CIMH

Caribbean Institute for Meteorology & Hydrology

THE ADVISORY

APRIL 2012

Delve into the first edition of the quarterly newsletter of the **Caribbean Institute for Meteorology & Hydrology** (CIMH) for 2012. This edition corresponds with the celebration of our 45th anniversary. Many persons still affectionately refer to the Institute as the Caribbean Meteorology Institute (CMI), while some of you only know it as CIMH, this edition will give the CMI to CIMH story. The edition will also provide insight into what the CIMH does and some of the great work being done by our staff.

In this Issue:

45th Anniversary CELEBRATIONS

September 22nd- Anniversary Gala Awards & Retirement Function

November 24th- Karaoke & Lime

TBA - Fun Day

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2011

FOREWORD

Dear friends,

Welcome to the launch of our quarterly magazine "The Advisory". As many of you may recall, during 2006-2007, CIMH launched its first online magazine "the Outfield" to provide readers with valuable weather and climate information to support preparations for the 2007 World Cup of Cricket. The Outfield was well received by its readership in the Caribbean and internationally for the quality of the information conveyed. Unfortunately, The Outfield was designed to come to a conclusion following the World Cup. Since that time, we have debated coming up with a new and sustainable magazine to inform readers of important weather and climate related activities in the region. As the discussion on weather and climate and their impacts on the region evolve, we believe it is critical to communicate this information to all stakeholders to ensure that better decisions are made. This desire has led us to launch this new periodical.

So why launch at this time? Well, March 2012 marked the 45th anniversary of the Caribbean Institute for Meteorology (CIMH). As you can imagine, being in operation for this length of time makes us one of the oldest Caribbean Community (CARICOM) Institutions and that for us is an amazing accomplishment given the ebb and flow of finances within the region. It also speaks volumes to our ability to adapt to the changing environment in the region and to constantly reassess our priorities and set new goals given the changing demand for weather, climate and hydro-meteorological services in the region.

As you can imagine, being in existence for 45 years means that we have a rich legacy with many wonderful stories to tell. This edition recounts some of these stories from our first twenty (20) years of operation. The founding of CIMH is a wonderful story, summaries of many of the original letters written by the Rt. Honourable Errol Walton to support the establishment of the organization are still in place along with the minutes of many meetings related to the matter. Mr. Barrow's strong support testifies to his insight into weather and climate and its role in the sustainable development of the region. On the topic of legacy and the preservation of the historical, this first edition also discusses two important CIMH projects that deal with the importance of historical climate data to the our adaptation to future climate change "the Caribbean Agrometeorological Initiative (CAMI)" and the "Caribbean Climate and Data Rescue Project" which are seek to rescue old climate data before they are lost for ever.

How often have you heard the saying "water is life?" The drought of 2009-2010 certainly made many of us pay more attention to water issues in the Caribbean and brought the forecast water deficits predicted for the future to the present. In this issue, we highlight the excellent research work of one of our young scientists who is developing the first comprehensive groundwater management model for Barbados. We are very excited about this work as it allows us to manage current day groundwater abstraction, forecast seasonal water availability and assess groundwater availability under changing climatic conditions. Lessons learned from this important activity will be shared with the region.

Let us stimulate, educate and update you about the meteorological, hydrological, agrometeorological news and trends within the region and globally. We look forward to receiving your feedback as we continue to produce a newsletter that your enjoy.

Dr. David Farrell Principal

In this issue

By David Farrell (P.G, Ph.D, MSc, BSc)

Technical support to Member States

As part of its mandate, CIMH provides technical support to member states. In this newsletter we highlight technical support provided to the Government of Dominica over the last year. In July 2011, The Matthieu earth dam formed by the damming of the Matthieu River by a series of landslides starting from 1997 failed, flooding a large portion of the lower section of the Layou River Valley. In addition to the flooding large amounts of silt were deposited in the river valley raising the base of elevation of the river. In response to the event, CIMH staff visited Dominica to support assessments of the safety and stability of the remnant dam as well as the lower section of the watershed.

By Shawn Boyce, (MSc, BSc)

CIMH & First Annual Colloquium

World Water Day and World Meteorological Day 2012 were celebrated on Thursday, March 22 and Friday, March 23 respectively. CIMH commemorated World Water Day and World Meteorological Day by hosting the first of an annual colloquium series on Friday, March 23.

Mr. Adriel Valentine, who is a student intern at the CIMH who is currently pursuing an M.Phil through collaborations with the CIMH, The University of the West Indies, Cave Hill Campus (UWICHILL) and the Max Planck Institute for Meteorology (MPI-M) presented "The Variation of Shallow Cumulus Rainfall for Radar Observations. "

Meanwhile, Mr. Karl Payne who is a research assistant at the CIMH, presented, "A Three-dimensional Numerical Model of Saline Intrusion for the Island of Barbados."

CIMH &the BWA Week of Activities

By Shawn Boyce, (MSc, BSc)

CIMH also participated in the Barbados Water Authority (BWA) week of activities in celebration of World Water Day 2012 by contributing to a showcase held on March 21 that aimed to educate the youth and wider public about water conservation and protection issues. The CIMH provided an exhibit that demonstrated how water is stored in the subsurface in addition to showcasing aspects of the ground water management model that is currently under development.

