Drought and Precipitation Monitoring for Enhanced Integrated Water Resources Management in the Caribbean

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Order of Presentation

- Caribbean Water Initiative (CARIWIN)
- Monitoring and data collection for IWRM
- Experiences with drought and flooding
- Climate change: trends and future projections
- Caribbean drought and precipitation monitoring network
- Decision-making: mainstreaming drought and flood information

Caribbean Water Initiative (CARIWIN)

- Launched in February 2007
- Implemented jointly by McGill University, CIMH and three partner countries (Grenada, Jamaica, Guyana)
- Goal is to increase the capacity of the Caribbean countries to deliver equitable and sustainable IWRM by
  - Improving the capacity to meet water management needs
  - Integrating IWRM approaches into CIMH
  - Build national capacities of meteorology and hydrology (CIMH)
  - Multiplier effect throughout the Caribbean

Examples:

Grenada Water Information System

National water sector data systems made compatible with IWRM principles

Caribbean Drought and Precipitation Monitoring Network (CDPMN)

National water sector data systems made compatible with IWRM principles

Monitoring for WRM

- Water resources management is central to sustainable growth and poverty reduction
- Water availability and variability contribute to risks people face every day
- IWRM can assist with these, and mitigate other risks
- Discussions through CARIWIN revealed need for climate risk management incorporation into decision making
- The CDPMN is proposed as a regional network, hosted by CIMH to address:
  - Coping with extremes in the climate change context
  - Monitoring indices & centralized data (at CIMH)
  - Increasing training capacity (water management)

Experiences with Drought and Flooding

Drought

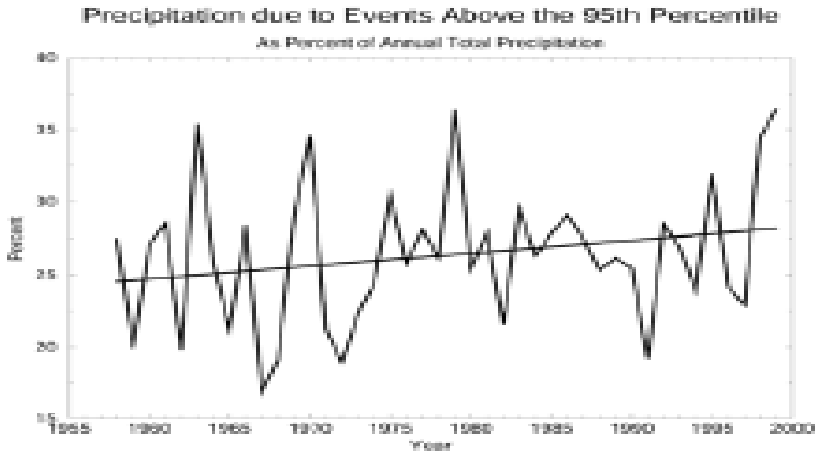
- 1997/98 El Niño caused widespread drought and forest fires in Guyana and Trinidad – loss of animals, timber
- …Guyana experienced water rationing, cessation of logging and river transport in some places
- …forced rice farmers to leave 35 % of their rice fields uncultivated and affected more than 1500 Amerindian families in Southern Guyana
- In Jamaica drought in 1997, prompted the government to offer the sector a US$ 100 million assistance package
- 1999-2000 drought, rainfall was less than 25 % of the average in some places, Jamaican authorities reported crop losses of approximately US$ 6 million between October 1999 and March 2000
- Carriacou also accounts for 30% of the nation's livestock production, and experienced losses of 20 and 40% due to drought in 1984 and 1992, respectively

