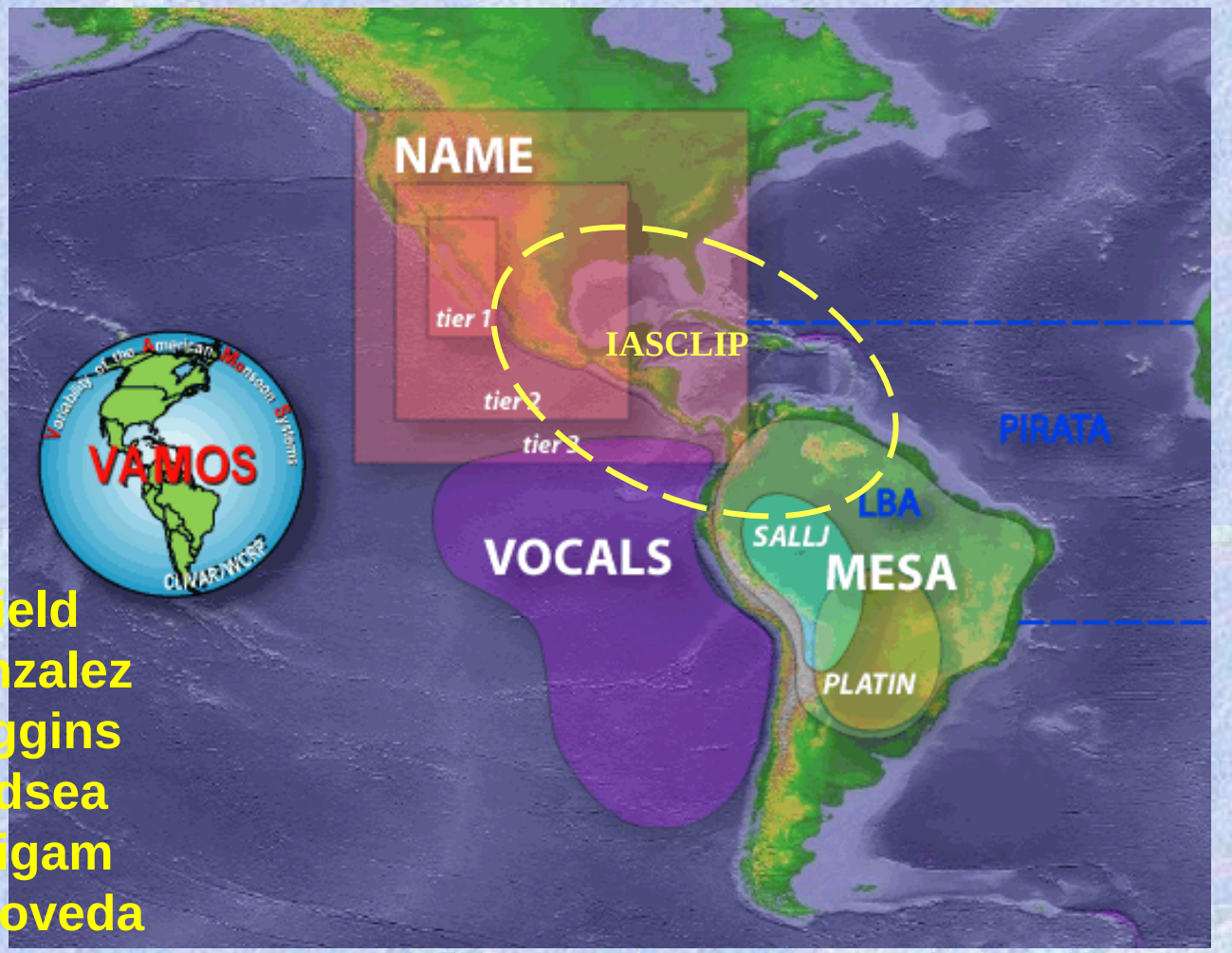
IASCLIP



David Enfield
Jorge Gonzalez
Wayne Higgins
Chris Landsea
Sumant Nigam
German Poveda
Chet Ropelewiski
Chunzai Wang
Chidong Zhang
Jorge A Amador

A brief history of the Intra Americas Sea Climate Process (IASCLIP):

- **2004-2005: An IASCLIP prospectus was prepared by a group of 12 scientists from 5 countries;**
- **March 2005: The IASCLIP prospectus was submitted to the VAMOS panel and its key scientific issues were presented and discussed at VPM8 in Mexico City;**
- **April 2006 :The IASCLIP Science Plan was updated and delivered (VPM9 at Foz de Iguazu) and the VAMOS panel recommended an IASCLIP implementation plan to be developed**

Purpose of this presentation:

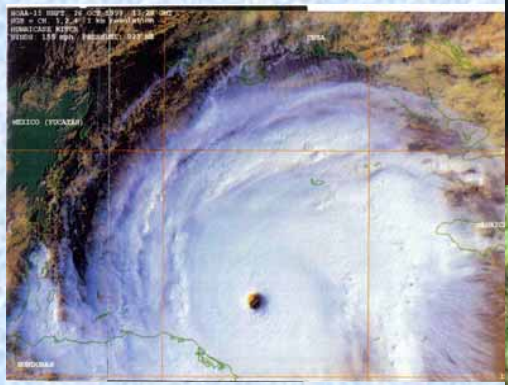
-Briefly summarize the key scientific issues of IASCLIP

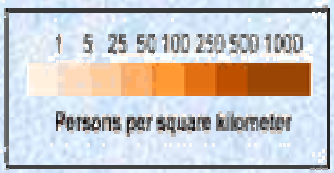
-Outline the implementation plan

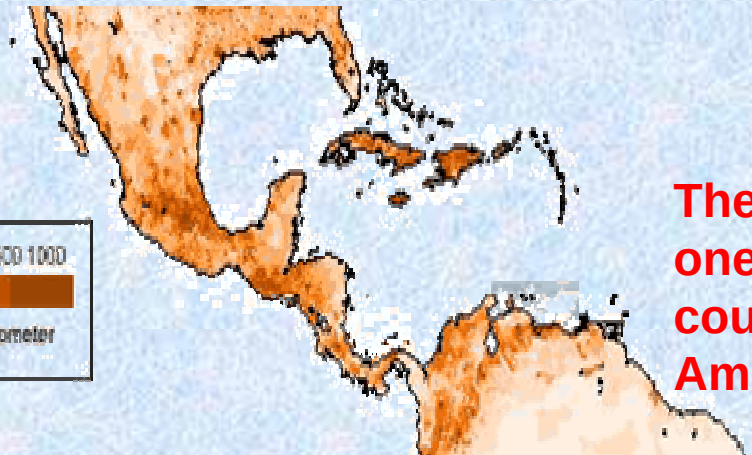
-Seek advices from the VAMOS panel and community for future actions

Societal Motivation

Climate variability at different time and space scales produces catastrophic loss of life and destruction of infrastructures and properties







The IAS region is home for more than one hundred million people. Some countries are among the poorest in the Americas.

