# Appendix 3 - Conference Program

## Regional Conference on Climate Variability and Change and their Health Effects in the Caribbean

### Information for Climate Variability and Change Adaptation Planning in the Health Sector

Sam Lords Castle Resort
Long Bay, St. Philip
Barbados

*May 21-22, 2002*

**Acknowledgments:**

This conference is organized by the Pan American Health Organization/World Health Organization, with the collaboration of the Government of Barbados, under the auspices of the Interagency Network on Climate and Human Health formed by the World Health Organization, the World Meteorological Organization and the United Nations Environment Programme.

Sponsors: U.S. Environmental Protection Agency, U.S. National Oceanic and Atmospheric Administration, U.S. National Aeronautics and Space Administration, Health Canada/Santé Canada and Environment Canada/ Environnement Canada.

Thanks go to the regional and local collaborating agencies/organizations, Caribbean Epidemiology Center (CAREC), Caribbean Environmental Health Institute (CEHI) and the Caribbean Program for Adapting to Global Climate Change (CPACC).

Thanks also go to MSTE.net — Lotus Domino Networks, of Madison, Maryland, USA for donation of the QuickPlace server on the World Wide Web for use in planning.

**Objectives:**

- To inform health scientists, practitioners, and officials of the impacts of climate variability and long-term climate change in the Caribbean region
- To integrate health-relevant sectors (e.g., water resources, agriculture and fisheries)
- To introduce strategies in coastal zone management as they relate to sewage disposal and other health issues
- To foster joint interdisciplinary research projects among local participants, as well as developed/developing nation scientist partnerships
- To promote the incorporation of global, regional and national climate information into planning for public health services at the national level

**Opening Ceremony**

| | | | |
|---|---|---|---|
| Master of Ceremony | | - | **Ms. Clare Forrester** |
| 9:00 | National Anthem | | |
| 9:05 | Welcome Remarks | - | **Mrs. Veta F. Brown**<br>*Caribbean Program Coordinator*<br>PAHO/WHO |
| 9:10 | Address | - | **Senator the Hon. Jerome Walcott**<br>*Minister of Health* |
| 9:20 | Remarks | - | **Dr. Carlos Corvalan**<br>*Interagency Network on Climate and Human Health*<br>⋆ World Health Organization<br>⋆ World Meteorological Organization<br>⋆ United Nations Environment Programme |
| 9:25 | Cultural Presentation | - | **St. Martin's Mangrove Primary School** |
| 9:45 | Feature Address | - | **The Hon. Elizabeth Thompson**<br>*Minister of Physical Development & Environment* |
| 9:55 | Closing Remarks/Vote of Thanks | - | **Mr. Vincent Sweeney**<br>*Executive Director*<br>*Caribbean Environmental Health Institute* |

**[10:00 – 10:15]** BREAK

**[10:15 – 12:20]** *Keynote Speakers*

*Conference Chair and Moderator:* - **Dr. Ulric O'D. Trotz**

Caribbean Planning for Adaptation to Global Climate Change / Adapting to Climate Change in the Caribbean (CPACC/ACCC), Centre for Environment and Development, University of the West Indies at Cave Hill, Barbados

**[10:15 - 11:15]**

*Keynote Speaker:* **His Excellency Tuiloma Neroni Slade, Ambassador of Samoa to the United Nations, Chairman of the Alliance of Small Island States**

*Biographical Sketch:* H.E. Tuiloma Neroni Slade is the Chairman of the Alliance of Small Island States (AOSIS) and the Permanent Representative of Samoa to the United Nations as well as his country's Ambassador to the United States of America. Previously he was Attorney General of Samoa and a senior legal adviser with the Commonwealth Secretariat in London, UK.

Ambassador Slade has a specialized background in international law issues, particularly relating to environmental law and development, nuclear weapons and humanitarian issues. As spokesman for AOSIS, he has played an active role in global climate change negotiations.

Title: Climate Change and Health, and the Sustainable Development of Small Island Developing States — the Perspective of the Alliance of Small Island States

*Abstract:* Small Island Developing States (SIDS) are recognized as being the most vulnerable to climate change. This arises from the acknowledgement of the sheer physical and geological vulnerabilities of small islands in a warming climate. Less recognized is the additional burden of climate stress that will be placed on the human health situation in SIDS. In some SIDS certain vector-borne diseases may make a return in a changing climate. Climate change will also place new stress on the water supply of SIDS, thereby creating other potentially serious health concerns.

Against the backdrop of the international climate change negotiations and the ongoing cooperation within the Alliance of Small Island States (AOSIS), the issue of health under a changing climate system is being considered by SIDS experts, and has been taken up by the Intergovernmental Panel on Climate Change (IPCC). AOSIS is committed to being the best informed on climate change issues, so that the process of adaptation can at least be planned or anticipated. New findings on climate and health may make this process of adaptation even more difficult, and raise the concern that early action on mitigating greenhouse gas emissions may be the best solution for the long term.

**[11:20 - 12:20]**

*Keynote Speaker:* **Professor Tony McMichael, Director, National Centre for Epidemiology and Population Health, Australian National University, Canberra, Australia**

*Biographical Sketch:* Tony McMichael is the newly-appointed Director of the National Centre for Epidemiology and Population Health at the Australian National University, Canberra. Previously he was Professor of Epidemiology at the London School of Hygiene and Tropical Medicine, London, UK.