CIMH at the National Career Showcase

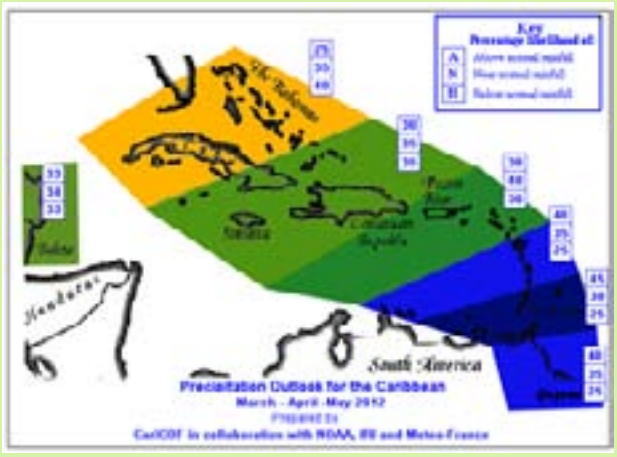
By Andrea Sealy (Ph.D)

CIMH participated in the Barbados Association of Guidance Counsellors (BAGC) National Career Showcase on Thursday and Friday, March 1st and 2nd, 2012 at the Lloyd Erskine Sandiford Centre.

Caribbean Climate Outlook Forum (CariCOF)

Regional Climate Outlook Forums (RCOF) are providing critical information that enhance the performance of hydro-meteorological and climate early warning systems. These RCOFs which are), sponsored by the World Meteorological Organization (WMO) and active in several parts of the world, lead to targeted and more effective disaster risk reduction across multiple sectors. In 1998, an RCOF was established in the Caribbean that soon quickly became inactive, leaving the Caribbean Institute for Meteorology and Hydrology (CIMH) alone to provide the service of regional seasonal rainfall forecasts.

In June 2010, however, a workshop was convened to re-establish the Caribbean Regional Climate Outlook Forum (CARICOF) in order to develop a sustained collaborative process. As a follow up to this workshop, in February 2012, the Caribbean Institute for Meteorology and Hydrology collaborated with the sponsors National Oceanographic and Atmospheric Administration (NOAA), WMO, The International Research Institute for Climate and Society (IRI) and the Caribbean Community Climate Change Centre to host the 2012 CARICOF.



The 2012 CARICOF consisted of three separate but complementary activities:

1.A Technical Training Workshop, which provided an opportunity for regional meteorological services to develop and utilize relevant information and tools, including forecasts.

2.A Partnership Workshop which brought together key partners and users of information in order to help develop a dialogue on the value and utility of available information and tools.

3.An Outlook Forum where products from the training workshop were used to develop the official Climate Outlook as the final activity CIMH looks forward to many future consensus forecasts emanating from this process.

Dr. Anderson Ward joins CIMH

In February 2012, Dr. Anderson (Andy) Ward joined the staff of CIMH under a short-term contract. Dr. Ward holds a Ph.D. in Vadose Zone Hydrology from the University of Guelph, an M.Sc. in Soil Physics also at Guelph, and a B.Sc. (1st class hons) in Agriculture from the University of the West Indies, St. Augustine. He has spent most of his career as a Research Scientist for Geohydrology at the Pacific Northwest Laboratories in Richland, Washington, USA. There, his primary role was to discover, evaluate, and integrate knowledge of the transport and fate of reactive contaminants, particularly radionuclides, and apply it to the development of groundwater remedial and protection strategies for U.S. Department of Energy waste sites. Dr. Ward is one of the developers of the STOMP code used to model ecohydrological processes and is an adjunct professor in the Department of Civil and Environmental Engineering at Washington State University. While at CIMH, Dr. Ward will be working with the staff on a number of groundwater management projects. Currently, Dr. Ward and the CIMH staff are working on updating the groundwater model for Barbados previously developed at CIMH. Dr. Ward will also support the various research and training programs of the CIMH.

THE CIMH CHRONICLES

By Judith King and Sandra Moore

1967

On Aug 23rd, 1967 the Caribbean Meteorological Institute (CMI) was established in Barbados at the former Husbands Plantation. The CMI was established by the Caribbean Meteorological Service in conjunction with the United Nations Development Programme (UNDP) and the World Meteorological Organization (WMO). In its inception the island and country membership included; Anguilla, Antigua, Barbados, British Virgin Island, Dominica, Grenada, Jamaica, Monsterrat, St. Kitts, St. Lucia, St. Vincent, Trinidad, Belize & Guyana).

The CMI's objectives at this time were to train personnel from the region, as there was a dearth of suitably trained regional observers and forecasters, as well as to conduct investigations and research into meteorologically related problems. However apart from training the Institute was also designed to fulfill several other functions including;

- Provision of facilities for maintenance, repair and calibration of meteorological equipment both at the Institute and the member country locations
- Collection, storage and analyzing of climatologically data from all participating member states
- Procurement and maintenance of a stock of meteorological instruments, spares and other consumables.

Additionally, the Institute played a major role in providing training and maintenance assistance to the six weather radars and agrometeorological observing stations within the region.

In order to carry out its mandate and achieve its objectives, the Institute established six sections; Agrometeorology, Hydrometeorology, Climatology, Instruments, Aerology and Administration. Each of these sections was then headed by an expatriate UNDP expert, while suitably qualified persons from the region were recruited and trained at various universities in the United States of America and the United Kingdom. These persons returned to the Institute and assumed responsibility for the various sections by 1975.

1973

A formal agreement between the Caribbean Meteorlogical Council and the University of the West Indies in 1973 provided a high degree of cooperation between the Institute and the University. The University introduced Meteorology as one of its BSc. Degree options in the Faculty of Natural Sciences and it is taught by the Institute's staff. The cooperation between the Institute and the University also extends to the development of graduate programs and research in meteorology.

