CARIBBEAN METEOROLOGICAL ORGANIZATION

AGROMETEOROLOGY IN THE MEMBER STATES OF THE CMO

The Role of the National Meteorological and Hydrometeorological Services

WHO or WHAT is the CMO?

Long history of regional cooperation in Meteorology & Allied Sciences

- 1951 – British Caribbean Met. Service (BCMS)
  - HQ in T&T
- 1958 – BCMS became Federated WI Met. Service (WIMS)
- 1962 – Caribbean Met. Council (CMC) formed
- 1962 – Dissolution of the WI Federation
- 1963 – WIMS replaced by Caribbean Met. Service (CMS)

WHO or WHAT is the CMO?

- 1967 – Caribbean Met. Institute (CMI) established
- 1973 – CARICOM established (August)
- 1973 – CMO established (October)
  - replaces CMS & integrates CMC & CMI
- 1982 – CMO establishes Caribbean Operational Hydrological Institute (COHI)
- Mid-1980s – CMI and COHI merged
- 1999 – Name change → Caribbean Institute for Meteorology and Hydrology (CIMH)

Reason for Establishment

After Federation:

- Many National Met. Services established
- *Caribbean Met. Service* less and less a practical entity
- Gov't recognized need for expansion of regional cooperation in meteorology & allied sciences, such as agriculture

Organizational Structure of the CMO

- The Caribbean Meteorological Council (CMC) - Supreme Organ (Ministerial level)
- The Headquarters Unit – based in Trinidad & Tobago
- The Caribbean Institute for Meteorology and Hydrology (CIMH) – based in Barbados
- Caribbean Meteorological Foundation (CMF)

CMO Membership

- **16 Member States:**
  - Anguilla, Antigua and Barbuda
  - Barbados, Belize, British Virgin Islands
  - Cayman Islands, Dominica, Grenada
  - Guyana, Jamaica, Montserrat
  - St. Kitts/Nevis, St. Lucia, St. Vincent
  - Trinidad & Tobago, Turks & Caicos Islands

- **CMO's membership different to CARICOM's**

Role & Mandate of the CMO

Regional & International Cooperation in Meteorology, Hydrology, Agrometeorology etc (Int'l difficulty in dealing with so many small islands individually)

- **Coordinate Joint *Scientific Activities* of National Met. Services**
- **Establish/upgrade *Technical Facilities* and *Systems***
- **Promote a Regional *Severe Weather Warning System***

Role & Mandate of the CMO

Regional & International Cooperation in Meteorology, Hydrology, Agrometeorology etc

- ***Advice to Governments* in development of Met. Services & on int'l weather & climate issues**
- ***Represent regional met. interests* in relation to *World Met. Org* (WMO) & *Int'l Civil Aviation Org* (ICAO), regional & int'l *disaster-related agencies***

Role & Mandate of the CMO

Through the CIMH…

- **Provide *Joint Training Facilities***
  - **Multi-level courses from technician to post – graduate in meteorology & related sciences**
- ***Research* in applied meteorology, agro-meteorology, hydrology (weather, climate & water)**
  - **Disaster-related studies**

    - flood forecasting, drought forecasting

    - storm surge forecasting & mapping

    - hydrogeological studies

    - climate variability & climate change impact studies

Met & Hydromet Services in CMO Member States (NMHS)

Two level of NMHS:

- **Weather *Forecast and Warning Offices:***
  - **Antigua & Barbuda, Barbados, Belize, Cayman, Grenada, Guyana, Jamaica, St. Lucia, Trinidad & Tobago**
  - **24x7x365 operations**
  - **Surface Observations of Rainfall, Sunshine, Evaporation, Soil Temperature & Moisture, etc**
  - **Upper Atmosphere Observations (selected NMHSs)**
  - **Vast Regional & Int'l Exchange of Data & Products**

Met & Hydromet Services in CMO Member States (NMHS)

- **Weather *Forecast and Warning* Offices:**
  - **Preparation & Dissemination of Routine Weather Forecasts for the Public, Aviation, Marine users**
  - **Warnings of Severe Weather to Public, Decision-makers and NDOs**
  - **Special Forecasts/Advice for Agriculture, Water-resources, Industrial Interests, etc (some NMHSs)**
  - **Seasonal or Inter-seasonal Climate Forecasts/Advice for Decision-makers & Special Interest Groups (depending on resources)**

Met & Hydromet Services in CMO Member States (NMHS)

- ***Aeronautical*** **Meteorological Offices:**
  - **Anguilla, British Virgin Islands, Dominica, Montserrat, St. Kitts/Nevis, St. Vincent & the Grenadines, Turks & Caicos**
  - **Hours based on Airport Operations**
  - **Surface Weather Observations mainly in support of the Public and Aviation Industry**
  - **Climate Data Collection**
  - **Forecast & Warning Services provided by the larger NMHSs (by CMO agreements)**

NMHSs with Agro Links

- **Barbados – Ministry of Agriculture**
- **Guyana – Ministry of Agriculture**

Types of Agromet Services by Some NMHSs

- **GUYANA HydroMet – Agromet Section**
  - **Weather Services to aid Food Production & Food Security**
  - **Functions with Climate Section to meet objectives**
    - **Operates two Agromet stations**
    - **Agromet Products to aid Farming, Land Management, Selection of Climate-adaptable Plant Varieties & Animal Breeds**
    - **Monthly Weather Bulletin for Farmers**
    - **Regular Agromet Advisories by telephone**

Types of Agromet Services by Some NMHSs

- **JAMAICA - *Climate Branch***
  - **Maintains Database of Rainfall and Climatological Stations**
  - **Archives & Analyses Data for Monitoring & Assessing the Island's Climate**
  - **Applied Meteorology Section processes Client Needs, including Crop Water Requirements**

Types of Agromet Services by Some NMHSs

- **BELIZE - Agromet Section**

- **Agromet Forecasts, including:**
  - **Precipitation Outlook for Caribbean & Central America, prepared by CIMH with contributions from NMHSs & UWI (Mona)**
- **Ten Day Cumulative Report**
- **Data Request**
- **Agromet Station Location**

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AGRO METEOROLOGICAL FORECAST FOR FARMERS AND LIVESTOCK PRODUCERS OF BELIZE

Period: Wednesday 10th February, 2010 until Saturday Feb 13th, 2010

Synopsis: A weak cold front will cross Belize late on Tuesday

Rainfall during the past 24-48 hours: Mainly dry weather has been prevailing across the country.

