

NIGER

West Africa Climate Data Rescue and Digitization Facility



The African Centre of Meteorological Applications Development (ACMAD) has an archive of historic climate data on various disintegrating media. This dataset, a diazo-copy, according to the World Meteorological Organization (WMO), is known as DARE I (Data Rescue for Regional Association I) and was launched for the 42 non-CILSS (Comité Inter-Etats pour la Lutte contre la Sécheresse au Sahel) countries in Africa. Officially, DARE I started in January 1989 and ended in June 1997. The project was executed by the International Data Rescue Coordination Center (IDCC) in Brussels and the WMO. From 1988 to the end of the project in 1996, DARE I produced 69,134 microfiches and more than 1,700 microfilms containing the photographs of African historic hydrometeorological data taken from deteriorating paper. ACMAD requested they be provided the capacity for imaging and digitizing of the DARE I microfiche climate records as well as assistance in rescuing, imaging and digitizing other hydrometeorological records on other at-risk media.

Phase I successfully completed: The purpose of Phase I of the USAID Climate Change Resilient Development (CCRD) Project was to establish the **West Africa Climate Data Rescue**

and Digitization Facility at ACMAD headquarters in Niamey, Niger. The International Environmental Data Rescue Organization Limited (IEDRO) in cooperation with ACMAD has successfully established that facility, which is operational today. IEDRO provided equipment, techniques, and support. Through USAID funding administered by Engility Corporation, IEDRO provided four scanning systems - each of which includes the Micro-Image Capture 7 high-resolution microfiche/microfilm scanner, a Hewlett-Packard Pro3500 Series MT Desktop computer, and a 27" high-resolution Samsung flat-screen monitor. In July 2013, the IEDRO Implementation Team installed the data rescue equipment and provided training on the scanning systems to ACMAD personnel. From July 2013 to present, IEDRO has been working closely with ACMAD staff to assist them in inventorying and scanning the DARE I microfiche, continuing to make recommendations to improve the speed and accuracy of the scanning process. As of December 2014, ACMAD technicians have scanned over 16,000 microfiche frames per month.

Proposed Phase II

Prior to the beginning of the West Africa Climate Data Rescue and Digitization Facility project, ACMAD, USAID and IEDRO realized that in order to ensure the successful and sustainable operation of this new facility, **the following three activities must occur:**

1. Historic hydrometeorological data at risk throughout Africa must be located and “rescued” (either scanned or photographed) before it is lost forever. This top priority is currently being accomplished by ACMAD’s **West Africa Climate Data Rescue and Digitization Facility**.
2. These data, both alphanumeric (i.e. weather observation forms) and analog charts (i.e. barograms, precipitation strip charts) must be accurately converted into a digital format for use by the global scientific and educational community.
3. These original images of the hydrometeorological data and the derived digitized parameter values must be shown to be of critical value to each of Africa’s National Meteorological and Hydrologic Services (NMHS). In order for this to occur, ACMAD must gain the commitment of each African NMHS Director, convincing each that Data Rescue and Digitization (DR&D) of their historic hydrometeorological data is of direct benefit to: (1) them professionally; (2) their NMHS; (3) their country, (4) humanity.

Phase IIa – IEDRO, with the ongoing cooperation of ACMAD, will continue to provide Quality Control and Problem Solving services to the imaging technicians at ACMAD. These services include daily access to IEDRO technical personnel to solve imaging and storage problems. In addition, IEDRO records and reports monthly on the operations from each of the four scanning systems installed by IEDRO at ACMAD.

Phase IIb – IEDRO, with input from ACMAD, will design and build a “Weather Wizards” software engine, housed in a secure Tier III data processing center and used via a secure Internet connection, to process images into usable digital data. The images and digitized data will then be returned to the originating country for use. Weather Wizards provides the manual digitization of historic hydrometeorological data, both analog and alphanumeric.