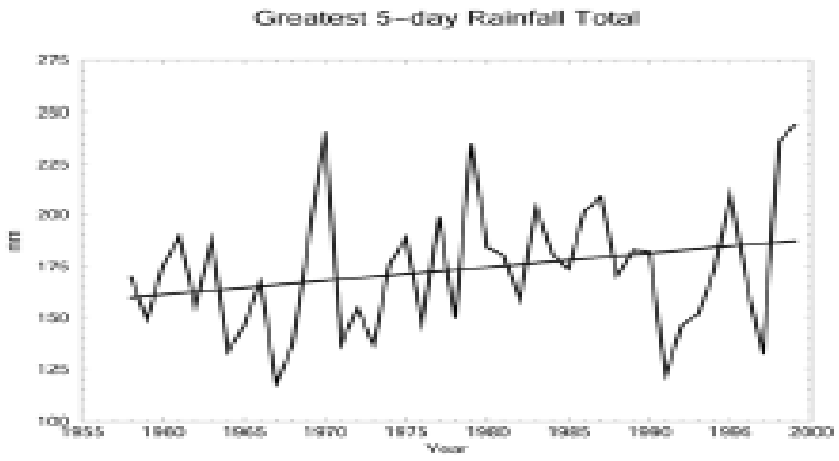
Flood

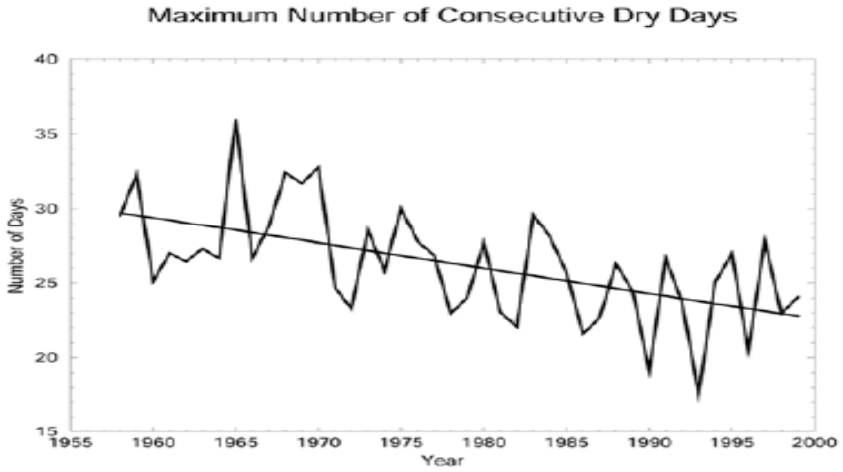
- Account for 70 % of all weather-related losses in the region's agriculture sector
- Guyana from January to February 2005 affected 37 % of the population, was blamed for the deaths of 34 people and
- Resulted in US$ 55 million in damage to agriculture sector which in 2004 accounted for 35.4 % of Guyana's GDP, US$ 250 million was lost in the housing sector
- A similar flood event in 2006 resulted in total losses to the sector of US$ 22.5 million
- In 2001, flooding associated with Hurricane Michelle, which resulted in some stations exceeding their average monthly total average on October 29 alone, damaged almost 2000 ha in crop farmland and approximately US$ 8 million in losses in crops and livestock

Climate Change: Trends and future projections

Trends of precipitation events since 1950







The maximum number of consecutive dry days is decreasing and the number of heavy rainfall events is increasing

