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Third Session of the CLIVAR VACS Panel

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Action Items

- 1) Contact the new director at ACMAD and inform him of CLIVAR activities in Africa as well as the work promoted by VACS
(C. Thorncroft and L. Ogallo)
- 2) Provide a list of African data rescue activities to ICPO and put it on the CLIVAR web page
(A. Makarau, L. Ogallo, A. Amani and R. Boscolo)
- 3) Identify and submit to the ICPO short summaries of socio-economic applications within the VACS activities in Africa.
(Panel members and R. Boscolo)
- 4) Liase with Aida Diongue to represent AMMA needs with respect to the PIRATA array in the next Southern Atlantic workshop
(C. Thorncroft, M. Rouault and T. Lebel)
- 5) Liase with the Southern and Eastern Africa climate community and identify potential scientific foci for promoting both regional activities to a GEWEX CSE level
(T. Lebel, M. Rouault, L. Ogallo and F. Semazzi)
- 6) Form a subgroup to overview Atlas production and content
(R. Washington, K. Cook, A. Makarau, L. Ogallo, A. Nassor, W. Thiaw and C. Reason)
- 7) Provide links on regional data and analysis to the Atlas project
(A. Makarau, L. Ogallo, A. Amani and R. Washington)
- 8) Promote plans to hold a workshop on the African Case Study (1997-2000 period) in early 2004 with venue in Nairobi
(N. Ward, F. Semazzi, C. Thorncroft, L. Ogallo, C. Reason and R. Boscolo)
- 9) Contact J. Polcher regarding the possibility of getting soil wetness estimation for the case study period
(T. Lebel and N. Ward)
- 10) Make the seasonal forecasts and their evaluations by the Climate Fora available on the CLIVAR website
(R. Boscolo, L. Ogallo, A. Amani and A. Nassor)
- 11) Further develop the document on decadal climate variability in Africa and publish it in an appropriate journal
(C. Reason, C. Thorncroft, R. Washington and L. Ogallo)
- 12) Report the problem with NGOs and the use of IPCC scenarios for sustainable development forecasts in Africa to the SSG and ask for appropriate action
(L. Ogallo and C. Thorncroft)
- 13) Make sure that AMMA needs are well represented at the next GCOS meeting (April 2003) in Dakar
(C. Thorncroft and T. Lebel)
- 14) Contact VAMOS and ask advice on how to get funding from GEF and VCP for AMMA
(C.Thorncroft)
- 15) Prepare a strawman on a potential project on East African lakes and distribute it to the panel
(F. Semazzi, L. Ogallo and K. Cook)
- 16) Provide a list of VACS related activities in Eastern Africa and make it available on the web
(L. Ogallo and R. Boscolo)
- 17) Provide a link to the PUMA project-related call for proposals on the VACS web page
(T. Lebel, L. Ogallo, A. Makarau, and R. Boscolo)
- 18) Support the creation of a center for excellence on ocean sciences in UCT:
 - Ask ITCP to support annual meeting in Cape Town
 - Find out possible contribution from the World bank
 - Distribute document on the creation of the center and coordinate feedbacks**(G. Philander and R. Boscolo)**

- 19) Write a letter to Valery Detemmerman (JPS for WCRP) and distribute to appropriate people at WMO in support of running rainfall workshops back to back to the Climate Fora. Identify potential contributors to the workshops.
(C. Thorncroft, L. Ogallo, A. Makarau and A. Nassor)
- 20) The panel welcomed the initiative to have the June issue of CLIVAR Exchanges focussed on Variability of Africa Climate System. The ICPO to distribute appropriate information to panel members and VACS chairs to provide an introduction
(R. Boscolo, L. Ogallo and C. Thorncroft)
- 21) Prepare material for VACS general outreach activities: Power Point presentation, poster and brochure
(R. Boscolo, C. Thorncroft and L. Ogallo)
- 22) Stress the importance of the Indian Ocean for VACS activities at the next AAMP meeting
(C. Thorncroft)
- 23) Prepare a list of potential candidates to replace members standing down from the panel and submit it to the SSG
(C. Thorncroft, L. Ogallo and R. Boscolo)
- 24) Next meeting to be held back-to-back with the proposed VACS workshop, possibly in Kisumu
(L. Ogallo, C. Thorncroft and R. Boscolo)

1. BACKGROUND

The CLIVAR VACS Panel is a part of the CLIVAR organization. The panel is in charge of developing the CLIVAR research agenda for studying the Variability of the African Climate System. More specifically its terms of reference are:

1. Develop and refine a VACS implementation plan, based on the work of the CAWG (CLIVAR Africa Working Group) and CLIVAR African Task Team (CATT), to diagnose the variability and predictability of African climate and its relationship to the global climate system. This plan should take into account the objectives listed below in points 2-9.
2. Prepare requirements for limited-period and sustained observations in support of the CLIVAR Programme in and around the African continent; establish links with, and present the requirements to, the other major climate-observing programs (e.g. GCOS, WWW, GOOS, etc).
3. Promote and coordinate efforts for evaluation and improvements to model simulations (e.g., AMIP, CMIP, IPCC relevant modelling, etc.) for the African region.
4. Promote development of African climate databases and foster access thereto for research purposes in cooperation with projects such as CLICOM, DARE, INFOCLIMA, etc.
5. Promote the involvement of African scientists within VACS and the use of VACS products in capacity building activities.
6. Develop cooperative investigations with other CLIVAR groups and national, regional or international research programs and organizations interested in this area of research.
7. Develop links with programs and organizations interested in the application of VACS research (e.g. CLIPS, and START) and, as far as feasible, integrate requirements of these programs and organizations into VACS.
8. Execute the VACS implementation plan and measure the success of the plan against stated objectives.
9. Report to the CLIVAR SSG as required on progress and problems in developing and implementing the VACS plan.

The members of the CLIVAR Atlantic Implementation Panel are:

C. Thorncroft (co-chair)	University at Albany, Albany, USA
L. Ogallo (co-chair)	Drought Monitoring Center, Nairobi, Kenya
K. Cook	Cornell University, Ithaca, USA
I. Kgakatsi	South African Weather Bureau, Pretoria, South Africa
T. Lebel	Laboratoire d'étude des Transferts en Hydrologie et Environnement, Grenoble, France
A. Makarau	University of Zimbabwe, Harare, Zimbabwe
A. J. Omotosho	Department of Meteorological Services, Lagos, Nigeria
G. Philander	Princeton University, Princeton, USA
F. Semazzi	North Carolina State University, Raleigh, USA
N. Ward	International Research Institute for Climate Prediction, Palisades, USA
R. Washington	University of Oxford, Oxford, UK

Ex-officio members:

Representative of ACMAD (Niamey, Niger)
Representative of the Drought Monitoring Center (Nairobi, Kenya)
Representative of the Drought Monitoring Center - Harare, Zimbabwe)
Representative of the Aghrymet Center (Niamey, Niger)

ICPO Representative is:

R. Boscolo ICPO SOC Southampton UK and IIM-CSIC Vigo Spain

2. OPENING SESSION

Chris Reason who kindly arranged a meeting venue for the VACS Panel at the EGS Dept. of the University of Cape Town, welcomed the attendees (Appendix A) to the 3rd annual session. The VACS meeting followed one day of informal science presentations on climate anomalies and ocean modelling, that were organized in two half-day workshops (Appendix B).

Chris Thorncroft (VACS co-chair) before reviewing the agenda, reminded the present members of the aims of the meeting:

- To review/update knowledge of African climate variability
- To discuss strategies for simulation and prediction of monsoon variability and its linkages with applications
- To discuss the observing networks over land and ocean
- Update and development of regional activities including (i) AMMA, (ii) East and Southern Africa initiatives, (iii) climate change projects
- To discuss the implementation plan and its development.

3. REVIEW OF ACTION ITEMS FROM LAST MEETING

Chris Thorncroft reported on the status of the Action Items agreed at the VACS second session (Niamey 2002). Several of them have been further discussed during the present meeting. The list below includes only those items that were not dealt with during the current session:

1) AMS Journals: A list of African institutions receiving these journals has been obtained and circulated (Appendix D). The panel was asked to review the list and assess if there were notable missing institutions. Other journals could be included in the future.

2) Non-reporting stations: Thierry Lebel sent a questionnaire to AMMANET on stations in Western Africa. He will get in contact with GCOS also.

3) Resource mobilization and ACMAD workshops: No progress has been reported on this item. Meanwhile it was noted that a new ACMAD director has been appointed.

ACTION ITEM 1: Contact the new director at ACMAD and inform him of the CLIVAR activities in Africa as well as the work promoted by VACS (*C. Thorncroft and L. Ogallo*)

4) Data Rescue activities: The progress on listing the data rescue activities in Africa should be made available on the web.

ACTION ITEM 2: Provide a list of African data rescue activities to ICPO and put it on the CLIVAR web page (*A. Makarau, L. Ogallo, A. Amani and R. Boscolo*)

5) Accessing ECMWF data: it was reported that ECMWF monthly mean reanalysis data can be freely be obtained by African scientists through ACMAD (<http://www.acmad.net/uk/default.htm>). It is also possible to get ECMWF data through WMO. In addition, ECMWF can be asked to make available identified datasets to African scientists.

4. RELEVANT ISSUES FROM THE LAST CLIVAR SSG

Chris Thorncroft reported on the last SSG meeting where he gave an overview of the VACS activities.

- The VACS panel was charged with creating a list of African institutions that would benefit from receiving free AMS (and other) journals. The ICPO and SSG will try to identify different means of distribution and encourage personal donations.
- The ICPO has started to solicit inputs from all CLIVAR panels on applications and end-users. Roberta Boscolo directly encouraged all the VACS members to submit their contributions and suggested placing them on the CLIVAR-VACS webpages

ACTION ITEM 3. Identify and submit to the ICPO short summaries of socio-economic applications within the VACS activities in Africa. (*Panel members and R. Boscolo*)

- The SSG encouraged VACS and AAMP to meet jointly in order to explore joint interests in East African climate and relation to Indian Ocean
- VACS was asked to approach AMMA and define the procedure for requesting CLIVAR endorsement.
- A few guidelines were suggested for organizing a Monsoon Modelling Workshop: ask GEWEX to be co-sponsor, AAMP, VACS and VAMOS should identify members of an organizing committee, WGCM, WGNE and WGSIP should be involved.

5. FEEDBACK FROM THE LAST WGSIP MEETING

The last session of the WGSIP (<http://www.clivar.org/organization/wgsip/>) was held at the University of Cape Town, South Africa, in November 2002. Chris Reason acted as local host and took part in some of the discussions. WGSIP discussed some updates on relevant studies with respect to regional modeling. Ongoing activities in the field include the so-called “big brother” experiments undertaken with the Canadian Regional Climate Model (CRCM) by researchers at the University of Quebec at Montreal (UQAM). WGSIP emphasized the importance of regional studies for aspects of application and training. A tropical ‘big-brother’ experiment is currently being performed at IRI; results from a regional study to investigate the capabilities to simulate dry spells in the NE of Brazil (State of Ceara) were presented. A Regional Spectral Model (RSM) at a resolution of 60km is capable of producing both large-scale and local-scale information and interannual variability at seasonal timescales. The probabilistic information in RSM simulations is better than that in the ECHAM 4.5 AGCM. The RSM has skills in simulating sub-seasonal events, such as dry spell and rainfall intensity distributions. The downscaling forecasts depend strongly on the skills of SST forecasts. Local scientists gave presentations on regional modeling:

- Review of southern African rainfall variability and regional forcing (*Chris Reason*)
- South east Atlantic warm and cold events (*Pierre Florenchie*)
- Interannual rainfall variability and potential predictability of Northern Zambian rainfall (*Henry Mulenga*)
- Overview of Department of Arts Culture Science and Technology (DACST) seasonal forecast project (*Bruce Hewitson*)
- Statistical Forecasting and Predictability of Indian Ocean Sea Surface Temperature (*Dan Collins*)
- Seasonal forecasting of climate over southern Africa using HadAM3 (*Mark Tadross*)
- A validation of HadAM3 and COLA AGCM hindcasts over southern Africa 1986-99 (*Deveerappa Jagadeesha*)
- Current operational forecasting capability at the South African Weather Service (*Warren Tennant*)
- Strengthening forecasts and early application in the SADC2 region: a focus on the 02/03 season. (*Emma Archer*)
- A qualitative review of 2001/02 seasonal forecast for South Africa from a user’s point of view. (*Peter Johnston*)

Chris Reason suggested as a possible VACS – WGSIP interaction exploration of how realistically the global models link to downscaling.