Four-day Outlook:

Day I: WED. Feb.10	Day II: THU. Feb.11	Day III: FRI. Feb.12	Day IV: SAT. Feb.13
 A few showers/Isolated T-storms.	 Some coastal showers	 A few coastal showers.	 A few showers(mainly inland).
Coast/Inland/Hill °F **Max.** 81/84/70 **Min.** 72/68/63	**Coast/Inland/Hill °F** **Max.** 78/82/68 **Min** 70/66/60	**Coast/Inland/Hill °F** **Max.** 86/90/70 **Min.** 73/70/63	**Coast/Inland/Hill °F** **Max.** 75/80/72 **Min.** 70/68/61
Rain: 1.00-1.50"	**Rain:** 1.20-1.60"	**Rain**: 0.80-1.00"	**Rain**: 0.40-0.80"

Feature(s) of Agro meteorological Interest: February is generally regarded as a dry month. The fire season officially starts on Feb.,15th.On average, two(2) cold fronts can be expected for February. A full fledged El Niño phase of the ENSO cycle continues across equatorial Pacific. Current observations and dynamic model forecasts indicate conditions will continue to intensify and persist through to the early part of 2010.(see Precipitation Outlook). El Niño conditions typically last twelve(12) to eighteen(18) months.

Forecaster: F.Tench Jnr(Weather Forecaster)

BELIZE NMS

NATIONAL METEOROLOGICAL SERVICE

February 10, 2010

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CUMULATIVE TEN-DAY RAINFALL JANUARY TO SEPTEMBER, 2004 FOR SOME STATIONS IN BELIZE, CENTRAL AMERICA

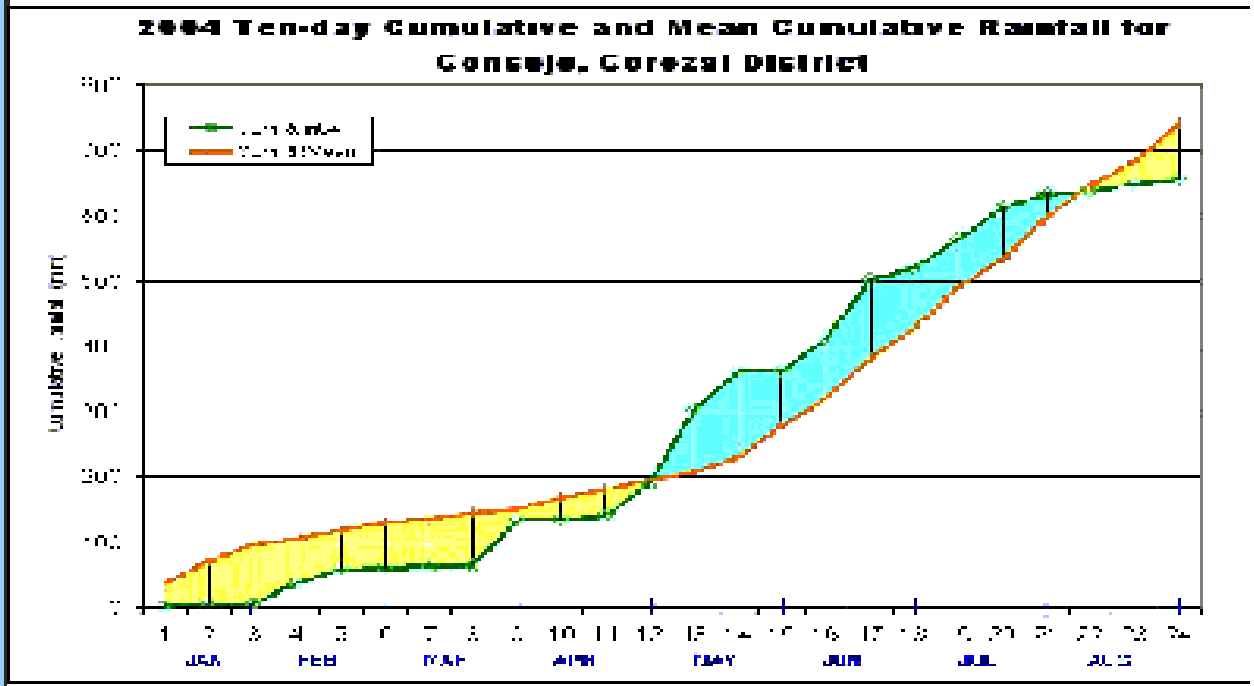


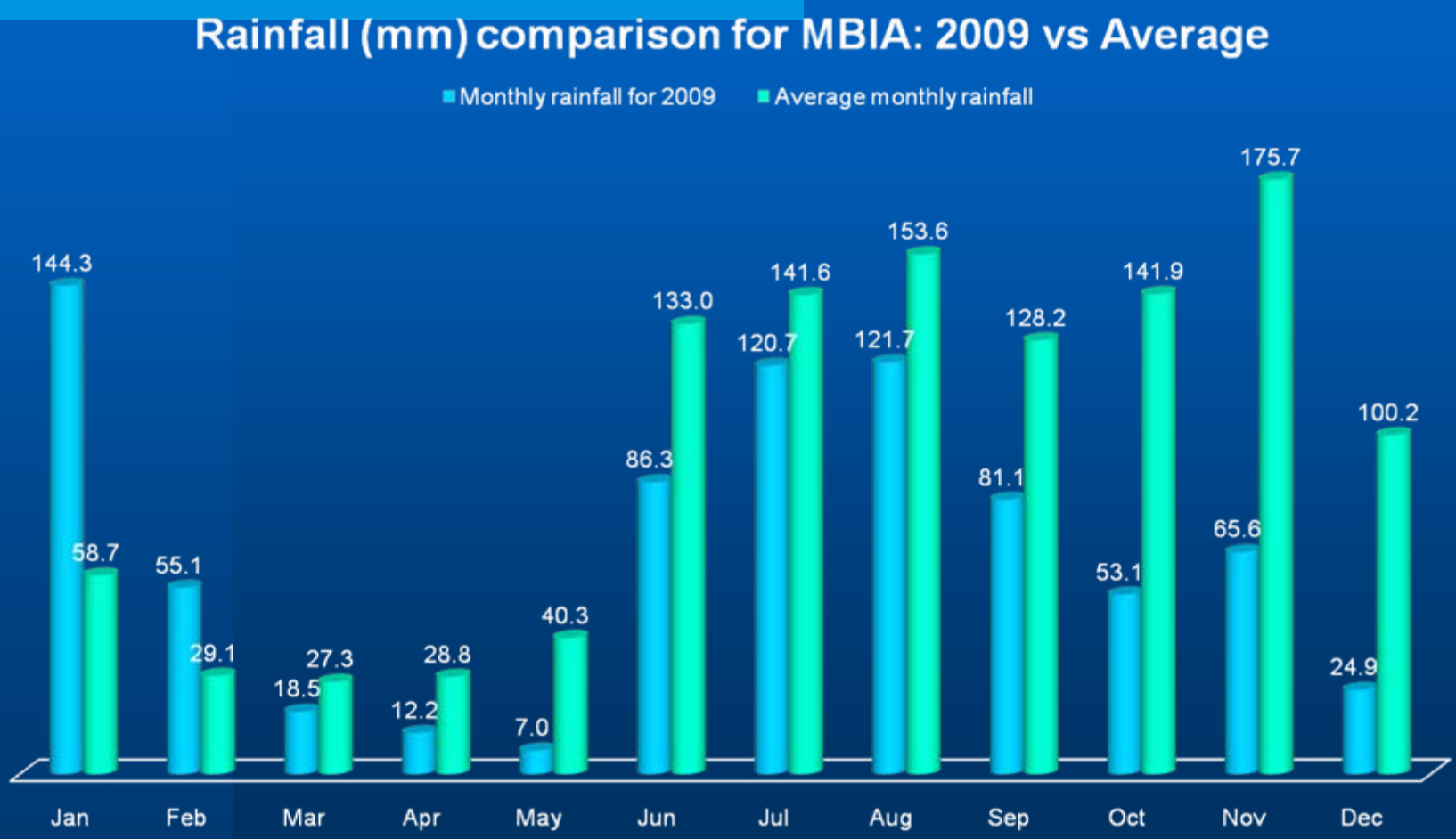
Fig. 1 Cumulative Ten-day Rainfall Jan. - Sep. 2004 at Consejo, Corozal district