An IAS Climate Program (IASCLIP)

This research program is envisioned as one that bridges the gaps between climate research for North America (NAME) and South America (MESA/SALLJEX/PLATIN) and for the Pacific (TEPPS, EPIC, VOCALS) and Atlantic (AMI, AMMA)

IASCLIP Objectives:

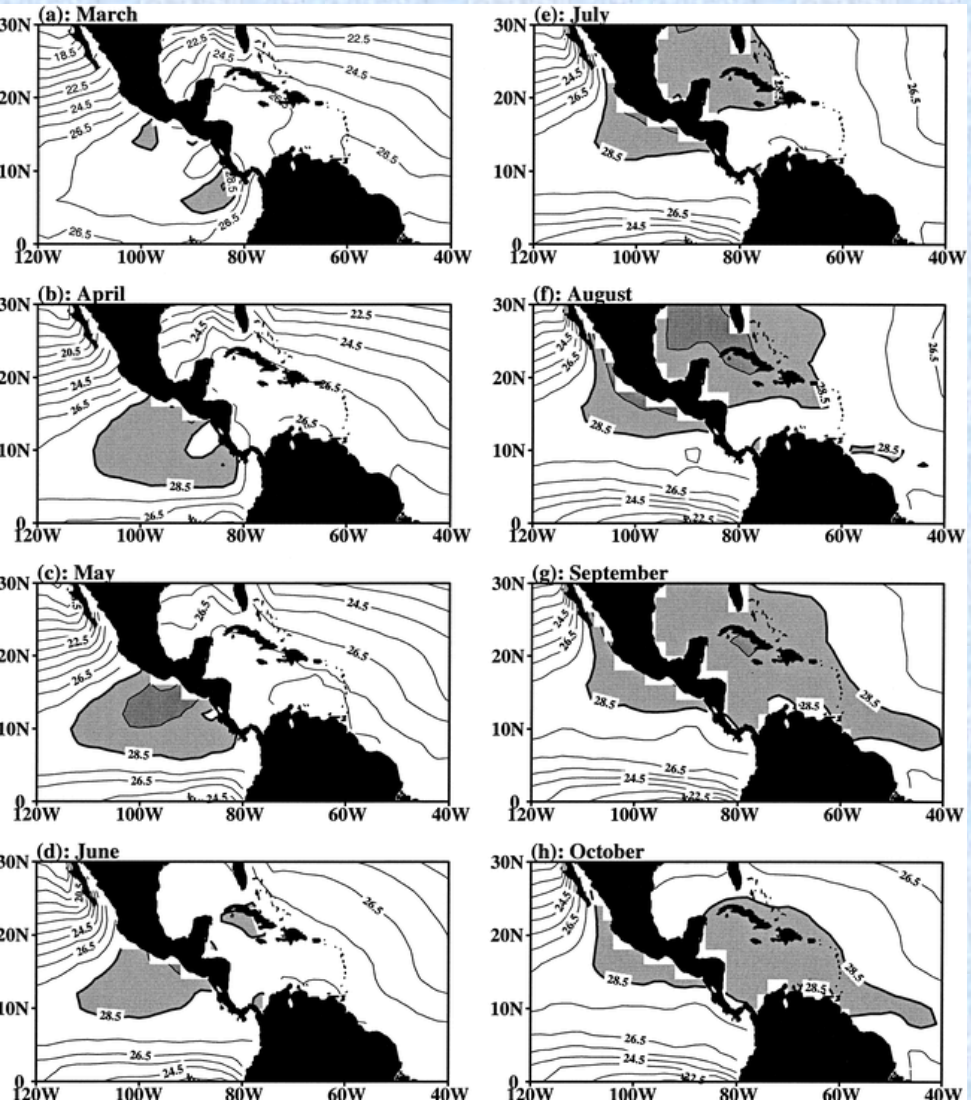
(1)Improve the understanding of climate processes in the IAS region key to the multiscale variability and predictability of rainfall in Americas.

(2) Contribute to model improvement for prediction of multiscale rainfall variability in the Americas

(3) Facilitate capacity building in the IAS region for societal benefit from advancement of climate studies and forecasts

In summary, some of the subjects of study for the IAS region

- **Western Hemisphere Warm Pool (WHWP)**



(a) What are the mechanisms by which the WHWP influences precipitation in the IAS region?