1974

As the regional meteorological services expanded, it became evident that training programs were needed with specialization in various areas and at the lower levels. The Institute developed a six month program (ClassIII) for senior observers in the areas of Agrometeorology, Climatology, Hydrometeorology, Radar Meteorology and Instrument Maintenance and Repair. Other short specialized courses have been offered in areas such as Satellite Meteorology and Interpretation of Numerical Weather Prediction Products.

1978

In 1978, CMI was designated a Regional Meteorological Training Centre (RMTC) for the Regional Area IV (RA-IV) by the WMO and has continued in this role since then. The Institute, however, is unable to offer courses to Spanish speaking countries in this area.

1982

The regional governments established the Caribbean Operational Hydrology Institute with assistance from UNDP, WMO and the Netherlands Government. It was located at the CMI to take advantage of existing staff and infrastructure. The Netherlands government provided the staff and equipment and established the training programs in conjunction with local staff. The programs were offered at two levels – a General Technician course and a Higher Technicians course of 18 months. This Institute was unique in the developing English-speaking world and as a result, several countries, primarily African, have shown an interest in our programs. To date four Gambians and one student from Bhutan have been trained.

1987

As both the CMI and COHI were controlled by the same Governments and there are many areas of overlap, the Caribbean Meteorological Council decided in 1987 that the two Institutes should be amalgamated to form the Caribbean Institute for Meteorology and Hydrology. The name change was finally ratified in 1997 by the member governments. The CIMH continues to carry out the functions of the former Institutes utilizing the same facilities and staff members wherever the functions overlap.

TODAY

CIMH can now boast of having trained personnel from every Meteorological office in the English speaking member countries, indeed in some cases CIMH has trained the entire staff. The Institute can also boast of training persons from the Bahamas, Suriname, Africa and the South Pacific. In fact today we have four students studying at the Institute who hail from from Papa New Guinea, Solomon Islands, Samoa and Vauatu.

Moreover CIMH works with a number of capacities in a variety of projects; providing assistance, overall management and execution and other supporting tasks on projects with CARICOM, UNDP, WMO and the European Union and many other reputable agencies across the region and the globe.

Here at CIMH we are constantly reviewing our training programs to ensure we stay abreast of new technologies and knowledge and meet the changing demands of our regional and global stakeholders.

COURSES TODAY

METEOROLOGY

BSc. Meteorology	formerly Class I
Senior Level Technician	formerly Class II
Mid-Level Technician	formerly Class III
Entry level Technician	formerly Class IV

HYDROLOGY

Diploma in Hydrology	formerly Senior Level Technicians
Hydrological Technicians	formerly General Hydrological Technicians
Hydrological Observers	

GROUNDWATER MODELING:

A SALINE INTRUSION MODEL FOR EFFECTIVE GROUNDWATER MANAGEMENT FOR BARBADOS

By Karl Payne (MEng, M.Phil, BSc)

Introduction

Most islands within the Caribbean are reliant on groundwater as their primary source of potable water. Barbados is no exception since the island almost exclusively meets its potable water demand through abstraction from karst aquifers. Desalinated water only accounts for five percent of the island's water supply. Many of the pumping wells across the island are located in coastal areas and are therefore susceptible to seawater encroachment. Under natural undisturbed conditions in a coastal aquifer, an equilibrium state is maintained with a stationary interface between freshwater and seawater. Unfortunately, if abstraction from coastal aquifers is not prudently managed harmful consequences can result. The phenomenon of sea water encroaching into freshwater aquifers is called sea water intrusion. Apart from overexploitation of groundwater resources from coastal aquifers, water quality in freshwater aquifers on the island is threatened by anticipated rise in sea level and a decline in precipitation. Long-term degradation of the island's water quality as a result of saline intrusion can severely affect the island's industrial, agricultural, and social sectors.

In light of the need to develop an effective long-term sustainable management framework of groundwater systems on Barbados, the CIMH has embarked on a research project which began in 2009 that will attempt to deal with groundwater management issues including:

- Optimization of groundwater pumping while minimizing saline intrusion.
- Projecting the impact of climate variability and change on the island's water resources.
- Providing a platform for informing the island's land use policy.

Development and successful implementation of a groundwater management system requires a groundwater flow model capable of modeling density-dependent fluid flow within karstic hydrogeologic systems. An accurate island-scale three-dimensional model accounting for density driven transport has been developed and calibrated using the HydrogeoSphere numerical model. The model will hopefully serve as a platform for groundwater management of the island's aquifers.

What is a Model?

A groundwater model is a mathematical representation of a groundwater flow system. The model simulates groundwater flow by means of solving governing equations that represent the physical processes that occur within the system. Models help researchers understand subsurface fluid flow and contaminant transport processes. They are also useful in analyzing the responses of aquifers to variations in existing and future hydrologic stresses, e.g., artificially recharging an aquifer through treated groundwater or predicting changes in hydraulic head due to climatic variations.

A groundwater model is an effective tool for screening alternative management strategies; the resulting hypothetical simulations are helpful for finding the most efficient, cost-effective strategies for groundwater management. By looking at many variables in several permutations, models can assist in explaining how complex systems respond to stresses and may, therefore, lead to improved well field designs.

A conceptual model for Barbados

One of the most important steps in the process of creating a model is the development of a conceptual model. A conceptual model is the initial representation of the subsurface, including; both the saturated and vadose zones. This conceptual model incorporates all field data including information on the water balance and data needed to assign values to hydrologic stresses and aquifer properties. In addition, hydrostratigraphic units and the extent of the domain being modeled are identified.