His research interests have encompassed occupational diseases, diet and cancer, and environmental health hazards. During 1990-1992 he chaired the Scientific Council of the International Agency for Research on

Cancer (WHO). More recently, he has concentrated his research upon assessing the health risks from global environmental change – and since 1994 he has chaired the health impact assessment for the UN's Intergovernmental Panel on Climate Change (IPCC).

He is a member of WHO's Expert Committee on Globalisation and Health, and of the International Science Council on Population and Environment. In 1993, he published "Planetary Overload: Global Environmental Change and the Health of the Human Species". In 2001, Cambridge University Press released his new book "Human Frontiers, Environments and Disease: Past Patterns, Uncertain Futures".

*Title: Global Climate Change: Where and When Might We Detect Health Impacts?*

*Abstract:* The continuing trend in global warming over the past three decades indicates that global climate change is real. Climatologists are now confident that most of this increase has been due to human influence on the composition of the lower atmosphere. Meanwhile, it has become apparent that, in recent decades, many non-human physical and biological systems have undergone alterations that are reasonably attributable to climate change. What impacts should we expect on human health?

The human species is much better – and often deliberately – buffered against environmental stressors than are all other plant and animal species. Hence we should expect *Homo sapiens* to be a less sensitive early-responder species. However, there are otherwise rather few generalisations that apply to this topic. After all, climate change will present a varied spectrum of environmental hazards in different geographical regions. Further, the vulnerability of particular human populations varies as a function of locality, level of material resources, technological assets and type of governance.

There is a wide range of expected health impacts of climate change. These do not entail novel processes and unfamiliar health outcomes (unlike the surprise appearance of HIV/AIDS or human "mad cow disease"). Rather, they entail climate-induced changes in the frequency or severity of familiar health risks – such as floods, storms and fires; the mortality toll of heatwaves; the range and seasonality of infectious diseases; the productivity of local agroecosystems; the health consequences of altered freshwater supplies; and the many repercussions of economic dislocation and population displacement. Most of the expected health impacts will be adverse; a few will be beneficial.

There is, tantalizingly, a modest array of evidence that climate change is already affecting some health outcomes. Some vector-borne infectious diseases such as tick-borne encephalitis, malaria and perhaps dengue have behaved in ways that accord with altered climatic influence over the past two decades. Cereal grain yields have become a little more unstable during the 1990s, displaying increased inter-annual variability: could this be (partly) due to changing climatic conditions? Extreme weather events appear to have increased in tempo during the 1990s, with predictable impacts on human life and limb. Several small island states are experiencing growing concern about sea-level rise, and this, at this early stage, may be jeopardizing wellbeing and mental health.

We cannot await conclusive evidence before investing in adaptive strategies to lessen population vulnerability. Climate change is an unusual exposure variable: we know that the exposure will increase over at least the next 3-5 decades, no matter what coordinated international action national governments might take. Indeed, realistically

(and given the long half-life of much of the excess greenhouse gas that we are generating), the exposure is likely to continue to increase throughout this century. For this reason, and because climate change is weakening some of Earth's life-support systems, we should take seriously now the need to introduce adaptive policies and practices. Ministries of Health should play a central role in this response – but should also remember that finding enduring solutions will depend on inter-sectoral communication and convergence.

**[12:30 - 1:30]** LUNCH (at conference venue)

**[1:45 - 3:20]**

*Climate Change and Climate Variability (Session 1)*

*Session Moderator:* **Roger S. Pulwarty, National Oceanic and Atmospheric Administration (NOAA) and University of Colorado at Boulder, USA**

Session 1 provides an overview of basic concepts of climate change and variability. The scope of the presentations ranges in scale from global to regional to local. Issues relevant to the Caribbean region are stressed.

**[1:45 - 2:00]**

*Speaker:* **Tamara Creech, National Climatic Data Center, Asheville, North Carolina, USA**

*Title: Climate Variability and Climate Change — The Fundamental Climate Issues*

Creech explains the global perspective on the fundamental concepts of climate variability and climate change on seasonal, interannual, decadal and centennial time scales. The presentation summarizes the findings of the World Meteorological Organization/United Nations Environment Programme Intergovernmental Panel on Climate Change (WMO/UNEP IPCC) in the Third Assessment Report with special reference to the Caribbean. Some related impacts with particular relevance to health outcomes are discussed.

*Full Authorship:* Same as above

**[2:05 - 2:20]**

*Speaker:* **Chris Sear, Natural Resources Institute, University of Greenwich, Kent, UK**

*Title: Climate Change Impacts on Small Island States — Caribbean Concerns and Recommendations for Action*

Sear describes a compilation of stakeholder opinions and research results to examine the impacts of projected climate change on selected UK Overseas Territories. The results are highly relevant to small island societies in the

Caribbean. The health sector is projected to be at increased risk from vector-borne diseases, heat stress and degraded water supply and quality. Other sectors at risk are tourism and fishing, agriculture, infrastructure and migration.

*Full Authorship:* C Sear[1], M Hulme[2], N Adger[2], K Brown[2]
1. Natural Resources Institute, University of Greenwich, Kent, UK
2. Tyndall Centre for Climate Change Research, University of East Anglia, Norwich, UK

---

[2:25 - 2:40]

*Speaker:* **Michael Taylor, Department of Physics, University of the West Indies at Mona, Jamaica**

*Title: Caribbean Climate Variability — Evidence of El Niño Influence and Longer Time-scale Climate Change*

Taylor analyzes the interannual variability of the Caribbean rainfall season, which is divided into an early season (May - July) and a late season (August - November). He provides evidence that anomalies in sea surface temperature of the equatorial Pacific Ocean are associated with Caribbean rainfall patterns. A study of daily weather records of the Caribbean region since the late 1950s finds more very warm days, fewer very cold days and an increase in extreme precipitation.

