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THE UCAR AFRICA INITIATIVE – OVERVIEW AND UPDATE

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1. INTRODUCTION

The UCAR community, as represented by UCAR-Member and Affiliate universities, NCAR, and the UCAR Office of Programs, has embarked on an effort whose goal is assisting in building atmospheric-sciences capacity in Africa. The UCAR Africa Initiative (AI) is motivated by the underrepresentation of Africa in international efforts to develop improved research capabilities, observing facilities, operational forecasting, and meteorological education.

This presentation provides a brief overview of the various efforts being conducted and planned as part of the UCAR African Initiative and gives a status update of efforts currently underway.

2. PURPOSE, GOALS, and VALUES

The purpose of the AI is to build a sustainable partnership between UCAR and African institutions in order to pursue research and applications for the benefit of the African people. The initiative is envisioned as enabling:

African solutions for African Problems

This encompasses, but is not limited to:

- Increasing knowledge of the role of African weather, climate, and biogeochemical processes in the Earth system critical to Africa and important to the world

- Enhancing the capacity for atmospheric research, operational systems, and dissemination strategies in Africa by investing in sustainable infrastructure and education
- Leveraging the research infrastructure in UCAR and strategic partners to add value
- Involving genuine collaboration with African institutions - issues addressed should arise from needs defined by local institutions and focus on developing and enabling long-term strategies led by those institutions

3. AFRICA-RELATED ACTIVITIES

3.1 Pilot Activities

One of the key early successes of the AI has been the initiation of communication and collaboration among the surprising number of NCAR and UOP programs already active in Africa. Representatives of these various programs proposed a set of collaborative pilot activities, which were funded by a combination of UCAR general funds and NCAR strategic initiative funds. These activities, chosen for their high probability of short-term results and alignment with longer-term efforts, will demonstrate UCAR capabilities and attract additional, more substantial funds from external sources.

The planned and ongoing pilot activities are:

AAAS-UCAR African Scholars Program

The goal of the AAAS-UCAR African Scholars Program is to help develop a network that can support and build capacity for climate and weather researchers in Africa. Envisioned is support for 20 African post-docs a year to do research at UCAR and

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UCAR universities and provision of startup funds to support the return of the scientists to Africa. Sabbatical support of US scientists to work in Africa is also desired.

For additional information, contact Raj Pandya, pandya@ucar.edu.

A Modest Radar Network and Data-distribution System in the Western Sahel

Radars in West Africa were renovated using software developed in NCAR's Research Application Laboratory that can be installed and maintained on personal computers. UCAR funds were used to leverage external funding devoted to cloud-seeding operations and evaluation. The three initial radars are located in Burkina Faso and Mali, and the data will be streamed using Unidata LDM/IDD software. Two new radars that have recently been installed in Mali will be added to the network as they become operational. In addition, rain gauges in the area of the Bamako radar have been surveyed for use in validating radar observations.

For further information contact Roelof Bruintjes, roelof@ucar.edu.

Operational Forecasts for West Africa

NCAR is currently running the Weather Research and Forecasting (WRF) model for West Africa; the output is used by researchers and operational forecasters in Ghana. The model output is also part of a demonstration project that aims to allow humanitarian agencies to share geo-referenced information in Africa via a web portal.

For further information, contact Ben Lamptey, lamptey@ucar.edu.

Sahel Conference 2007: Improving Lives by Understanding Weather Ouagadougou, Burkina Faso April 2-6, 2007

Eighty researchers, operational forecasters, and policymakers from 18 countries, including 15 African countries, participated in discussions that outlined priorities for meteorological research and operations and also envisioned regional collaborations to reach those priorities. The workshop included hands-on training on UCAR-developed tools and technology, as well as a field trip to Lycee Nelson Mandela, where a GLOBE weather station was installed for ongoing student use.