Types of Agromet Services by Some NMHSs

- **Drought Alerts, when required:**

- **Examples - Barbados, St. Lucia, Antigua, Grenada, Trinidad & Tobago**
  - **Barbados & Grenada– 2010 Drought Alerts issued by CIMH in consultation with NMHS**
  - **St. Lucia – 2009/10 Drought Watch – use of the Standardized Precipitation Index (SPI)**

Types of Agromet Services by Some NMHSs



Grenada

Types of Agromet Services by Some NMHSs

DROUGHT MONITORING STATISTICAL ANALYSIS FOR HEWANORRA (2009)												
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
T1	204.8	63.3	24.7	192.7	145.5	120.4	156.8	165.7	99.5	84.6	96.6	34.3
37 yr MEAN	80.0	52.8	56.3	62.2	72.1	114.2	148.0	163.2	184.9	202.1	172.2	104.7
%N	256.0	119.9	43.9	309.8	201.8	105.4	105.9	101.5	53.8	41.9	56.1	32.8
SPI	2.91	0.30	-0.60	2.21	1.40	0.08	0.13	0.04	-0.76	-1.25	-1.43	-1.11
T3	432.1	328.7	292.8	280.7	362.9	458.6	422.7	442.9	422.0	349.8	280.7	215.5
37 yr MEAN	359.9	239.2	189.04	171.3	192.5	248.5	334.3	425.4	496.1	550.1	559.1	478.9
%N	120.1	137.4	154.9	163.9	188.5	184.5	126.4	104.1	85.1	63.6	50.2	45.0
SPI	0.72	1.12	1.23	1.1	1.73	1.64	1.49	0.13	-0.47	-1.27	-1.35	-2.09
T6	1117.8	973.3	774.0	712.8	691.6	751.4	703.4	805.8	880.6	772.5	1415.2	637.5
37 yr MEAN	912.2	801.49	668.7	542.1	429.1	437.5	526.6	617.9	744.6	884.4	984.5	992.1
%N	122.5	121.4	115.7	131.5	161.2	171.7	133.6	130.4	118.3	87.3	143.7	64.3
SPI	1.17	1.25	0.71	1.16	1.71	1.93	1.96	0.99	0.68	-0.55	-0.54	-1.71

LEGEND	
Tx	RR total for corresponding month thrown back 'x' months.
%N	percent of normal drought index
SPI	Standardized Precipitation (drought) Index

SPI Intensities	
2.0+	extremely wet
1.5 to 1.99	very wet
1.0 to 1.49	moderately wet
-0.99 to 0.99	near normal
-1.0 to -1.49	moderately dry
-1.5 to -1.99	severely dry
-2 and less	extremely dry

A drought event occurs any time the SPI is continuously negative and reaches an intensity of -1.0 or less. The event ends when the SPI becomes positive.

DROUGHT MONI			
	JAN	FEB	MAR
T1	75.5		
38 yr MEAN	79.8		
%N	94.6		
SPI	-0.10		
T3	206.4		
38 yr MEAN	355.9		
%N	58.0		
SPI	-1.46		
T6	556.2		
38 yr MEAN	902.9		
%N	61.6		
SPI	-1.89		

LEGEND	
Tx	RR total for corresponding monti
%N	percent of normal drought index
SPI	Standardized Precipitation (drou

SPI Intensities	
2.0+	extremely wet
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1.0 to 1.49	moderately wet
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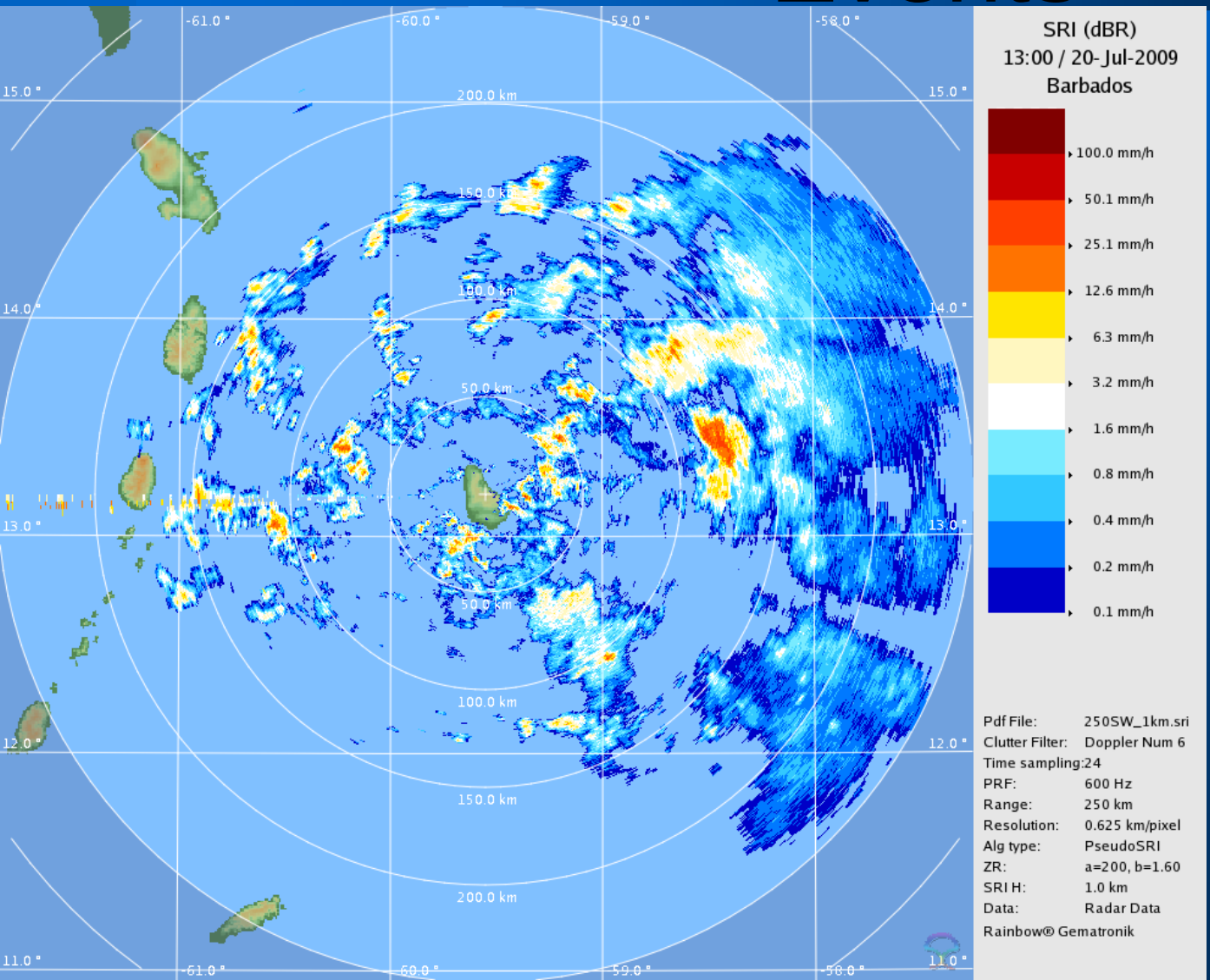
-1.0 to -1.49	moderately dry
-1.5 to -1.99	severely dry
-2 and less	extremely dry