*Full Authorship:* Same as above

---

[2:45 - 3:00]

*Speaker:* **Jorge E. Gonzalez, Mechanical Engineering Department, University of Puerto Rico at Mayaguez, USA**

*Title: Urban Heat Island Studies for San Juan, Puerto Rico*

Gonzalez presents observational data and an atmospheric model of the impact of urban development in the metropolitan area of San Juan, Puerto Rico. An airborne image from 1998 shows the absence of vegetation over the metropolitan area of San Juan substituted by a concrete block of almost 300 km$^2$. Satellite data of the apparent surface temperature reveal a hot spot in this area. The Regional Atmospheric Model System introduces concrete as a soil type to analyze the Urban Heat Island Effect.

*Full Authorship:* Alexander Velázquez[1], Jorge E. Gonzalez[1]
1. Mechanical Engineering Department, University of Puerto Rico at Mayaguez, USA

---

**[3:05 - 3:20]** Panel Discussion

**[3:20 - 3:35]** BREAK

**[3:35 - 5:35]**

*Health Status in the Caribbean Region & Frameworks for Assessment (Session 2)*

*Session Moderator:* **Samuel C. Rawlins, Caribbean Epidemiology Centre (CAREC), Port of Spain, Trinidad**

Session 2 reviews the health status in the Caribbean region with particular reference to climate change and variability. Three major public health institutions in the region — Caribbean Epidemiology Centre (CAREC), Caribbean Environmental Health Institute (CEHI) and PAHO/WHO's Office of Caribbean Program Coordination — provide perspectives. This session also presents frameworks for evaluating the vulnerability of the health system to climate change and for assessing and responding to climate-related health risks.

**[3:35 - 3:50]**

*Speaker:* **C. James Hospedales, Director, Caribbean Epidemiology Centre (CAREC), Port of Spain, Trinidad**

*Title: Caribbean Health Situation: Summary for Climate Change and Human Health*

Hospedales (CAREC) identifies three domains of health threats in the Caribbean today: 1) chronic, non-communicable diseases along with "social pathologies", such as violence; 2) emerging and re-emerging diseases, such as dengue hemorrhagic fever; and 3) environmental and climatic changes, such as global warming with increased vector production and sea level changes. Fundamental threats are the lack of investment in health promotion and public health capacity along with the lack of sufficient attention to poverty and long-term environmental issues.

*Full Authorship:* Same as above

**[3:55 - 4:10]**

*Speaker:* **Herold Gopaul, Caribbean Environmental Health Institute (CEHI), Castries, Saint Lucia**

*Title: Climate Variability and Change and their Potential Health Impacts for Caribbean States - An Environmental Health Perspective*

Gopaul (CEHI) focuses on the need for good quality data for predicting the impact that climate change may have on human health in the Caribbean region. This presentation identifies some health and climate parameters that should guide the development of a monitoring and surveillance system. It also proposes some methodologies for

the collection, processing, storage and dissemination of data with specific reference to the supporting mechanisms and institutional arrangements in Caribbean countries.

*Full Authorship:* Same as above

**[4:15 – 4:30]**

*Speaker:* **Veta F. Brown, Caribbean Program Coordinator, Pan American Health Organization (PAHO)/ World Health Organization (WHO), Barbados**

*Title: Challenges of the Health Systems in Relation to Climate Change*

Brown (PAHO/WHO) addresses the challenges that face Caribbean health systems in relation to climate change. Health systems provide many essential public health functions at the central and local levels. The effects of climate change on public health are likely to require the strengthening of the national health authority.

*Full Authorship:* Same as above

**[4:35 – 4:50]**

*Speaker:* **Ligia Castro de Doens, Centro del Agua del Trópico Húmedo para América Latina y el Caribe (CATHALAC), Panama, Republic of Panama**

*Title: Conceptual and Methodological Framework for the Evaluation of Vulnerability in the Health System before Climate Change*

Castro de Doens proposes a conceptual and methodological framework for evaluating vulnerability in the health system to climate change. This framework considers climate both in terms of natural variability and the results of human processes. The climate-health relationship is determined by the influence of multiple factors — natural, social, economic, political, and cultural. The systems approach considers the systems to be analyzed and their properties, the methods of analysis, and the practical application of the results.

*Full Authorship:* Ligia Castro de Doens[1], Emilio Sempris[2], José Mateo[3], Hernán Luque[4], Maira Celeiro[5], Reina Roa[6], Maria Gloria Fabregat[7], Washinton Lum[8], Paulo Ortiz[9], Eladio Vera[10], Lina Santos[11], René López[12]

1. Subdirectora del Centro del Agua del Trópico Húmedo para América Latina y el Caribe (CATHALAC), Panamá
2. Coordinador del Programa de Cambio Climático de la Autoridad Nacional del Ambiente (ANAM/PNUD), Panamá
3. Profesor Titular de la Facultad de la Geografía, Universidad de la Habana, Cuba
4. Director de Políticas de Salud del Ministerio de Salud (MINSA), Panamá
5. Investigadora del Instituto de Geografía Tropical del Ministerio de Ciencia, Tecnología y Medio Ambiente, Cuba
6. Departamento de Análisis de Tendencias de Salud, MINSA, Panamá