3.2 Ongoing and New Activities

Over the past one to two decades, UCAR researchers have been involved in a wide range of activities in Africa. Activities continue in some 11 countries to this day, and many were enhanced by connections made at the Sahel Conference 2007. The following presents a brief overview of some ongoing UCAR activities in Africa:

The ASMET Project: African Satellite Meteorology Education & Training

African forecasters rely heavily on data from meteorological satellites due, in part, to the scarcity of conventional surface-based observations. Under the ASMET project funded by EUMETSAT, the ASMET team creates self-paced, interactive learning programs that teach forecasters to produce more accurate forecasts by making better use of satellite imagery. The modules are in English and French and are available on CD and, more recently, the Web. The CDs are distributed to all forecast offices and meteorology programs on the African continent. The modules include Tropical Cyclones over the Southwest Indian Ocean, Combining Satellite Imagery and Model Output in Weather Forecasting, Integrating Satellite Imagery of the ITCZ into Analyses, and Satellite Meteorology in Africa. The ASMET supports the efforts of African meteorological instructors from Nairobi, Kenya and Niamey, Niger to develop distance learning modules for Africa on satellite meteorology.

The ASMET team is currently working on a series of case studies that focus on the use of Meteosat Second Generation data to depict weather phenomena over Africa, including dust storms, cloud clusters, and secondary lows behind frontal systems. The team currently consists of six meteorology instructors from the WMO Regional Meteorological Training Centers in Kenya and Niger and the South African Weather Service, Marianne Weingroff, instructional designer at COMET/UCAR, and Henk Verschuur, Training Officer for Africa at EUMETSAT. The team was originally trained in the instructional design process during a nine-month fellowship at COMET/UCAR.

For additional information, contact Marianne Weingroff, marianne@ucar.edu.

Climatologies of Deep Convection and Forecast Applications in Africa

Climatologies of the propagation and diurnal cycles of deep convection and associated precipitation in Africa have been developed by co-author Arlene Laing. These climatologies are being used in forecast applications.

For example, Arlene worked with Peter Chen of the WMO World Weather Watch to train and prepare forecasters for the WMO Severe Weather Forecast Demonstration Project in held in southern Africa during November 2006.

Furthermore, the statistics of convection (such as timing, duration, and diurnal cycle) are being used in physical process and model-development projects by African and US scientists. Figures illustrating the daily, monthly, and seasonal statistics of convective precipitation in Africa will be made available on the web (<http://www.mmm.ucar.edu/observations/africa>) as a resource for African scientists and forecasters.

Arlene also contributes to research applications in Africa by serving on the AMMA-THORPEX Working Group Core and the AMMA-US Steering Committee.

For additional information contact Arlene Laing, laing@ucar.edu.

Improving Regional-scale CO₂ Flux Estimates in Africa

Co-author Sherri Heck, a PhD student at the University of Colorado at Boulder, is analyzing regional fluxes of carbon dioxide in Africa, a critical part of the global climate puzzle. By working with local schools in poorly served areas of Kenya, Heck hopes to entrain students in gathering data that could prove vital to climate research.

A boon for Heck's research is the Autonomous Inexpensive Robust CO₂ Analyzer (AIRCOA), a new tool developed by NCAR's Britton Stephens and colleagues. Standard CO₂ samplers can cost upwards of \$40000, but each AIRCOA unit runs less than \$10000. The device gathers and relays CO₂ readings every 2.5 minutes, and it can be run without human intervention for months at a time. All these qualities make the device nearly ideal for deployment in Africa, where both funding and staffing for long-term measurement campaigns can be a challenge.

While at the Sahel Conference 2007, Heck met with several African scientists who were eager to help find suitable locations for AIRCOA units. Later in 2007 she teamed with the Kenya Meteorological Office with plans to place the instrument atop Mount Kenya in March 2008 as part of a global CO₂ monitoring network. With the help of the Kenya Meteorological Office, Heck has set up collaborations with the University of Nairobi and with an elementary or secondary school in the area.

