

Caribbean Institute for Meteorology & Hydrology

CARIWIN Initiative

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Principal

UN Millennium Goals: 7 & 8

- **Goal #7: Ensure Environmental sustainability**
 - Integrate the principles of sustainable development into country policies and programmes; reverse loss of environmental resources
 - Reduce by half the proportion of people without sustainable access to safe drinking water
 - Achieve significant improvement in lives of at least 100 million slum dwellers, by 2020
- **Goal #8: Develop a Global Partnership for Development**
 - Address the special needs of landlocked and small island developing States

CIMH Mission Statement

- “... to assist in improving and developing the Meteorological and Hydrological Services as well as providing the awareness of the benefits of Meteorology and Hydrology for the economic well-being of the CIMH member states. This is ***achieved through training, research, investigations and the provision of related specialized services and advice***”.

CIMH History

- Caribbean Meteorological Institute (CMI) established August 23, 1967 under special funding from UNDP and WMO
 - 16 Commonwealth Caribbean Governments that comprise the Caribbean Meteorological Organization operate CMI
- CMI becomes affiliated with UWI in 1973
 - Undergraduate major in meteorology established in Faculty of Natural Sciences
- CMI designated by WMO as a Regional Meteorological Training Centre in 1978
- Caribbean Operational Hydrology Institute (COHI) established in 1982 and located at CMI
- CIMH established in 1987 by combining CMI & COHI

Existing 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



Meteorology Training Programmes

- WMO professional programmes
 - Entry Level Technician (6 months)
 - 2 courses conducted per year
 - 11 persons trained in 2006
 - Mid Level Technician (8 months)
 - 1 course per year
 - On-going course has 3 students
 - Senior Level Technician (18 months)
 - 1 course every two years
 - On-going course has 2 students
 - Next course starts in January 2008
 - *Applications of Meteorology*
 - Provides joint training in agrometeorology, hydrology, and climatology

Meteorology Training Programmes ... cont'd

- *B.Sc. Degree (joint with the University of the West Indies)*
 - Students in this programme are fully registered at the University but receive instructions in meteorology from staff of the Institute.
 - **UWI Quality Assessment Review (2007) recommended**
 - Inclusion of instruments lab course (may require an upgrade to the existing facilities)
 - Inclusion forecaster simulation course
- **M.Sc. Natural Resource and Environmental Management specializing in Applied Meteorology** *(joint with CERMES, University of the West Indies)*
 - The programme provides students with training in advanced techniques suitable for the analysis of meteorological and hydrological data and their application in various sectors of the regional economy.

Meteorology Training Programmes ... cont'd

- On-Line M.Sc. *(managed by the On Line Foundation for Meteorology & Hydrology)*

Over 1400 students have received training in Meteorology through CIMH

Hydrology Training Programmes

- *Hydrological Observers*
 - Four week course designed to train technicians on applications of hydrology databases, basic hydrometeorology observation techniques, and field activities.
- *General Technicians*
 - Six month course with students being trained in the fundamentals of surface water hydrology and hydrogeology. The course also covers water quality monitoring, basics of surveying, and instrument maintenance.
- *Higher Technicians*
 - This is an eighteen months course and is designed to allow personnel with several years experience to gain further knowledge in hydrology

Hydrology Training Programmes ... cont'd

- *Limited number of trained water resources professionals on most Caribbean islands*
- *No advanced training in hydrology and water resources management is currently being conducted at tertiary level institutions in the English-speaking Caribbean. However, sustainable management of water resources and flood mitigation and management are significantly lacking.*
- Few students are entering the programme so that the cost per student is high
- Redesign of the programme is required to expand the courses offered
- Development of an undergraduate programme in water resources management is being examined
- Hydrological observers course may be offered to the general public

Over 200 students trained through the programme since its inception in 1982

Future Plans for Training

- Review and redevelopment of the hydrology training programme to address current and future regional needs
 - Water resources management (surface water & groundwater)
 - Exploration
 - Development
 - Management
 - Policy
 - Flood forecasting and mitigation strategies (hydro-meteorology)
 - Disaster management
 - Climate change impacts
- Requirements
 - Collaborations with regional and international universities and training institutions
 - Funding to support
 - Infrastructural upgrades to support teaching and laboratory facilities
 - Appropriate staffing
 - Equipment and software acquisition

CIMH is developing a public education programme to attract more students into hydrology and is going to offer the Hydrology Observers course to high school students and the general public.