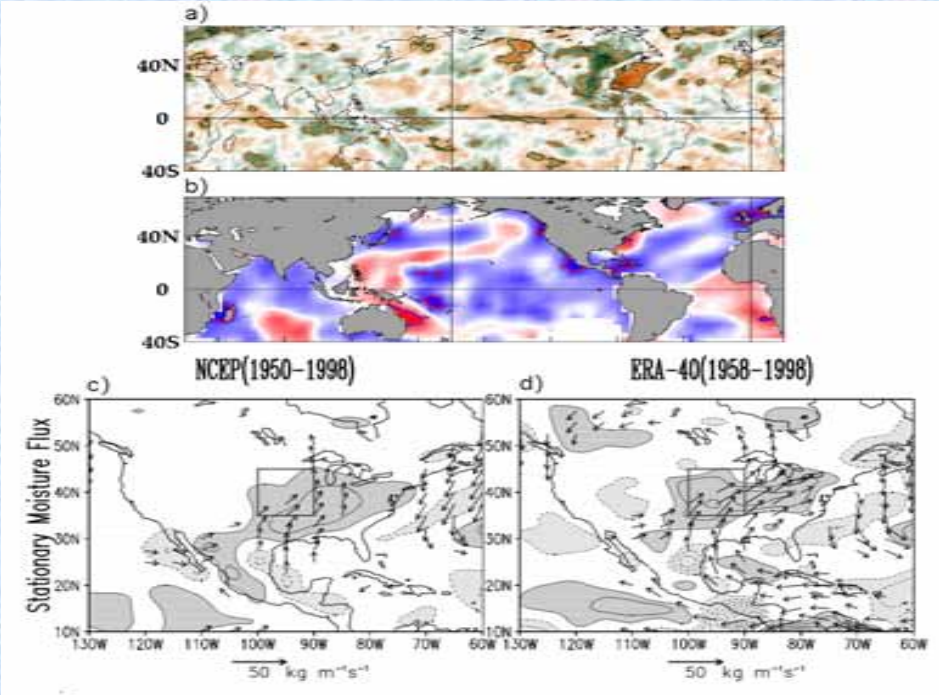
(b) What are the mechanisms for the variability of the WHWP?

(c) How well can the WHWP be reproduced by ocean models?

(d) How does the warm pool influence hurricanes?

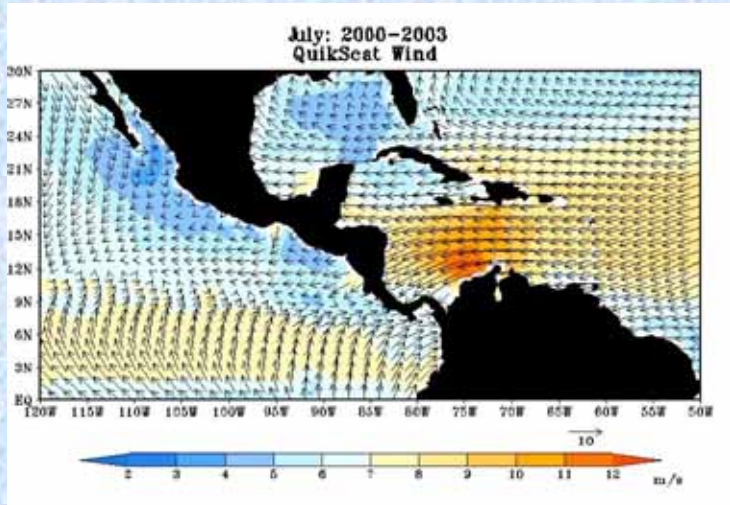
Seasonal distributions of SST for the tropical WHWP: (a) Mar, (b) Apr, (c) May, (d) Jun, (e) Jul, (f) Aug, (g) Sep, and (h) Oct. The shading and dark contour represent water warmer than 28.5°C. (From Wang and Enfield 2003)

Water vapor transport



Upper panels: Correlation of northward moisture flux across the Gulf of Mexico with CMAP precipitation (a) and sea surface temperature (b), from Mestas-Nuñez et al. (2007). Lower panels: Regression of NCEP reanalysis precipitation (c) and ERA reanalysis precipitation (d) on summer precipitation over the Great Plains (box area), from Ruiz-Barradas and Nigam (2005).

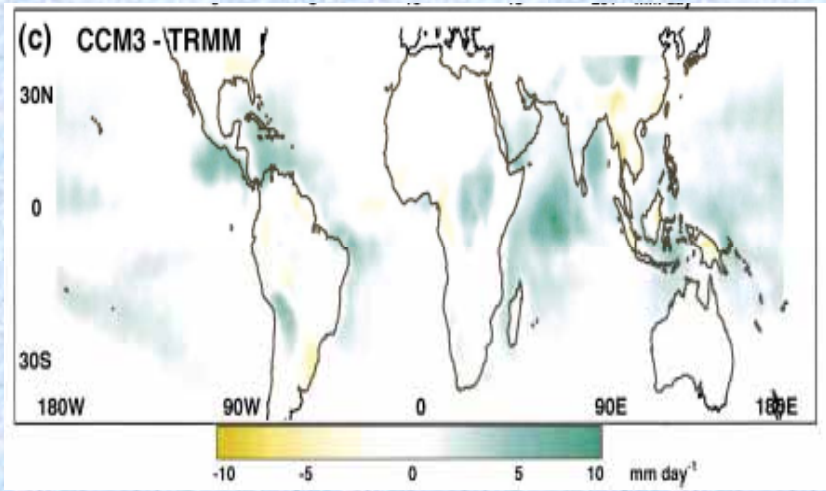
(a) *What are the structure and dynamics of the low-level jets in the IAS?*
(b) *What are the mechanisms for the interannual variability of water vapor transports?*
(c) *How well do global and regional models reproduce the low-level jets? –*
(d) What are the major uncertainties and p*roblems with reanalyses?*
(e) What are the l*inkages between the IAS and the Pacific? IALLJ and Choco Jet?*



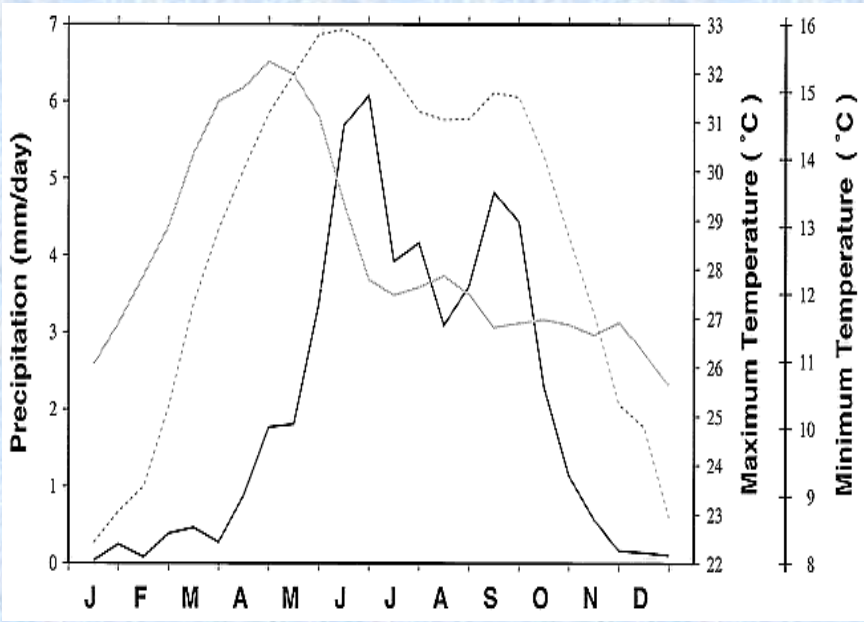
July mean QuikScat winds (m s-1) for the period 2000-2003 (from Amador et al., 2006)