The Pleistocene limestone aquifer of Barbados consists of the Pleistocene coral reef limestone that covers approximately 85% of the island (Fig. 1). There are three limestone units separated by the First and Second High Cliffs known as the Lower Coral Reef unit (LCR), the Middle Coral Reef unit (MCR), and the Upper Coral Reef unit (UCR) respectively. The Pleistocene limestone is up to 100 m thick and has a porosity of 20-60%, and a specific yield of 12.5 -15%. The Pleistocene limestone is underlain by Tertiary-age pelagic rocks of the Upper Scotland Formation and Oceanic Group. The low permeability Oceanic Group forms an approximately triangular area in the northeastern part of the island known as the Scotland District. The Pleistocene limestone aquifer is divided into two hydrologic zones locally referred to as the Sheet-water and Stream-water zones. The Sheet-water zones occur primarily in coastal areas where the interface between the Pleistocene limestone and the Oceanic Group lies below sea level. In this Sheet-water zone water occurs as a freshwater lens. Conversely, the Stream-water zone occurs in areas where the base of the limestone aquifer is above sea level (Fig. 2).

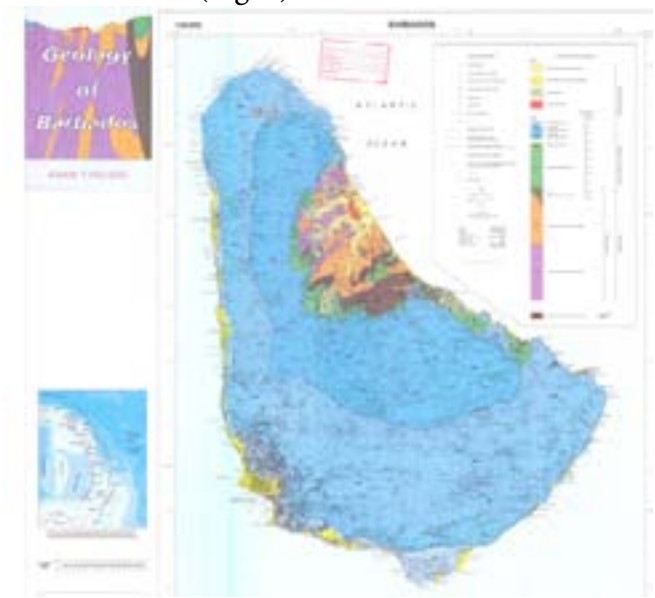


Fig 1: Geology map of Barbados

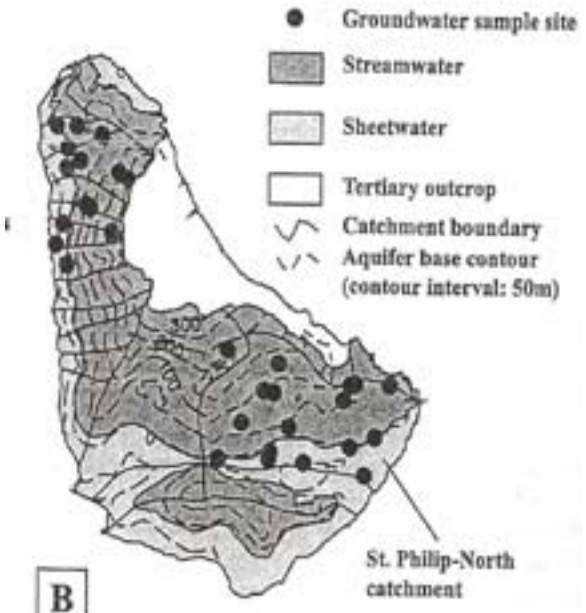


Fig 2: Map of the two hydrologic zones

The conceptual model for the island is based on the assumption that contributions of flux from the Scotland District are negligible and due to the low permeability nature of the Oceanic stratum underlying the limestone unit, it is also assumed that there is no vertical flux across the contact between the coral rock and the aquitard. Flow is assumed to have three spatial components and there is flow within both the unsaturated and saturated zones.

Implementation of the Numerical Model

HydroGeoSphere, a code jointly developed by groundwater scientists at the University of Waterloo and Laval University, Canada was used primarily because of its capability to model several processes that govern flow on the island of Barbados.

The model domain was discretized areally using a resolution of 100 m in coastal areas and 300 m farther inland. The vertical resolution of the model was seven computational layers. The finer discretization closer to the coast was done in order to accurately capture the salinization process in coastal regions where concentration gradients are relatively steep (Fig. 3).

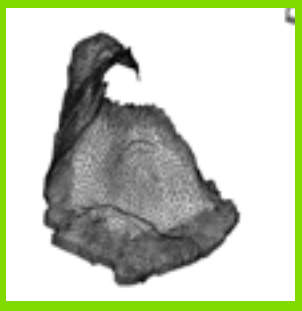


Fig 3: The finite element mesh generated

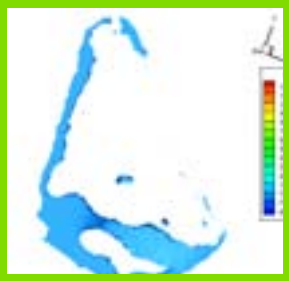


Fig 4: Freshwater lens in plan view

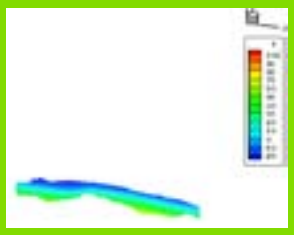


Fig 5: Pressure head distribution

The model parameterization included an areal averaged recharge value which was assumed to be 15% of average annual precipitation (1500mm/yr) on the island. The hydraulic conductivity field was assumed to be homogeneous and isotropic with a value of 10-4 m/s, which is within the range of hydraulic conductivity values for limestone aquifers. The porosity was assumed to be 0.3 which is consistent with the Senn report, a seminal study on the geology of Barbados.