6. SOUTH ATLANTIC CLIMATE OBSERVING SYSTEM WORKSHOP

The WCRP/GOOS Ocean Observing Panel for Climate (OOPC) and the CLIVAR, together with the Inter-American Institute for Global Change Research (IAI), are sponsoring a workshop for discussing the needs for a South Atlantic Climate Observing System (SACOS). The workshop will be held in Brazil, February 2003 and aims to assess ongoing efforts and to discuss the scientific rationale for a climate observing system in the South Atlantic. The SACOS Workshop is motivated by the belief that the South Atlantic circulation influences, directly or indirectly, the variability of regional and global climate and yet the South Atlantic remains one of the more poorly sampled portions of the World Ocean. It is also believed that, in order to address the challenges posed by the lack of data in the South Atlantic, it is essential to foster the participation of the South Atlantic countries in the formulation of a research strategy. Considering their strategic locations, these countries could greatly contribute to the development of an observing system, which will not only augment observational databases, but will also build scientific and operational partnerships to train their technicians and to reduce the operational costs. Considering all this, the workshop has the following goals:

- To provide an overview of the scientific understanding of the influence of the South Atlantic Ocean on regional and global climate.
- To discuss existing and identify new elements for a South Atlantic observing system required for a more complete understanding of the climate system in regional and global scales.
- To integrate the region’s diagnostic, modeling and observational communities and to develop joint actions and principles for a long-term observing strategy.
- To identify potential funding sources and associated operational partners

Review presentations are going to be prepared by a group of specialists selected by each lead author. Lead authors and collaborators are given below:

- *Review of South Atlantic intraseasonal to interdecadal variability.* (C.Vera, W. Hazeleger, I. Wainer, J. Servain)
- *The South Atlantic role on the global thermohaline circulation* (A.Piola, A. Gordon, E. Campos)
- *Interocean Exchanges* (W. de Ruijter, S. Cunningham, A. Gordon, J. Lutjeharms, R. Matano and A. R. Piola)
- *South Atlantic links and impacts to regional and global climate* (A. Grimm, A. Robertson, Chris Reason)
- *The South Atlantic Observing System* (S. Garzoli, M. Johnson, A. Piola, C. Provost)
- *The Mesoscale Circulation of the South Atlantic Ocean: Does it Matters to Climate?* (R. Matano, B. Barnier, E. Campos, A. Coward, J. McLean, E. Palma, T.Penduff, M.Schouten, A. M. Treguier, I. Wainer and D. Webb)
- *The role of the South Atlantic in the variability of the ITCZ* (Y. Kushnir, A. Lazar, M. Barreiro, P. Rizzoli)

Chris Reason will participate to the workshop. Aida Diongue plans to attend as representative of Senegal.

ACTION ITEM 4. Liase with Aida Diongue to represent AMMA needs with respect to the PIRATA array in the next Southern Atlantic workshop (C. Thorncroft, M. Rouault and T. Lebel)

7. LINKS WITH GEWEX AND THE CEOP PROJECT

Thierry Lebel reported on the activities of the GEWEX Hydrological Panel (GHP) in order to explore links and synergies with the CLIVAR VACS panel. GHP has been promoting the Continental Scale Experiments (CSEs). A currently there are 6 experiments going on. Few examples follow:

- **BALTEX: Baltic Sea Experiment.**

The aim of the BALTEX is to enhance the scientific understanding of the mechanisms responsible for energy and water transports within the atmosphere, the land surface and the Baltic Sea with the objective of improving weather forecasts and climate models. The Phase I of BALTEX (1993-2002) brought an improved understanding of the energy and water cycle in the Baltic Basin. In Phase II BALTEX will focus on: 1) climate variability for 1800-2100 including climate change scenarios; 2) transport of nutrients and pollutants in the air and water using regional coupled models; and 3) impact analysis (responding to society needs and support decision makers in global change issues related to the Baltic Basin).

- **GAME: GEWEX Asian Monsoon Experiment.**

Phase I of GAME focused on the interaction and feedback processes between land and atmosphere. The Regional and continental-scale vegetation, such as the tropical monsoon forest in Southeast Asia and the boreal forest in east Siberia, have been shown to play an important role in controlling the seasonal surface energy and water balance. Phase II focuses on understanding of the seasonal cycle and interannual variation of the Asian monsoon. Almost all current GCMs have very large systematic errors in simulating the mean monsoon climate and circulation. For example the simulated monsoon precipitation on land, particularly near the coast in South and South-eastern Asia, tends to be much larger than observed.

- **GAPP: GEWEX Americas Prediction Project.**

.This is the follow up of an experiment focusing on studying the coupling process between land and atmosphere over the Mississippi basin. GAPP research covers a broad range of issues pertaining to the objectives of GHP and WCRP/GEWEX in general. A number of new GAPP projects have been initiated through joint NOAA and NASA funding and address land surface and monsoon processes. These include multi-model ensembles in both climate and hydrology. The development of a Land Data Assimilation System (LDAS) has been central to these efforts. Monsoonal processes are being studied in conjunction with CLIVAR/PACS supporting the North American Monsoon Experiment (NAME). These efforts are directed towards NOAA plans for seasonal to interannual prediction and closer collaboration between GAPP and CLIVAR.

By entering their Phase II, the CSEs are driven more by the climate variability research agenda. Recently GHP encouraged a focus on Africa and AMMA/CATCH was proposed, however AMMA/CATCH wasn't able to meet the following logistical/technical and scientific criteria for a full GEWEX CSE:

- Dedicated NWP centre for atmospheric and surface data assimilation and estimates of hydro-meteorological properties
- Suitable atmospheric-hydrological models, numerical experimentation and climate change studies
- Mechanism for collecting and managing adequate hydrometeorological data sets
- Participate in the open international exchange of scientific information and data
- Interactions with water resources agencies and related groups to address the assessment of impacts on regional water resources
- Simulation of the diurnal, seasonal, annual and interannual cycles
- Close water and energy budgets
- Determination and understanding climate system variability and critical feedbacks
- Demonstrate improvements in predictions and water-related climate parameters
- Demonstrate the applicability of techniques and models to other regions AMMA/CATCH at the moment has the status of a CSE associated.

.Other components of GHP include:

International Satellite Land Surface Climatology Project (ISLSCP Global Data Sets).

The first data set produced included monthly surface meteorology, soils, surface routing and runoff, and atmospheric radiation data for 1987-88. The second data set is almost completed and covers 10-years (1987-95) with an improved spatial and temporal resolution ($1/4^\circ$ to 1°). This data set will include carbon data as well. A number of WCRP and IGBP initiatives are leveraged on this effort, including the GEWEX Global Soil Wetness Project-2, the Global Observing System and the GEWEX Global Land Atmosphere System Study. A third effort is planned that will expand the physical and biological near-surface global compilation to over 25 years (1982-2007) and focus on exploiting the data from the new series of satellite sensors becoming available (TERRA, AQUA, ENVISAT, ADEOS II, etc...) as well as the carbon/biophysical data needed for addressing the broad climate change issues of concern.

Global Runoff Data Centre (GRDC).

This provides a mechanism for international exchange of data pertaining to river flows on a continuous, long-term basis. The scope of data collection is global, regional and river-basin scales. Approximately 150 countries have contributed to the development of the GRDC database, which currently comprise monthly discharge data from over 6400 stations (daily data for 3400 stations). GRDC aims at cooperation and data exchange with the hydrological data centres of the GSEs. Based on update data sets, GRDC is currently reiterating its estimate of mean annual freshwater surface water fluxes into the world oceans. By using a digital elevation model (DEM) it will be possible to estimate freshwater fluxes from within arbitrary reaches of the coastlines.

Global Precipitation Climatology Centre (GPCC).

GPCC regularly collects monthly precipitation from about 7000 stations worldwide via the WMO World Weather Watch Global Telecommunication System (GTS). GPCC's full database includes monthly precipitation data since 1986. The GPCC products are available in two resolutions (2.5° by 2.5° and 1° by 1°) for near-real time based upon GTS data only and non real-time with data provided by national institutions.

North American Monsoon Experiment (NAME).

NAME is a component of VAMOS and is a joint CLIVAR-GEWEX process study aimed at determining the sources and limits of predictability of warm season precipitation over North America, with emphasis on time scales ranging from seasonal to interannual.

GHP recent initiatives are: 1) WEB (Water and Energy Balance Study) for encouraging and coordinating water and energy balance studies in CSEs and 2) WRAP (Water Resources Application Project) for initiating a dialogue with water managers on their needs and the GEWEX products available to address those needs. This aims to identify useful forecast/modeling products for water managers, understand how these are used in decision-making and determine preferred product delivery mechanisms.

Other GEWEX panels relevant to CLIVAR VACS are:

.
GEWEX Ratiation Panel (GRP).

GRP provide global precipitation, clouds, aerosols and top-of-atmosphere and surface radiative fluxes (covering almost two decades) to be combined with the operational sounder products (atmospheric temperature and humidity) and the reanalysis (atmospheric circulation) to determine the global energy and water cycles. GRP has promoted SeaFlux to figure out how to get the turbulent heat and water fluxes over oceans from satellite data.

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Modelling and Prediction Panel (GMPP).

The aim of GMPP is to develop the numerical representation of the processes linked to the water and energy cycle in the climatic system. The focus is on three topics: clouds, land-surfaces and the planetary boundary layer. This panel includes the GEWEX Cloud System Study (GCSS), the Atmospheric Boundary Layer Study (GABLS) and the Global Land-Atmosphere System Study (GLASS). GLASS has four subprojects: one is the Global Soil Wetness Project (GSWP), which should help the CSEs to close the water budget and provide “best estimates” of surface fluxes to GRP and other GEWEX panels. GMPP should be able to provide the tools to help other GEWEX projects to analyze and understand their data.

The GEWEX agenda is moving from process-oriented projects (mesoscale) to long-term large-scale (CLIVAR-type) studies. This is the the new vision of GEWEX mission dictated by recent developments within WCRP.

The Coordinated Enhanced Observing Period (CEOP, www.ceop.net) was originally envisioned as a major step towards bringing together the research activities in the GHP within GEWEX/WCRP. However its implementation requires close and strong cooperation across other projects and related activities within WCRP, in particular CLIVAR. The observation and data collection phase extends from 1 July 2001 to 30 September 2004. the implementation of this phase will be divided into four Enhanced Observing Periods (EOPs). The four periods are designed to start at a relatively low level. Hence EOP-1. is an enhanced seasonal observing period focusing on a selected set of reference sites over the period 1 July to 30 September 2001. EOP-2 from 1 October 2001 to 30 September 2002 will entail a coordinated “buildup period” in which CEOP participants begin to make contributions as their capability for model output and satellite data is implemented. The primary focus will be on the collective 2-year data sets beginning with EOP-3, starting in October 2002, which will cover the first of two annual cycles with emphasis on a data set suitable for synoptic climatology case studies. EOP4 will cover the second annual cycle with provisions for some intensive water and energy-cycle experiments using coordinated Intensive Observing periods (IOPs) as part of the major activities. The CEOP organizational structure consists of a Science Steering Committee to give scientific guidance, an Advisory Committee to advise and provide funding support and a Coordination Body for implementation issues. Four Working Groups are in charge of CEOP implementation:

.
Water and Energy Simulation and Prediction.

