requesting the CCRIF to explore the possibility of offering drought insurance to national governments to offset financial losses from drought.

- As indicated by the current drought, decision making in one sector can have significant implications in other sectors. Member States are encouraged to implement appropriate multi-sector working groups to ensure that all sectors are familiar with the various sensitivities and needs of other sectors to ensure timely and effective decision making. A model for similar working groups currently exists among CARICOM Institutions. Member States are encouraged to draw on the strengths of this model.
Recommendations for Water Resources Management

• Given the increasing complexity associated with sustainable water resources management, Member States are encouraged to ensure that they have access to skilled professionals through investments in tertiary training and continuous professional development. Where resources are lacking, Member States are encouraged to utilize south-south bilateral relations or other regional cooperation arrangements.
# Other Drought-Related Tools

- **Caribbean Water Monitor**
  
  Tool creates calculates SPI and Deviation from Normal for any station and time period in its database. These are automatically graphed.

  SPI is also mapped using the open access GIS software Grass. Some tweaking of the software still to be done.

- **Dewetra Multi Hazard Platform**

## SPI OUTLOOK for April, 2010

<table>
<thead>
<tr>
<th>Station</th>
<th>1 mth</th>
<th>3 mth</th>
<th>6 mth</th>
<th>12 mth</th>
<th>Probability</th>
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</thead>
<tbody>
<tr>
<td>VC Bird Antigua</td>
<td>0.42 - 2.15</td>
<td>-0.01 - 2.65</td>
<td>-0.73 - 1.14</td>
<td>-0.70 - 0.33</td>
<td>35</td>
</tr>
<tr>
<td></td>
<td>-0.43 - 0.42</td>
<td>-1.10 - -0.01</td>
<td>-1.27 - -0.73</td>
<td>-0.95 - -0.70</td>
<td>40</td>
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<tr>
<td></td>
<td>-1.64 - -0.43</td>
<td>-2.43 - -1.10</td>
<td>-1.76 - -1.27</td>
<td>-1.16 - -0.95</td>
<td>25</td>
</tr>
<tr>
<td>CIMH Barbados</td>
<td>0.39 - 1.72</td>
<td>-0.34 - 1.98</td>
<td>-1.64 - -0.13</td>
<td>-1.10 - -0.28</td>
<td>30</td>
</tr>
<tr>
<td></td>
<td>-0.44 - 0.39</td>
<td>-1.59 - -0.34</td>
<td>-2.17 - -1.64</td>
<td>-1.35 - -1.10</td>
<td>45</td>
</tr>
<tr>
<td></td>
<td>-2.04 - -0.44</td>
<td>-3.54 - -1.59</td>
<td>-2.65 - -2.17</td>
<td>-1.55 - -1.35</td>
<td>25</td>
</tr>
<tr>
<td>Point Saline Grenada</td>
<td>0.41 - 2.67</td>
<td>-0.32 - 2.54</td>
<td>-2.23 - -0.20</td>
<td>-3.04 - -1.92</td>
<td>30</td>
</tr>
<tr>
<td></td>
<td>-0.43 - 0.41</td>
<td>-1.48 - -0.32</td>
<td>-2.59 - -2.23</td>
<td>-3.19 - -3.04</td>
<td>45</td>
</tr>
<tr>
<td></td>
<td>-1.27 - -0.43</td>
<td>-2.74 - -1.48</td>
<td>-2.83 - -2.59</td>
<td>-3.28 - -3.19</td>
<td>25</td>
</tr>
</tbody>
</table>

**Rainfall Impact Reporter Example from Trinidad**
CARICOM/Brazil programme in DRR

Drought

- Implemented by CIMH
- Pilot Countries: Grenada, St. Lucia, Jamaica
- Training in drought monitoring and planning (assisted by NDMC)
- Provision of monitoring instruments (illustrative, but part of national network)
- Upgrade of CWM tool
- Draft Implementation plans for DEWIS (to Cabinet)...
- In the context of a Drought Management framework
Framework for National Drought Management

Focus on Drought Early Warning & Information Systems
What are in the Plans?...

- Objectives
- Agencies to be involved
- Scope of Work
- Terms of Reference
- Reporting process for each network/working group
Where are we Now?

• St. Lucia has since approved, in July 2013 under NEMO, Terms of Reference for the NEMO Flood and Drought Mitigation Committee

• Grenada has met since the first draft and has decided to have one more round of meetings before taking to cabinet

• Jamaica has a draft plan...

• Others Member States?...

• Why so difficult to move from Draft to Approved Plan to Implementation? What is needed to facilitate the move forward?

Implementation and success depends on the Member States

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