A drought event occurs any time the SPI the SPI becomes positive.

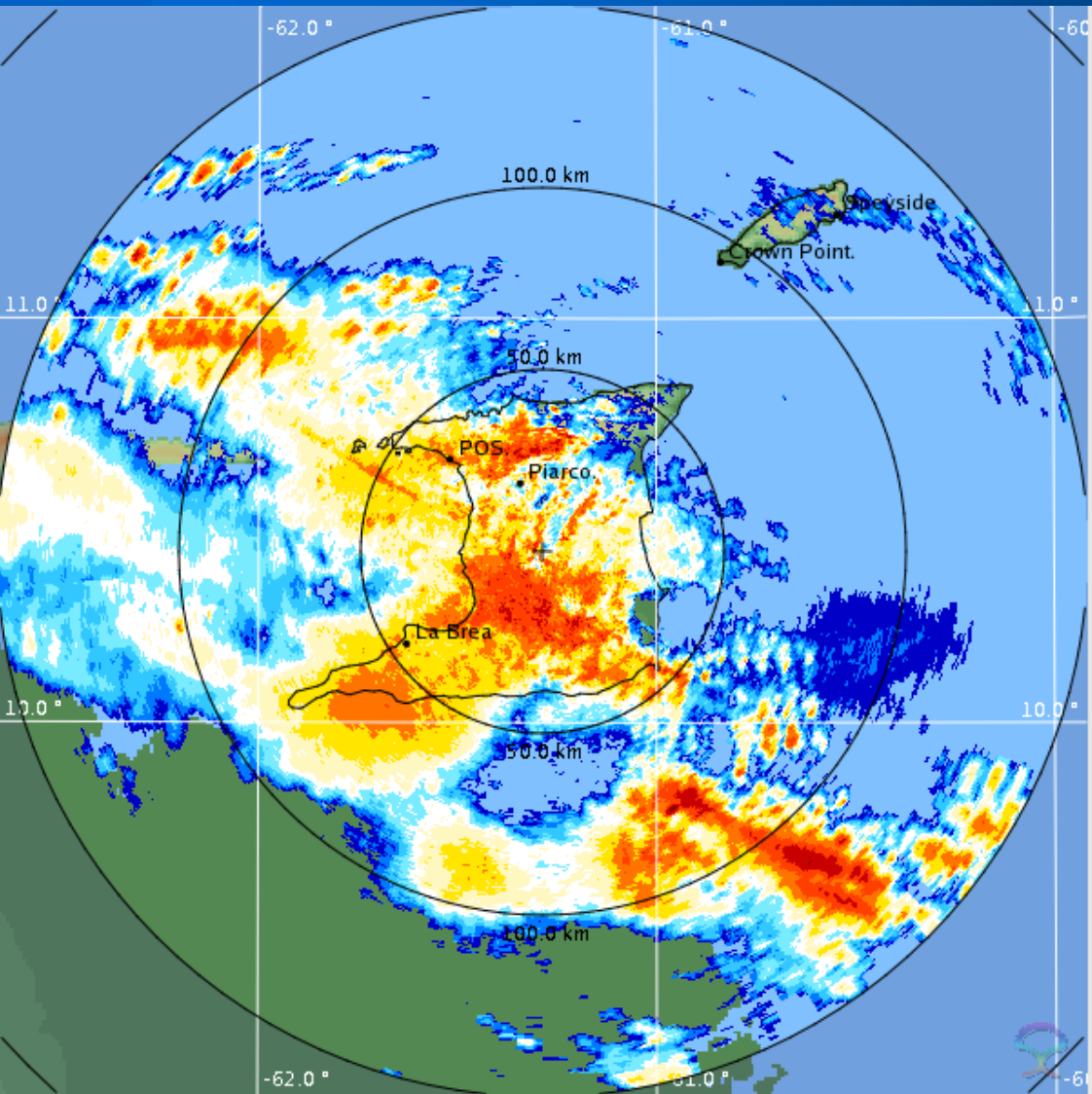
St. Lucia 2009 & 2010

Heavy Rainfall & Flood Events



Barbados Radar

Heavy Rainfall & Flood Events



PAC (dBA)
15:15 / 08-Aug-2009
TrinBago

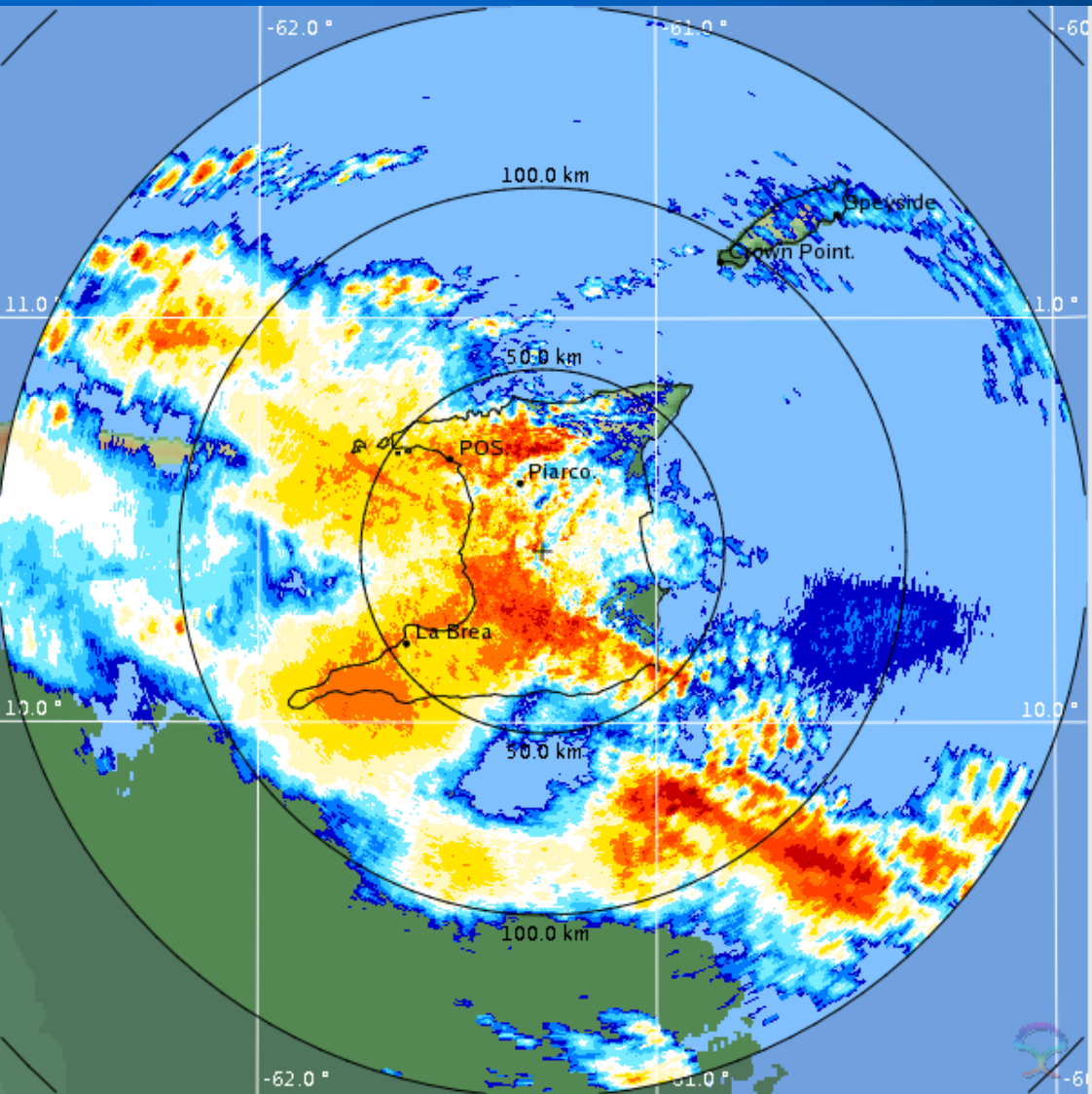
	100.0 mm
	50.1 mm
	25.1 mm
	12.6 mm
	6.3 mm
	3.2 mm
	1.6 mm
	0.8 mm
	0.4 mm
	0.2 mm
	0.1 mm

Pdf File:	1hr_ppi.pac
Clutter Filter:	Doppler Num 6
Time sampling:	63
PRF:	1000 Hz / 666 Hz