Peterson et al. 2001

Climate Change: future projections

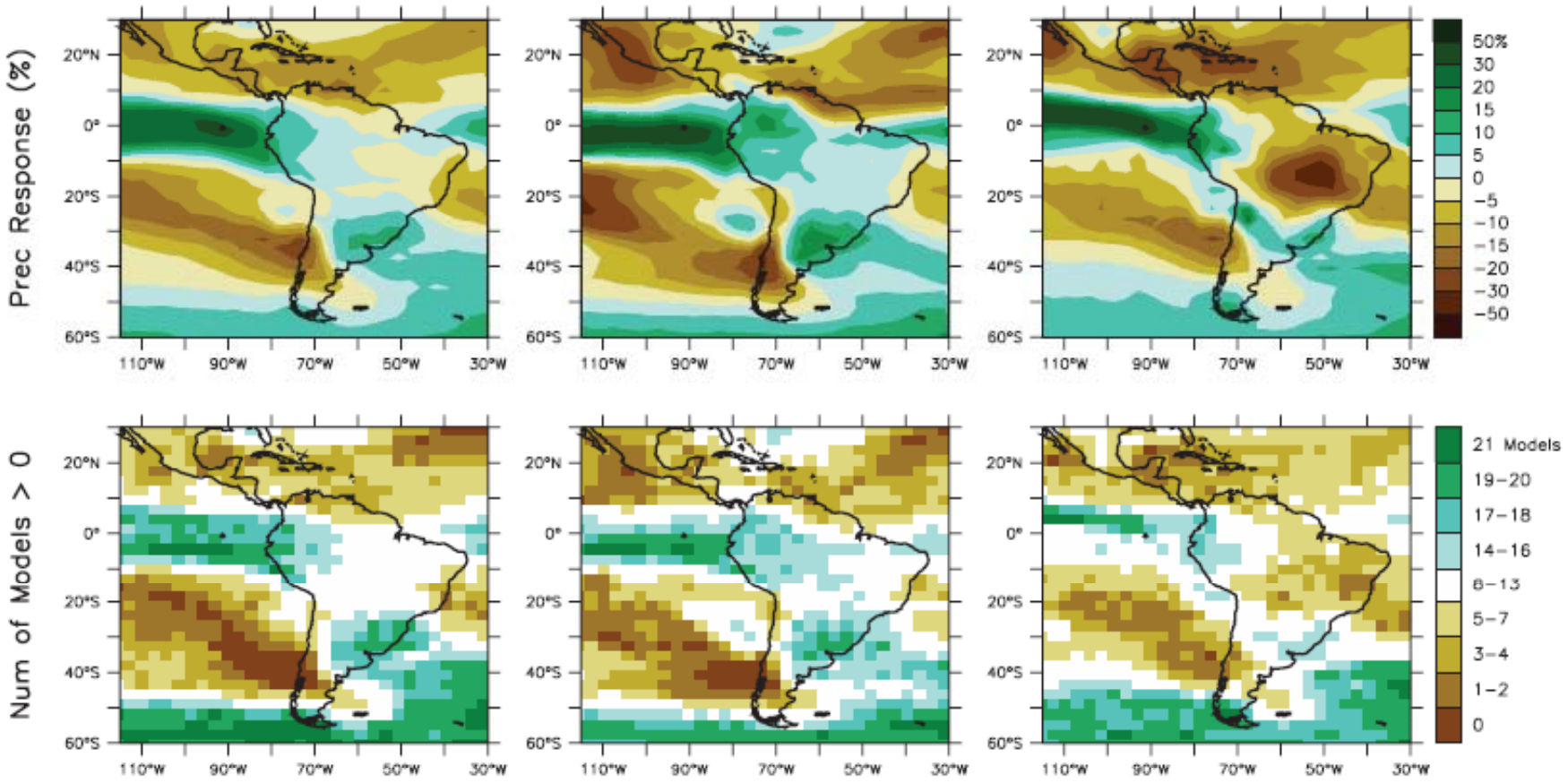
- Very likely (90 -99%) that temperatures will rise. Increase in mean annual temperature could be in the range of 0.8 to 2.5^{o}C by 2050.
- Greater uncertainty in the rainfall projections
- Most models predict a decrease in annual precipitation in the region of 5 to 15 % with the greatest change during the months of June to August

Table 16.2. *Projected change in precipitation (%) by region, relative to the 1961–1990 period.*

Region	2010–2039	2040–2069	2070-2099
Mediterranean	–35.6 to +55.1	–52.6 to +38.3	–61.0 to +6.2
Caribbean	–14.2 to +13.7	–36.3 to +34.2	–49.3 to +28.9
Indian Ocean	–5.4 to +6.0	–6.9 to +12.4	–9.8 to +14.7
Northern Pacific	–6.3 to +9.1	–19.2 to +21.3	–2.7 to +25.8
Southern Pacific	–3. 9 to +3.4	–8.23 to +6.7	–14.0 to +14.6