Future Plans for Training

- Continued expansion and diversification of the meteorology training programme to address current and future regional needs
 - Expansion of applied meteorology programmes to address
 - Analysis climate change and climate variability across the Caribbean region (including support for sealevel rise monitoring and analysis)
 - Development of agrometeorology expertise and products in the region
 - Development of marine meteorology products
 - Development of meteorology products and programmes aimed at pre-university students and the general public
- Requirements
 - Collaborations with regional and international universities and training institutions
 - Funding to support
 - Infrastructural upgrades to support teaching and laboratory facilities
 - Appropriate staffing
 - Equipment and software acquisition

Staffing

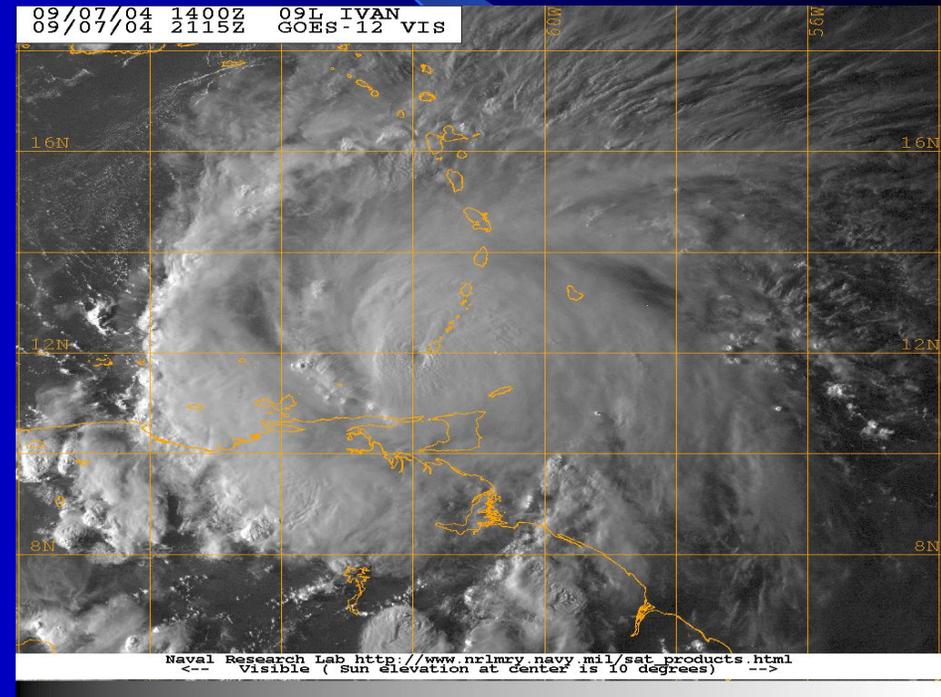
- Meteorology
 - Staffing
 - 6 academic staff (M.Sc. level or greater)
 - 11 technical staff
 - Equipment
 - Over 20 Linux and Microsoft Windows workstations
- Hydrology
 - Staffing
 - 2 academic staff (M.Sc. Level or greater)
 - 2 technical staff
- Instruments
 - Staffing
 - 2 technical staff (2 additional appointments will be filled shortly)
- Data Management & Networking
 - 7 technical staff
- Additional staffing
 - 12 administrative and support staff

Concern: Significant amount of staff turn over is expected in the next 10 years. As a result, a significant amount of resources will have to be committed to training and development.