Range:	150 km
Resolution:	0.500 km/pixel
Alg type:	Average
Start:	Sat Aug 8 14:15:04 2009
Interval:	0 d, 1 h, 0 m
Num Prod:	5
Miss Time:	0 d, 0 h, 0 m
Data:	Radar Data

Rainbow® Gematronik

Trinidad Radar

Heavy Rainfall & Flood Events



PAC (dBA)
15:30 / 08-Aug-2009
TrinBago

	100.0 mm
	50.1 mm
	25.1 mm
	12.6 mm
	6.3 mm
	3.2 mm
	1.6 mm
	0.8 mm
	0.4 mm
	0.2 mm
	0.1 mm

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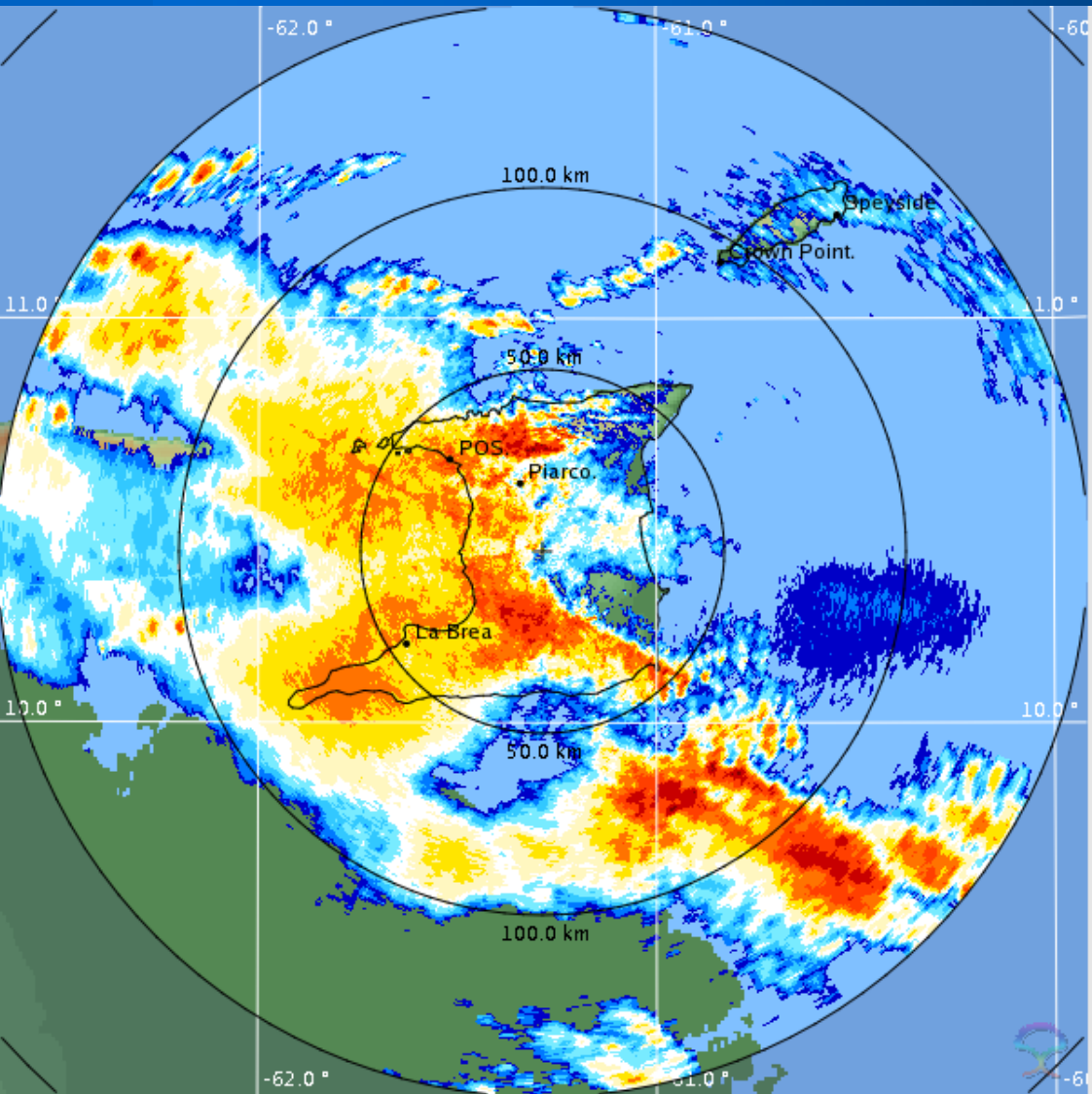
Trinidad Radar