This WG uses the enhanced observation data sets to better understand and improve the simulation of water and energy fluxes and reservoirs over land on diurnal to annual temporal scales well as the prediction of these on time scales up to seasonal for water resources applications. Specifically WESP WG agreed to undertake: 1) comparisons between NCEP reanalysis and the ARM reference sites using MOLTS data from various NWP Centers; 2) diagnosis of the HIRLAM weather prediction system, including comparison to Cabauw and Lindenberg Sodankyla reference sites in the framework of BALTEX; and 3) analysis and comparisons between reanalysis and observations to encompass predictions of WEB variables and to improve model physics including both regional and global climate models. WESP uses 34 reference sites (2 in Africa: Niger and Benin) and seeks to select reference watersheds.

Monsoon Systems.

This WG is addressing the implementation of one of the main CEOP aims associated with the documenting of the seasonal march of the monsoon systems, assessing the driving mechanisms of monsoon systems and investigating the possible physical connections between such systems. It was recommended that the WG proceed with a CEOP Inter-monsoon Model Study (CIMS). CIMS will be an international research project to validate and assess the capabilities of climate models in simulating physical processes in monsoon regions around the world. For CIMS, a major effort will be devoted to defining the data requirements and modeling

strategy for validating model physics. Validation data will be derived from CEOP reference sites, which include the GEWEX CSEs and planned CLIVAR field campaign sites.

Data management.

This WG is charged with the responsibility of developing a CEOP data management plan to provide access to comprehensive in-situ, remote sensing and model output data sets for CEOP research activities.

Satellite Data Integration.

This WG carries out the responsibilities for providing access to the satellite remote sensing data products and for defining a research plan including a recommended implementation plan to demonstrate the utility of satellite data products to achieve the CEOP science objective for WESP and monsoon systems studies.

ACTION ITEM 5. Liaise with the Southern and Eastern Africa climate community and identify potential scientific foci for promoting both regional activities to a GEWEX CSE level (*T. Lebel, M. Rouault, L. Ogallo and Semazzi*)

8. Annual Cycle of the West African Monsoon: Recent Results in the Literature

The annual cycle of rainfall in the West African region is characterized by a poleward migration of peak rainfall up to about August followed by a more rapid retreat. It also includes an apparent “jump” in the location of peak rainfall at the end of June from the coastal region around 5° N to about 10° N (Sultan and Janicot, 2000; Le Barbé et al, 2002). As shown in the CLIVAR-Africa Implementation Plan (2000), state-of-the-art GCMs used for climate prediction have difficulty simulating the annual cycle of rainfall and associated regional circulations. This raises serious concerns about whether these models can realistically represent the key interactions between the WAM and the rest of the globe that are important for determining interannual-to-decadal variability of West African and regional climates. It is fundamentally important that we improve our understanding of the annual cycle of West African rainfall and the associated regional circulations including in particular the processes that influence rainfall intensity, its meridional migration, onset, the apparent “jump” and rapid retreat. Mechanisms have been proposed to explain various aspects of monsoons and their evolution and need to be investigated in the context of the WAM. These include the role of changes in boundary layer equivalent potential temperature gradients and inertial instability on the establishment of direct circulations and the location of rainfall (e.g. Emanuel, 1995, Zheng et al, 1999, Tomas and Webster, 1997), the role of dry intrusions from higher latitudes on the associated intensity and meridional extent of the rainfall (e.g. Parsons and Redelsperger (2000), Chou et al, 2001), the role of surface processes including soil moisture and vegetation feedbacks and atmosphere-ocean interactions (e.g. Taylor and Lebel, 1998, Chou et al, 2001, Zheng et al, 1999) and the role of remotely forced circulations including those associated with the Asian Monsoon (e.g. Rodwell and Hoskins, 1996). Central to any investigation of these mechanisms are the annually varying surface conditions over the continent and ocean. Over the continent we rely heavily on remote sensing and off-line models to give us the observed land-surface conditions through projects such as GLDAS (<http://ldas.gsfc.nasa.gov/>). There is a need for more in situ data for evaluation of these products over the African continent and more investigation of the coupled processes that determine them and their impact on the WAM. Over the ocean there are still gaps in our understanding of processes that determine the annual cycle of SSTs in the tropical Atlantic and their interactions with the WAM. The evolution of the SSTs in the Gulf of Guinea and in particular the evolution of the cold tongue are particularly important in this regard (e.g. Grodsky and Carton, 2003). The nature of the interactions between surface conditions and the atmosphere must be investigated through an analysis of surface energy and water budgets, atmospheric convection (moist and dry) and radiation. The associated regional circulations and jets need to be analysed, including their impact on transport of water vapour and their role in influencing the weather systems.

9. Atlas on African Climate Variability

Richard Washington presented his plans for producing an African Climate Atlas, one of the activities that VACS has promoted since its establishment. It was recognized that an Atlas of African Climate Variability would help to promote research on African climatology and represent a focus for evaluating dynamical models used for seasonal to interannual prediction. The Africa Climate Atlas aims at providing info and

evidence of African climate variability to climate researchers, African climatologists and application communities (for health, agriculture, vulnerability assessment etc....). It was agreed that the development of the atlas should initially focus on the continental annual cycle and its interaction with global climate.

The proposed content included:

- Basic graphics of annual cycle
- Harmonic analysis
- Maps (more than graphs)
- Explanatory text (proposed by VACS)

The initial format will be as a web based interactive mode possibly with downloadable data were appropriate. However depending on funding resources, CD-ROMs and hardcopies are also planned. The data for the graphs and maps will be observations (in situ and satellites), reanalysis (NCEP, ERA) and model simulations of variables such as rainfall, temperature, dust, wind, pressure etc...

Production of the atlas will be performed in 3 phases. The first phase has started with the set-up of a basic team involved in data handling and web design. In this first phase the team will develop web applications for interactive mode access to atlas content while inputs on contents from VACS and WMO/CLIPS will be requested. The second phase will see the launch of the basic web proto-type atlas to be circulated among the interested parties for providing feedbacks. In the third phase the web atlas should be consolidated and liaisons should start with similar efforts. Hardcopy and CD-ROMs version of the atlas is envisaged after the consolidation phase.

ACTION ITEM 6. Form a subgroup to overview Atlas production and content (*R. Washington, K. Cook, A. Makarau, L. Ogallo, A. Nassor, W. Thiaw and C. Reason*)

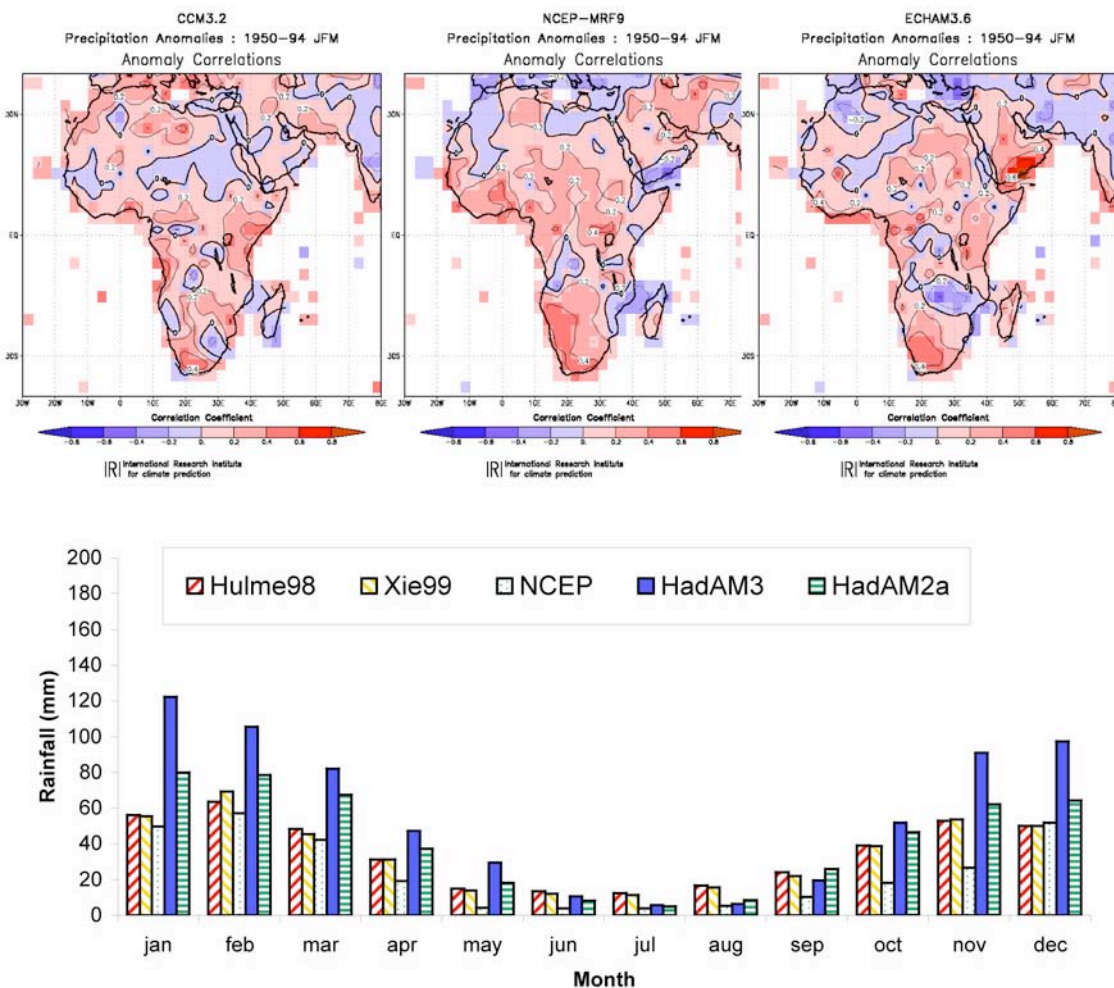


Figure 1. Examples of the Atlas content: top) Model versus Observations of JFM precipitation 1950-1994, bottom) annual cycle of precipitation at 25°-32°S from observations, reanalysis and model outputs.

10. Update on the Compendium of Southern Africa Climatology.

The climatological compendium for Southern Africa is an initiative developed by several experts from both NMSs and universities in the region. The VACS panel welcomed such activity and asked Amos Makarau to give an update on the status of the project. The compendium domain is 20N-30W and 60S-90E and the main objectives are:

- To collate research findings on the climate of the Southern Africa
- To provide a regional baseline climatology for a wide range of users
- To understand the physics and dynamics of the atmosphere over Southern Africa and adjacent oceans.