7. Especialista de actividades científicas e investigativas de la Unidad de Análisis de Tendencias en Salud, Centro Provincial de Higiene y Epidemiología (CPHE), Cienfuegos, Cuba
8. Departamento de Vigilancia y Control de Factores Protectores y de Riesgo a la Salud, MINSA, Panamá
9. Centro Nacional del Clima del Instituto de Meteorología, Ministerio de Ciencia, Tecnología y Medio Ambiente, Cuba
10. Subsecretaria Nacional de Medicina Tropical, Ministerio de Salud de Ecuador
11. Facultad de Marítima, Escuela Politécnica del Litoral (ESPOL), Ecuador
12. Sub-coordinador del Programa de Cambio Climático de la Autoridad Nacional del Ambiente (ANAM/ PNUD), Panamá

**[4:55 - 5:10]**

*Speaker:* **Roger S. Pulwarty, National Oceanic and Atmospheric Administration (NOAA) and University of Colorado at Boulder, USA**

*Title: Designing Effective Assessments and Responses to Climate-related Health Risks: What Do We Know and What Do We Need to Know?*

Pulwarty presents the design of effective assessments of the climate-health interface with emphasis on managing uncertainty. Both integrated research and application have generally been focused on improving prediction and telecommunications rather than on improving organizational systems, information flows and decision-making. The discussion addresses the characteristics of processes for ensuring sustained interaction that most favor legitimacy, accessibility and acceptability of new integrated information for decision making.

*Full Authorship:* Same as above

**[5:15 - 5:35]** Panel Discussion

**[6:00 - 8:00]** *Reception — Government of Barbados*

**Wednesday, May 22, 2002**

**[8:00 - 8:50]** *Special Session for Posters — Meeting the Presenters*

**Topic 1: Climate Change and Climate Variability**

***Daniel E. Comarazamy, Mechanical Engineering Department, University of Puerto Rico at Mayaguez, USA***

*Title: Atmospheric Modeling of the Caribbean Region: Precipitation and Wind Analysis in Puerto Rico for April 1998*

*Full Authorship:* Daniel E. Comarazamy[1], Jorge E. Gonzalez[1], James R. Stalker[2]
1. Mechanical Engineering Department, University of Puerto Rico at Mayaguez, USA
2. EES-8, Los Alamos National Laboratory, Los Alamos, New Mexico, USA

**Roger S. Pulwarty, National Oceanic and Atmospheric Administration (NOAA) and University of Colorado at Boulder, USA**

*Title: A Review of Climate Variations and Atlantic Hurricane Activity in the 20th Century*

*Full Authorship:* Same as above

**Nazario D. Ramirez-Beltran, Department of Industrial Engineering, University of Puerto Rico at Mayaguez, USA**

*Title: A Statistical Model to Predict Puerto Rico Rainfall Process*

Full Authorship: Nazario D. Ramirez-Beltran[1], Amos Winter[2], Nazario Ramirez[3], Jorge E. Gonzalez[4], Ramon E. Vasquez[5]
1. Department of Industrial Engineering, University of Puerto Rico at Mayaguez, USA
2. Department of Marine Science, University of Puerto Rico at Mayaguez, USA
3. Department of Civil Engineering, University of Puerto Rico at Mayaguez, USA
4. Department of Mechanical Engineering, University of Puerto Rico at Mayaguez, USA
5. Department of Electrical and Computer Engineering, University of Puerto Rico at Mayaguez, USA

**Topic 2: Linkages between Climate and Human Health**

**Simon Hales, Wellington School of Medicine, Wellington, New Zealand**

*Title: The Potential Global Distribution of Dengue Fever*

*Presented by:* Alistair Woodward, Wellington School of Medicine, Wellington, New Zealand

*Full Authorship:* Simon Hales[1], Neil de Wet[1], John Maindonald[1], Alistair Woodward[1]
1. Wellington School of Medicine, Wellington, New Zealand

**Marsha A. Ivey, Faculty of Medical Sciences, University of the West Indies, St. Augustine, Trinidad and Tobago**

*Title: Climatic Variables are Associated with Seasonal Acute Asthma Admissions to Accident and Emergency Room Facilities in Trinidad, West Indies*

*Presented by:* Michele A Monteil, Faculty of Medical Sciences, University of the West Indies, St. Augustine, Trinidad and Tobago

*Full Authorship:* Marsha A. Ivey[1], Donald A. Simeon[1], Michele A. Monteil[1]
1. Faculty of Medical Sciences, University of the West Indies, St. Augustine, Trinidad and Tobago

**Jonathan Patz, Johns Hopkins Bloomberg School of Public Health, Baltimore, Maryland, USA**

*Title: US National Assessment on the Potential Consequences of Climate Variability and Change: Health Sector Assessment*

*Full Authorship:* Same as above

**Joseph M. Prospero, Rosenstiel School of Marine and Atmospheric Science, University of Miami, Miami, Florida, USA**

*Title: Long-term Measurements of African Dust Transport to the Caribbean*

*Full Authorship:* Same as above

**Guillermo Rua, Programa de Estudio y Control de Enfermedades Tropicales -PECET Universidad de Antioquia, Medellín – Colombia**

*Title: Effect of Temperature on the Gonotrophic Cycle of Anopheles albimanus (Diptera: Culicidae) in Relation with El Niño in Colombia*

*Full Authorship:* Guillermo L. Rúa[1], Martha L. Quiñones[1], Iván D. Velez[1], William Rojas[2], Germán Poveda[3], Juan S. Zuluaga[2], Daniel Ruiz[3]
1. Programa de Estudio y Control de Enfermedades Tropicales -PECET Universidad de Antioquia, Medellín – Colombia