IPCC, 2007: WG2-AR4

Projected rainfall changes



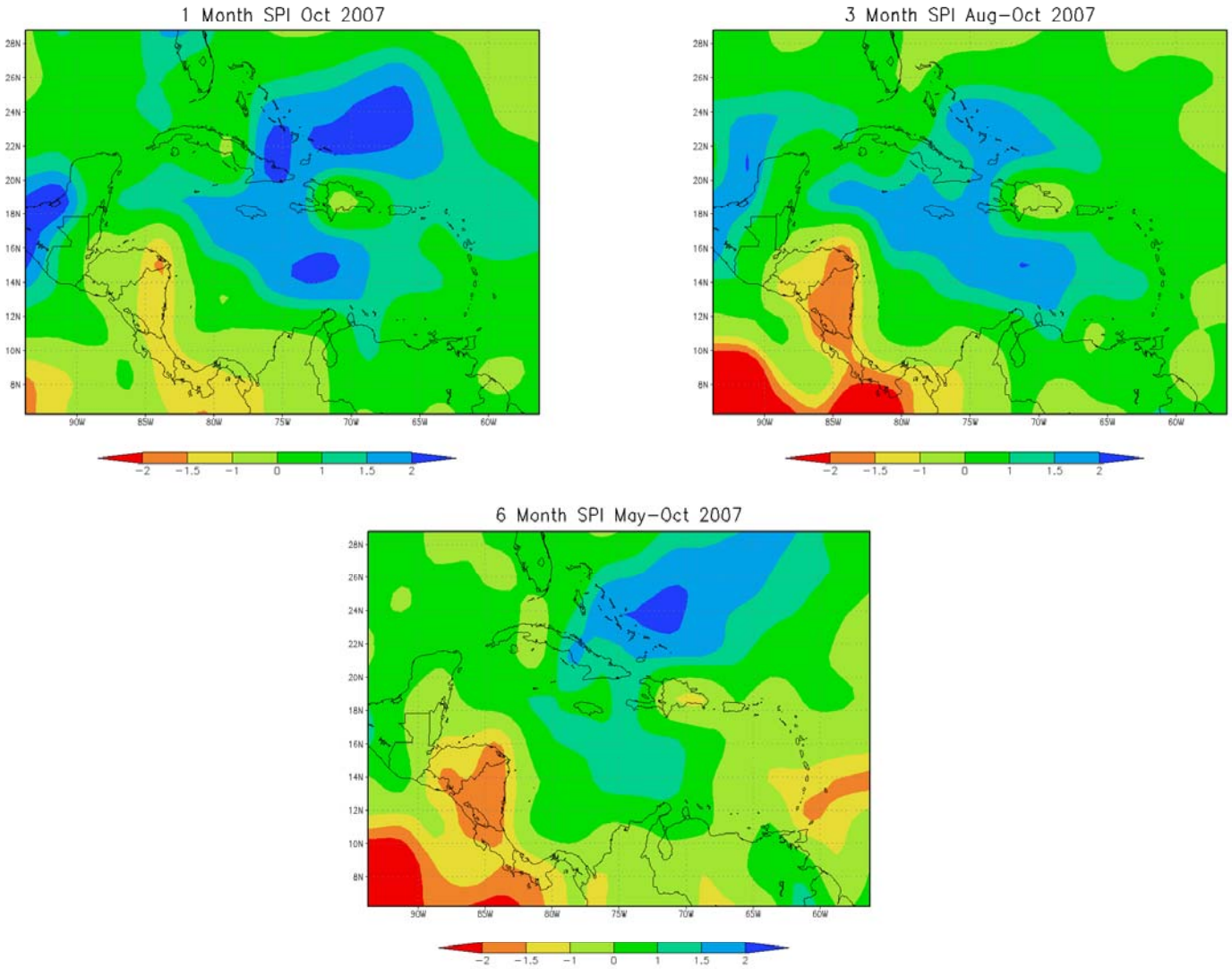
Top row: Fractional change in precipitation DJF and JJA between 1980 to 1999 and 2080 to 2099, averaged over 21 models .
Bottom row: number of models out of 21 that project increases in precipitation.