Using Weather Wizards, the keying technician brings up a scanned digital image containing weather parameter values (temperature readings, precipitation measurements, relative humidity, and/or dozens of other weather parameters) in one window on the monitor. An accompanying digitizing keying format form, nearly identical to the image in the first window, appears in a second window. The keyer merely copies the parameter value from a box in the digital image in the first window to the corresponding box in the keying format form in the second window. Once all the parameter values in the image have been entered into the keying format, the keyer hits a “submit” icon. A new image then appears in the first window while a new blank keying format appears in the second window awaiting input.

Weather Wizards will allow keying options - either employees or volunteers to provide the keying of the data from the rescued images into a digital database. Since Weather Wizards is an Internet-based system, the digital images can be sent just to ACMAD technicians to allow their

keying in of the parameter values from the digital images they recently scanned. Weather Wizards will not only provide quality control of the entered values but will also track the number of pages keyed into the database by each individual technician. As a result, ACMAD management can provide wages based on quality and quantity of input. However, if ACMAD technicians are not available to digitize the rescued and imaged data, Weather Wizards can send the images out to IEDRO volunteers throughout the world who will key the data into the digital database. The Weather Wizards system will perform quality control, archive correctly keyed data for eventual transmission back to ACMAD, and from there, transmit digitized data to the country from which the data originated.

The basic “Weather Wizards” program has already been initiated by IEDRO using non-USAID funds. However, additional funds will be required for customizing the system to each of the dozens of unique historic hydrometeorological observation sheet formats being imaged by ACMAD.

Phase IIc - IEDRO will assist ACMAD in communicating the critical value of these original images of the hydrometeorological data and the derived digitized parameter values to each of Africa’s National Meteorological and Hydrologic Services (NMHSs). ACMAD, with assistance from IEDRO, will identify scientific applications that produce value-added products from the newly rescued, imaged and digitized data.

Uzbekistan

Uzbekistan Climate Data Restoration Project

IEDRO, under the administration of the World Meteorological Organization (WMO), with funding provided by the Korea Meteorological Administration (KMA), and with the agreement of Uzbekistan’s National Meteorological and Hydrologic Service (Uzhydromet), is negotiating an agreement to assist Uzhydromet in preserving their historic hydrometeorological observations.

The most important activity of the Uzbekistan Climate Data Restoration Project is to locate and photograph the data at risk before it is lost forever.

IEDRO will establish a Data Rescue (Imaging) facility within Uzhydromet where their employees will digitally photograph and save approximately 17,000,000 pages of historic hydrometeorological data dating back to the 1800s. Once the imaging is accomplished, the data can be digitized when time and funds are available. IEDRO expects the implementation of the project to begin in April 2015.

El Salvador El Salvador Data Rescue Project



In November 2009, IEDRO visited the El Salvador National Meteorological Service (SNMS), in the capital city of San Salvador, to begin rescuing and digitizing thousands of historic hydrometeorological records that had been documented over the last 100 years. IEDRO was able to gather daily precipitation strip charts covering 49 stations from the past 25 years. The total number of charts from the site's two warehouses was in excess of 300,000. Dr. Rick Crouthamel, IEDRO's Executive Director, brought back 2,000 strip charts with him from the trip.

The huge quantity of weather data to be rescued at the site presented a challenge. While a few thousand charts could be handled by existing volunteers, rescuing the 300,000 pieces of historic data at this site required developing new approaches and methodologies.

The availability of historic weather data can help the scientific community anticipate extreme conditions and provide forewarning for possible catastrophes like Hurricane Ida, which hit El Salvador the week before IEDRO's visit.

The torrential downpours set off massive landslides and killed over 200 people.

El Salvador lies in the tropics, about thirteen degrees north latitude, and is a land of volcanoes and mountainous terrain. The poorest families construct shanties on these steep slopes while trying to manage a living.

Without an adequate warning system, equipped with the data necessary for effective forecasting, families have no way to escape impending floods during heavy rain.

IEDRO's collection of weather data from this site will be used by computer forecast models to improve flood and mudslide warning capabilities in El Salvador, which will hopefully prepare citizens for future climatic disaster and, in turn, save hundreds of lives every year.

In June 2011, IEDRO Director of Scientific Applications, Teddy Allen, met with Luis Garcia, Rosa Maria Araujo (user applications), Pablo Ayala (climate prediction), and Ricardo Zimmerman (climate and database coordinator) to discuss the status of their data rescue operations and goals.