2. Corporación para Investigaciones Biológicas, Medellín – Colombia
3. Posgrado en Aprovechamiento de Recursos Hidráulicos, Universidad Nacional de Colombia at Medellín, Medellín – Colombia

**Daniel Ruiz, Universidad Nacional de Colombia at Medellín, Medellín – Colombia**

*Title: Modeling Entomological-Climatic Interaction of Malaria Transmission — Case of study: El Niño 1997-1998 and La Niña 1998-2000*

*Presented by:* Guillermo Rua, Universidad de Antioquia, Medellín – Colombia

*Full Authorship:* Daniel Ruiz[1], Germán Poveda[1], Martha L. Quiñones[2], Iván Darío Vélez[2], Guillermo Rúa[2], William Rojas[3], Juan Santiago Zuluaga[3]
1. Posgrado en Aprovechamiento de Recursos Hidráulicos, Universidad Nacional de Colombia at Medellín, Medellín – Colombia
2. Programa de Estudio y Control de Enfermedades Tropicales -PECET Universidad de Antioquia, Medellín – Colombia
3. Corporación para Investigaciones Biológicas, Medellín – Colombia

**Palmira Ventosilla, Instituto de Medicina Tropical, Universidad Peruana Cayetano Heredia, Lima, Perú**

*Title: Influence of El Niño Event on the Transmission of Malaria in Luciano Castillo & Colonna Health Region (Piura, Perú)*

*Presented by:* Joan L. Aron, Science Communication Studies, Columbia, Maryland, USA and Johns Hopkins Bloomberg School of Public Health, Baltimore, Maryland, USA

*Full Authorship:* P. Ventosilla[1], E. Huarcaya[1], E. Chinga[2,3], F. León[1], A. M. Palacios[4], P. Gutiérrez[4], S. Vidal[4], J. Aron[5]
1. Instituto de Medicina Tropical, Universidad Peruana Cayetano Heredia (UPCH), Lima, Perú
2. Facultad de Salud Pública-UPCH, Lima, Perú
3. A.B. PRISMA, Lima, Perú
4. Región de Salud Luciano Castillo y Colonna-Piura, Perú
5. Science Communication Studies, Columbia, Maryland, USA and Johns Hopkins Bloomberg School of Public Health, Baltimore, Maryland, USA

**[9:00 - 11:00]**

*Linkages between Climate and Human Health (Part I) (Session 3)*

*Session Moderator:* **Patricia Aquing, Caribbean Environmental Health Institute (CEHI), Castries, Saint Lucia**

Session 3 examines linkages between climate and human health, placing most of the emphasis on vector-borne

diseases and other infectious diseases. This session addresses both short-term climate variability, especially the phenomenon of El Niño, and long-term climate change under scenarios of enhanced global warming. The study sites are in Caribbean countries and Pacific island countries.

**[9:00 - 9:15]**

*Speaker:* **Samuel C. Rawlins, Caribbean Epidemiology Centre (CAREC), Port of Spain, Trinidad**

*Title: How Climate Impacts on the Occurrence of Dengue Fever: A Fifteen Year Retrospective Study of Correlation of Dengue Fever and Rainfall in Trinidad and Tobago*

Rawlins reports on the occurrence of dengue fever cases on Trinidad & Tobago in relation to rainfall for the years 1986 - 2000. The strongest effect came in 1998 ("El Niño + 1" year) with heavy rainfall and high incidence of dengue fever. The year 1998 is designated "El Niño + 1" because a major El Niño event began in 1997. Other possible determinants of dengue cases - such as social, environmental and biological features - need to be incorporated into these analyses. Future work will investigate seasonal dynamics and the effects of ENSO and non-ENSO cycles as part of a regional Caribbean study project on climate and dengue.

*Full Authorship:* Samuel C. Rawlins[1], Beverly Andrews[1], A. Anthony Chen[2]
1. Caribbean Epidemiology Centre (CAREC), Port of Spain, Trinidad
2. Department of Physics, University of the West Indies at Mona, Jamaica

**[9:20 - 9:35]**

*Speaker:* **Guillermo L. Rua, Programa de Estudio y Control de Enfermedades Tropicales -PECET Universidad de Antioquia, Medellín – Colombia**

*Title: El Niño Southern Oscillation (ENSO) Related to Malaria Transmission, Density and Parity of Anopheles albimanus (Diptera: Culicidae) in Colombia*

Rua describes a study of the effect of ENSO variability on malaria in Colombia during the period 1997-1999, which includes the 1997-1998 El Niño event and the 1998-2000 La Niña event. The study site is two villages in Chocó on the Pacific coast. Data were collected on reported malaria cases and the mosquito vector Anopheles albimanus. The number of malaria cases increased during El Niño, associated with an increase in average air temperature, but not precipitation or humidity. There was no observed association between the entomological and climatological variables. More studies of climate and malaria are needed to explain their relationship.