The topics under investigation are the major weather bearing systems affecting the region: ITCZ, monsoons, easterly and westerly waves, Botswana Upper Anticyclones and the Tropical Cyclone Activity (frequency, trajectories, circulation patterns). In addition the compendium includes applications-oriented topics like: agro-ecological zoning, interannual and intra-seasonal variability, role of teleconnections with seasonal rainfall, climate change scenarios and impacts. The compendium has reached an advanced stage:

- Completed the rainfall atlas (monthly, seasonal and annual maps for 14 SADC countries and the overall region)
- Completed the wind atlas for 700, 500 and 200 hPa (monthly maps)
- Temperature data almost ready for processing
- Completed cyclone data, statistics and trajectories drafts
- Almost completed and updated hydrological data, statistics and maps (hydrological formations, groundwater resources, wetlands, return periods for major rivers, etc...)
- Role of teleconnections (SST grid boxes identified) has been addressed at national level
- Completed agroclimatic zoning at country level

ACTION ITEM 7. Provide links on regional data and analysis to the Atlas project (*A. Makarau, L. Ogallo, A. Amani and R. Washington*)

11. Interannual Variability: Update on the Case Study of the African Climate 1997-1999

The 1997-98 El Nino event heightened awareness in many parts of Africa of the existence of a relatively new body of scientific knowledge claiming ability to foresee some aspects of seasonal climate patterns with a lead-time of months. The interest continued with the prevailing La Nina event (1998-2000) and further significant climate anomalies in many African regions. Such anomalies represent a challenge and an opportunity to the climate community to explore their causes and their predictability, especially in terms of actual and potential enhanced downscaled forecast information.

Neil Ward provided an initial assessment of the potential for a case study in this area of work by a presenting preliminary analysis of observational and GCM data sets. The observational data sets used came from NCEP/NCAR reanalysis and the Climate Anomaly Monitoring System - Outgoing longwave radiation Precipitation Index (CAMS/OPI) rainfall. Rainfall data from a number of GCMs forced with time varying observed SST were analyzed. Observed rainfall for East Africa, Southern Africa and the Sahel region (west Africa) were compared with GCM outputs in order to determine the extent to which rainfall anomalies in these years may have been forced by regional SST anomalies surrounding the Africa continent. The results shown for the Sahel region indicate that the models captured well the 97 (dry) and 99 (wet) conditions during mature El Nino and La Nina, but fail for the 98 conditions (wet) (see figure 2). The expected wet conditions in eastern Africa during Oct-Dec 1997 were likely amplified by prevailing warm conditions in the western Indian Ocean, and perhaps also in the tropical southeastern Atlantic, a region capable of impacting Equatorial African climate anomalies (see figure 3). The climate anomalies observed in Southern Africa were not consistent with the typical ENSO signature: in January-March 1998 the observed rainfall conditions were near normal in the eastern part thus suggesting the possible existence of Indian Ocean SST forcing. Communication of ENSO effects into a region can also be modulated by internal atmospheric variability, including interactions with mid-latitudes, and this aspect also requires consideration. A further consideration is whether the modes were influenced by longer timescale background changes to the climate state, especially those associated with global warming.

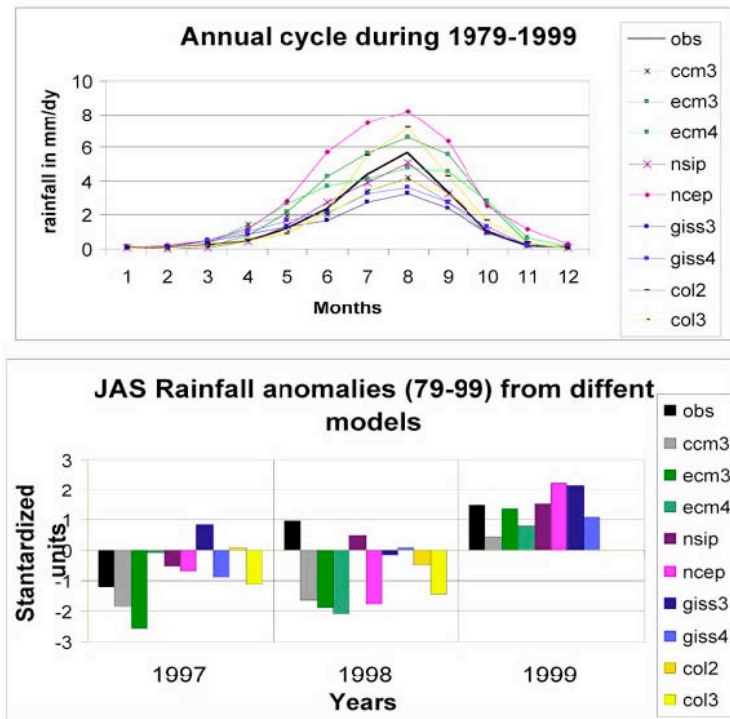


Figure 2. West Africa rainfall. Top: simulated mean annual cycles compared to observations. Bottom: simulated summer anomalies (wrt 1979-99) compared to observations

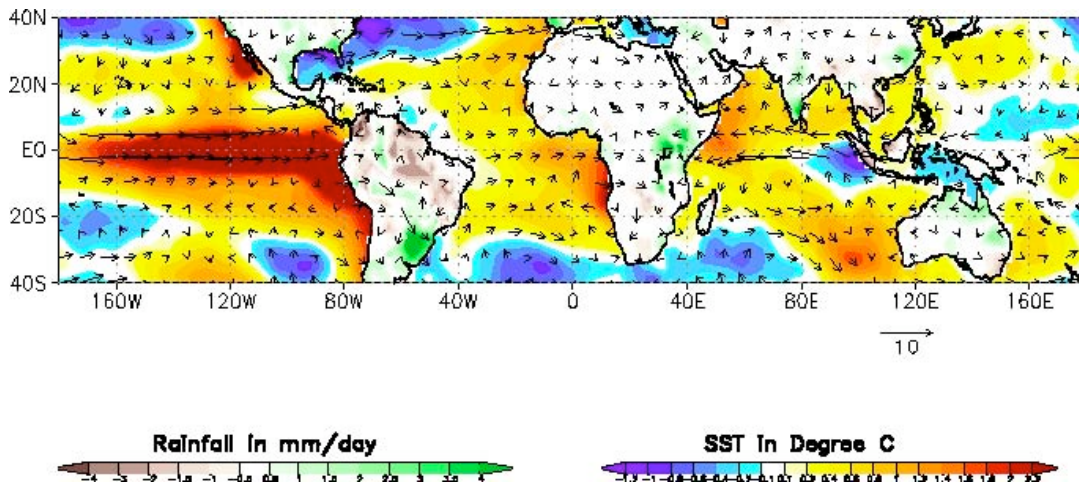


Figure 3. Observed SST anomaly, 850mb wind anomaly (vectors) and rainfall anomalies over land for October-December 1997.

These preliminary analyses seem to confirm that the 97-99 period contains good examples of the ENSO signal extending toward Africa and interacting with regional basins, especially the Indian Ocean. Reanalysis and GCMs forced with observed SST show likelihood of being good tools to shed light on the teleconnection mechanisms that were operating at the large scale. In addition there is a need for more detailed regional interpretation of observed variability and regional modeling as a tool for better understanding the regional scale mechanisms.

ACTION ITEM 8. Promote plans to hold a workshop on the African Case Study (1997-2000 period) in early 2004 with venue in Nairobi (*N. Ward, F. Semazzi, C. Thorncroft, L. Ogallo, C. Reason and R. Boscolo*)

The role of the land surface is a further additional important factor to consider. For example, it is known that the March-May period in east Africa has less strong SST forcing than the October-December season.

ACTION ITEM 9. Contact J. Polcher regarding the possibility of getting soil wetness estimation for case study period (*T. Lebel and N. Ward*)

12. East Africa: ENSO Research

Laban Ogallo reviewed the ongoing and planned regional ENSO research activities that are being undertaken at the Drought Monitoring Centre (DMC) in Nairobi, Kenya.

- **Risk Zoning.** National rainfall atlases are being developed and several homogeneous rainfall zones have been identified.
- **Development of simple ENSO/SST based models.** The sea surface temperature at the surrounding oceans is correlated with the rainfall of each homogeneous zone with the use of empirical-statistical regression models.
- **Probability associated with ENSO phases and specific rainfall seasons.**
- **Probability of certain weather/climate extremes.** Conditional probabilities
- **Process Studies.** ENSO modulation by the Indian/Atlantic Ocean and the role of the surrounding ocean for seasonal and interannual variability.
- **ENSO related extremes: vulnerability and impacts.** Numerical simulations are carried out with the assistance of IRI and other institutions. Regional scale workshops are promoted

13. Scientific Challenges of the Climate Outlook Fora

The regional climate outlook forum (COF) involves scientists from universities, government forecasting organizations, national meteorological services and international forecast centers. At each Outlook Forum the participants produce probabilistic, consensus-based, seasonal forecasts for given regions. In Africa the COFs are held at DMC Nairobi (Kenya), DMC Harare (S.Africa) and ACMAD Niamey (Nigeria) focusing on Greater Horn of Africa (GHA), Southern and Western Africa respectively. Laban Ogallo stressed the importance of this activity for Africa and proposed developing links between these and VACS activities. DMCN has organized 10 so called GARCOF meetings. The next one will be held in March 2003 in Uganda. There have been 6 SARCOF organized by DMCH and one by ACMAD (PRESAO). The large number of COFs organized in the GHA is due the persistent rainfall in the region. There are two international COFs each year and an extra regional one coordinated with ACMAD. The major achievements of the fora are:

- Provide consensus on regionally downscaled seasonal outlook products to the users
- Develop capacity building, education and awareness
- Build confidence on seasonal outlooks
- Enhance understanding of regional climate processes and challenges
- Address observation and data needs
- Develop new models and tools for regional downscaling
- Enhance dissemination and new questions/needs
- Promote international regional and national cooperation

There are several scientific issues that need to be addressed and VACS could play an important role by helping to promote them:

- Develop methods for consensus
- Enhance understanding of regional climate processes
- Map risk zoning: vulnerability and impacts 0
- Help with observations and data issues
- Develop new models and tools for regional downscaling
- Prioritize regional research
- Promote verification

Ideally the COFs together with VACS could aim at providing users with the following products:

- **Prediction Products:** 1) 10 days, monthly, decadal, 2) pre-season consensus outlooks, 3) general impacts, 4) seasonal updates and 5) Indian/Pacific ocean variability modes – temperature gradients.
- **Climatological Products:** 1) risk maps, 2) users specific products, 3) drought severity, 4) dominant synoptic systems and 5) climate outlook.
- **Socio-economic conditions and their impact:** 1) agriculture and food security, 2) livestock, 3) hydropower and water resources, 4) health, 5) disaster management

The fora are quite expensive and one possibility to sustain them could be to take advantage of the latest technology in videoconferencing.

ACTION ITEM 10. Make the seasonal forecasts and their evaluations by the Climate Fora available on the CLIVAR website (*R. Boscolo, L. Ogallo, A. Amani, and A. Nassor*)

14. African Climate Decadal Variability

Chris Reason is leading the initiative of documenting decadal climate variability in Africa. He presented the first draft of a white paper where he highlighted the evidences and raised the issues that need urgent attention by the climate research community. One of the strongest climate signals in the world on decadal-multidecadal scales involves the extended wet and dry spells in the Sahel region. The mechanisms responsible for this variability are complex and likely involve changes in tropical Atlantic SST gradient and also regional and global SST anomalies. Observations suggest that the leading global mode of natural variability on various decadal and multidecadal scales is an ENSO-like pattern. Interdecadal signals in rainfall over various parts of South Africa and neighboring countries can be accounted for to some degree by these ENSO-like changes in regional circulation and SST. On bi-decadal scales, the second mode appears to be a strengthening and weakening of the subtropical high-pressure belt with associated warming and cooling of SST. It is a high priority to achieve better understanding of the mechanisms associated with African decadal variability and to determine the relative roles of local and remote forcing. Local effects include land surface – atmosphere interactions (including albedo, soil moisture, surface roughness) and local SSTs (for example the influence of the SW Indian Ocean on Southern African rainfall), while remote forcing include African manifestations of large-scale modes such as ENSO and NAO. Much work is now underway to develop climate change scenarios for various African regions. A significant challenge is to assess whether long-term signals in various climate parameters are anthropogenically forced or are part of a slow natural mode or, in fact, are some combination of these. Addressing this challenge will likely require sophisticated analysis of CGM and RCM outputs in combination with improved understanding and identification of slow natural modes in instrumental and proxy records. The white paper also documents attempts to list the societal impacts of decadal climate variability together with the challenges and opportunities. This is still a work in progress so contributions for improvement are welcome.