During the meeting, Teddy was given a tour of their historical data (non-digitized) storage area. The data, consisting of many cabinets and shelves of books, charts, and strip charts, was kept in a storage facility shared by the hydrological group. That same storage unit housed a substantial amount of valuable weather / hydro related instruments. Because of this, the storage area was kept locked and unauthorized visitors were unable to access the area. Lack of access made organization and categorization very difficult since the meteorological staff was unable to dedicate enough of their time to the DR&D process; thus discouraging volunteers and others from making an impact.

The excitement towards digitizing their precipitation strip charts was tangible. Teddy estimated they had over 300,000 charts ready to be digitized. He discussed progress on IEDRO's strip chart digitization software.

Project personnel were eager for this endeavor due to their agricultural sensitivities to the well-known veranillo (or mid-summer drying) which is especially pronounced in the southeast region of the country near San Miguel. In addition, there is much need for increased data for a flash flood warning system. Both of these concerns immediately impact the livelihood and economic prosperity of the people.

Overall, this visit allowed IEDRO to connect with its partners on a personal level and to share progress with the new IEDRO strip chart software. Site visitations like this one are a valuable component to the development of a productive partnership due to the exchange of information in a personal setting. Their enthusiasm was evident and best conveyed directly.

IEDRO's new strip chart digitization process, "Weather Wizards," will soon be digitizing thousands of El Salvador's precipitation strip charts, providing data that will save thousands of lives from flooding and mud slides.

MALAWI

Precipitation Observations Imaging and Digitization



In mid-July 2011, IEDRO’s Executive Director, Rick Crouthamel, accompanied by fellow Rotarian, Anthony Clarke, traveled throughout “The Warm Heart of Africa” for ten days.

They gathered information about the historic environmental data needs of the Malawian people and met with officials from the Malawi Department of Climate Change and Meteorological Services.

The Republic of Malawi is one of IEDRO’s first cooperating countries in Data Rescue and Digitization (DR&D). Nearly 14 million people inhabit a narrow strip of land of about 45,000 square miles (about the size of Pennsylvania).

The Malawi Department of Climate Change and Meteorological Services has an excellent website, www.metmalawi.com, in addition to being one of our foremost rescuers of data.

The country is nestled between three other cooperating DR&D countries – Zambia to the northwest, Tanzania to the northeast and Mozambique on the remaining sides. Lake Malawi, sometimes called the Calendar Lake as it is about 365 miles long and 52 miles wide (Wikipedia), forms most of its eastern border.

Malawi is one of the poorest countries in the world with a Gross Domestic Product of less than \$350 per person. Other than HIV, water-borne diseases are the most significant public health problem. Diseases such as malaria, yellow fever, hepatitis and amoebic dysentery are among the most common. These diseases are promulgated through a lack of potable water supplies with many villagers walking 2 to 3 kilometers, to drink from polluted sources. Standing water during the lengthy rainy season provides breeding areas for mosquitoes and acts as a conduit to spread diseases. Thus, the management of water resources is important to the improvement of the standard of living of all Malawians.

The Bore Hole Project: The first part of the trip focused on the water needs of the Malawians. As part of a Rotary International effort, Rick and Anthony visited a school in Nkhamenya in the northern part of the country where donations funded the drilling of a well.



The project provided a safe and consistent water supply to over 700 school children who heretofore had to walk 2-3 km to get a drink from a polluted pond. Providing a drilled well assisted the area with responsible water management by not only giving the residents a safe source of drinking water, but also by encouraging the Malawians to drain their former drinking water sources – the non-potable, mosquito-laden ponds.

The hope of the project was to help stem the spread of insect-borne diseases that affect the region. As there is little or no rain from May through October, the residents depended on a water supply even though it was polluted.

Data Rescue and Digitization: The first step was to understand what water resources existed at the time and what water resources would likely be needed during the next five to ten years. This analysis should be based on a complete analysis of precipitation that has occurred over the past few hundred years, including the amounts, the intensities, the durations and the trends. Unfortunately, although these data are available at the Malawi Department of Climate Change and Meteorological Services, they are not usable in their present form.