Land-air-sea interaction

(a) *How does land affect surface and low-level pressure distributions?*
(b) *Why do many, if not most, GCMs misrepresent the spatial distribution of precipitation in the IAS region?*



Mid-summer drought (MSD)

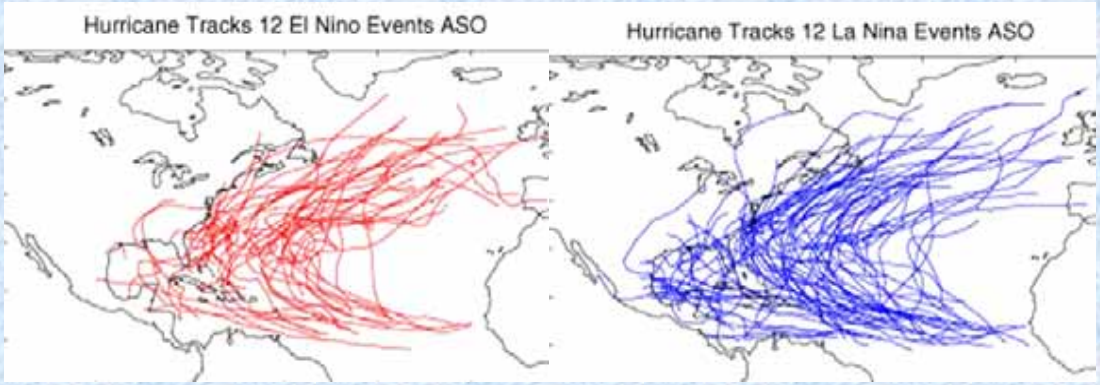


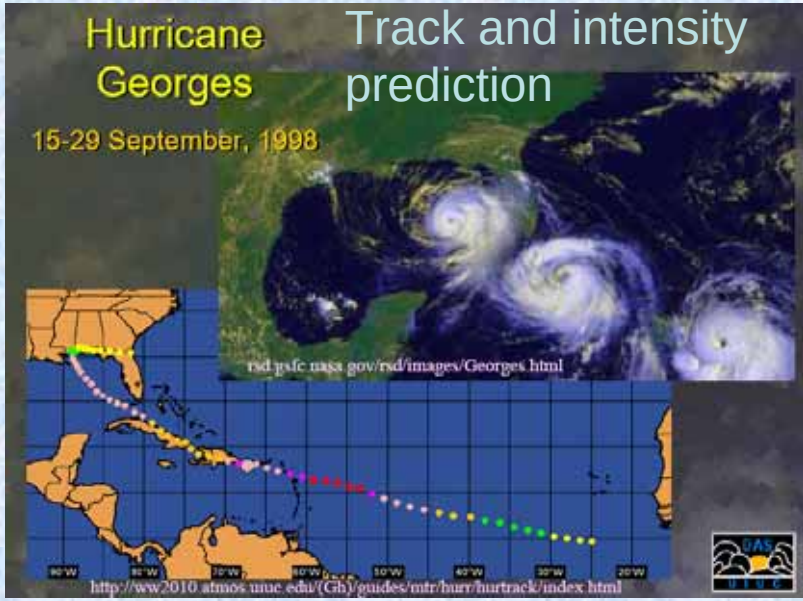
(a) *What are the relative importance of NASH, ITCZ, SST, IALLJ, land effects, and related local atmospheric circulation in the MSD and its interannual variability?*
(b) *What are the typical errors in global and regional models in their simulation and prediction of the MSD?*

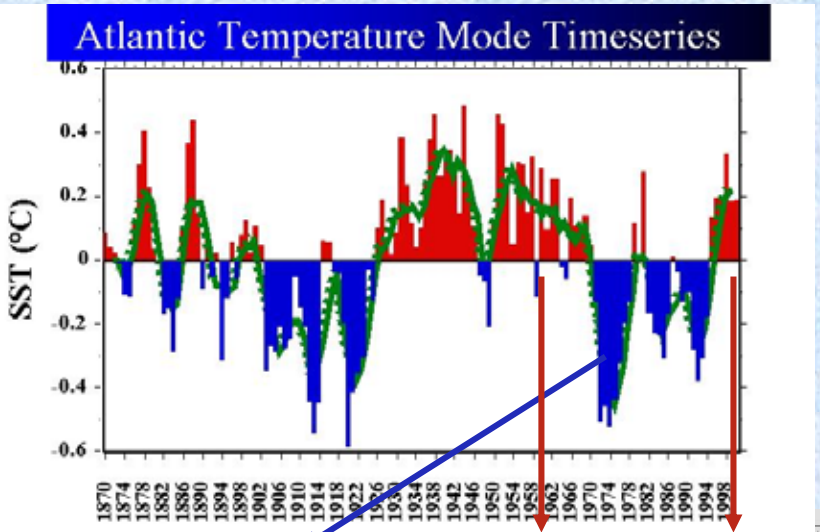
Biweekly climatology of precipitation (black solid line), maximum temperature (gray solid line), and minimum temperature (dotted line) for Oaxaca, Mexico (17.8˚N, 97.8˚W). (From Magana et al. 1999)