IPCC, 2007: WG2-AR4

Caribbean Drought and Precipitation Monitoring Network (CDPMN)

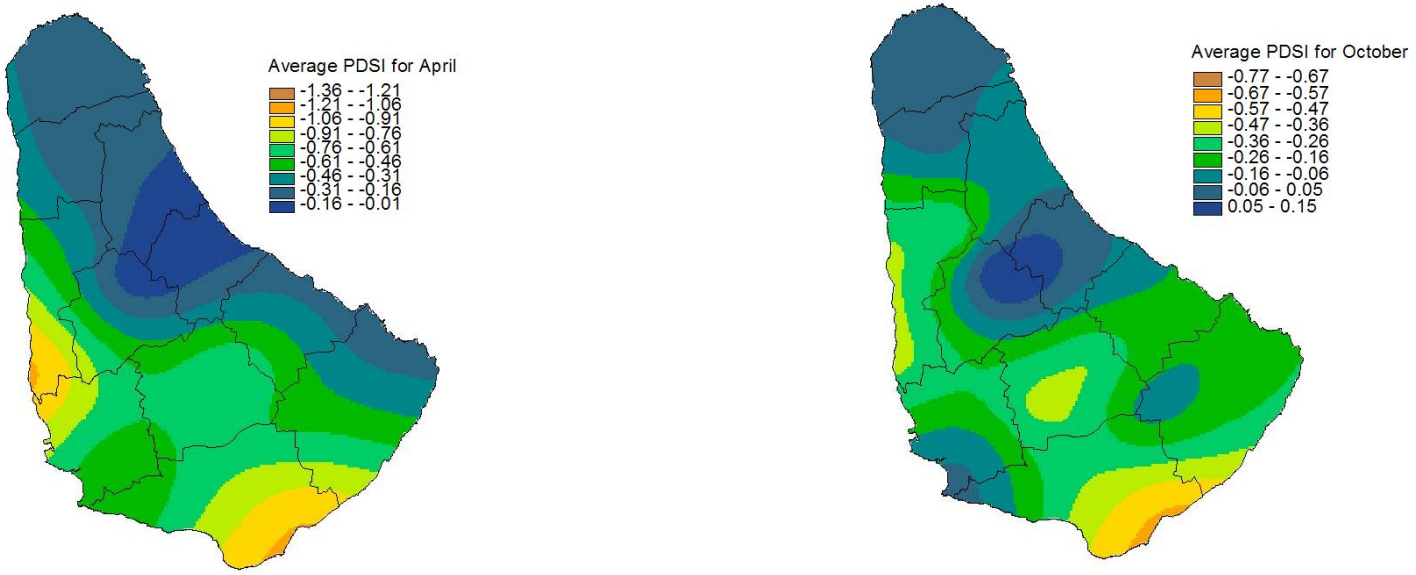
- Precipitation status monitored using a number of indices
- …Standardized Precipitation Index; Palmer Drought Severity Index; Crop Moisture Index
- Other indicators (e.g. water levels, state of vegetation and ecosystems)
- Final precipitation status determined, by consensus, by a network of persons from different sectors, institutions and communities embracing the diversity in definitions and impacts of drought
- Short term and seasonal precipitation forecasts to provide a projection of future drought (1 - 3 months)