Detailed records, which are ink traces on analog charts called “strip charts,” graphically show the precipitation characteristics, including amount, rate, intensity and duration.



Strip charts: Manual digitization vs. software approach

To extract the detailed precipitation information from these charts manually, an experienced technician would have to spend at least 30 minutes on each chart. Considering that Malawi has least 20,000 to 30,000 charts requiring digitization, another method had to be found. Over the past three years using Malawi precipitation charts as a base, IEDRO has developed a software program that will, in seconds, take the scanned images of these charts and digitize the data at 5 minute intervals (288 values per day) and do so more accurately.



IMAGE, ABOVE, left to right: Donald Kamdonyo, Dir, National Meteorological Society; Martin Munkhanya, IEDRO volunteer; the meteorological society volunteer staff and behind, Ken Clark, former NOAA/NWS employee and IEDRO volunteer.

Keying of Alphanumeric Data: A start-up project called **Weather Wizards** is being developed at IEDRO Headquarters in Deale, MD to establish a prototype for digitizing alphanumeric and strip chart data. Once programming is completed and processes are established, IEDRO will provide Malawi Department of Climate Change and Meteorological Services employees the ability to digitize their alphanumeric and analog strip chart data extremely quickly and accurately.

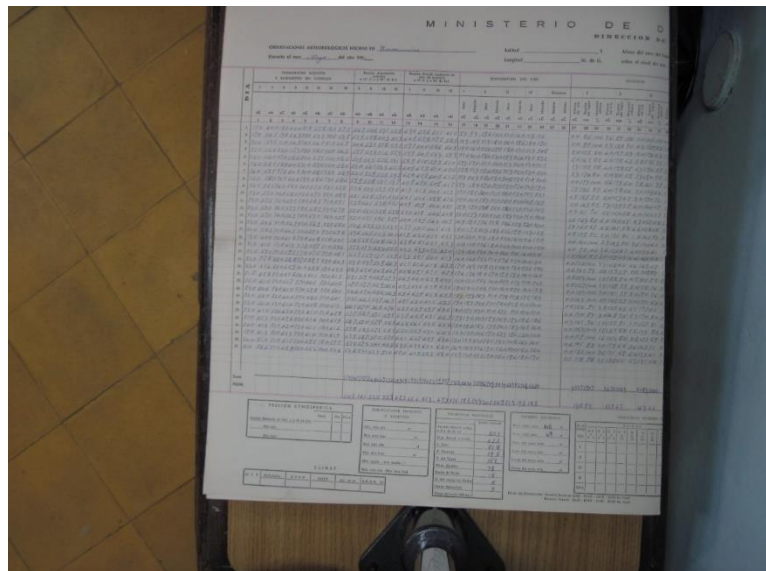
PARAGUAY

Precipitation and Surface Observations Imaging and Digitization

In 2006, IEDRO held discussions with the Meteorological Service in Paraguay regarding the rescue of weather data. Although there is a great need for rescuing and digitizing the surface data, funding has not yet been secured.

Project status: Needs have been identified.

Potential future activities: Funding of approximately \$40,000 is required to establish a DR&D program at the National Meteorological Service of Paraguay.



In April 2010, IEDRO Data Rescue Staff, Larry Nicodemus and Rick Crouthamel along with two volunteers Monica Drazba from Nicaragua and Patricia Martin, journeyed to Ascension, Paraguay to discuss possibly setting up a DR&D effort to rescue and digitize Paraguay's National Meteorological and Hydrologic Service's (NMHS) precipitation strip charts and surface data.

BOLIVIA

Bolivia Data Rescue Program

Data at Risk: Much of the historical weather data at the Bolivian National Meteorological Service (SENAMHI) is at risk of being lost forever. The data is diverse and includes agricultural information such as soil temperature at various depths.



The data is organized, but there is no catalog of the bound data. In addition to the bound data, there are also rolls of precipitation strip charts that are saved in boxes both on-site and off-site.