ACTION ITEM 11. Further develop the document on decadal climate variability in Africa and publish it in an appropriate journal (*C. Reason, C. Thorncroft, R. Washington and L. Ogallo*)

15. Ongoing Paleoclimate research in Africa and links to VACS

Paleoclimate research is particularly active in Africa. Three types of climate proxy archives stand out in their potential to yield continuous records of interannual or decadal-scale climate variability: fossil corals, speleotherms and lake sediments. The great abundance of natural lakes spread over most regions of tropical Africa suggests that sedimentary archives accumulating in them may offer unique potential for reconstruction of tropical African continental paleoclimates in both time and space. The International Decade for the Eastern African Lakes (IDEAL, www.d.umn.edu/llo/Ideal/) was established by IGBP/PAGES with the aim of retrieving a long, high resolution record of climate change in tropical east Africa and investigating the biogeochemistry and physical dynamics of the lakes to better understand the paleoclimate record. The sediment records from lake Victoria showed dramatic shifts in the lake's ecosystem caused by the introduction of the Nile Perch in the 1950s. The lake also dried up completely prior to 12400 yr BP. Thus, the hundreds of species of fish in the modern lake Victoria may have evolved within the last 12400 years; this is the fastest rate of vertebrate species evolution ever recorded. Drilling projects are underway in Lake Malawi and Tanganyika too. The Lakes Malawi Drilling Project seeks to undertake a scientific drilling campaign on Lake Malawi, to recover a series of ~400 m-long continuous sediment cores for paleoclimate studies [<http://malawidrilling.syr.edu/>]. The main scientific objective is to obtain a continuous, high-resolution (annual-decadal) record of past climates in the continental tropics over the Brunhes epoch, and to determine if tropical African climate responded to changes in low-latitude precessional insolation (19-23 kyr) or to high-latitude ice volume (100 kyr and 41 kyr) forcing, in the last part of the Pleistocene. The project will assess the phasing of lake level changes in Lake Malawi during this time, and determine if Malawi responded to Southern Hemisphere insolation forcing, as is suggested in late-Pleistocene and Holocene records. From the high-resolution Lake Malawi drill core records it will be determined if high-

frequency climate variations (analogous to Dansgaard-Oeschger or Heinrich events) are superimposed on glacial-interglacial timescale variations in the form of wet/dry cycles. The continuous Lake Malawi record will allow us to establish how interannual African climate variability has changed in association with longer-term climate variations. The project will determine the long-term evolution of tropical East African climate, and assess the postulated shift in the dominant Milankovitch frequency, from the present day 100 kyr dominance to 41 kyr dominance to 21 kyr dominance as observed in the marine record. ODP sites off the East Africa coast were used to reconstruct subtropical African climate during the Pliocene-Pleistocene. Analysis of fossil record from East Africa together with paleo climate reconstruction lend new support to the environmental hypothesis of African faunal evolution and made progress on the question of how the evolution of hominids and other African vertebrates may have been shaped by past changes in African climate.

Numerous paleoclimatic data show that the early Holocene (10 kyr BP) was a relatively humid period in Northern Africa. The humid conditions at this time were associated with a strengthening of the summer monsoon circulation due to an increase in the land-sea thermal contrast under influence of the relatively high summer insolation. Some paleo evidence from ocean cores indicates that the African Humid period came to an abrupt end around 6 kyr BP. Climate models experiments are trying to reproduce this abrupt termination by testing the biogeophysical feedback responsible mechanism. Paleoclimate research in Africa seems developing more than the research on present climate. It was suggested that VACS should take advantage from paleo record for understanding the physical process responsible for past climate events and to start get involved with the activities promoted by IGBP/PAGES.

16. Climate change projects update

Chris Thorncroft mentioned four projects concerned with the impacts of climate change in Africa and how to communicate this information to various users including decision and policy makers.

- **Conservation and Sustainable use of Biodiversity of Global significance in the Arid and Semi-arid Zones (TWNZO).** This is part of a global project with many international collaborators. Among other things, this project is concerned with land degradation, drought, climate change and water resources and their relationship with conservation and sustainable use of biodiversity. It includes many activities: case studies, database developments and networking.
- **Climate, Water and Agriculture: Impacts on and Adaptation of Agro-Ecological Systems in Africa (World Bank).** This project is implemented by GEF and concerns the impact of climate change and climate variability on water and agriculture including economic impact studies. This is an Africa-wide project, which also has a capacity building component. The countries currently targeted for involvement include: Niger, South Africa, Burkina Faso, Cameroon, Egypt, Ethiopia, Ghana, Kenya, Senegal; Zambia, Zimbabwe.
- **Africa Climate Change Decision Support Toolbox Project (EU).** This is a decision support system (Toolbox) for policy makers and practitioners. The aim is to include climate change considerations in sustainable development work in Africa. Two years will be spent developing the "toolbox" which will be followed by three years "implementation" working with the users of those toolbox.
- **Reinforcement of the Adaptation Capacity of the Sahel against climate change (CIDA).** The aim of this project is to perform regional studies on impact, vulnerability and adaptation of the Sahel on climate change. As part of this there will be reinforcement of the capacity of AGHYMET to do such studies. A further aim is to communicate the implications of the research to policy makers.

As far as VACS is concerned: VACS would like to be kept informed of the activities and will be happy to comment and advise on climate variability and climate change issues. Specifically, the experts included in these projects should know the limitations of climate change predictions and be familiar with the issues regarding attribution of climate change to climate variability. The VACS community in Africa is especially concerned about the dangers of wrong use of IPCC scenarios for Africa climate change studies.

ACTION ITEM 12. Report the problem with NGOs and the use of IPCC scenarios for sustainable development forecasts in Africa to the SSG and ask for appropriate action (*L. Ogallo and C. Thorncroft*)

17. Regional Research and Field Program Initiatives: AMMA

Thierry Lebel reported on last updates of the African Monsoon Multidisciplinary Analysis (AMMA) project and started by giving an overview of the scientific rationale. The Western African Monsoon (WAM) is one of the three main monsoon systems of the planet, its simulation is poorly performed by GCMs and so high uncertainties are associated to its variability and future scenarios. The main difficulty lies on the numerous processes and wide range of scales that seem to be involved in the WAM phenomenon. Seasonal and weather forecasting are still challenging and the WAM dynamical and thermodynamical features are not well understood. The Western African region is also experiencing the largest rainfall deficit worldwide with a decline of water resources over the past 30 years. Food security is threatened and impacts on the natural resources and other socio-economic elements are likely to be large. AMMA's main goals are to:

- Improve our understanding of the WAM dynamics, water cycle, variability and associated scale of interactions
- Improve our understanding of the atmospheric chemistry over WA and its global impact
- Identify and implement observing strategy in WA needed to support research and prediction (medium-range, seasonal and climate scale)
- Develop and test the long term monitoring of surface and atmosphere (satellite, ground networks)
- Implement a strategy to use weather and climate observations and modeling/assimilation outputs for applications (health, food security, water resources,.....)
- Develop training/education activities for African countries

To achieve these aims a multidisciplinary approach to the study of the WAM is required involving substantial international collaboration. AMMA will link observations, data analysis and modeling on a wide range of space and time scales. The project will address the following interacting science areas: Monsoon dynamics and scale interactions, continental water cycle, aerosols, atmospheric chemistry, food, water and health. Current observing systems do not provide all the information needed to fully understand and quantify multi-scale and multi-process interactions. The spectrum of scales to cover is very broad, ranging from local to regional (the whole of West Africa) and beyond (global). The observational strategy will thus associate operational observations (great attention will be paid to collecting and archiving historical datasets in close collaboration with African countries) with long term observations concentrated in a sub-regional window and obtained from various ongoing research projects (CATCH, IMPETUS, INTEO, GLOWA-Volta, AERONET, IDAF). In addition, intensive multi-disciplinary observations will be performed during specific periods, focusing on the understanding of key processes. The utility of bringing in additional observations for the future will be tested using modeling and assimilation systems. Recommendations for future optimal networks will result, an important demand of African services and regional agencies. Building links between research and applications is a major objective of this project. Here models and data sets will be developed in collaboration with African institutions and International bodies so that they can test/use them as tools for decision making and to develop adaptation strategies in response to the evolving West Africa environment and climate. A particular focus of attention will be on integrating models representing various scales and applications (e.g. water resources management, crop models, health models). The collaboration between scientists working on processes and those involved in applications will be fostered through fora and training sessions. The project will also provide updated global climate change scenarios for stakeholders and hopefully better weather and seasonal forecasts. Various on-going observing programs are already carried out in close collaboration with national and regional institutions. A colloquium held in Niamey with the participation of ACMAD and AGRHYMET in February 2002 resulted in setting up a network of over 200 African scientists from various disciplines that are involved in developing core activities related to training, blended education and applications. Summer schools, supervised PhDs, visiting scientists opportunities for African scientists and participation of researchers outside Africa in teaching in African Universities are among the various tools that will be used to build a strong links with African scientific communities. Such links already exist at national levels through specific programs but the project will provide the opportunity to rationalise and boost these efforts.

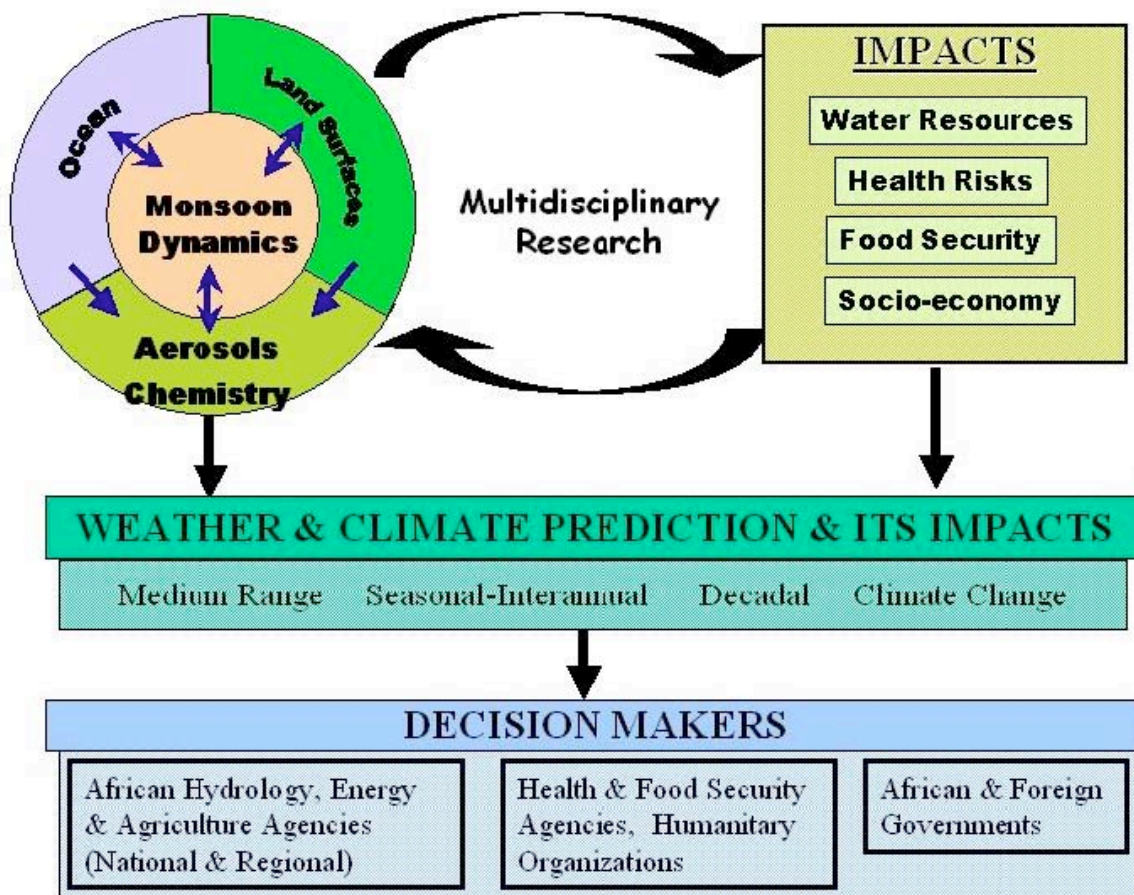


Figure 4. Schematic of AMMA project.