Research & Development

Satellite & Marine Meteorology

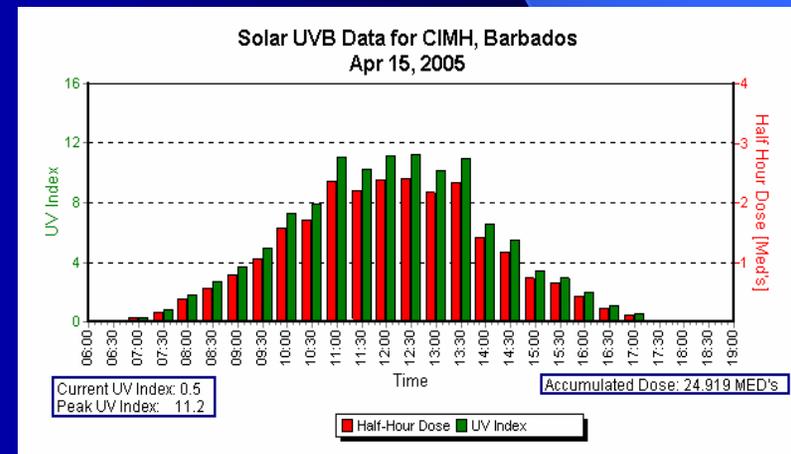
- Satellite capability is available but utilization is low due to limited training
 - RAMSDIS
 - COROBOR
- With the exception of storm surge modeling marine meteorology is not practiced
 - Marine activities are becoming important to national economies
- Needs:
 - Increased training in marine and satellite meteorology



Research & Development

Physical Meteorology

- Radar Meteorology
 - Development of packages to support realtime and short-term forecasting
 - Integration of radar output with numerical numerical modeling output to improve forecasts
- UV Studies
 - Supply of solar radiation data to the World Radiation Data Center, Russia
 - Measurement and analysis of UVB radiation levels for Barbados
 - Study of some of the factors which affect UV radiation levels
- Needs
 - Radar meteorology training will be required in the near future to replace retiring staff
 - Specialized training in radiation monitoring will be required in the near future



Research & Development

Computational Meteorology

- Application of Mesoscale Models to Support Weather Forecasting and Disaster Management

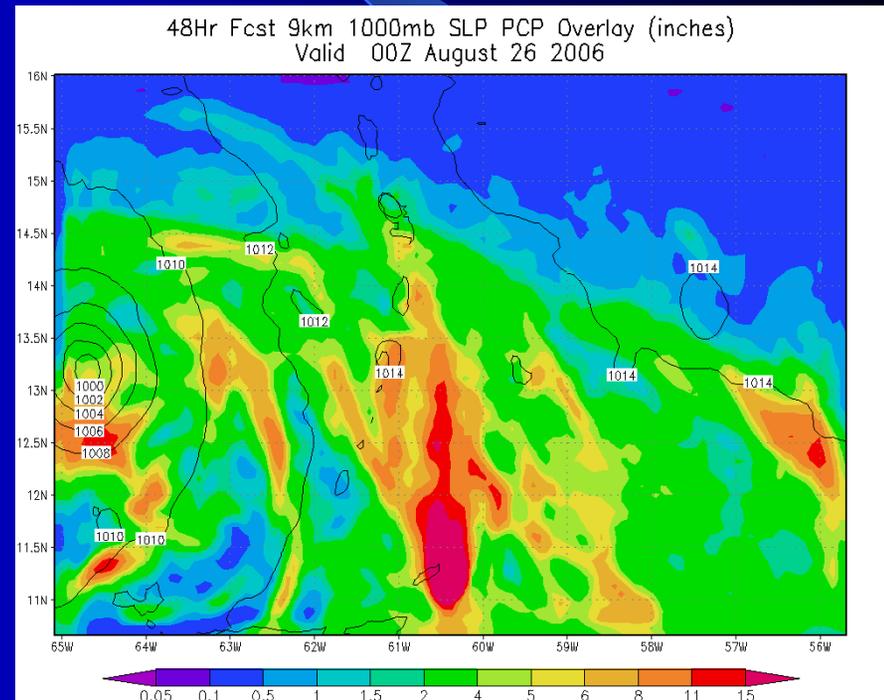
- MM5V3 and WRF used to support work
- Validation phase in progress
- Integration of modeling results into disaster management will commence this year
- Student interns are involved in this activity

- Climate Change Modeling

- Use of the PRECIS model to support analysis of climate change and climate variability across the Caribbean (MACC project)
- Outcomes being used to support sectoral analyses (e.g., impact of climate change on agriculture)