In addition to this critical data being **recorded on rapidly deteriorating paper**, it is virtually impossible to use the data for any useful purpose in its current state. The lack of inventory makes it challenging to determine exactly how much information is currently available.

There are hundreds upon hundreds of volumes on-site, each containing hundreds of pages, and within those pages, hundreds of weather parameter values such as temperature, wind, pressure, rainfall and more. In the archive's current state, it is doubtful any useful information can be retrieved.

For example, to find the highest temperature recorded in Bolivia using these records, it would take an investigator well over a year to search through all the volumes. However, once all the

data in those volumes are photographed, digitized and available in an electronic database, an investigator would find the answer in a matter of seconds.



Initiating the Rescue of Bolivia’s Climate Data: Dr. Sharon LeDuc, IEDRO’s Chief Scientist, visited SENAMHI in February 2011 to discuss roles and responsibilities between IEDRO and SENAMHI for data rescue efforts.

The objective was to outline the data rescue mission: to support data rescue and digitization in Bolivia according to a two-phase project plan, as well as to

coordinate management and implement the project’s technical and administrative aspects. A presentation was made, and a camera was given to SENAMHI with the focus on proposed cooperation on the project.

Data Rescue Process: In April of 2012, Dr. LeDuc led a second IEDRO data rescue team to LaPaz, Bolivia to initiate IEDRO’s 15th data rescue and digitization project. Darío Damián Di Franco, IEDRO’s South American Program Manager, and Teddy Allen, IEDRO’s Manager of Scientific Applications, accompanied her on this trip.

A computer system was purchased and installed along with a stand to mount the camera for digitizing books, allowing the training of three SENAMHI employees in the process of imaging, documenting and transferring rescued data. Photographs of samples of data were collected that required imaging and Teddy Allen performed a demonstration and training session of how to easily make life-saving analyses.

To begin the project, the initial imaging emphasis was placed on imaging non-strip chart data from Bolivia’s historic data library.

In July 2012, the next activities were built on the introductory stage and focused on ensuring an efficient and continuous flow of data from SENAMHI to IEDRO. IEDRO installed free online software to assist in the data delivery. Future activities planned include imaging SENAMHI’s other types of data.



Goals: Once digitized, the digital dataset will be provided for incorporation into the database at NCDC. Users from across the world will be able to access this information at no charge. This data will be of tremendous value to scientists who research various

phenomenon including global climate change, hind cast studies, climate model evaluation, and statistical climate analysis. Applications of this work include, but are not limited to agricultural, hydrologic, energy, and economic policies.

Progress: Between July 2012 and September 2013, IEDRO personnel began receiving surface data images from Bolivia. To date, IEDRO has received synoptic observations and Summary of Day observations for 22 surface stations – 16,544 pages/records in total, the equivalent of at least 10 years of data.

Project status: Project stalled. No images have been received since September 2013.

Future activities: IEDRO is currently awaiting additional images and funding for further data rescue efforts to be completed. If funding can be found (\$15,000 to complete the project), IEDRO plans a progress visit to SENAMHI in 2015 to ensure that the rescue of these surface observations continues. Funding will also go toward developing digital keying formats for the dozens of different types of meteorological forms rescued. Funding will help initiate keying of data, provide data to NCDC, and provide cataloged data to SENAMHI.

CHILE

Glacier Photographs Digitization

IEDRO rescued and digitized over 500,000 images of surface observation data from the city of Punta Arenas, the southernmost city in the world. The data had been collected over 100 years by Jesuit priests starting in 1870 and kept safe at the private regional museum, Museo Maggiorino Borgatello. After NOAA digitized the data, it was placed in NOAA's free and unrestricted database where it can be accessed by the international community. The data was extremely valuable to efforts by scientists like Dr. Gil Campo of CIRES at the University of Colorado because it added insight into global weather patterns.

Project status: Completed.