The model was initialized from fully saturatez conditions from which the model was iterated through time until some steady-state condition was reached. Figure 4 shows an iso-surface plot of the pressure head at atmospheric pressure. The plot clearly shows the Sheet-water zones which exists primarily in coastal areas. These zones of fresh water correspond well with the delineated hydrologic regimes from Figure 2. Figure 5 shows the pressure head distribution for a cross-section through the St. George valley. The negative pore water pressures at the top of the section are consistent with the vadose zone where capillary forces dominate. Conversely, at greater depths below the ground surface the results show pressure heads greater than atmospheric which correspond with the saturated zone.

In order to be useful, a groundwater model must be able to reproduce the reality it was developed to represent. The purpose of calibration is therefore to establish that the model can reproduce field-measured hydraulic heads and flows. During calibration a set of values for aquifer properties and hydrologic stresses is found such that the discrepancy between model generated heads and field observations is minimized. The Parameter Estimation (PEST) software package, a powerful tool for parameter estimation and uncertainty analysis of complex environmental models, was used to perform the calibration.

GROUNDWATER MODELING:

A SALINE INTRUSION MODEL FOR EFFECTIVE GROUNDWATER MANAGEMENT FOR BARBADOS

Fig 6: Sinkhole map of Barbados

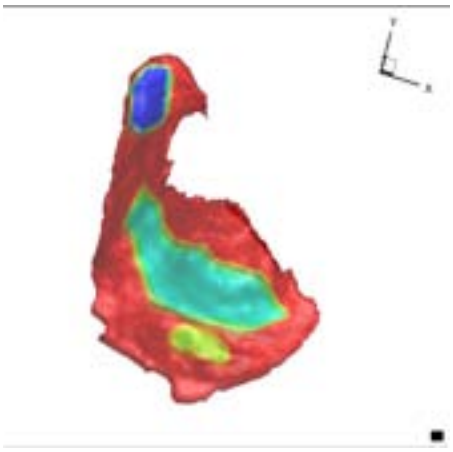


Fig 7: Delineation of model into hydraulic conductivity zones

The density of sinkholes based on a sinkhole map for Barbados (Fig. 6) was used as a proxy for degree of karstification. The island was then delineated into four hydraulic conductivity zones which capture the spatially variability of permeability. Each hydraulic conductivity zone was assumed to be homogeneous and isotropic. Figure 8 shows the calibration results. The model was constrained on hydraulic head data from a geologic investigation conducted in 1946 (Senn, 1946). The correspondence between predicted and observed hydraulic head is favorable with a correlation coefficient of 0.96.

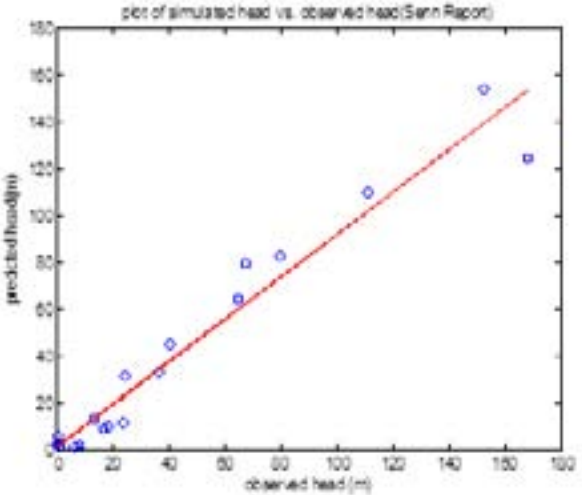


Fig. 8: Results of model calibration

There are two modeling frameworks commonly used to simulate saline intrusion into freshwater aquifers. These are the sharp interface model and the diffuse or transition zone model. The fundamental distinction between the two approaches is that the abrupt interface model assumes that seawater and freshwater have uniform densities and are immiscible. By contrast, the transition zone model assumes that seawater and freshwater are miscible; hence, solutes transported in the seawater are allowed to mix with the freshwater in response to hydrodynamic dispersion. Since in reality a zone of dispersion exists between seawater and freshwater and a management strategy based on solute concentration is important, the mixing zone model was adopted.

A hydrostatic pressure boundary condition was applied to the coast while fresh water and sea water densities were assumed to be 1000 kg/m3 and 1025 kg/m3 respectively. Figure 9 shows the time evolution of the salinization process starting from an initial time, t=0 yrs, until a final time of t=100yrs. The figures clearly show for t= 50 yrs and t= 100yrs a migration of seawater into the freshwater zone. There is also a diffuse transition zone between the saline water from the ocean and freshwater discharging toward the coast. The mixing zone is present due to the combined effects of mechanical dispersion and chemical diffusion.