- Needs:

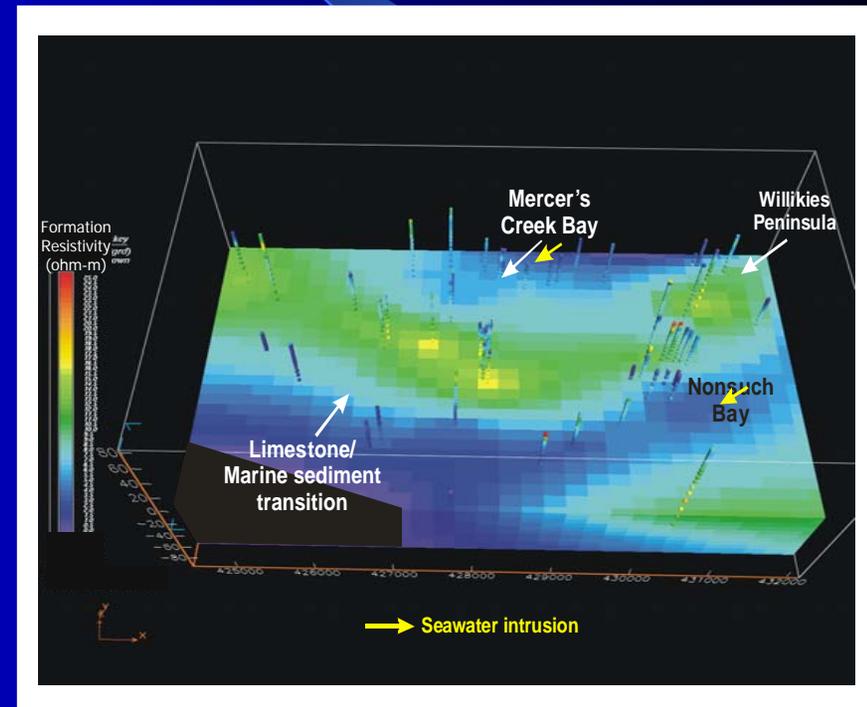
- Additional training in areas such as ensemble and probabilistic forecasting
- Increased computational capacity
- Increased collaboration and technical exchanges



Research & Development

Hydrology/Hydrogeology

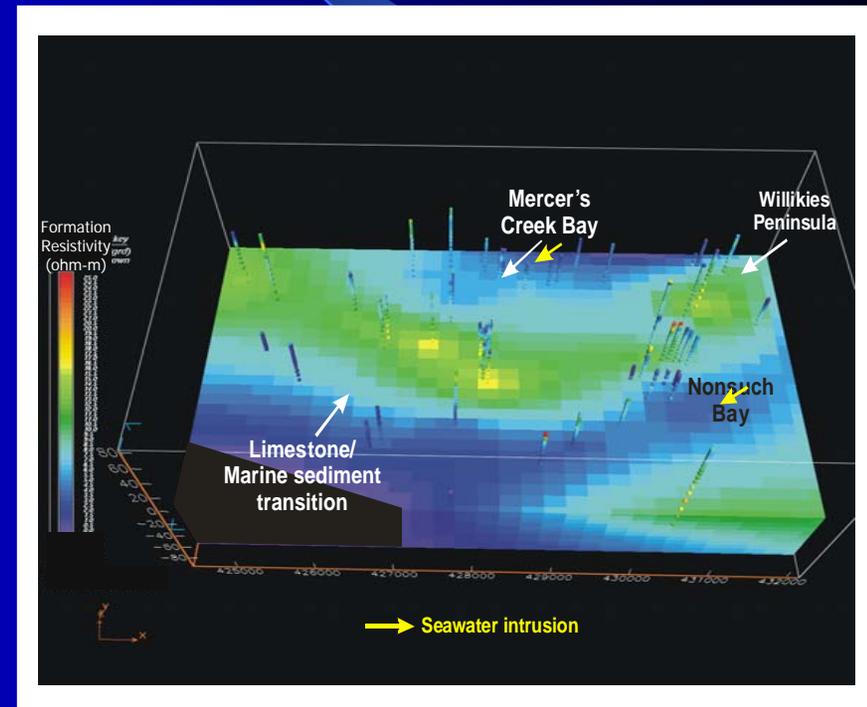
- Hydrometeorology
 - Floodplain mapping to support international projects within the region (JICA)
 - Storm surge modeling
 - Stream flow modeling
- Hydrologic Site Characterization
 - Application of geophysical methods to characterize and monitor aquifer systems and construction sites (including proposed radar site on Barbados)
- Groundwater & solute transport modeling
 - Seawater intrusion modeling to support sustainable groundwater management of karst aquifers