AMMA is becoming a truly international project with the participation of African scientists (AMMAnet), several European countries and USA. A steering committee has been formed and the scientists involved are busy writing science plans to mobilize funding.

ACTION ITEM 13. Make sure that AMMA needs are well represented at the next GCOS meeting (April 2003) in Dakar (C. Thorncroft and T. Lebel)

ACTION ITEM 14. Contact VAMOS and ask advice on how to get funding from GEF and VCP for AMMA (C. Thorncroft)

18. East Africa Research and Proposal

Fred Semazzi has been involved in studies on climate variability and predictability over the Great Rift Valley Lake Basins of Eastern Africa. The climate of the Eastern Africa is strongly modulated by the presence of the three of the largest lakes in the world (Malawi, Tanganyika and Victoria); lake-atmosphere interactions have an impact in the regional climate system. The regions surrounding the three lakes are home for over 80-100 million inhabitants and it is economically among the most productive regions in Eastern Africa. The gross economic product of Lake Victoria catchments alone is on the order of US\$3-4 billion annually. A comprehensive study would help to contribute to the following high priority regional social-economic sectors of the region: pollution control in the lake; the water hyacinth (*Eichhornia crassipes*) problem; aquaculture; fisheries, water supply; water quality, hydroelectric power generation; marine tourism; transportation; agriculture; and health; water supply and quality. There are major ongoing research and management programs that would highly benefit from a VACS initiative. These include the following; (i) Lake Victoria Environmental Management (LVEM) Project. This project is funded by the World Bank/GEF and other international agencies at the level of over US\$100 million/5years [<http://www.gefweb.org/COUNCIL/council7/wp/lakevic.htm>], (ii) Lake Tanganyika Research (LTR), (iii) ENSO, (iv) CLIMate variability and ecological dynamics in LAKE Tanganyika (CLIMLAKE), (v) Lake Tanganyika biodiversity

project (LTBP), (vi) Creation and management of a Regional Research station in Applied Hydrobiology (CRRHA), (vii) [International Decade of East African Lakes](http://www.d.umn.edu/llo/Ideal/index.html) (IDEAL; <http://www.d.umn.edu/llo/Ideal/index.html>) - A multi-disciplinary study of the East African lake system intended to retrieve a long, high resolution record of climate change in tropical East Africa, and establish a comprehensive training program for African students and scientists, and (viii) North Carolina State University initiative for the development of a fully coupled regional climate model for Eastern Africa [<http://climlab4.meas.ncsu.edu>]. A recent study (Song-Semazzi-Ogallo-Xie 2002, in review) indicates that the hydrodynamics of Lake Victoria play an important role in determining the coupled variability of the lake and the regional climate. These results show that by adopting the traditional modeling approach in which the lake hydrodynamics are neglected and the formulation is entirely based on thermodynamics alone is not satisfactory for Eastern Africa. Such a strategy precludes the ability of the coupled regional climate models to transport heat realistically within the lake and thereby results in degraded simulation of the climate downstream over the rest of the lake and the surrounding land regions. Based on paleoclimatic records it has been established that the lakes of eastern Africa (Lake Malawi, Lake Tanganyika, and Lake Victoria) have fluctuated between 50% and 150% of their present size in the past. Clarification of the physical mechanisms that led to these dramatic fluctuations would contribute directly to the objectives of the IDEAL (International Decade for Eastern African Lakes) program and of the factors that lead to these dramatic changes in climate. There are several outstanding problems that needs to be addressed:

- RCM customization for eastern Africa presents unique challenges that have not been addressed within CLIVAR (mix of large lakes, ocean influence, complex topography)
- Regional variability and predictability for over the Eastern Africa lake catchments is least understood throughout the region
- Large data voids over many of the catchments and within the lakes makes it difficult to address the above,

A comprehensive observational campaign (SOP) is proposed involving simultaneous monitoring of climate conditions within the lakes and the surrounding regions to support evaluation of models and predictability studies. This effort should be coordinated with ongoing or planned paleo monitoring initiatives and capitalize on other related ongoing activities, including the paleoclimate drilling programs, and the international lake environmental management funded projects. The proposed monitoring should also be designed to support water budget studies.

ACTION ITEM 15. Prepare a strawman on a potential project on East African lakes and distribute it to the panel (*F. Semazzi, L. Ogallo and K. Cook*)

Laban Ogallo made some remarks on the East African ongoing activities that are relevant to the research proposal presented by Fred Semazzi. Among those he mentioned:

- Data quality control and archive
- Enhancing observations in collaboration with GCOS and African GOOS
- Atlas of climate variability over the GHA region
- Decadal climate variability maps
- Identification and monitoring of the climate change indicators

With respect to process studies, the ongoing research in Eastern Africa includes:

- Eastern and Southern Monsoons
- Indian / Atlantic Ocean processes
- ENSO related studies (see Section 11)
- Regional processes: climate modeling and improving understanding of the impacts
- Verification

Research efforts on climate change studies were also mentioned. Regional climate change scenarios are produced for integrated impacts and vulnerability assessment studies.

ACTION ITEM 16. Provide a list of VACS related activities in Eastern Africa and make it available on the web (*L. Ogallo and R. Boscolo*)

ACTION ITEM 17. Provide a link to the Preparation for Use of Meteosat second generation in Africa (PUMA) project-related call for proposals on the VACS web page (*T. Lebel, L. Ogallo, A. Makarau and R. Boscolo*)

19. Update on PIRATA extension

Mathieu Rouault as the chairman of the PIRATA South-East Extension (PIRATA-SEE) committee briefed the panel on last achievements and status of the project. The PIRATA-SEE project would involve the participation of several institutions from Angola, Namibia and South Africa charged with the logistics, operation, and deployment of one to three ATLAS buoys in the tropical waters off the Angola Current and north of the Benguela Current. The general scientific objectives of the extension are similar to those of the PIRATA established array:

- Monitor the surface and upper ocean thermal structure at key locations off Angola
- Improve the description of air-sea fluxes of momentum, heat and moisture and gain new insights into ocean-atmosphere interaction
- Improve the description of temperature and salinity in the ocean and better understand the mechanisms governing SST variability
- Study the effect of the coupling between heat and salt balances
- Help characterize seasonal and interannual variations in the surface moisture fluxes, in particular associated to rainfall variations in Southern Africa
- Help determine the relationship between regional impacts of climate variations on agriculture and fisheries
- Contribute to the existing and future status of the observing system in the tropical Atlantic
- Validate regional and global ocean, atmosphere and coupled models
- Serve as a ground truth for satellite missions and to the development of blended satellites-in situ analyses.

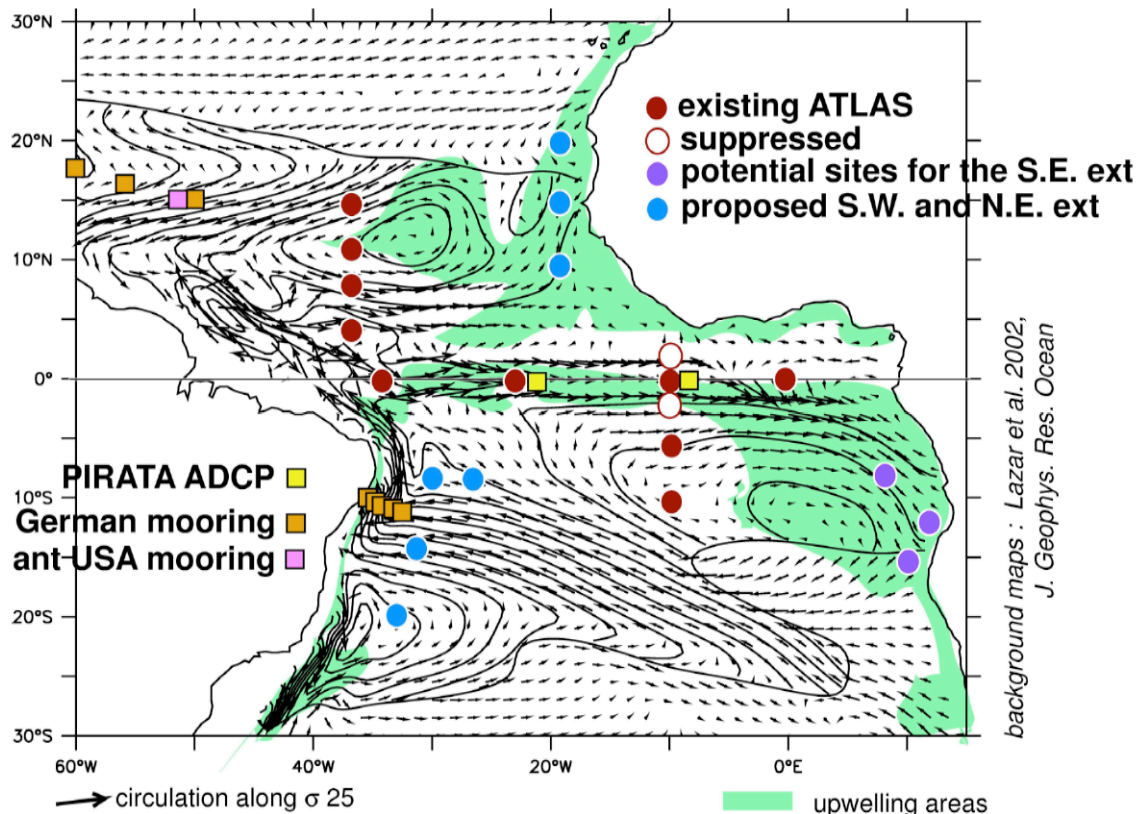


Figure 5. Status of PIRATA in 2002. The location of the SE extension moorings will be officially proposed in May 2003.

The PIRATA SEE committee after consultation with the Environment Variability Group (EVAG) of the Benguela Current Large Marine Ecosystem (BCLME) received support for one year to carry out a feasibility

study of the PIRATA extension. The feasibility study will try to answer the questions of where to place the moorings, how much it will cost to set up and maintain them, who provide technical support, data, logistics etc.... Mathieu Rouault joined a French PIRATA cruise in the Gulf of Guinea to verify the technical requirements and will submit a white paper to CLIVAR and the PIRATA committee on the scope and rationale of the PIRATA SEE for endorsement. The ultimate goal of the PIRATA SEE is to show the usefulness of a pilot extension project in order for the countries of southern Africa to buy into a permanent extension at the end of the Benguela Current Large Marine Ecosystem program in 2007.