Potential future activities: The IEDRO team discovered approximately 900 glass photographic slides taken of glaciers from 1870 to about 1920 in the Museo Maggiorino Borgatello. IEDRO proposes to send a photographer to Chile to record the current status of these glaciers. The current and historic photos could be compared by climate scientists to determine the changes in ice volume and temperature. Approximately \$48,000 in funding would be required for: imaging the glass slides, travel and fees for the photographer, digitization of the historic and recent data, and production of a full color book showing 100 of the most dramatic "then and now" photos. Copies of this book printed for resale would be IEDRO's contribution to the Museo Maggiorino Borgatello for its assistance in rescuing these data.

KENYA

Upper-Air Observations Imaging and Digitization

A DR&D site in Kenya was established in 2002 with funding from NOAA. Upper air observations were rescued and digitized by NOAA contractors.

Project status: Data of initial upper air observations completed.

Potential future activities: IEDRO has offered to rescue and digitize surface hydrometeorological data. In 2015, IEDRO will contact Kenya's Meteorological Service to initiate activity on this project. Funding of approximately \$32,000 is needed to re-establish the DR&D Program in Kenya.

MALAWI

Upper-Air Observations Imaging and Digitization

In 2002, NOAA began one of the first DR&D sites in Malawi. The Meteorological Service's Martin Mwanangwa Munkhondya became the focal point for the Malawian data rescue efforts. He is now IEDRO's volunteer Program Manager for Africa.

Project status: Project is ongoing. IEDRO, in coordination with Mr. Munkhondya and NOAA, has rescued and digitized all the Malawi upper air data.

Future activities: IEDRO is now working with Mr. Munkhondya to begin rescuing historic surface data. Mr. Munkhondya has established a non-profit organization, the Centre for Climate Change and Environment Management, to further the data rescue and digitization effort in Malawi. IEDRO is currently receiving weather data from Malawi and will begin digitizing it as soon as funding is found to develop data keying formats for the various hydrometeorological data forms used by Malawi. Funding of approximately \$13,000 is needed for the digitization of the surface data.

Data analysis: An important application of weather data can be seen in trend analysis of Malawi's precipitation. In Malawi, 100% of electricity generation is based on water. Both electricity and water are relatively expensive resources. As an alternative, Malawians use wood from trees for cooking fires. Re-forestation has been initiated only recently and weather data is needed to help promote the growth of new forests. People may be more likely to use electrical cooking rather than cutting down trees, if trend analysis in precipitation indicates an increase in the water supply and a corresponding decrease in electricity prices.

MOZAMBIQUE

Upper-Air Observations Imaging and Digitization

A DR&D site focusing on upper air data was established with NOAA funding in Mozambique in 2002. In April 2014, Maputo, Mozambique hosted the World Meteorological Organization for the International Workshop on Rescuing Climate Heritage of Indian Ocean Countries.

Future activities: In 2015, IEDRO will be negotiating with Mozambique's Meteorological Service to resume data rescue and digitization activities. Funding required to re-establish a data rescue and digitization site in Maputo, Mozambique would be approximately \$23,000.

NIGER

Upper-Air Observations Imaging and Digitization

Project status: Starting in 2002, a DR&D site focusing on upper air data was established in Niger. Upper air observations were rescued and digitized through NOAA contractors.

Future activities: The data rescue effort has been expanded and will take place as part of IEDRO's West African Climate Data Rescue and Digitization Facility project.

SENEGAL

Upper-Air Observations Imaging and Digitization

In 2002, NOAA funded the DR&D effort with the Senegal NMHS and all the upper-air data was imaged and digitized by NOAA contractors.

Project status: Upper-air data rescue and digitization have been completed.

Potential future activities: Rescuing surface data would be the next effort. Funding of approximately \$48,000 would be required for IEDRO to send a team to rescue and digitize surface data. The project would involve the provision of cameras, scanners and computers and the training of personnel.

TANZANIA

Upper-Air Observations Imaging and Digitization

This DR&D Project was begun in July 2008 when the IEDRO Africa Programs Manager, Martin Munkhondya, made an initial data rescue trip to Dar es Salaam, Tanzania from his home base in Blantyre, Malawi. Martin instructed the Tanzania Meteorological Agency (TMA) staff how to photograph their PIBAL (Pilot Balloon, upper-air weather observations) data sheets then on paper.