Research & Development

Hydrology/Hydrogeology

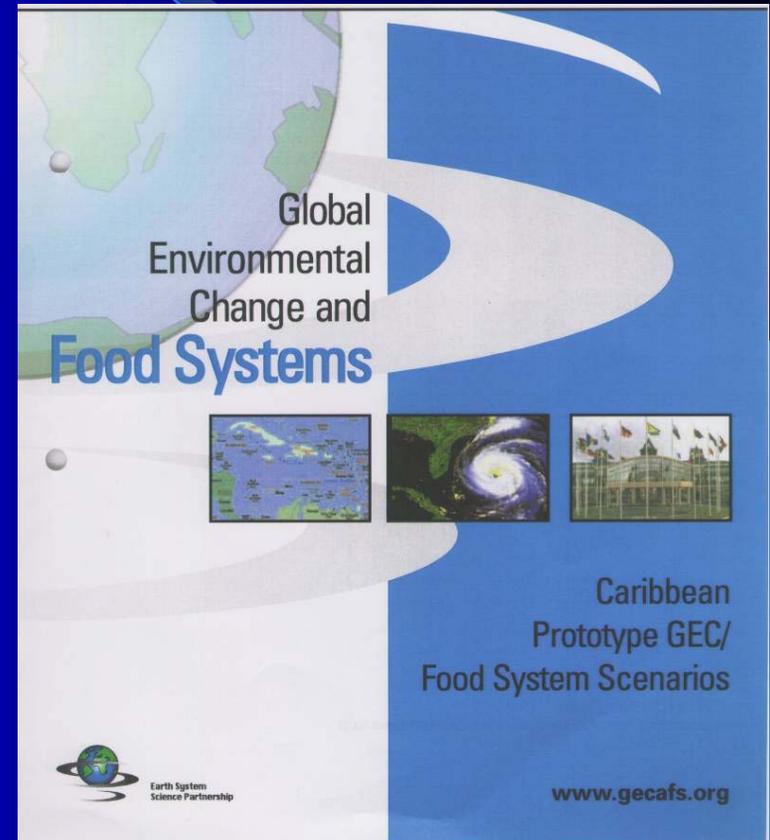
- Realtime Monitoring
 - This is an area of interest that we have been approached about.
- Vulnerability Assessments & EIS/EA
 - Area of interest
- Disaster Management
 - Area of interest
- New Project
 - CARIWIN
- Needs:
 - Software to support modeling activities
 - Collaborations to support staff training
 - Laboratory facilities
 - Equipment to support site characterization and real time data acquisition