Tropical storms and hurricanes

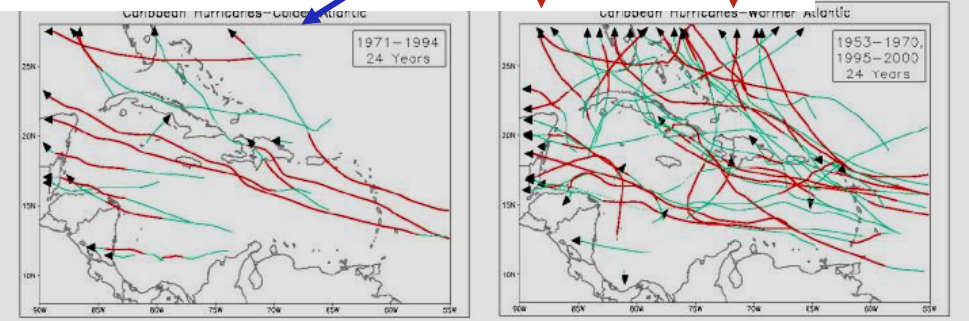
Influences of ENSO

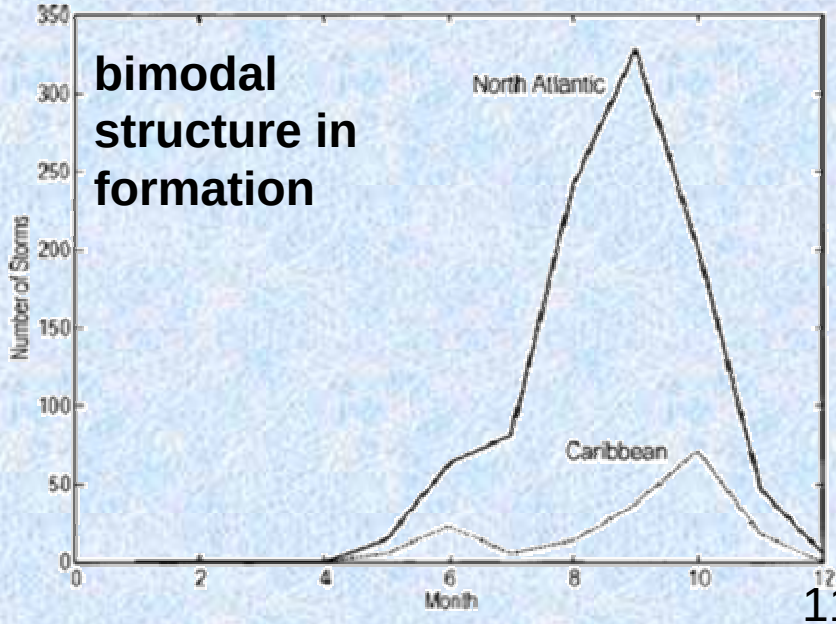




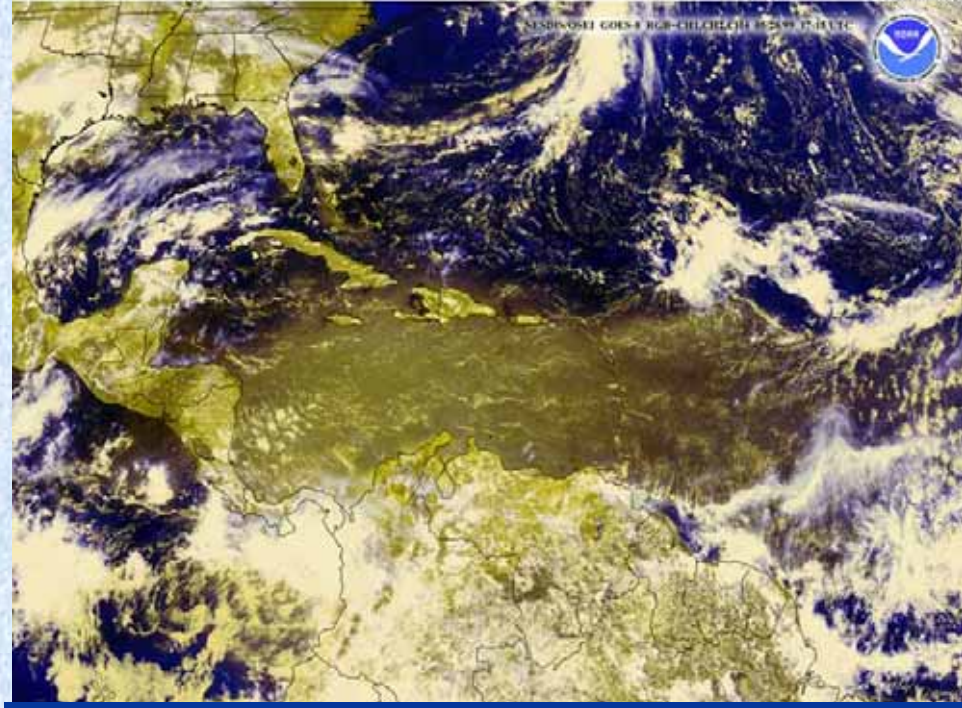


Multidecadal variability





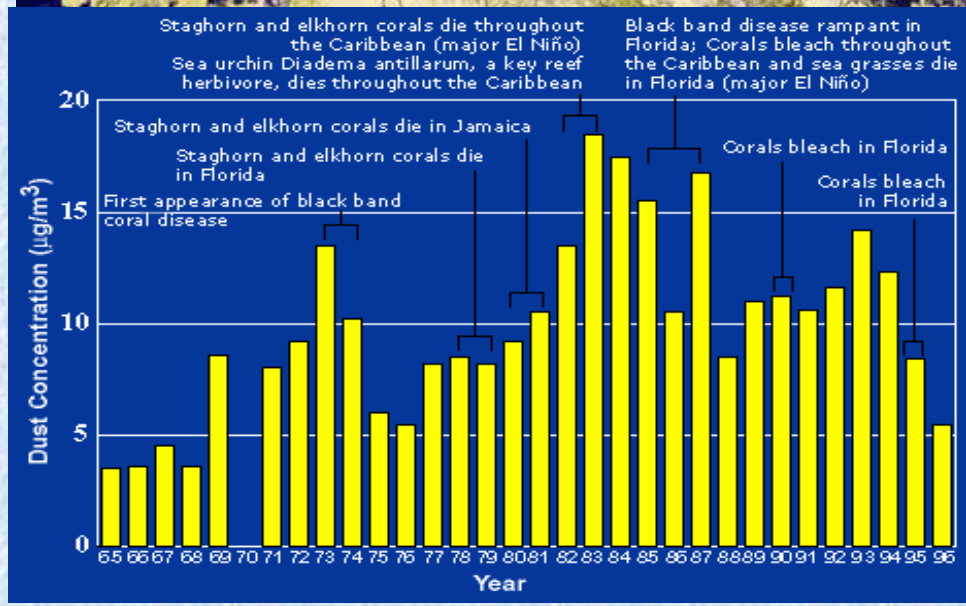
Satellite image (05/28/1999) showing dust covering the southern Caribbean, (From NOAA, Prospero and Stone, 1997)