Heavy Rainfall & Flood Events



PAC (dBA)
15:45 / 08-Aug-2009
TrinBago

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	25.1 mm
	12.6 mm
	6.3 mm
	3.2 mm
	1.6 mm
	0.8 mm
	0.4 mm
	0.2 mm
	0.1 mm

Pdf File:	1hr_ppi.pac
Clutter Filter:	Doppler Num 6
Time sampling:	63
PRF:	1000 Hz / 666 Hz
Range:	150 km
Resolution:	0.500 km/pixel
Alg type:	Average
Start:	Sat Aug 8 14:45:04 2009
Interval:	0 d, 1 h, 0 m
Num Prod:	5
Miss Time:	0 d, 0 h, 0 m
Data:	Radar Data

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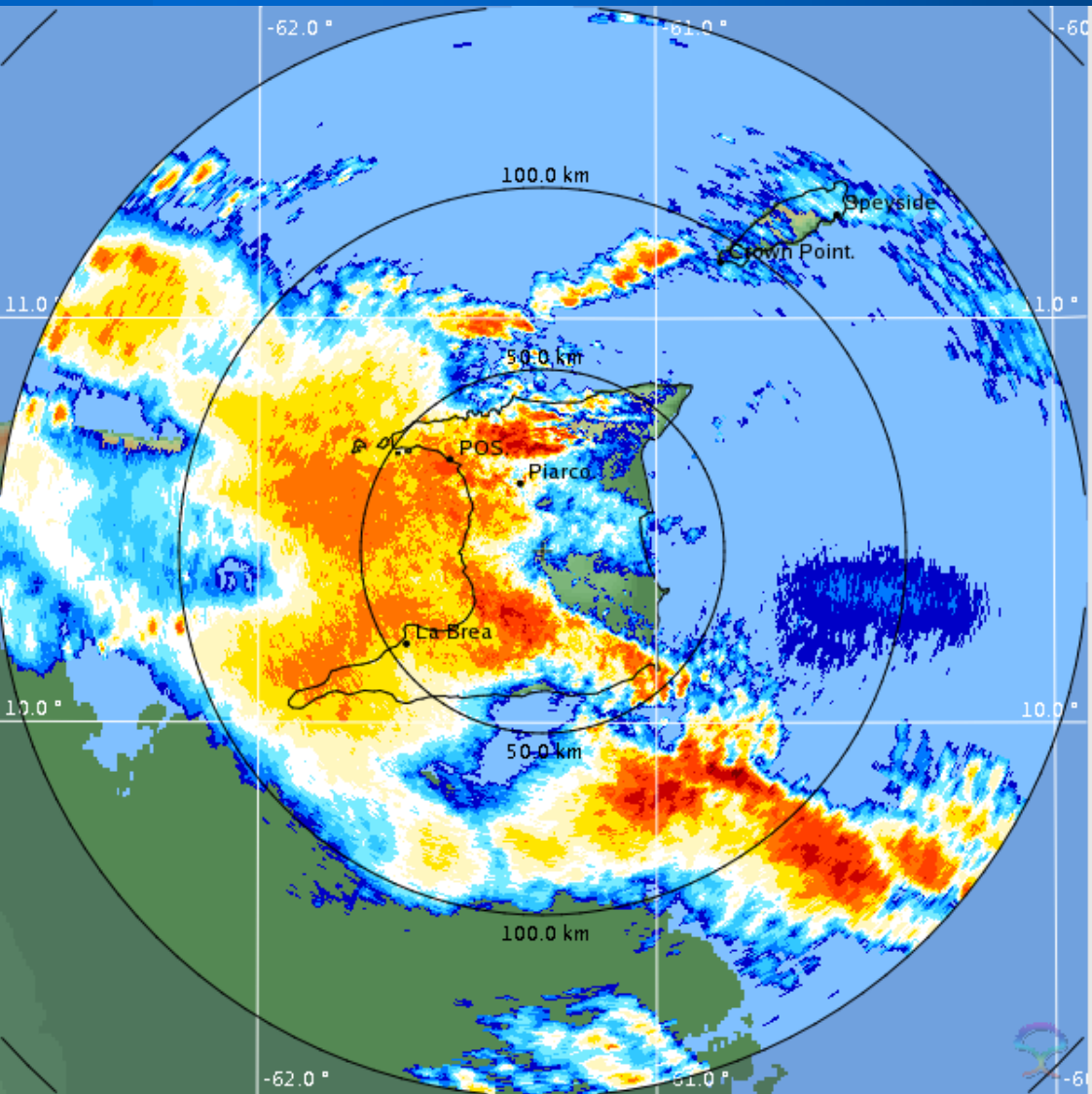
Trinidad Radar

Heavy Rainfall & Flood Events



PAC (dBA)
16:00 / 08-Aug-2009
TrinBago

	100.0 mm
	50.1 mm
	25.1 mm
	12.6 mm
	6.3 mm
	3.2 mm
	1.6 mm
	0.8 mm
	0.4 mm
	0.2 mm
	0.1 mm

Pdf File:	1hr_ppi.pac
Clutter Filter:	Doppler Num 6
Time sampling:	63
PRF:	1000 Hz / 666 Hz
Range:	150 km
Resolution:	0.500 km/pixel
Alg type:	Average
Start:	Sat Aug 8 15:00:04 2009
Interval:	0 d, 1 h, 0 m
Num Prod:	5
Miss Time:	0 d, 0 h, 0 m
Data:	Radar Data