SPI for the Caribbean



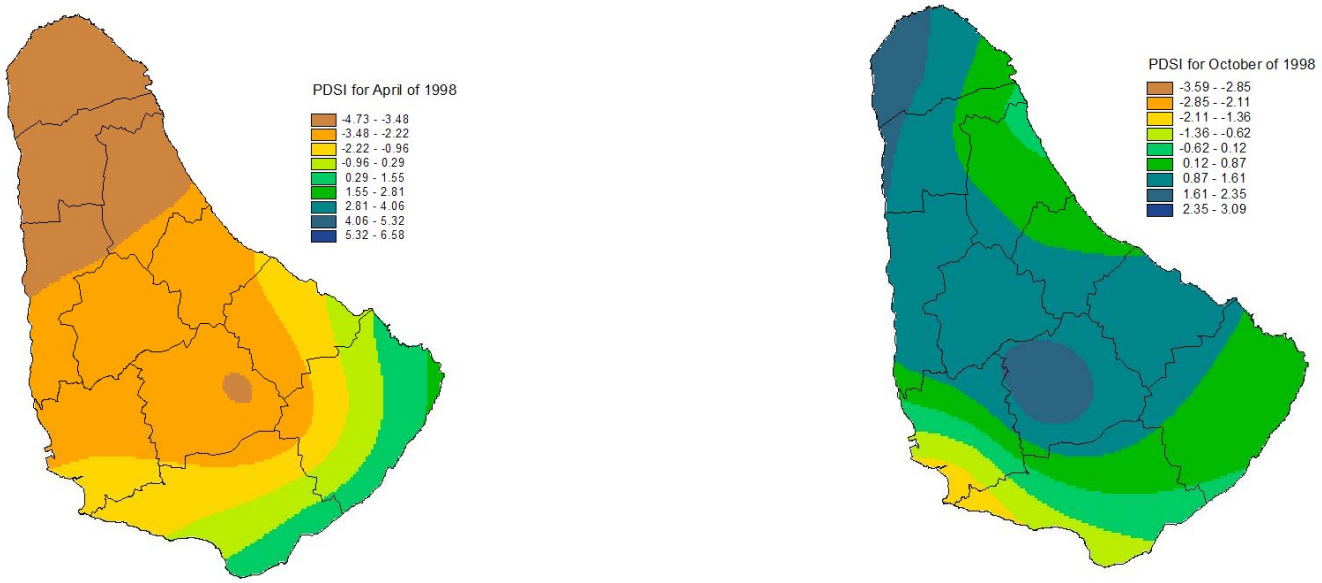
1-, 3- and 6 - month SPI for the Caribbean for October 2007