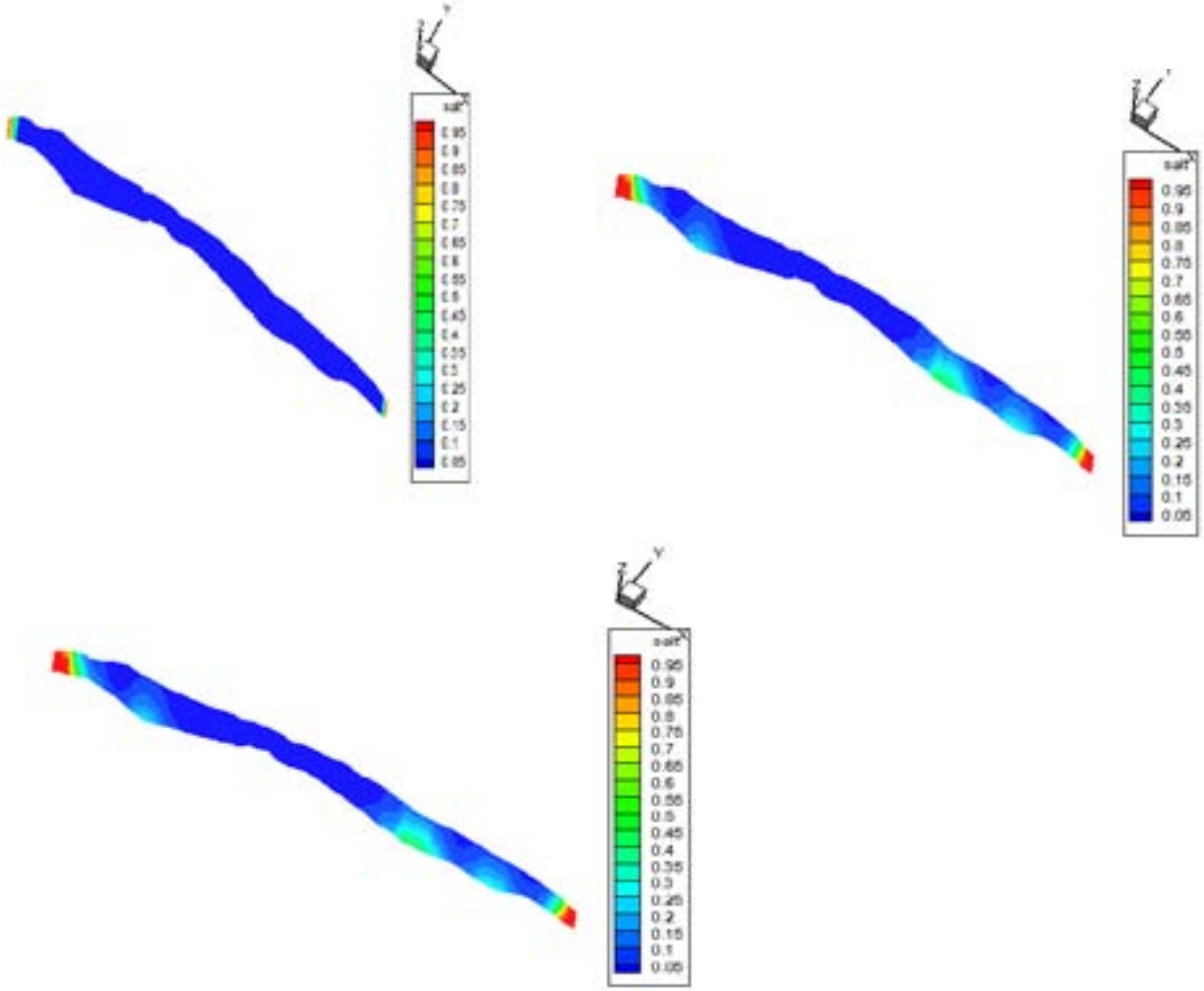


Fig 9: Time evolution of the salinization process for t=0, 50 and 100 yrs respectively

Forecasting the future and management

Groundwater models are indispensable tools for predicting what will happen within the subsurface in the future. What will the extent of saline intrusion be in 20, 50, and 100 years if the "business as usual" approach is adopted? If efforts are indeed made to mitigate against seawater intrusion, how will the underground environment respond to anthropogenic changes in the subsurface? What should the optimal pumping rates be in order to minimize saline intrusion? Where should additional wells be located and what should be the rates of extraction?

Thus far, the approach to groundwater management has been to temporarily abandon pumping wells once the salinity levels reach a threshold value of 250 mg/l, a water quality standard based on the World Health Organization (WHO) standards. A more robust and scientifically sound approach is required so as to ensure an effective aquifer management strategy. The three-dimensional calibrated numerical model can be very effective in helping to answer the aforementioned questions whereas the current approach is a short-term solution. The more accurate the calibrated conceptual model, the more accurate the forecasts simulated by the model will be. Current research thrusts are targeted to improve the conceptual model to include flow in the Oceanic formations as well as the development of recharge maps that are more representative of the spatial distribution of recharge. As the conceptual model continues to evolve, the end result will be a more accurate representation of the island's hydrogeology which will lead to improved management of Barbados's freshwater resources.

Featured member

Nigel Atherley…*a CIMH cornerstone*

It would be remiss of us to not highlight one of the long-standing employees of CIMH during our celebration of 45 years in existence. Mr. Nigel Atherley joined CMI in 1970 and has been with the Institute for 41 years.