The interactiones between clouds and aerosols

Modulation of rainfall?

a)- What is the 4-D distribution of Cloud Condensation Nuclei (CCN) in the IAS, what are their sources, variability and what are their roles in clouds formation?
b)- What is the variability of cloud heights and depths in the Caribbean as function of regional SSTs, and large scale forcings such as the ENSO, the NAO the Atlantic dipole and the Atlantic multi-decadal oscillation?
c)- What is the relationship between aerosols and seasonal climate variation in the IAS?



Barbados Mineral Dust Annual Average and Benchmark Caribbean Events (After Prospero 2002)

Societal impacts

Climate variability in the IAS region has had a profound influence on society and economy of the region (thousands of human losses and millions of dollars in infrastructure)

The early seasonal rainfall and MSD can have important impacts on agriculture, tourism, and hydropower generation and there has been little research on direct and indirect effects of tropical storms on society. While there is some seasonal predictability in the overall character of the hurricane season, there is no long range predictability on where, the storms will hit. Except for the northern coast of SA, the IAS region must be prepared for excess/defficit of rainfall with the obvious implications for risk management.

Variability on time scales from interannual through decades not to mention climate change, represent unique challenges for the practical application of the knowledge expected to be gained in the IASCLIP.

IASCLIP Hypotheses:

- **Predictability of climate variability in the IAS region are affected by both remote (e.g., ENSO, NAO, TAV) and local (warm pools, land, EW, LLJ) factors;**
- **High impact weather (e.g., TC, flood, severe storms) play critical roles in local manifestations of climate variability and change in the IAS region;**
- **Easterly waves-mean flow interaction is crucial to understand climate in the IAS;**
- **Air-land-sea interaction and tropical-extratropical interaction are the thrusts of climate variability in the IAS region.**
- **Multiscale interaction is crucial to rainfall variability in the IAS region.**

Implementation

To sufficiently address the issues raised before, a combination of diagnoses of existing data, modeling, and process studies are needed.

The IASCLIP program would be conducted in three phases

Pase I (2008-2011) : Diagnostics and Modeling

Phase II (2011-2012) : Field Campaign (if deemed necessary)

Phase III (2012-2014) : Post field campaign, data analysis and modeling

Phase I (2008-2011) : Diagnostics and Modeling

To identify the most critical processes for the IAS Climate and the model deficiencies in replicating them.

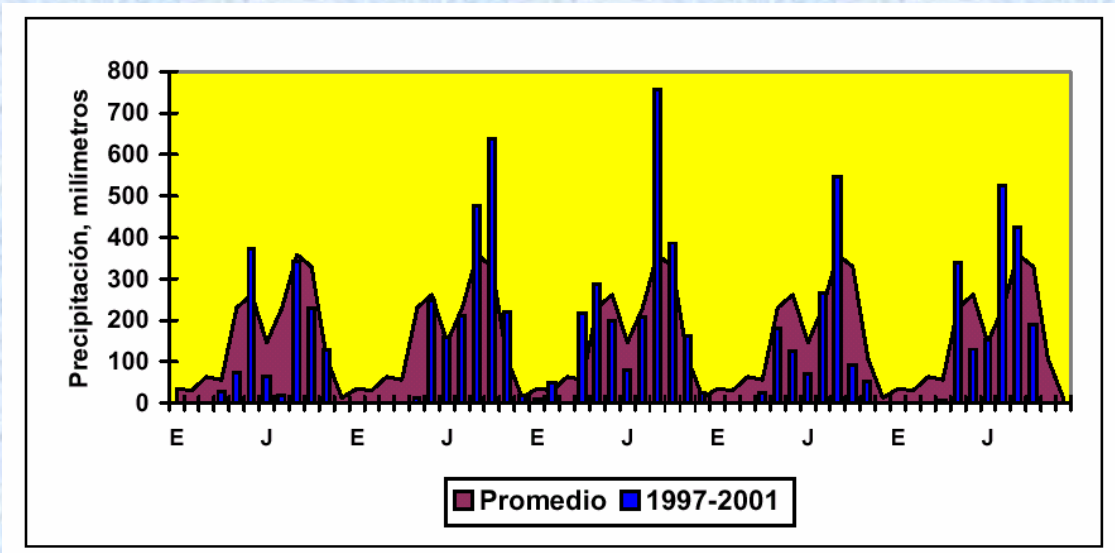
Model diagnoses should include weather prediction and regional climate models since the distinction between them has become blurred.

The NAME Model Intercomparison Project should naturally extend into this.