*Full Authorship:* Guillermo L. Rúa[1], Martha L. Quiñónes[1], Iván D. Velez[1], William Rojas[2], Germán Poveda[3], Juan S. Zuluaga[2], Daniel Ruiz[3], Ricardo Mantilla[3]
1. Programa de Estudio y Control de Enfermedades Tropicales -PECET Universidad de Antioquia, Medellín – Colombia
2. Corporación para Investigaciones Biológicas, Medellín – Colombia
3. Posgrado en Aprovechamiento de Recursos Hidráulicos, Universidad Nacional de Colombia at Medellín, Medellín – Colombia

**[9:40 - 9:55]**

*Speakers:* **Nancy D. Lewis, Director of Studies, East-West Center, University of Hawaii, Honolulu, Hawaii, USA and Michael P. Hamnett, Director, Social Science Research Institute, University of Hawaii, Honolulu, Hawaii, USA**

*Title: Climate Variability and Human Health in the Pacific Islands*

Lewis and Hamnett analyze climate variability and human health in the Pacific Islands from 1974 - 1996. Their primary focus is on dengue, ciguatera and diarrheal disease. Follow-up sub-regional studies are in Fiji and the Cook Islands. They also present evidence that the use of climate forecasts in the 1997-98 El Niño event in the US affiliated Pacific Islands decreased the impact of that event on health and well being. Lessons learned in the Pacific are relevant to the Caribbean because of many demographic and environmental similarities between islands in the Caribbean and those in the Pacific.

*Full Authorship:* Same as above

---

**[10:00 - 10:15]**

*Speaker:* **Brian Challenger, Consultant, Ministry of Public Utilities, Antigua & Barbuda**

*Title: Health Sector Climate Change Impacts and Adaptations: Initial Assessment Results from St. Lucia*

Challenger provides an initial assessment of some of the possible impacts of climate change in St. Lucia and makes certain broad recommendations for climate change adaptation in the St. Lucia health sector. He identifies existing health conditions in St. Lucia likely to be most vulnerable to the impacts of climate change projected by the IPCC for the Caribbean – rainfall variability, sea-level rise, increased temperatures, and changes in tropical storm and hurricane activity. He also identifies possible areas for priority attention for enabling greater adaptation by the health sector to climate change.

*Full Authorship:* Same as above

---

**[10:20 - 10:35]**

*Speaker:* **Dana Focks, Infectious Disease Analysis, Gainesville, Florida, USA**

*Title: Impact of Anticipated Climate Change on Dengue in the Caribbean Based on the New Ocean/Atmosphere-Coupled Hadley Climate Model version 3 (HadCM3) and Report on Statistical and Neural Net Early Warning Systems for Dengue on the Island of Java*

Focks anticipates the consequences of climate change on dengue in weather-driven dengue models (CIMSiM/DENSiM) for several of the smaller islands in the Caribbean. He uses the HadCM3 climate model that

projects only slight elevations in temperature but larger changes in rainfall deficits in the eastern Caribbean region. Rainfall changes would modify the hydrology of rain-filled containers in which the mosquito vector Aedes aegypti breeds. Even slight elevations in temperature have a significant influence on transmission. He also briefly reports on dengue early warning systems developed for Yogyakarta on the island of Java in Indonesia. The systems depend on links between dengue transmission and interannual climatic variability.

*Full Authorship:* Same as above

---

**[10:40 – 11:00]** Panel Discussion

---

**[11:00 – 11:20]** BREAK

---

**[11:20 – 12:55]**

*Linkages between Climate and Human Health (Part II) (Session 4)*

*Session Moderator:* **Leslie Walling, Caribbean Planning for Adaptation to Global Climate Change/ Adapting to Climate Change in the Caribbean (CPACC/ACCC), Centre for Environment and Development, University of the West Indies at Cave Hill, Barbados**

Session 4 examines additional linkages between climate and human health, with discussion of ecological effects that are unique to the Caribbean. One linkage is the effect of unusual climatic conditions in 1999 on fish mortality in the southeast Caribbean. Another linkage is the transport of African dust across the Atlantic to the Caribbean with implications for ecosystem health (coral reefs), agriculture and livestock (safety of the food supply), and human health. This session also provides information about satellites as shared resources for climate and health studies in the Caribbean.

---

**[11:20 – 11:35]**

*Speaker:* **Avril M. Siung-Chang, Pan American Health Organization (PAHO), Port of Spain, Trinidad**

*Title: Unusual Climatic Conditions Associated with Mass Fish Mortalities in the Southeast Caribbean from Trinidad and Tobago to Barbados, During the Period July to October, 1999*

Siung-Chang reports on a number of fish kills near the islands of Trinidad, Tobago, Grenada, St. Vincent and the Grenadines and Barbados during the period July to October 1999. The affected fish were all reef or shallow water demersal species. Mass mortality incidents of marine organisms affecting several countries in the Caribbean are infrequent. It is hypothesized that the agent/s of the July/October 1999 fish kills, physical and/or biological, can be attributed to unusual rainfall, resulting in large volumes of surface water from the South American mainland being transported northwards in retroflection eddies, to the islands of Trinidad and Tobago to Barbados.

*Full Authorship:* Avril M. Siung-Chang[1], Amoy Lum Kong[2]
1. Pan American Health Organization (PAHO), Port of Spain, Trinidad
2. Institute of Marine Affairs, Chaguramas, Trinidad

**[11:40 - 11:55]**

*Speaker*: **Christina A. Kellogg, Center for Coastal Studies, U.S. Geological Survey, St. Petersburg, Florida, USA**

*Title: Characterization of Microbial Communities Associated with African Desert Dust and Their Implications for Global Human and Ecosystem Health*

Kellogg discusses the relationship between climate change and the continued rise since 1970 in the amount of dust crossing the Atlantic, coincident with the worsening drought conditions in the Sahara/Sahel region of Africa. Peaks in the dust record correspond to some major coral morbidity/mortality events in the Caribbean. Microbiological and molecular techniques identified over 60 bacterial and 20 fungal isolates from a series of dust storms sampled in Bamako, Mali, West Africa. The transcontinental movement of microbes in African dust as part of the global system of dust transport has implications for ecosystem health (coral reefs), agriculture and livestock (safety of the food supply), and human health.