20. Proposal for a Center of Excellence on Ocean Sciences at UCT

For this discussion item several members of the oceanography department of Cape Town University joined the VACS panel. A task group formed in November 2001, recently presented a report on the development of a vision and implementation strategy for Ocean Sciences at UCT. The vision is for UCT to become a premier University in Ocean Sciences in the Southern Hemisphere and this will be achieved by exploiting existing strengths in order to establish an inter-disciplinary initiative in Ocean Sciences. Globally the ocean sciences are at a threshold. The last decade has seen radical developments with emphasis in two areas:

- Large-scale ocean monitoring and modelling for ocean weather and climate predictions
- Management of the shelf seas and the coastal zone in respect to fisheries, offshore industries, pollution and shipping

These developments have been made possible by advances in computing, communication, remote sensing and in situ instrumentation thereby paving the way for operational oceanography. These achievements have been led by the first world countries and are already implemented in the Northern Hemisphere. The Southern Hemisphere is truly dominated by the ocean and is ready participate as an equal partner in the global development of the ocean sciences. Cape Town can offer a good venue for developing ocean sciences in the southern Hemisphere; it is situated at the crossroads of the Atlantic, Indian and Southern Oceans. It has had a long association with activities and endeavours involving the sea. The burgeoning international ocean industry is investing in Cape Town and major players are locating their research and development arms in the region. By exploiting local advantages and using them to strengthen the UCT role as a global player UCT will be able to position itself as a hub of excellence in the Ocean Sciences and take up the opportunities on behalf of the entire Southern Hemisphere. Over the past three decades the Ocean Sciences at Cape Town have grown in strength, broadening their horizons at all levels: locally, nationally, regionally and internationally. However further developments are required in the academic structure to accommodate this new initiative. It will be necessary to enhance the quantitative and modelling skills of ocean science professionals, to provide best practice training and experience in operational oceanography, to encourage interdisciplinary postgraduate training and to attract and build full partnerships with international institutions. The strategic role that UCT center of excellence would play in cross-basin sustained observations in South Atlantic and Indian Ocean for climate monitoring and study was also highlighted.

ACTION ITEM 18. Support the creation of a center for excellence on ocean sciences in UCT

(G. Philander and R. Boscolo):

- Ask ITCP to support annual meeting in Cape Town
- Explore the possibility of a contribution from the World Bank
- Distribute the document on the creation of the center and coordinate feedbacks

21. Intraseasonal Climate Variability

Chris Thorncroft reminded the panel of the proposal for Daily Rainfall workshops (see Appendix B of the 2nd Session of the CLIVAR VACS Panel, 2002, publ. Series No. 66) and asked suggestions for their implementation. Laban Ogallo supported the idea of having those workshops attached to the Climate Fora and providing the outputs to the African Climate Variability Atlas project (see section 8)

ACTION ITEM 19. Write a letter to V. Detemmerman (JPS for WCRP) and distribute to appropriate people at WMO in support of running rainfall workshops back to back to the Climate Fora. Identify potential contributors to the workshops. *(C. Thorncroft, L. Ogallo, A. Makarau, and A. Nassor)*

22. VACS Outreach activities

Roberta Boscolo gave an overview of the ICPO organization and relevant activities (<http://www.clivar.org/organization/icpo/>). The ICPO is hosted by the Southampton Ocean Centre, UK. John Gould who had been the director since 1998, retired in August 2002 and Howard Cattle, who was head of UK Met Office's Ocean Applications Branch, took over. The current staff corresponds to 5.5 full time equivalent and are allocated to individual panels and working groups. Among the tools developed at ICPO for improving distribution of information and monitoring CLIVAR implementation, the web-pages, the Newsletter "Exchanges" and SPRINT (searchable data base) were mentioned. The web-pages related to the VACS panel have been recently renovated, one page is dedicated to the organizational aspects of VACS (www.clivar.org/organization/africa.vacs.htm) and contains: members, terms of reference, activities and relevant reports. The other recently-developed webpage address all the aspects related to VACS science and implementation (www.clivar.org/science/vacs.htm), it contains a list of articles which have recently appeared in appropriate peer-reviewed journals and a list of regional activities, data and applications. Those pages are maintained by Roberta Boscolo. CLIVAR Exchanges (www.clivar.org/publications/exchanges/) is increasing in popularity amongst the scientific community because it allows to early publication of results as short contributed papers. The editors of Exchanges have proposed African Climate Variability as topic for the spring 2003 issue.

ACTION ITEM 20. The panel welcomed the initiative to have the June issue of CLIVAR Exchanges focusing on Variability of Africa Climate System. ICPO to distribute appropriate information to panel members and VACS chairs to provide an introduction (*R. Boscolo, L. Ogallo and C. Thorncroft*)

Laban Ogallo also suggested few tools that should be developed in order to raise CLIVAR VACS visibility at international, regional and national level. A set of brochures, posters and PowerPoint presentations on CLIVAR VACS should be prepared and made available (probably through the web) to the VACS panel members to be used at workshops, meetings, conferences for advertising VACS activities. In addition the VACS panel members should think to organize a general lecture at the African venues aside from their annual meeting.

ACTION ITEM 21. Prepare material for VACS general outreach activities: PowerPoint presentation, poster and brochure (*R. Boscolo, C. Thorncroft and L. Ogallo*)

23. VACS Future Initiatives and Panel business

It was suggested that regional programs like AMMA should develop in Southern Africa as well as Eastern Africa (see section 17).

There has been some pressure in starting to address the role of the Indian Ocean on the global climate and of the surrounding regions. VACS can certainly contribute on the science and implementation plans that are developing given the level of expertise reached through the ongoing research in Eastern Africa.

ACTION ITEM 22. Stress the importance of the Indian Ocean for VACS activities at the next AAMP meeting (*C. Thorncroft*)

Ben Kgakatsi and Amos Makarau resigned as VACS panel members due to new job responsibilities. The Panel was asked to review the terms of each member (see Appendix E) and suggest potential candidates.

ACTION ITEM 23. Prepare a list of potential candidates to replace members standing down from the panel and submit it to the SSG (*C. Thorncroft, L. Ogallo, and Boscolo*)

Finally some discussion took place for deciding where and when the VACS Panel should have its annual session next year. It was suggested to take advantage of the organization of the proposed case study workshop and meet before or after the event. Everybody agreed.

ACTION ITEM 24. Next meeting to be held back-to-back with the proposed VACS workshop, possibly in Kisumu (*L. Ogallo, C. Thorncroft and R. Boscolo*)

APPENDIX A – List of Attendees

Kerry Cook
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APPENDIX B –

Informal Workshops, Jan. 14th 2003

Climate Anomalies across Africa 1997-2000: Nature, Causes and Predictability

- 9:00-10:00 Introduction and Overview (*N. Ward*)
10:00-10:15 Anomalies in East Africa, model results (*F. Semazzi*)
10:15-10:30 Southern rainfall anomalies and HadAM3 model results for austral summers 1997-1999 (*C. Reason*)
10:30-10:45 Discussion 10:45-11:00 Coffee Break 11:00-11:15 South East Atlantic warm and cold events & Southern African rainfall anomalies 1997- 2001 (*M. Rouault*)
11:15-11:30 Predictability of South East Atlantic warm & cold events (*P. Florenchie*)
11:30-11:45 Spatial patterns of dry spell frequency over West and Southern Africa during ENSO events (*M. Usman*)
11:45-12:00 A qualitative review of 2001/2 summer season forecast over South Africa
12:00-12:30 Discussion

Ocean Modelling: overview of ongoing and planned projects – opportunities for synergies and collaboration

- 14:00-14:15 Introduction (*G. Philander*)
14:15-14:30 Plans for a UCT Ocean Science Research Centre (*G. Brundrit*)
14:30-14:45 The IDYLE/BEP5 modelling experiment (*C. Roy*)
14:45-15:00 A proposed biogeochemical simulation modeling framework in the Benguela region that addresses the BCLME needs linked to low oxygen water variability, new production, harmful algal blooms and pollution (*P. Monteiro*)
15:00-15:15 The planned Benguela Current Large Marine Ecosystem (BCLME) modeling platform (*P. Florenchie*)
15:15-15:30 Overview of other Atlantic and Indian Ocean modeling projects at UCT (*C. Reason*)
15:30-16:00 Coffee Break 16:00-17:30 Discussion and way forward

Appendix C - Agenda

Wednesday 15 January

- 9:00-9:10 Welcome from host (*Chris Reason*) 9:15-11:00 Panel business (*Chris Thorncroft*)
- . •Objectives of the meeting
 - . •Review of agenda
 - . •Action item from last meeting
 - . •SSG action items relevant to VACS
- 11:00-11:20 Coffee Break
- 11:20-12:15 Links with GEWEX and the CEOP project (*Thierry Lebel*)
- 12:15-12:30 Annual Cycle: Recent Results in the Literature (*Chris Thorncroft*)
- 12:30-13:20 Atlas on African Climate Variability (*Richard Washington*)
- 13:20-14:15 Lunch
- 14:15-14:45 Update on the Compendium of Southern Africa. (*Amos Makarau*)
- 14:45-16:00 Interannual Variability: Update on the Case Study (*Neil Ward*)
- 16:00-16:20 Coffee Break
- 16:20-16:40 East Africa: ENSO Research (*Laban Ogallo*)
- 16:40-17:00 Discussion on Case Study (*all involved*)
- 17:00-18:00 Climate Fora (*Laban Ogallo*)

Thursday 16 January

- 9:15-9:30 Introduction to EGS and Oceanography Depts of UCT (*Chris Reason*)
- 9:30-10:15 White Paper on Decadal Variability (*Chris Reason*)
- 10:15-11:15 Links of VACS with Paleoclimate research (*Kerry Cook and George Philander*)
- 11:15-11:40 Coffee Break
- 11:40-12:00 Climate change projects update (*Thierry Lebel*)
- 12:00-13:00 Regional Research and Field Program Initiatives: AMMA (*Thierry Lebel*)
- 13:00-14:00 Lunch
- 14:00-15:00 East Africa Proposal (*Fred Semazzi*)
- 15:00-16:00 East African Research (*Laban Ogallo*)
- 16:00-16:20 Coffee
- 16:20-16:45 Update on PIRATA extension (*Mathieu Rouault*)
- 16:45-18:00 Southern Africa Ocean Projects and Center of Excellence (*George Philander and invited UCT representatives*)
- 20:00 Panel Dinner at Botanical Gardens

Friday 17 January

- 9:15-9:45 Intraseasonal Variability: Agricultural Risk Management (*Ben Kgakatsi*)
- 9:45-10:15 Intraseasonal Oscillations and their scale of Variability (*Amos Makarau*)
- 10:15-11:00 Intraseasonal Variability (*Chris Thorncroft*)
- . •Recent Results in the Literature
 - . •Rainfall workshops
- 11:00-11:10 Coffee Break
- 11:10-11:30 ICPO tools for CLIVAR Promotion (*Roberta Boscolo*)
- 11:30-11:50 VACS Outreach activities (*Laban Ogallo*)
- 11:50-12:30 VACS Future Initiatives (*Chris Thorncroft*)
- . •Implementation Plan
 - . •Indian Ocean
- 12:30-13:00 Any other Panel business (*Chris Thorncroft*)
- . •Membership
 - . •Next Meeting
- 13:00 Adjourn