For additional information, contact Sherri Heck, sheck@ucar.edu.

COMET Training Activities

COMET modules are used in over 50 African Countries. In addition, COMET hosts the NWS staff member who develops and supports WRF EMS, which used in many African countries and provides support for training workshops. COMET is developing a distance learning package this fiscal year. In addition, COMET hosts the server that is used to initialize WRF EMS by countries in Africa that are using the model operationally.

For additional information, send inquiries to info@comet.ucar.edu.

GLOBE – Global Learning and Observations to Benefit the Environment

GLOBE is a worldwide hands-on, primary and secondary school-based science and education program. GLOBE's vision promotes and supports students, teachers and scientists to collaborate on inquiry-based investigations of the environment and the Earth system working in close partnership with NASA and NSF Earth System Science Projects in study and research about the dynamics of Earth's environment.

GLOBE began operations on Earth Day 1995. Today, the international GLOBE network has grown to include representatives from 110 participating countries, 26 of which are in Africa, and 139 U.S. Partners coordinating GLOBE activities that are integrated into their local and regional communities. There are more than 40000 GLOBE-trained teachers representing over 20000 schools around the world. GLOBE students have contributed more than 17 million measurements to the GLOBE database for use in their inquiry-based science projects. GLOBE brings together students, teachers and scientists through the GLOBE Schools Network in support of student learning and research.

To find out more about GLOBE in Africa, contact the GLOBE Regional Desk Officer(s) for Africa, africa@globe.gov.

Internet Collection and Redistribution of Radar Data from the Sahel

Co-author Tom Yoksas is the Unidata Program Center contact for efforts aimed at the relay of full volume scan radar data from Mali and Burkina Faso to UCAR/NCAR; their incorporation in composite products; and the distribution of the radar products

back to cooperating countries in the Sahel. This activity is being conducted in response to recommendations of the Data Sharing, Infrastructure, and Telecommunications working group of the Sahel Conference 2007.

To date, proof-of-concept relay of data to the radar installation in Bamako, Mali using the Unidata LDM/IDD has been conducted. In the near future, tests of near-real time relay of full volume scan radar data from the RAL Thunderstorm Identification, Tracking, Analysis, and Nowcasting (TITAN) systems installed in Mali and Burkina Faso will be conducted again using the Unidata LDM/IDD. Unidata and/or RAL tools will then be used to create composite radar products which will be made available to the data providers via either or both of the Unidata LDM/IDD or EUMETSAT's EUMETCast satellite broadcast system.

For additional information, contact Tom Yoksas, yoksas@unidata.ucar.edu.

Mali Rain Gauge Survey

The weather observation network in the West African Sahel has been plagued with data scarcity, owing to a decreasing number of regularly reporting rain gauge stations since the 1980s. A number of weather radars that were recently installed throughout the Sahel region in the context of scientific field campaigns and weather modification programs could help remedy this data shortage problem by complementing, not replacing, existing rain gauge networks. Although primarily used for weather forecasting purposes, weather radars could provide precipitation estimates useful for a range of scientific applications when calibrated-against/validated-with rain gauge data in order to quantify their accuracy and limitations.

In September, 2007 co-author Stefanie Herrmann, in collaboration with representatives from the Mali Meteorological Service, conducted a survey of existing rain gauges located in the reach of the 75C 5-cm weather radar located in Bamako, Mali which had been installed in the beginning of the 2006 rainy season as part of a precipitation enhancement project.

The goals of this survey were to:

- Determine the exact geographic location of existing rain gauges
- Assess their suitability to provide reference values ("ground truth") for a validation study

(taking into account exposure, quality of the rain gauge, data availability)

- Retrieve data for the rainy seasons of 2006 and 2007 when available
- Determine candidate sites for the installation of additional, automatic rain gauges

To this end, 37 rain gauges were surveyed within a radius of 150 km around Bamako, of which 4 were part of synoptic meteorological stations; 1 was part of a climatological station; 4 were part of agro-meteorological stations; 21 were rain gauge stations, and 7 were farmer's rain gauges.