Fresh from The Foundation School, Mr. Nigel Atherley joined the staff of CMI, in August 1970 as a Meteorological Assistant. On joining CMI, Nigel participated in the WMO Class IV Certificate course which he successfully completed in December 1970.
In 1973, Nigel was promoted to the post of Training Assistant, where he assisted with the preparation of training materials for all training courses, instructed Class IV students in Basic Mathematics and Technical subjects. During this year Mr. Atherley also took part in the Government Training Center's Training of the Trainer Course.
Nigel, continued his training and personal development at the CMI by participating in and /or completing the following;

- WMO Class III Certificate course in 1977 which he completed with credit
- BSc degree in Meteorology (major) with Mathematics (minor) and Computer Science (minor) from the University of the West Indies, Cave Hill Campus in 1982
- A Course in Tropical Meteorology and Forecasting at the University of Miami, Florida in 1984
- Understanding Climate at the University of East Anglia UK in 1985
- WMO RA III/IV Training Seminar for National Instructors held in Costa Rico in 1992

In 1983, Mr. Atherley was promoted to the acting post of Technical Officer in 1983 and in May 1986, he was appointed Technical Officer I. His duties, during this period, included teaching Mathematics and Meteorology in programs up to WMO Class II Certificate level. In 2009, Nigel Atherley was promoted to Senior Technical Officer.

Currently, Mr. Atherley, teaches all of the Mathematics for the Senior Level Meteorological Technicians (SLMT) and Mid-Level Meteorological Technicians (MLMT) courses offered at the CIMH. Moreover, he conducts the weather observations section of the METE1000 Introduction to Physical Meteorology & Weather observation offered in the UWI BSc. Degree program and assists with practicals for Radar Meteorology in the SLMT and the UWI METE3400 Weather Radars and Satellites (Radar section). Nigel, has also taught Physical Meteorology for the WMO Class II Certificate course and is the coordinator of the Class II/Mid-Level Meteorological Technicians Course at CIMH.

With his many years at the CIMH, Nigel has interacted and impacted on the lives of many of the students including Kathy-Ann Casear, who is currently the Acting Chief Meteorologist at the CIMH, who says;
"Nigel has not changed since he taught me in the 1980's, he is one of the most patient, diligent and understanding teachers I know. At the time that he taught me, he was teaching General Meteorology, Radar Meteorology and Mathematics. Losing him, would be like losing the cornerstone of CIMH."

"A very pleasant, easy going, dedicated maths tutor. He is patient with students and always willing to go beyond the call of his duties."

CAMI

The objective of the Caribbean Agrometeorological Initiative (CAMI) is to increase and sustain agricultural productivity at the farm level in the Caribbean region through improved dissemination and application of weather and climate information using an integrated and coordinated approach.

By Adrian Trotman, (M.Phil, MSc, BSc)

The Caribbean Farming Community will be the ultimate and major beneficiaries of the CAMI project as the project will provide this community with a variety of information relevant to the success of their busines. This information will be provided through the regional network of Meteorological and Agricultural Services and research institutes and will include;

- Rainfall prediction
- The efficient use of climatological information
- The development of pests
- Disease forecasting
- Information related to irrigation management

Up until the time of writing, all activity excluding irrigation management has already begun. The proposed means of dissemination of the information was through user-friendly newsletters and bulletins. To facilitate this, CAMI has teamed up with the Technical Centre for Agriculture and Rural Development (CTA) to begin work on developing a Communication Strategy for weather and climate information. This is expected to continue beyond the duration of the CAMI project. In the mean time, after formal training in developing and laying out an agrometeorological bulletin that stressed on using appropriate farmer-friendly language, CAMI has been producing (since September 2011) regional bulletins. So far, two of the CAMI countries have been preparing and disseminating their own national bulletins, with other CAMI countries preparing to launch their national bulletins soon.

In continuing to equip the National Meteorological Services and the two regional research partners, the focus now turns to training in crop water use and irrigation management. Work also continues on the validation of developed models for Black Sigatoka (of banana), Citrus Psyllid (greening), whitefly and soybean rust. However CAMI is seeking more biological data from across the region to continue the process. Analysis of climatological data for trends and relationship with major seasonal climate drivers in the El Niño Southern Oscillation and the North Atlantic Oscillation, particularly rainfall and temperature, is just about complete. There was also training in a crop simulation model Decision Support System for Agrotechnology Transfer (DSSAT), which will be used in CAMI to assess the potential of Climate Change on regional production. This work is just about to commence.

One of the major activities is the hosting of farmers' forums. During a mid-term evaluation debriefing meeting, the evaluator indicated that "the farmers' forums conducted during Year 2 of the project were 'absolute hits'". Many farmers and extension services officers were allowed, in many cases for the first time, to interact with meteorologists. They were very attentive to the explanations of terms used by meteorologists, which most of them – no matter what country they were from - admitted they were ignorant of the interpretation of many of the terms. During the first round of forums, presentations were also made on their local/national

weather and climate by their national Meteorological Services with specific focus on the year 2010. The year 2010 was a rare one for rainfall extremes. In the entire Caribbean, from Guyana in the southeast to Jamaica in the northwest, 2010 began with severe to exceptional drought up until April/May, only then to translate into excessive rainfall that was often accompanied by flooding and landslides.

CAMI is also in the process of sustaining the progress made during the farmers' forums and the project at large. An e-forum has recently commenced that discusses topics that arose during the Year 2 face-to-face forums. This will maintain the dialogue between the many CAMI stakeholders until the Year 3 versions begin. Tri-partite committees, made up of meteorologists, agriculture extension officers and farmers are being formed in each CAMI country. It is hoped that this will sustain the work of CAMI by maintaining the collaborative links and necessary dialogues that will dictate future weather and climate-related information provisioning for the farming communities.

That year, fresh in the memories of the farmers attending the forums made the sessions even more meaningful as they related to the devastation and high yield losses associated with these extreme rainfall events during that year.

The CAMI Stakeholders are CIMH, Caribbean Agricultural Research and Development Institute (CARDI), World Meteorological Organization (WMO), National Meteorological and Hydrological Services (NMHSs) of ten Caribbean member States, the European Union, the CaribbeanFarming Community and Agriculture Extension Agencies.