*Full Authorship:* Christina A. Kellogg[1], Dale W. Griffin[1], Eugene A. Shinn[1]
1. Center for Coastal Studies, U.S. Geological Survey, St. Petersburg, Florida, USA

**[12:00 - 12:15]**

*Speaker:* **Edmund Blades, Department of Biological and Chemical Sciences, University of the West Indies at Cave Hill, Barbados**

*Title: The Transport of Soil Dust and Microbes from Africa and Their Relationship to Asthma in Barbados*

Blades describes a study of possible causes of asthma on Barbados, which has a relatively high incidence –19.8% prevalence and a 17-fold increase since 1973. The study sampled African dust daily from 1996 on the easternmost point of Barbados and from 2000 inland. The samples produced variable numbers of Bacillus species and fungi. The study also counted local pollen and spores, collected rainfall data, and reported the number of asthmatic visits to a hospital emergency room. An increased number of asthmatic visits in September to December correlated with these counts as well as rainfall. In order to establish a relationship between African aerosols and asthma, it will be necessary to examine the composition of the aerosols in detail rather than simply the total concentration of the dust component.

*Full Authorship:* Edmund Blades[1], Joseph Prospero[2], Raana Naidu[3] , George Mathison[1]
1. Department of Biological and Chemical Sciences, University of the West Indies at Cave Hill, Barbados
2. Rosenstiel School of Marine and Atmospheric Science, University of Miami, Miami, Florida, USA
3. School of Clinical Medicine and Research, University of the West Indies at Cave Hill, Barbados

**[12:20 – 12:35]**

*Speaker:* **Nancy Maynard, Associate Director, Environment and Health, Goddard Space Flight Center, National Aeronautics and Space Administration (NASA), Greenbelt, Maryland, USA**

*Title: Satellites as Shared Resources for Caribbean Climate & Health Studies*

Maynard describes how remote sensing, geographic information systems (GIS) and interdisciplinary research between the Earth and health science communities are being combined in collaborative studies which are resulting in more rapid problem-solving, early warning, and prevention in global health issues. She summarizes some of the remote sensing systems that are most useful for climate, environment and health studies of the Caribbean region. She gives examples of remote sensing technologies used to study algal blooms, pollution transport, coral reef monitoring, vector-borne disease, and potential health effects of African dust on Trinidad and Barbados.

*Full Authorship:* Same as above

**[12:40 – 12:55]** Panel Discussion

**[1:10 – 2:10]** LUNCH (at conference venue)

**[2:30 – 4:30]**

*Public Health Policies and Strategies for Adaptation to Climate Variability and Change (Session 5)*

*Session Moderator:* **Ulric O'D. Trotz, Caribbean Planning for Adaptation to Global Climate Change/Adapting to Climate Change in the Caribbean (CPACC/ACCC), Centre for Environment and Development, University of the West Indies at Cave Hill, Barbados**

Session 5 addresses public health policies and strategies for adaptation to climate variability and change. This session covers a broad range of topics, from the control of specific diseases to general communication strategies for climate and health. It brings a global perspective as well as insights from experiences in the Caribbean region.

**[2:30 – 2:45]**

*Speaker:* **A. Anthony Chen, Department of Physics, University of the West Indies at Mona, Jamaica**

*Title: Is the Climate Right for Predicting and Mitigating an Outbreak of Dengue Fever?*

Chen reports on a new project aiming to: 1) confirm a relationship between an increase in the incidence of dengue and the occurrence of El Niño in the Caribbean; and 2) establish an early warning public health system to

monitor El Niño events so that health officials can take the necessary steps to reduce the spread of the disease when appropriate. He elaborates on several difficulties, which range from scientific issues, such as model validation, to implementation issues in establishing a network involving climate forecasters, public health officials and the information media. He relates experiences based on the conduct of past Climate Outlook Forums in the Caribbean that reveal many obstacles to overcome in building such a network.

*Full Authorship*: A. Anthony Chen[1], Samuel C. Rawlins[2]
1. Department of Physics, University of the West Indies at Mona, Jamaica
2. Caribbean Epidemiology Centre (CAREC), Port of Spain, Trinidad

---

**[2:50 – 3:05]**

*Speaker*: **Ana Rosa Moreno, United States-Mexico Foundation for Science, Mexico City, Mexico**

*Title: Climate Change and Human Health: Risk Communication and Information*

Moreno argues that the time is right to engage in a dynamic process to educate all citizens about climate change issues. Risk communication is an important tool for risk management. It is important for risk communicators to provide not only accurate and timely information, but also to be able to convey a sense of efficacy. This may mean tailored information. It is therefore necessary to make the impacts on climate change and human health information available and useful to the different types of users, to broaden and intensify the dissemination of this information, and to provide capacity building for the management of this information. International networks could contribute to communicating the monitoring of the impacts of climate change.