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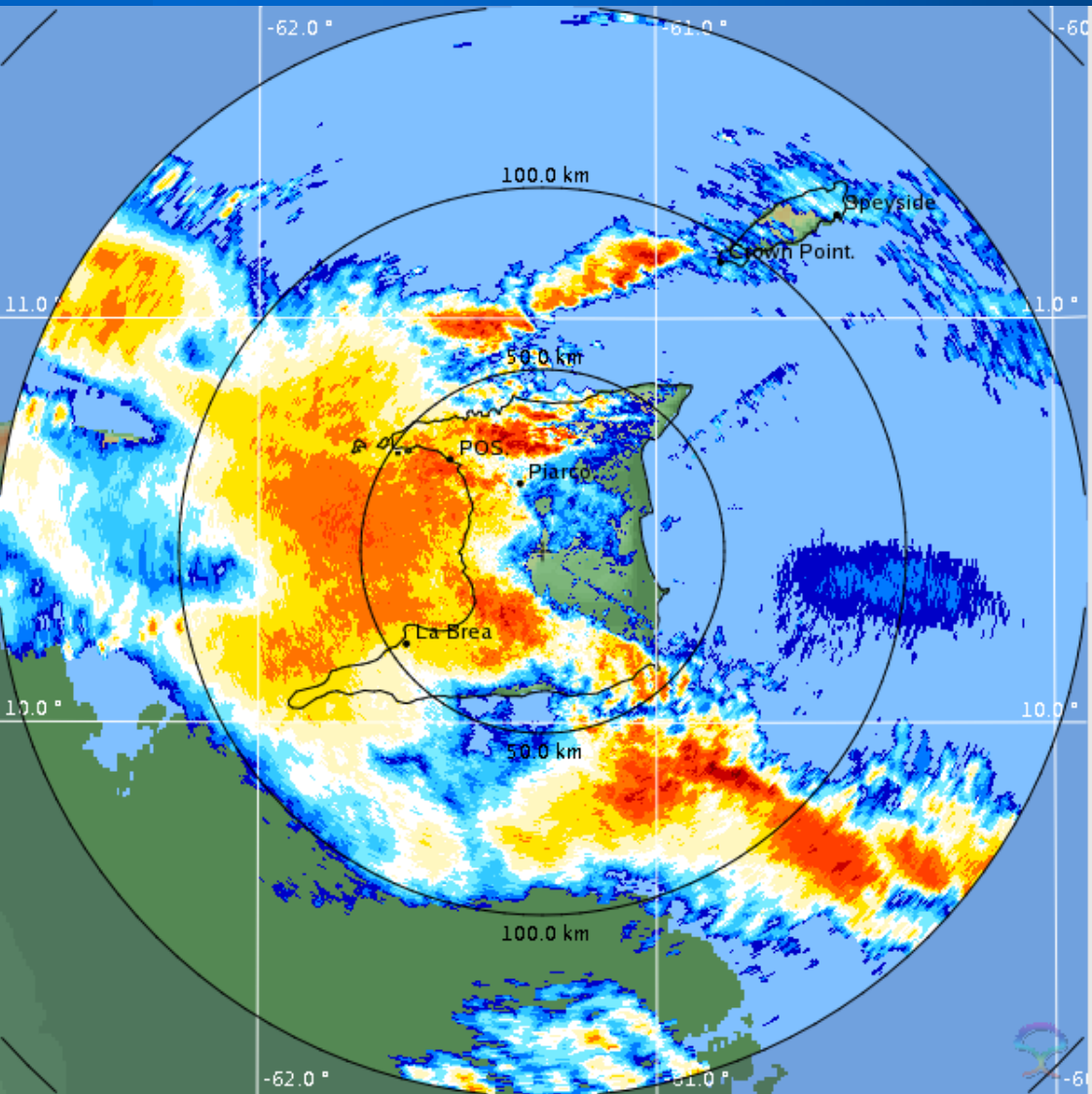
Trinidad Radar

Heavy Rainfall & Flood Events



PAC (dBA)
16:15 / 08-Aug-2009
TrinBago

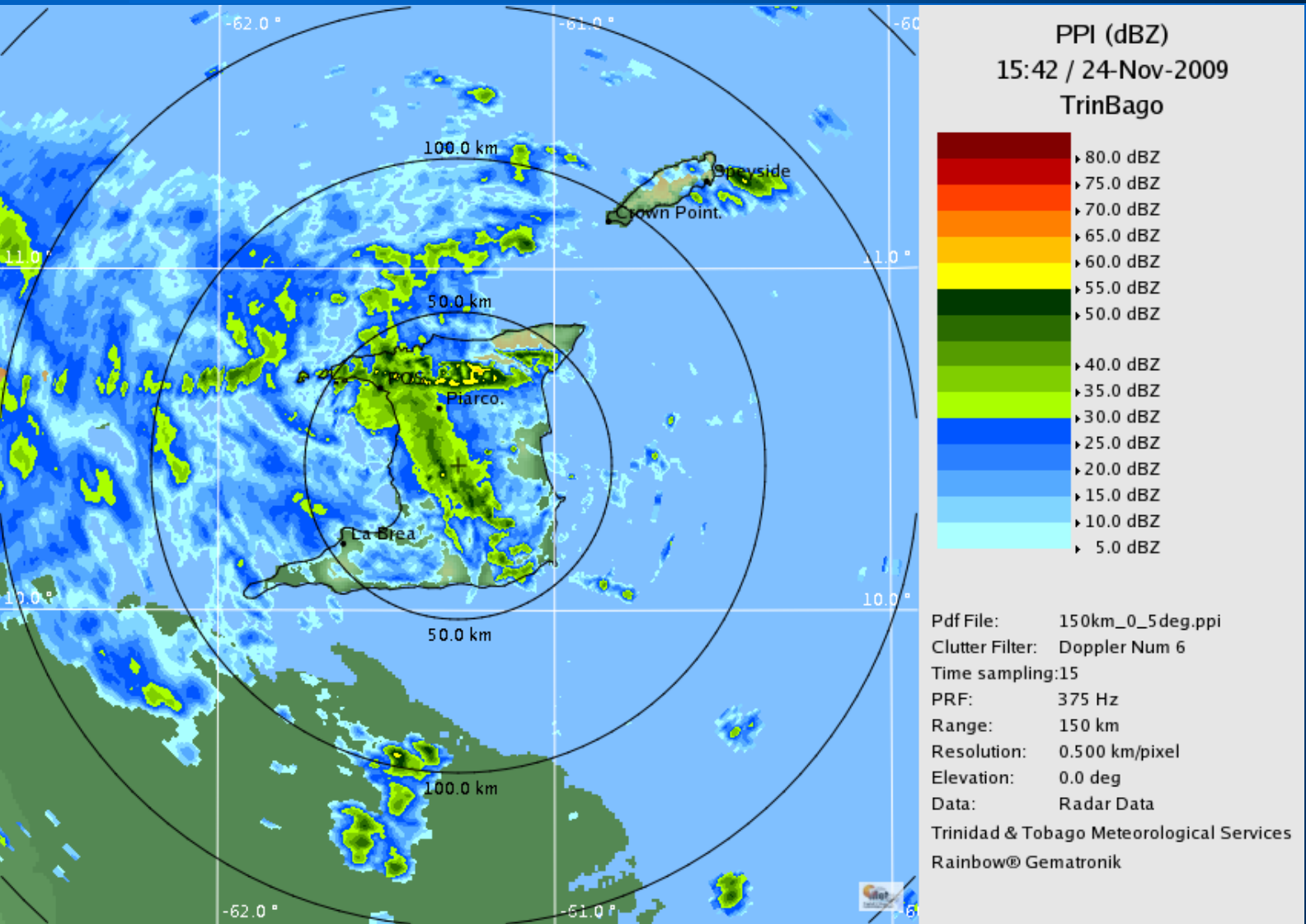
100.0 mm	
50.1 mm	
25.1 mm	
12.6 mm	
6.3 mm	
3.2 mm	
1.6 mm	
0.8 mm	
0.4 mm	
0.2 mm	
0.1 mm	