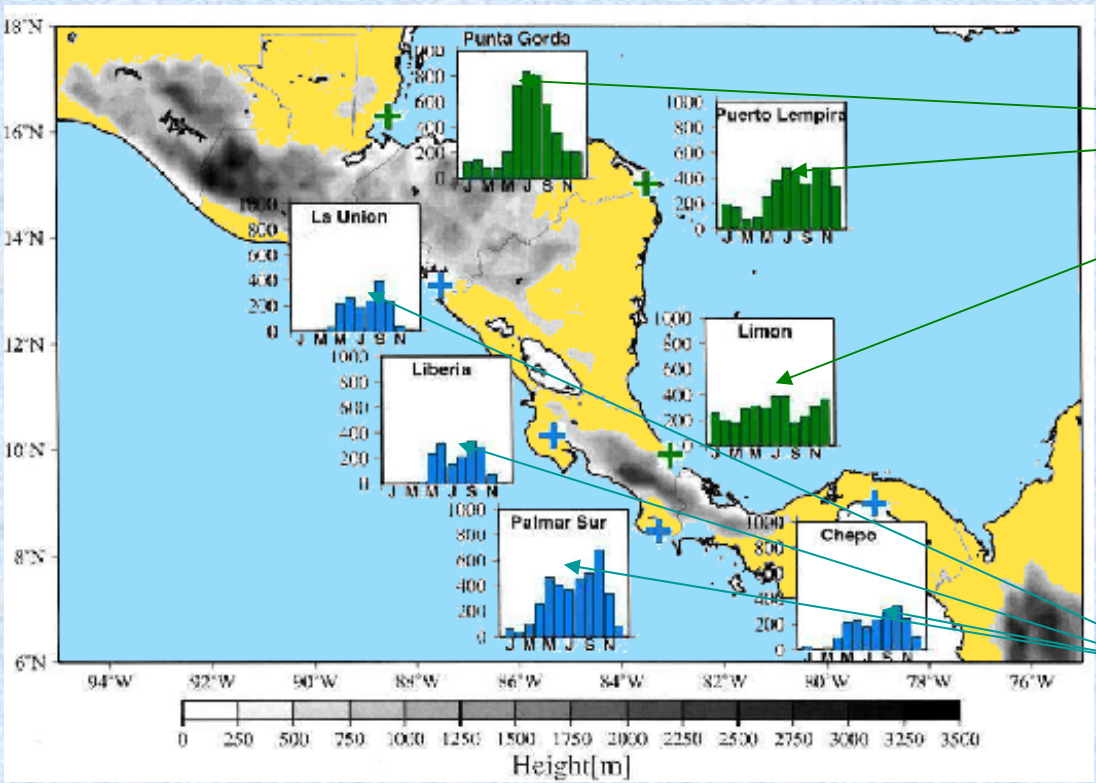
Priority Tasks (Particular Phase I tasks include but are not limited to)

1) Document the regional atmospheric and terrestrial water cycles, including their uncertainties (attention on key circulation and hydroclimate features, such as llj´s, regional terrain and vegetation)
2) Identify uncertainties in global reanalysis and possible sources for them (for example uncertainties in moisture flux near the northern part of the Gulf of Mexico)
3) Document model deficiencies in simulating the key climate features (e.g., MSD, IALLJ, MJO, ITCZ) and ocean variability (e.g., IAS ocean circulation)

Key issue 4: Multiscale interaction (a) The Mid Summer drought (MSD)



Annual cycle of precipitation in Guanacaste, Costa Rica



Maximum in precipitation in July

Minimum precipitation in July (MSD)

Phase I (2008-2011) : Diagnostics and Modeling

4) encourage modeling innovations for simulation, prediction and predictability studies of the region

5) Conduct diagnostic modeling for assesing the importance of the IAS region through various forcing sources (e.g., WHWP, regional diabatic heating)

6) Investigate the need and feasibility of producing a regional high-resolution reanalysis for the IAS region (limitations of current NARR for IAS studies :lack of coverage and undesirable boundary effects). Regional WMO RMTC´s, currently using models such as the MM5 and WRF to collaborate in the development of regional reanalysis as part of the IASCLIP capacity building program (c.f. recommendation from VPM8 (2005) in Mexico City)

7) Identify the in situ observations from the IAS region that are most urgently needed for model validation and improvement.

World Meteorological Organization (WMO)
Regional Meteorological Training Centers (RMTC)

Regional Association III (ARIII)

BRAZIL
Univ Fed do Pará - RMTC Brazil
Universidade Federal do Pará, Centro de Geociencias
Departamento de Meteorologia, Caixa Postal 1611
CEP 66.075-110 - BELÉM-PARÁ , Brazil
http://www.ufpa.br/cg/DM.htm
Tel: (55-91) 230 3104
Fax: (55-91) 211 1609
Mail: jricardo@ufpa.br
Last Update: 15-Jul-03
Deliveries overview

* Undergraduate programme: BSc in Meteorology; 4 years;
* MSc in Hydrometeorology; 2 years.

VENEZUELA
Central Univ of Venezuela - RMTC Venezuela
Universidad Central de Venezuela
Departamento de Meteorología e Hidrología
Ciudad Universitaria, CARACAS 1051, Venezuela
www.ucv.ve
Tel: (00 58) 212 993 8121
Fax: (00 58) 212 993 2208
Mail: asalcedo@cantv.net
Last Update: 23-Apr-04
Deliveries overview

* BSc in Meteorology and Hydrology
* Postgraduate courses in Hydrology
* Other specialized courses online

Regional Association IV (AR4)

BARBADOS
CIMH Bridgetown - RMTC Barbados
Caribbean Institute for Meteorology and Hydrology
Husbands, St. James, P.O. Box 130
BRIDGETOWN, Barbados, W.I.
http://www.cimh.edu.bb
Tel: 246 425-1362
Fax: 246 424 4733
Mail: cdepradine@cimh.edu.bb
Last Update: 06-Dec-04
Deliveries overview

* Training Courses to qualify Meteorological and Hydrological Technicians
* Short-term specialised training; 1-2 weeks.

COSTA RICA
Univ San José - RMTC Costa Rica
Universidad de Costa Rica
Departamento de Física Atmosférica, Oceánica y Planetaria
Sede "Rodrigo Facio"
2060 SAN JOSÉ, Costa Rica
http://www.imd.ac.cr
Tel: (506) 207 5394
Fax: (506) 207 5619
Mail: wfer@ariel.efis.ucr.ac.cr
jaim613@yahoo.co.uk
Last Update: 16-Sep-05
Deliveries overview

* BSc in Meteorology; 4 years;
* Licenciado (postgraduate Diploma) in Meteorology; 1 year;
* MSc in Meteorology; 2 years;
* Specialist Diploma in Applied Meteorology; 1.5 years.