Research & Development

Agrometeorology

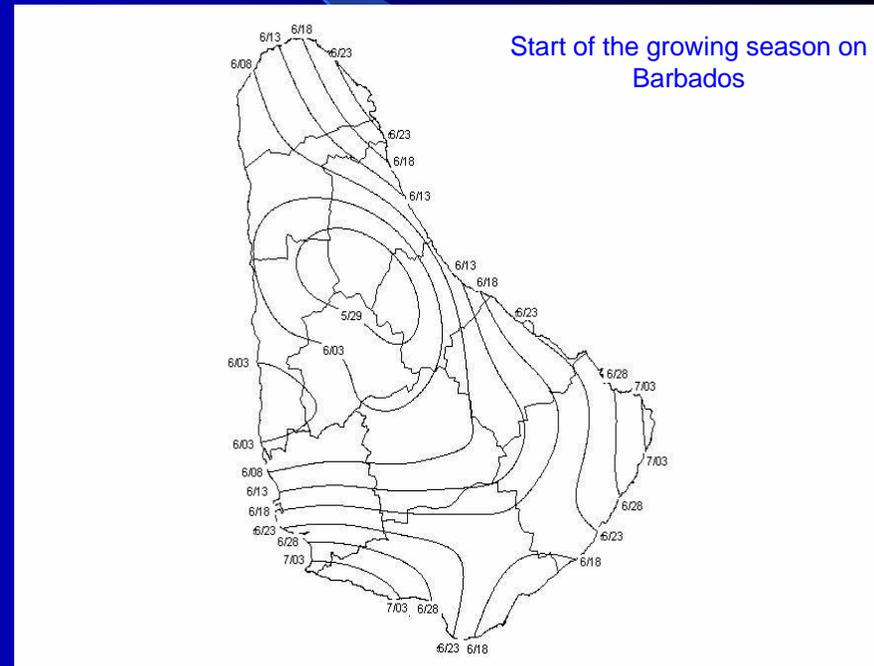
- Food system research within the project Global Environmental Change and Food Systems (GECAFS)
 - regional component GECAFS Caribbean
- Impact and vulnerability studies of climate variability and change on agriculture
 - Sectoral study in Mainstreaming Adaptation to Climate Change (MACC) project
- Crop water and irrigation requirement research



Research & Development

Agrometeorology

- Crop growing seasons and agroclimatic zoning
 - Started for some islands but needs to be expanded to all islands
- Development of drought indices to support agriculture planning
- Needs
 - Training of additional staff to support these activities
 - Development of agrometeorology laboratory and field testing facilities



Instrument Calibration and Maintenance

- Regional Instrument Calibration Laboratory
 - Establishment of the instruments calibration lab should be completed by the end of February 2007
- Sealevel Monitoring and Equipment Maintenance
 - CIMH currently involved in redevelopment of sealevel monitoring stations across the Caribbean
 - CIMH will be responsible for maintenance of several of these stations
- Regional Maintenance/Support
 - CIMH continues to support requests from regional meteorological office and governments
- Needs
 - New staff will be joining CIMH in the near future. These staff will require training

Regional Data Archiving Centre

- Responsible for storing the meteorological data from national meteorological services in the Caribbean
 - Not all stations submit data
- CLIDATA system
- Few data products produced from data collected
- Needs
 - CLIDATA system need to be installed at all meteorological offices in the Caribbean to ensure smooth data transfers
 - Support needed to identify products that can be developed from the data

Goals of Water Resources Management

- Production of a freshwater supply that meets demand and is affordable
- Resource characterization and evaluation
- Resource protection ... including
 - Identification of future impacts
 - Development of mitigation strategies
 - Establishment of regulatory frameworks
- Identification and protection of alternative water resources for future use

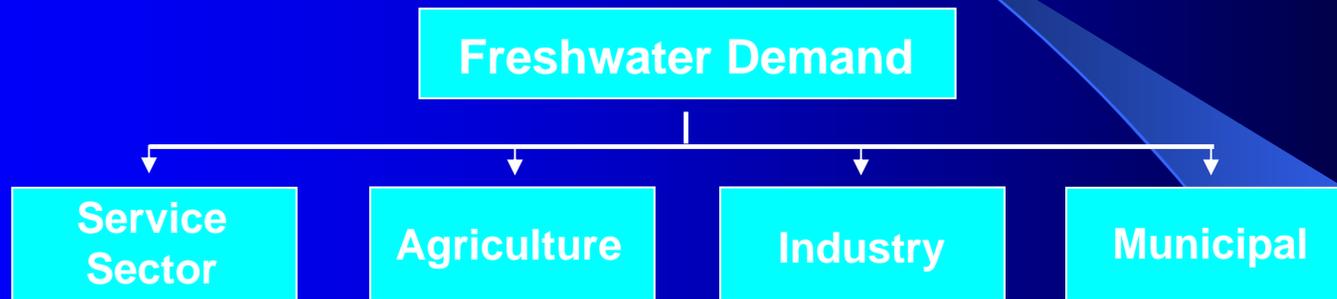
Achieving Water Resources Management Goals