PDSI on Agricultural Drought in Barbados



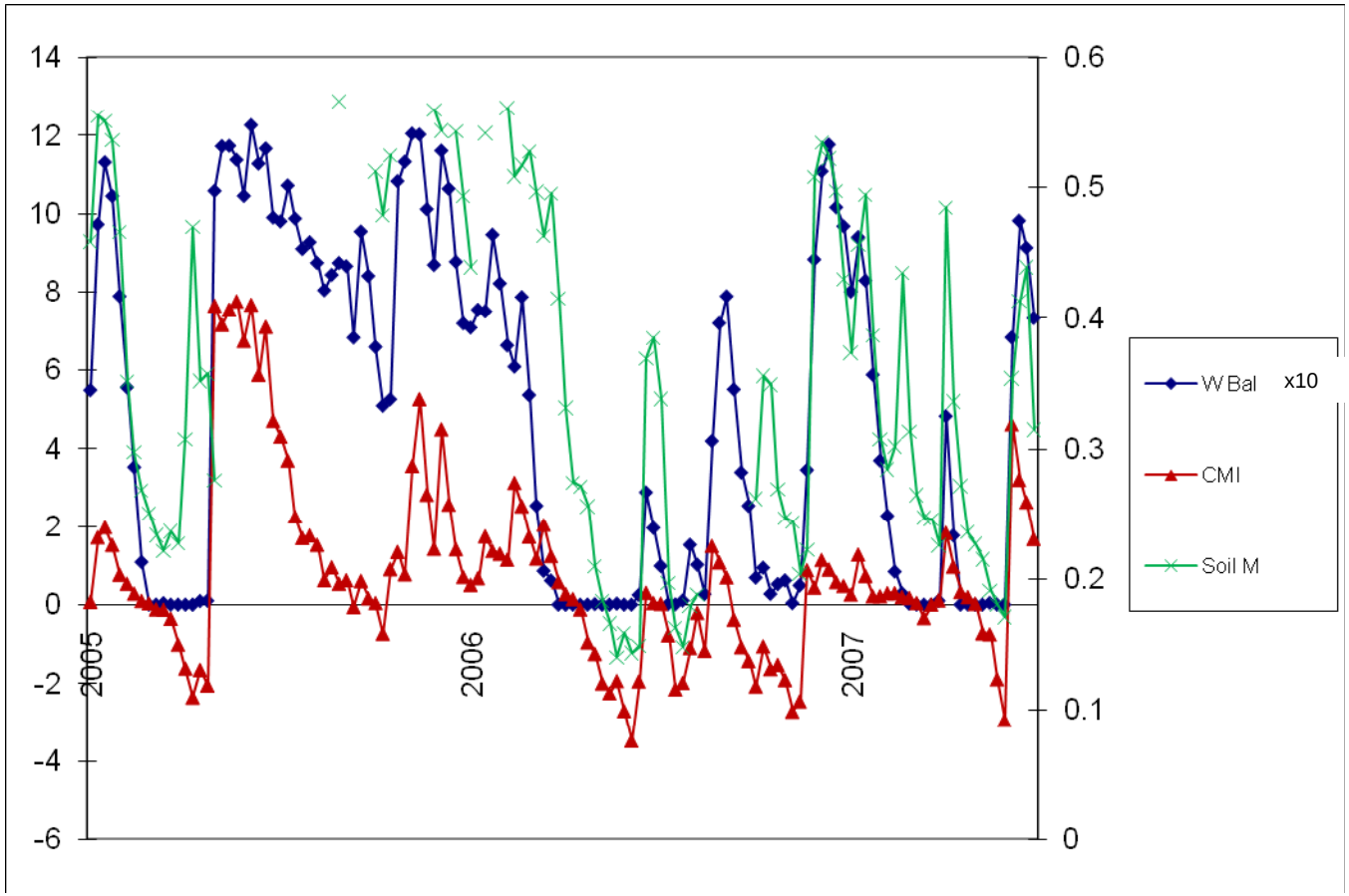
Mean PDSI values for April and October 2007

PDSI on Agricultural Drought in Barbados



PDSI values for April and October 1998 (an El Niño year)

CMI Appropriate for Agricultural Drought?



Time series of agricultural drought indicators from January 2005 to June 2007.

Monitoring stations

- One hydrological and meteorological monitoring station will be installed in each partner country
- The pilot communities for the three countries are

  - Great River (Grenada)
  - St. Cuthbert's Amerindian mission (Guyana)
  - Mile Gully/ Warwick Castle (Jamaica)

- The CDPMN will afford an opportunity for a participatory process, between CIMH, national and local governments and pilot communities, to propose new *community water strategies* which consider the extremes of drought and flood for water resource management

Outcomes of the CDPMN

1. Through the hydrometric stations and sensor data, monitor hydrological indicators, climate indicators...
2. Projection of future status (using precipitation forecasts and drought indices
3. Early warning information through CIMH website and networking with key agencies, governments
4. Build adaptation and response strategies to drought and flooding events – collaboration with a network of communities, researchers and decision makers

Drought and Flood Planning

MANAGING RISK

- Data collection, monitoring and dissemination
- Integrating climate indices and other indicators into routine decision making processes
- Determining existing needs, scientific knowledge gaps
- Forecasting, predicting, strengthening infrastructure
- Establish monitoring systems and early warning systems
- Information can then be used by decision makers at community level and national level to improve livelihoods

CDPMN Timeline

- This network is in the start-up phase
- Hosted by CIMH, will be web-based
- First announcement: June 24 on WIS in Grenada
- Others to follow in Jamaica, Guyana, Barbados
- Implementation over next year, completely operational by 2010

www.mcgill.ca/cariwin