For additional information, contact Stefanie Herrmann, stefanie@ucar.edu.

RAL Training in the use of Radar and Satellite Imagery

Co-author Rita Roberts has been involved in training forecasters from several of African countries in the interpretation of radar data and in the use of radar and satellite data for nowcasting thunderstorms. This effort is an outgrowth of Sahel Conference 2007 breakout sessions. Previously she lectured and provided radar interpretation workshops at the WMO-sponsored World Weather Research Program's 2005 Nowcasting workshop in Pretoria, South Africa. Approximately 20 forecasters from different countries in Africa attended the workshop and received radar and nowcasting training. Two forecasters who attended the WMO WWRP workshop (Previsionniste Kone Diakaria from Abidjan, Ivory Coast and Previsionniste Hama Hamidou from ASECNA in Niamey, Niger) were very active in the Sahel Conference 2007 giving presentations that illustrated how forecasters are trying to incorporate the latest scientific ideas and techniques into their daily operations. Kone Diakaria discussed how he used the radar, satellite and nowcasting training he received at the WMO WWRP workshop to nowcast the development of intense Ivory Coast thunderstorms that developed at the intersection of a sea breeze boundary and mesoscale outflow boundary. Other Sahel Conference 2007 attendees have requested copies of the radar training modules. The modules are available free-of-charge from the WMO website.

For additional information, contact Rita Roberts, rroberts@ucar.edu.

Co-author Paul Kucera and the University of North Dakota's Dave Delene conducted a training workshop at Programme SAAGA headquarters in Ouagadougou, Burkina Faso in mid-October, 2007.

The workshop, which was another follow-on activity to the Sahel Conference 2007, had three goals:

- Provide assessment of existing cloud seeding operations
- Provide recommendations to Programme SAAGA to improve their operational seeding program
- Develop a plan for a long-term measurement and assessment program for rainfall enhancement in Burkina Faso

The training program was a combination of in-class lectures on radar, aircraft instrumentation, surface observations, and weather modification assessment during morning sessions and hands-on training, radar calibration, airborne instrumentation, data analysis and interpretation, and coordinated research flights in the afternoons.

For additional information, contact Paul Kucera, pkucera@ucar.edu.

4. STRATEGIC PARTNERSHIPS

We recognize that there are a number of substantial efforts being undertaken by US universities and government agencies and international organizations such as EUMETSAT (Darmstadt, Germany) and the International Training Center (ITC, Enschede, The Netherlands) that are aimed at building atmospheric-science capabilities in Africa. It is our desire to build strategic partnerships with and among these groups to enhance the impact for the people of Africa.

Given the substantial existing unmet needs and the size of the challenge, UCAR is augmenting the above-described and other activities in a variety of ways. For example, Professor Fred Semazzi of North Carolina State University, who is on sabbatical at UCAR to help lead the Africa Initiative, is focusing on building connections between UCAR activities and the university community, in Africa and the US.

It is hoped that this presentation will encourage UCAR-Member and Affiliate universities, US government agencies and other national and international organizations, to share information relevant to their endeavors with the community at-large so that all can better achieve the common goal of improving the atmospheric-sciences infrastructure in Africa.

5. FUTURE DIRECTIONS

In the next year, the Africa Initiative will concentrate on developing a portfolio of funding to support the extension of the pilot activities described previously. With additional external funding, we hope to initiate a program for early-career scientists that would allow new African researchers to develop projects at NCAR and then transition those products back to Africa. We would also like to extend the modest radar-network established in West Africa to more comprehensive sharing of meteorological data, as suggested by participants in the Ouagadougou conference.

Additional information on the UCAR Africa Initiative is available on www.africa.ucar.edu or by contacting Raj Pandya, pandya@ucar.edu.

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