APPENDIX D – List of Institutions receiving AMS journals

Address	Receiving JCLI/MWR	Receiving WAF
Mr. Ferhart Ounnar Dir. de la Meteorologie Ministere des Transports 119 rue Didouche Mourad 16000 Alger Gare ALGERIA	Y	Y
Directeur Inst Hydro de Form Reg. Met. Training Center B.P 7019 Seddikia Oran ALGERIA	Y	Y
Dr. Gualberto de Honorato Joao Dir., Inst Nacional de Hidromet. e Geofisica C.P. 1228 - C Luanda ANGOLA	Y	Y
Monsieur M. Jose Dir., du Centre Regional de Formation Professionnelle en Met. c/o Inst. Nac. de Hidrmet. e Geofisica C.P. 1228 – C Luanda, ANGOLA	Y	N
The Perm Rep of Benin w/WMO ASECNA B.P. 379 Cotonou BENIN	Y	Y
Ms. G.K. Ramothwa Director Botswana Met. Services PO Box 10100 Gaborone BOTSWANA	Y	Y
Mr. Niama Frederick Outtara Directeur de la Meteor Natl 01 B.P. 576 Ouagadougou 01 BURKINA FASO	Y	Y
Manasse Nduwayo Directeur General Inst Geo. du Burundi IGEBU Boite Postale 331 Bujumbura BURUNDI	Y	Y
Mr. Hilary Mbifngwen Bongmum Dir. de la Meteor. Nationale 296 Rue Ivy, B.P. 186 Douala CAMEROON	Y	Y
Mr. E.F. Santos Soares Director Nat Services of Met. & Geophysics Alto da Igreja C.P. No 76 Ilha Do Sal CAPE VERDE	Y	Y

Mr. Clement-Thyrrel Feizoure Dir Gen de L'Aviation Civile et d la Met. (DGACM) B.P. 224 Bangui CNTL AFRICAN REP	Y	Y
Mr. Neasmiangodo Betoloum Dir des Ressources en eau et de la Met. Nationale Boite Postale 429 N'Djamena CHAD	Y	Y
Mahamoud Ali Bay Poundja Charge des Relations Intl a la Direction de l' Aviation Civile Service Met. B.P. 78 Moroni COMOROS	Y	Y
The Perm Rep of Congo w/WMO B.P. 208 Brazzaville CONGO	Y	Y
Mr. Osman Saad Said Chef de Service de la Meteor. Ministry of Tourism & Telecom. B.P. 204 Djibouti, DJIBOUTI	Y	Y
M.A.M. Rebba Chairman, Board of Directors Egyptian Met. Authority Koubry El-Quobba PO Box 11784 Cairo Egypt	N	Y
Director Regional Met. Training Ctr Meteorological Authority PO Box 11784 Cairo, Egypt	N	Y
Mr. Bekuretsion Kassahun General-Manager Natl Met. Services Agency PO Box 1090 Addis Ababa ETHIOPIA	Y	Y
Mme Arlette Kelly Mackosso Dir. de la Meteor. Nationale B.P. 377 Libreville GABON	Y	Y
Mr. Bubu P. Jallow Acting Director Water Resources Dept 7 Maumar Ghadaffi Ave Banjul GAMBIA	Y	Y
Dr. N.B. Yelifari Acting Director of the Met. Service PO Box 87 Legon GHANA	Y	Y
Mr. Malam Da Silva Dir. du Service Meteor. Nat. Caixa Postal No. 75 Bissau 1001 GUINEA-BISSAU	Y	Y

Dr. Mamadou Lamine Bah, Director Met. Nationale B.P. 566 Conakry GUINEA	Y	Y
Dr. Annabelle Konan-Brou Lab. d'Ecologie Benthique Centre de Recherches Oceanologiques B.P. V18 29, rue des Pecheurs Abidjan, IVORY COAST	Y	N
Mr. Abdoulaye Kignaman-Soro Sous-dir de la Met. Nat'l ANAM 15 B.P. 990 Abidjan 15, IVORY COAST	Y	Y
Dr. Ezekiel Okenwa, Director Kenya Marine & Fisheries Research Inst. PO Box 81651 Mombasa KENYA	Y	N
Director Kenya Met. Dept. Inst. for Met. Training & Research Regional Met. Training Center PO Box 30259 Nairobi, KENYA	Y	Y
The Registrar Univ. of Nairobi PO Box 30197 Nairobi, KENYA	Y	N
Mr. Joseph R. Mukabana Director, Met. Dept. Dagoretti Corner Ngong Road PO Box 30259 Nairobi KENYA	Y	Y
Mr. Bruno Sekoli Head, Lesotho Met. Serv Hydromet. Services PO Box 772 Maseru 100, LESOTHO	Y	Y
Hon. Albert T. Chie Asst Minister for Mineral & Environment Research Ministry of Land Mines & Energy PO Box 9024 Monrovia, Liberia	N	Y
Mr. John Collins Dir., Met. Services Roberts Intl Airport PO Box 1 Robertsfield LIBERIA	Y	N
Ecole Superieure Polytech, D'Antananarivo Dept. Meteorologie, Madagascar B.P. 1500 ou 562 Antananarivo, MADAGASCAR	Y	N
Mme Christine Razafy Dir. de la Met et de Hydro Boite Postale 1254 Antananarivo (101), MADAGASCAR	Y	Y

Directeur "Ecole Superieure Polytechnique d'Antananarivo" Univ. de Antananarivo Reg. Met. Training Center B.P. 1500 ou 562 Antananarivo (101), MADAGASCAR	Y	Y
Donald R. Kamdonyo Acting Director Met. Dept., Ministry of Transport PO Box 2 Chileka MALAWI	Y	Y
Mr. Kaliba Konare Dir. de la Met. Nationale Boite Postale 237 Bamako MALI	Y	Y
Mr. Ould Mohamed Laghdaf Bechir Chef du Serv. de Meteorologie Boite Postale 205 Nouakchott MAURITANIA	Y	Y
Mr. S.N. Sok Apadu Acting Director, Meteoro. Services St. Paul Road Vacoas MAURITIUS	Y	Y
Mr. Azzeddine Diouri Dir. de la Met. Nationale B.P. 8106 CASA-OASIS 20103 Casablanca MOROCCO	Y	Y
Dr. Adriano Alfonso Macia, Jr University Eduardo Mondlane University Campus Box 257 Maputo, MOZAMBIQUE	Y	N
Filipe Domingos Freires Lucio, Director Serv Met de Mozambique Inst. Nacional de Met. Rua de Mukumbura 164 C.P. 256 Maputo MOZAMBIQUE	Y	Y
Mr. F. Uirab, Chief Namibia Meteorological Service 12C Hugel St Private Bag 13224 Windhoek NAMIBIA	Y	Y
Mr. Idrissa Also Dir. de la Met. Nationale Service Met. du Niger B.P. 218 Niamey NIGER	Y	Y
Directeur, Ctr AGRHYMET B.P. 11011 Niamey NIGER	Y	Y

Directeur EAMAC Reg. Met. Training Center B.P. 746 Niamey NIGER	Y	Y
Prof. Larry Awosika Marine Geology/Geophysics Div. Nigerian Inst. of Ocean. & Marine Research P.M.B. 12729 Victoria Island Wilmot Point Rd. Bar-Beach, Victoria Island Lagos NIGERIA	Y	N
Dr. T. A. Fasheun Head Dept of Meteorology School of Sciences Federal University of Technology P.M.B. 704 Akure NIGERIA	Y	N
Mr. Yusuf A. Salahu Director Meteorological Dept. Strachan St., Oshodi Private Mail Bag 12542 Lagos NIGERIA	Y	Y
Principal Met Dept Met. Res. & Training Inst Reg. Met Training Ctr Oshodi Lagos NIGERIA	Y	Y
Mr. Didace Musoni, Chef de Div Met Min des Transports et des Comm Direction Gen. de L'aero B.P. 898 Kigali RWANDA	Y	Y
Eng. Aderito Santana Dir de l'Inst National de Meteorologie C.P. 30, Sao Tome SAO TOME & PRINCIPE	Y	Y
Dr. Diafara Toure, Director Centre d'Océanographie Dakar CRODT B.P. 2241 Dakar SENEGAL	Y	N
Mr. Alioune Ndiaya Dir de la Met. Nationale Min du Tourisme et des Transports B.P. 8257 Kakar Aeroport Dakar-Yoff SENEGAL	Y	Y

Mr. Rolph Payet Director General, Min of Env & Transport Div of Policy, Planning & Services Natl Met. Services PO Box 1145 Botanical Gardens Victoria SEYCHELLES	Y	Y
Mr. J.T.O. Pratt Director Meteorological Dept. F. 18 Charlotte Street Freetown SIERRA LEONE Director-General Meteorological Service Civil Aviation, Min. of Transport PO Box No 310 Mogadishu SOMALIA	Y	Y
Mr. Mohamed El Khidir Abdalla Director General, Met. Authority PO Box 574 Khartoum SUDAN	Y	N
Mr. E. Dumisani Dlamini Director Nat. Met. Service Ministry of Public Works & Transport PO Box 58 Mbabane SWAZILAND	Y	Y
The Perm Rep of SOMALIA w/WMO Met Service c/o Perm Mission of Somalia to the Office of the UN & the other Intl Orgs in Geneva 9 rue du Valais 1202 Geneva, Switzerland	N	Y
Mr. Adote Blivi FLESH Universite de Benin B.P. 1515 Lome TOGO	Y	N
Mr. Awadi Abi Egbare Dir Gen de la Met. Nationale Boite Postale 1505 Lome TOGO	Y	Y
Mr. Hamda Hajji Dir.-General Inst National de Meteorologie B.P. 156 Tunis-Carthage TUNISIA	Y	Y
Mr. Bwango Apuuli Commissioner for Meteorology Dept of Meteorology PO Box 7025 Kampala UGANDA	Y	Y

Dr. Mohamed S. Mhita Director-General Dir. of Meteorology PO Box 3056 Dar es-salaam TANZANIA	Y	Y
Mr. Jean-Felix Mupande Kapwa Director General METTELSAT B.P. 4715 Kinshasa 11 ZAIRE	Y	Y
Mr. G.B. Chipeta Dir., Met. Dept PO Box 30200 10101 Lusaka ZAMBIA	Y	Y
Professor Prem Jain Physics Dept./School of Natural Sciences The Univ. of Zambia PO Box 32379 Lusaka, ZAMBIA	Y	N
Mrs. Rungano Karimanzira Director Dept of Met Services PO Box BE 150 Belvedere, Harare ZIMBABWE	Y	Y

APPENDIX E – Panels Members Terms

PRESENT MEMBERS

C. Thorncroft (co-chair)	USA	2001-2005
L. Ogallo (co-chair)	Kenya	
K. Cook	USA	
I. Kgakatsi	SA	
T. Lebel	France	
A. Makarau	ZW	
A. J. Omotosho	Niger	
G. Philander	USA	
F. Semazzi	USA	
N. Ward	USA	
R. Washington	UK	

EX-OFFICIO MEMBERS

N. Abdallah (ACMAD)	Niger
A. Amani (Aghrymet)	Niger
Rep of DMC	ZW
Rep of DMC	Kenya

2001-2005 2001-2005 2001-2003 (RETIRING) 2001-2005 2001-2003 (RETIRING) 2001-2005 2001-2004
2003-2007 2001-2005 2003-2007

PROPOSED NEW MEMBERS

C. Reason	SA
A. Diongue	Senegal
A. Diedhiou	Senegal (France)
Wassila Thiaw	(CPC/NOAA Africa) USA
Daniel Olago	Kenya (PAGES/START)

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