- Requires understanding and quantifying
 - Dynamics of the system ... achieved through
 - Data collection and analysis
 - Model, calibration, and validation
 - Monitoring and testing
 - Stresses on the system (past, present, and future)
 - Natural system variability
 - Anthropogenic factors
 - Physical principles governing the system
- Requires institutional capacity to develop and maintain systems
 - Training and technology transfer
 - National, regional and international collaborations and consultancies
 - Funding
- Requires an understanding of future challenges

Water Resources Concerns in the Caribbean

- In many cases limited freshwater resources
- Susceptibility to water stress due to competing factors and demands
- Fragile ecosystems
- Extensive interface between land and sea
- Vulnerable to extreme climate events

Water Resources Concerns in the Caribbean



Service Sector	Tourism and related sectors are heavy user of freshwater. National Water Commission of Jamaica estimates that the tourism sector require 10x more water per capita than the domestic sector.
Agriculture	Regional water demand in this sector has not been thoroughly assessed (except Jamaica). Expected that demand will vary depending on the type of crop and its contribution to GDP.
Industry	Use of water by industry is generally not well documented.
Municipal	Not well defined on most islands ... limited metering of homes.

Water Resources Concerns in the Caribbean

Country	Water Availability (x10 ⁶ m ³ /yr)		Water Supply (x10 ⁶ m ³ /yr)		Desalination Plants
	Aquifer	Surface	Aquifer	Surface	
Antigua & Barbuda	4.6		4.6		2
Barbados	76	6.3	> 76	> 6.3	1
Belize	N/A	N/A		3.1	1(?)
Dominica		26		>16	
Grenada	1.7	8-11.6	0.8	8	3
Guyana	2355-11775		65		
Haiti	0.13		0.13		

Water Resources Concerns in the Caribbean

Management Issues from IICA Meeting in St. Lucia (1999)

Resource Management	Multiple institutions involved in water resources management in any one country. However, no mechanism exists to facilitate integration of respective priority actions and to assess their combined impact on water resources development planning.
Data Collection & Inventory	Data are critical for planning, design, and implementation of water resources projects and achieving management objectives. Many islands lack basic data on available resources, supply, and demand.
Institutional Capacity, R&D	Institutional capacity with regard to water resources and management is generally weak. This has adverse impacts on research and development project activities and the successful implementation of integrated water resources projects.
Market Based Frameworks	Water rights, water markets, and pricing are not an important component of resource management. This framework is essential to funding development and growth.
Regulatory Frameworks	National policies, frameworks, and laws to protect freshwater resources are often non-existent, poorly implemented, or out-dated.

What is CARIWIN?

Where Does It Fit In?

The Caribbean Water Initiative (CARIWIN) is a collaborative effort between the Caribbean Institute for Meteorology and Hydrology (CIMH), Caribbean partner governments, and McGill University's Brace Centre for Water Resources Management (BCWRM) to address some of the complex challenges to water resources management in the Caribbean region.

The goal of CARIWIN is to increase capacity of Caribbean countries to deliver sustainable and equitable integrated water resources management (IWRM).

What is CARIWIN? Where Does It Fit In?

To develop the mindset of integrated water resources management in the Caribbean, the CARIWIN project will strengthen CIMH's ability to integrate such concepts into its existing training programmes.

Through CIMH, CARIWIN will pilot capacity building initiatives aimed at the national, local government, and community levels in Jamaica, Guyana, and Grenada. Barbados will benefit from being the host country of the project.

What is CARIWIN?

Where Does It Fit In?

- Specific benefits to CIMH include
 - Systemization of CIMH's approach to regional training in integrated water resources management through
 - Issuance of a certificate programme in the subject
 - Short term training programme in issues related to the subject
 - Expansion of CIMH's ability to interface with important sectors of the population and economy that can benefit from the implementation of an integrated water resources management programme (downstream users and beneficiaries)
 - Ability of CIMH to coordinate the development of national and regional policies and activities related to integrated water resources management
 - Upgrading of existing facilities to accommodate CIMH's thrust into this area of work