…"the farmers' forums conducted during Year 2 of the project were 'absolute hits'…"

CAMI concludes in November 2012, but not before it brings together all the stakeholders for the final time to bring everyone up-to-date with the results of the project and to create perspective for future activity.

For more information contact Mr Adrian Trotman, Agrometeorologist, Caribbean Institute for Meteorology and Hydrology (atrotman@cimh.edu.bb) or refer to the CIMH website (www.cimh.edu.bb).

WEATHER AND WATER CAMP

By Andrea Sealy, Ph.D.

The Weather and Water Camp offered at CIMH is a four week Hydrological and Meteorological Observer's course. The course offers students an introductory look into the world of Meteorology and Hydrology. It is practical and focuses on a few of the aspects of these fields, it therefore includes:

Field trip with theCoastal Zone Management Unit

- **An introduction to meteorology and hydrology**
- **Observation and measurement techniques**
- **An introduction to data management**
- **Exposure to global weather systems and their impacts**
- **Exposure to weather forecasting, agrometeorology and climate change issues**
- **Applications of the Earth Sciences**
- **Field trips that involve key players in meteorology, hydrology and related sciences such as Barbados Meteorological Services, Barbados Water Authority, Ionics Freshwater Limited and Coastal Zone Management Unit**

CIMH continues to raise the awareness of such disciplines in the schools and other public domains. The demand for persons with such expertise continues to increase as the region implements climate change adaptation strategies. It is hoped that students taking these courses would be encouraged to pursue Hydrology, Meteorology and or other related atmospheric and earth sciences as career choices.

There are no academic prerequisites for entry into the programme and it is offered to secondary school students entering 4th form and older. The course is also open to teachers/trainers at secondary and tertiary level institutions. This year's course is scheduled to commence on Monday, July 2nd and end on Friday July 27th.

Field trip to Ragged Point research facility

Tour of Ionics Freshwater Limited

SUMMER INTERNSHIP PROGRAM

By Kathy-Ann Caesar M.S.

The Summer Internship Programme at the Caribbean Institute for Meteorology and Hydrology (CIMH) began in 2007. The goal of the programme was and is to offer meteorology students, from the University of the West Indies at Cave Hill (UWI Cave Hill), research and work experience. The program extends from June 1st to July 30th, annually. The programme has now grown to include students outside of the university programme.

Primarily, students are assigned to a lecturer or lecturers and work on existing or especially designed projects. The students are encouraged to design and work on their own project as well. Students also get the chance to teach as well in the CIMH "Weather and Water Summer Programme for Secondary/High School students.

Students learn to work independently and develop their communication, writing and presentation skills. There have been occasions when students have contacted and conversed with other professionals to gain access to required data. At the end of the two months, students complete a research paper and present their work the Summer Internship forum.

Over the years, student projects have been varied and have yielded very good results, some with international implications. One of the very first projects was the TAF Verification program for the Caribbean region. Most of the initial work was completed by interns, Mr. John Peters and Mr. Rohan Brown in the two summer months. After two years of testing the program was launched as the official CIMH TAFver Program. This program which is required by Aeronautical Meteorological Services as part of their Quality Management System is currently being implemented across the Caribbean and now being requested by Meteorological Services across Latin America.

Other successful projects include:

- An investigation into the sensitivity of WRF model to SST in simulating tropical cyclone development An Ivan Case Study, by Mr Ronald Gordon
- The Radar Rain Rate verification project, by Mr Adriel Valentine;
- The Vertical Profile of the Sahara Dust Layer Over Barbados, by Ms. Diana Ellis
- The Trans-Atlantic Ozone Experiment 2010, by Mr. Ashford Reyes
- The Importance of proper choice of PBL parameterization schemes in numerical models, by Ms. Wazita Scott
- The Guyana Fog Event Case Study, by Ms. Candi Hosein
- The Automatic Rainfall calculator by Mr. Mandela Maloney

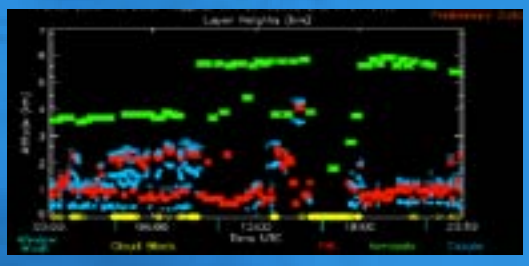


Figure 1: Low Level Dust Profile from the Lidar Ragged Point Barbados, from Diana Ellis' Study

Fourteen students have thus far completed the Summer Internship Program. Of these students, six have gone on to be accepted into Masters Programs at institutions such as University of the West Indies at Cave Hill and St. Augustine, University of Miami, Howard University, Reading University and McGill University. Others have also gone to find employment in the Meteorological services in the region, while others have settled here at the CIMH. To apply for the program send a letter and resume to Dr. David Farrell, Principal, Caribbean Institute for Meteorology and Hydrology, by April 30th of the applying year

Coming Up...

45th Anniversary Celebrations

Anniversary Gala Awards & Retirement Function
September 22nd

Karaoke & Lime
November 24th

Fun Day
TBA

Other Events

Training in Crop Water Use & Irrigation Management
June 4th -8th

Dewetra Installation in Barbados & Antigua
May 3rd –11th

Training in Drought Monitoring & Planning in Jamaica
May 22nd – 24th

Summer Internship Program
June 1st – July 31st

Seminar of Early Flood Warning Systems
June 4th – 5th

Weather & Water Summer Camp
July 2nd – July 27th

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