Phase II (2011-2012) : Field Campaign

The observational phase must await the Phase I results, however, several motivations can be articulated for a field campaign to obtain in situ observations unavailable from the existing operational network. (e.g.,)

- Our confidence of using reanalysis products as validations for model simulations must be built upon direct validations of the analysis products themselves against in situ observations.

- It is desirable to obtain a comprehensive in situ observational data set that provides a full description of processes key to the MSD not available from existing data. Based on our current understanding, such a data set should include the CLLJ and its water vapor transport, air-sea fluxes, large-scale pressure distribution associated with the NASH, aerosols, convection and precipitation

-Central to understanding the mechanisms for the interannual to interdecadal variability of TCs in the IAS is the knowledge of the effects of the large scale environment, in both atmosphere and ocean. In coordination with NOAA hurricane research that usually focuses on the storms, additional measurements from land, ship and aircraft over the IAS would augment our ability to document and understand the role of the large-scale environment, including that of tropical easterly waves, and the MJO in TC genesis, intensification, and movement.

-

Phase III (2012-2014) : Post field campaign, data analysis and modeling

- An evaluation of the ability of the current generation of seasonal climate forecast models to characterize the early part of the rainfall season (April to June) including the MSD, in the IAS region is also needed along with an effort to diagnose and improve the model outputs. Diagnostics studies to examine whether forecast models replicate the rainfall mechanisms and the statistics of sub-seasonal rainfall is also required to provide tools for managing climate risk.

- Tools for better management of climate related risks in areas of health (vector-borne diseases), water management, and agriculture need to be developed in collaboration with decision makers in the region. IASCLIP will build on efforts initiated in other programs e.g., the IAI Collaborative Research Networks and emerging IRI regional activities in agriculture and health, to develop climate risk management projects. This will require establishing collaborations not only with national and regional governmental bodies but also with NGOs and international organizations e.g., Pan-American Health Organization (PAHO), Consultative Group on International Agricultural Research (CGIAR), Global Water Partnership (GWP).

2000+

Phases/Activities	Objectives/Comments	07-11	11-12	12-14
IASCLIP	Aproval by VAMOS Panel (recommendation to CLIVARs)	●		
Phase I (Diagnostic and Modeling)		———		
Workshop on IAS Climate (I) (2008)	i) to summarize the current activities and most updated knowledge on IAS climate studies, (ii) to brainstorm current and potential PIs on the best way of organizing and coordinating research efforts on the issues discussed in this document, and (iii) to form working groups to target specific problems. **WG** considered **A**: Diagnostics, simulations and predictions **B**: Model development and experiments **C:** Data Gaps **D**: Climate Impacts (Human Dimension)	●		
WG Meetings (2009)	A meeting will be held for SSC and WG leaders to review programmatic progress and adjustment of the program plan	●		

2000+

Phases/Activities	Objectives/Comments	07-11	11-12	12-14
Phase I (Continued)				
Workshop on IAS Climate (II) (2010)	i) to summarize the progress made (ii) discuss weather a field campaign is needed **SWG** will be formed to design and execute the campaign			
Field Campaign Preparation Continued Modeling and Diagnostic Analysis				

2000+

Phases/Activities	Objectives/Comments	07-11	11-12	12-14
Phase II (Field Campaign)	(must await Phase I results)		—	
Phase III (Consolidation)				—

Other Activities related to the IAS:

Inter-American Institute for Global Change Research (IAI)

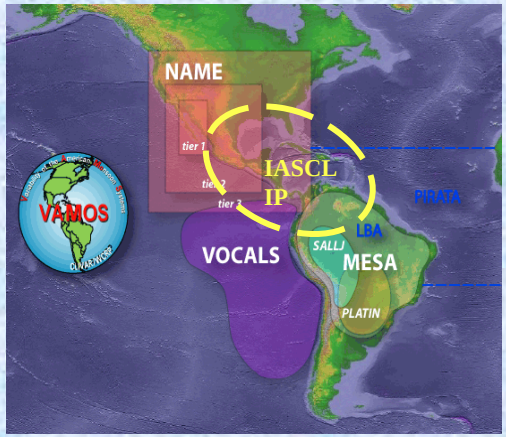
- **The Caribbean Community Climate Change Center (CCCC)**
- **Water Center for the Humid Tropics of Latin America and the Caribbean (CATHALAC)**
- **Comite Regional de Recursos Hidraulicos (CRRH)**
- **WMO Regional Training Centers (Four RMTC´s)**

- **Intra-Americas Sea Initiative (IASI)**
- **The Southeast Atlantic Coastal Ocean Observing System (SEACOOS)**
- **The Global Ocean Data Assimilation Experiment (GODEA)**
- **Gulf drilling**
- **AMI/AMMA**
- **VOCALS**
- **NAME/MESA**
- **ECAC**
- **NASA Ticosonde activities**

A Prospectus for An IntraAmericas Study of Climate Processes (IASCLIP)

Prepared for the 8th VAMOS Panel Meeting

March 2005, Mexico City



Preface

This prospectus outlines the need for a research program for the study of physical and dynamical processes key to rainfall variability and prediction in the IAS region and its surroundings. The main purpose of this prospectus is to solicit feedbacks from the research community and VAMOS panels for further development of a science plan for such a program. Constructive criticisms and suggestions on this prospectus are sincerely welcome. This prospectus was prepared by

Chidong Zhang (University of Miami, editor)
Jorge Amador (University of Costa Rica)
Dave Enfield (NOAA/AOML)
Rong Fu (Georgia Tech)
Christopher Landsea (NOAA/AOML)
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Brian Mapes (University of Miami)
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Ramon Perez (Institute of Meteorology)
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Table of Contents: The Science

IASCLIP Elements :

- **Search for broad societal support**
- **Coordinate with existing IAS-related programs**
- **Quantify model errors and identify their sources; quantify errors and uncertainties in global and regional data assimilation products**
- **Data mining and assimilation**
- **Empirical analyses of existing data for statistical relationships**
- **Model sensitivity and predictability studies**
- **Process studies**
- **Model improvement**
- **Coordinate climate assessment/prediction efforts**
- **Education, capacity building**
- **Facilitate applications of climate information through development of decision made schemes for various sectors**

The role of intraseasonal variability

Climate change issues