Pdf File:	1hr_ppi.pac
Clutter Filter:	Doppler Num 6
Time sampling:	63
PRF:	1000 Hz / 666 Hz
Range:	150 km
Resolution:	0.500 km/pixel
Alg type:	Average
Start:	Sat Aug 8 15:15:04 2009
Interval:	0 d, 1 h, 0 m
Num Prod:	5
Miss Time:	0 d, 0 h, 0 m
Data:	Radar Data

Rainbow® Gematronik

Trinidad Radar

Heavy Rainfall & Flood Events



PPI (dBZ)
15:42 / 24-Nov-2009
TrinBago

- 80.0 dBZ
- 75.0 dBZ
- 70.0 dBZ
- 65.0 dBZ
- 60.0 dBZ
- 55.0 dBZ
- 50.0 dBZ
- 40.0 dBZ
- 35.0 dBZ
- 30.0 dBZ
- 25.0 dBZ
- 20.0 dBZ
- 15.0 dBZ
- 10.0 dBZ
- 5.0 dBZ

Pdf File:	150km_0_5deg.ppi
Clutter Filter:	Doppler Num 6
Time sampling:	15
PRF:	375 Hz
Range:	150 km
Resolution:	0.500 km/pixel
Elevation:	0.0 deg
Data:	Radar Data

Trinidad & Tobago Meteorological Services
Rainbow® Gematronik

Trinidad Radar

Types of Agromet Services by Some NMHSs

Flood Bulletin

Date: Tuesday 24th of November 2009
ISSUED AT:01:06PM

DANGEROUSLY HIGH LEVELS OF THE CAPARO RIVER

Trinidad and Tobago has experienced prolonged periods of moderate to heavy rainfall during the last 12 to 18 hours.

As a result of the large accumulations of rainfall, the Caparo River has risen to a dangerously high level. Although much less accumulations are anticipated during the afternoon, expected runoff can cause the Caparo River to spill its banks.

In light of the above, The Trinidad and Tobago Meteorological Service wishes to advise that with the continued runoff, flooding can be expected in areas along the banks of the Caparo River, Mamoral and Todd's Road area in particular. All interests in these areas are asked to take every necessary precaution to protect life and property from any floodwaters.

The Trinidad and Tobago Meteorological Service will continue to monitor the situation and will issue another alert as the situation warrants.

A. Aaron
Meteorologist

Trinidad & Tobago

NMHSs and International AgroMet Programmes

WMO's Agricultural Meteorology Programme (AGM)

- **Supports Member States for:**
  - **Provision of Meteorological Services to Agricultural Community**
  - **Improving Agricultural Production & Quality**
  - **increased Efficiency in Use of Water, Conservation of Natural Resources**
  - **Decrease Pollution by Agricultural Chemicals to Minimize Environmental Degradation**

NMHSs and International AgroMet Programmes

WMO's Agricultural Meteorology Programme (AGM)

- **Fosters Transfer of Technology**
- **Organizes Regional & International Training Events**
- **Provides Global Agromet information Service (WAMIS)**

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Objectives

The main objective of WAMIS is to provide a dedicated webserver for disseminating agrometeorological products issued by WMO Members. By providing a central location for agrometeorological information, WAMIS will aid users to quickly and easily evaluate the various bulletins and gain insight into improving their own bulletins. The web site will also host a tools and resources section to further help Members improve the quality and presentation of their agrometeorological bulletins.

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Belize

Agrometeorological Forecasts and Various Weather Products

The National Meteorological Service of Belize (NMS) provides various agrometeorological and weather products for Belize. The Agromet Section of the NMS also provides a map of agrometeorological stations in the country.

Information and Products provided are:

- **Agrometeorolgical Forecast for Farmers and Livestock Producers**
- **Four day Weather Forecast**
- **Seasonal Precipitation Outlook** Three Month Precipitation Outlook for the Caribbean
- **Fire Forecast**
- **Flood Forecast**
- **Monthly Weather Summary**

Examples of Extra-Regional NMHSs AgroMet Focus

ISRAEL

- Irrigation is Critical to Agriculture
- Evaporation - Important to Water Balance

Israel Meteorological Service (IMS) focuses on

- **Daily Evaporation (several sites) for Plant Water Loss in a Variety of Crops**
  - **Observed Values from Class A Evaporation Pans**
  - **Calculated Potential Evapotranspiration**

Examples of Extra-Regional NMHSs AgroMet Focus

IRELAND - The Irish Meteorological Service

- **Daily Agricultural Forecasts with 3-day Outlook**
- **Extended 4/5-day Forecast**
- **Weekly 7-Day Farming Forecast & Farming Analysis of Forecast**

Focus on Agricultural Risk & Warnings

- **Spread of Potato Blight from May to September**
- **Forest Fire Risk**
- **Frost for Fruit Growers in Spring**
- **Advice on the Risk of Animal Diseases**

Examples of Extra-Regional NMHSs AgroMet Focus

KENYA

- 32 Agromet Stations operated by Kenya Met Dept., Agri Ministry, Universities & Agri Research Institutions
  - Wide Variety of Parameters
  - Focus on Prime Crops - Maize, Beans & Wheat
  - General Assessment of Crop Performance & Expected Yield
  - Crop Damage by Pests, Diseases & Adverse Weather

CONCLUSION

NMHSs in CMO Member States already provide varying levels of:

- **Agricultural/Hydrological Services**
  - **Farmers Forecasts (some NMHSs)**
  - **Crop Dusting/Spraying Forecasts (some NMHSs)**
  - **Precipitation Forecasts**
  - **Drought & Flood Forecasts**

- **Special Forecasts**
  - **Seasonal Predictions**

CONCLUSION

CAMI - To Help NMHSs in CMO States:

- **Improve Collaboration with Agro Services & Research Institutes in Product Development**
- **Improve Provision of Forecasts/Information on Rainy Season & Drought Potential**
- **Develop Products for Specific Crops & Agro Activities at National Level**

CONCLUSION

CAMI - To Help NMHSs in CMO States:

- **Develop Information for Pest & Disease Control**
- **Improve the Provision of user-friendly Weather & Climate Information**
- **Improve Understanding of Weather & Climate Information by Farming Community**

THANK YOU

Tyrone Sutherland

Coordinating Director

Caribbean Meteorological Organization