*Full Authorship:* Same as above

---

**[3:10 – 3:25]**

*Speaker:* **Paulo L. Ortiz Bulto, Climate Center, Meteorological Institute, Havana, Cuba**

*Title: Impacts of Climate Change and Variability on Some Diseases in the Tropical Region: An Example of the Strategies for Adaptation to Climate Variability and Change*

Ortiz describes methodology that finds seven diseases sensitive to climate change in Cuba: acute respiratory infections (ARIs), acute diarrheal disease (ADDs), viral hepatitis (VH), varicella (V), meningococcal disease (MD) and malaria due to Plasmodium falciparum and P. vivax. The impacts of climate on human health are complex for any region and disease, including the costs of the impacts and the application of adaptation measures. He finds that a Bioclimatological Monitoring System is successfully applied with the implementation of control programs for climate-sensitive diseases. These measures contribute to enhancing preparedness and improving human health in the broader sense, with or without climate change.

*Full Authorship:* Same as above

**[3:30 – 3:45]**

*Speaker:* **Sari Kovats, London School of Hygiene and Tropical Medicine, London, UK**

*Title: Guidelines to Assess the Potential Health Impacts of Climate Variability and Change*

Kovats presents guidelines on how to assess the potential health impacts of climate change and adaptation strategies. Key issues include: stakeholder involvement; use of an integrated assessment approach; policy and economic analyses; data archival; a peer review process; and communication strategy. Assessments can combine a variety of methods, including expert judgement, surveys, literature reviews and modelling. Countries of the Caribbean region have different capacities, including human and material resources, data and priorities for assessing the impacts and adaptation measures for climate change. In some situations, a multi-country regional assessment may be more efficient than individual national assessments.

*Full Authorship:* Kristie L. Ebi[1], Bettina Menne[1], Sari Kovats[2]
1. European Center for Environment and Health, WHO, Rome, Italy
2. London School of Hygiene and Tropical Medicine, London, UK

**[3:50 – 4:05]**

*Speaker:* **Leslie Walling, Caribbean Planning for Adaptation to Global Climate Change/Adapting to Climate Change in the Caribbean (CPACC/ACCC), Centre for Environment and Development, University of the West Indies at Cave Hill, Barbados**

*Title: Adapting to Climate Change in the Caribbean*

Walling provides a perspective on adaptation strategies from his experience with the Caribbean Planning for Adaptation to Global Climate Change (CPACC) Project. CPACC supported Caribbean countries in preparing to cope with the adverse effects of global climate change, particularly sea-level rise in coastal areas, through vulnerability assessment, adaptation planning and related capacity-building. The CARICOM Heads of Government have endorsed a Regional Climate Change Centre to coordinate follow-on activities. Two new projects are Mainstreaming Adaptation to Climate Change in the Caribbean (MACC) and Adapting to Climate Change in the Caribbean Region (ACCC), which has an explicit health component.

*Full Authorship:* Same as above

**[4:10 – 4:30]** Panel Discussion

**[4:30 – 4:50]** BREAK

**[4:50 - 5:10]** *Fill out evaluation forms.*

**[5:10 - 5:30]** *Closure*

Next steps

**END OF CONFERENCE**

## The Terminology of Climate — Variability and Change

| | |
|---|---|
| Weather | Changes in the atmosphere on a daily basis. |
| Climate | The average of the weather over months, seasons and longer periods. |
| Global climate system | Patterns of global circulation operate at spatial scales larger than 10 million square kilometers, which is about four times larger than the area of the Caribbean Sea. The general circulation of the global atmosphere changes over a wide range of time scales. Three time scales of changes in the global climate system (below) are especially relevant to this conference. |
| Seasonal to interannual | The global climate system changes regularly from season to season. Year-to-year changes are dominated by the El Niño/Southern Oscillation (ENSO). Every two to seven years, ENSO produces warming and cooling of the equatorial Pacific ocean and associated fluctuations in atmospheric pressure. ENSO effects in the Pacific region influence climatic conditions worldwide. The North Atlantic Oscillation (NAO) and other oscillations are also important. |
| Decadal | Changes in the global climate system across decades are of great interest in the Caribbean region because changes in the development of Atlantic hurricanes occur on this time scale. In the 1930s and 1940s, the Caribbean region experienced strong hurricane activity. The period from the late 1960s to the 1980s was relatively quiet in terms of hurricane activity. |
| Centuries and longer | Changes in the global climate system across centuries and longer time periods may be profound. Earth's climate in past millennia has been much colder (ice sheets in Pennsylvania) and much warmer (no polar icecaps). During the 20th century, the average sea level rose by 10 to 20 centimeters, a rate of increase about 10 times faster than observed over the past 3000 years. |

| | |
|---|---|
| Climate variability | Typically refers to the global climate system on time scales that are seasonal to interannual and decadal. |
| Climate change | In the global climate system occurs over centuries and longer. |
| Local and regional climate systems | Interact with the global climate system. |
| Effect of human activities on climate | Human activities affect climate at multiple scales. Locally, for example, urbanization may create an urban heat island warmer than the surrounding countryside as well as problems in sewage management, urban flooding and air mass stagnation. A more complex linkage is global climate change as the consequence of enhanced global warming caused by increased emissions of greenhouse gases (e.g., carbon dioxide) from industrial and agricultural sources. The U.N. Framework Convention on Climate Change seeks to avoid damage to the environment caused by enhanced global warming. |
| Stratospheric ozone depletion | Affects climate differently than does enhanced global warming. The loss of stratospheric ozone permits more ultraviolet radiation to reach Earth's surface. This loss is accelerated by industrial emissions of chlorofluorocarbons. The poles are most strongly affected ("the ozone hole"). The U.N. Environment Programme periodically assesses the environmental effects of ozone depletion. The next review is expected to appear in late 2002. |