PIBAL data determines the wind speed and wind direction for an area. In planning a new airport runway, for example, the data can help to determine from which direction the heaviest winds have historically come.

Tanzania had trouble imaging their PIBAL charts since the data was written in pencil too faint for the camera to capture. IEDRO suggested that Tanzania FedEx their original paper records to IEDRO Headquarters where our very sensitive scanner should be able to image the records so that the data can be read by the NOAA digitization contractors.

In October 2008, IEDRO received three CDs from the Tanzania Meteorological Agency containing 1878 PIBAL Observations from Bukoba (WMO#63729) for the period January 1965 through June 1970. They passed quality checks and were sent to the National Climatic Data Center (NCDC). In subsequent months several CDs containing thousands of PIBAL records were received.

In August 2009, Martin met with: Mr. F. Tilya, Manager in the Climatology and Climate Change Division and focal point for Tanzania's data rescue activities; Mr. A. Kanemba, Manager of International Affairs; and Dr. E. J. Mpeti, Director for Research and Applied Meteorology. Dr. Mpeti welcomed the idea of the ongoing project of upper air data rescue in their agency.

In January 2010, IEDRO received a CD with Tabora (63832) PIBAL observations covering the years 1972, 75, 77, 78, 79, 80, 82, 84 and 85, totaling 1,303 images.

In March 2010, IEDRO received over 2500 PIBAL Observations from Tanzania that successfully passed quality checks. The data were sent on to the National Climatic Data Center (NCDC) for digitization.

June 2010, Tanzania sent IEDRO two CDs with the upper-air PIBAL observations for MWANZA (from the Mwanza station) for the period 1967 through 1985. These also passed quality checks. The data were sent onto NCDC for digitization.

Project status: PIBAL data has been rescued. Project is ongoing.

Future activities: In 2015, Tanzanian PIBAL observations will be digitized using the IEDRO Weather Wizards system.

Once these historic upper-air observations are digitized, IEDRO hopes to begin a surface DR&D program. Funding of approximately \$48,000 would be required.



IMAGE, ABOVE | Left: Mr. Martin M. Munkhondya; middle: Mr. P.F. Tibajuka, Director General for the Tanzania Meteorological Agency; right: Mr. F. Tilya

ZAMBIA

Upper-Air Observations Imaging and Digitization

Zambia began DR&D activities with NOAA funding in 2002. The focus was on upper air data.

Project status: Upper-air data was rescued and digitized.

Future activities: In 2015, IEDRO will be negotiating with Zambia's Meteorological Service to establish a surface DR&D program. Funding of \$46,000 is required to complete the project.

DOMINICAN REPUBLIC

Upper-Air Observations Imaging and Digitization

In 2002, NOAA funded IEDRO personnel to coordinate with the Meteorological Service in rescuing upper air data. The process of DR&D began.

Project status: Upper-air data was rescued, digitized and added to NOAA's open and unrestricted world database.

Potential future activities: The Meteorological Service recently allocated several employees to manually digitize the surface precipitation data from the original strip charts. This is commendable; however there is a risk. By digitizing directly from the paper data, no electronic copy of the original data is retained. Thus, the digitized data may not be able to be validated in the future. IEDRO's Data Rescue and Digitization Programs always image the data first, so that the original document is preserved in case the paper is destroyed or discarded. Approximately \$12,000 in funding is required. IEDRO would provide scanners and on-site training to image data from the original paper charts. IEDRO would also develop a program that recognizes the Dominican Republic's unique strip chart format in order to automatically digitize the data provided by the Dominican Republic scanners.

URUGUAY

Upper-Air Observations Imaging and Digitization

With NOAA funding, IEDRO established data rescue sites for Uruguay's National Meteorological Service and SOHMA, the Navy of Uruguay. Both sites captured upper air data and surface observations. The resulting data was sent to NOAA where the upper-air data were digitized by contractors. NOAA no longer provides this digitization service.

Project status: Upper-air data rescue and digitization have been completed.

Potential future activities: IEDRO is seeking funds to establish surface DR&D programs at both sites. The funding required would be approximately \$37,000.