United Nations
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International
Hydrological
Programme

AFRICAN DROUGHT MONITOR [IHP-VIII]

INTERNATIONAL HYDROLOGICAL PROGRAMME
Division of Water Sciences

THE CONTEXT

Drought is one of the leading impediments to development in Africa. Much of the continent is dependent on rain-fed agriculture, which makes it particularly susceptible to climate variability. Recurring drought conditions, most recently seen in Eastern Africa, have had devastating humanitarian impacts and impose significant reductions in GDP for countries whose economies are tied to agriculture. The prospect for continued drought impacts and water scarcity is made more worrisome because of climate change and population pressures.

Alleviating the impacts of drought across sub-Saharan Africa requires a transition from drought crisis management to drought risk management and reduction, including the development of national drought policies, increasing coping capacity and adapting to likely future changes at local levels. Given the tremendous impact of drought in Africa, the implementation of this system is a key step forward in building capacity through technology and knowledge transfer. In particular, the application of hydrological and climate research into transferable technology with minimal overhead has been made possible and has the potential to reduce the impacts of droughts across Africa.

A key element in managing drought risk is the provision of early warning of developing drought conditions and impacts. Such information can provide governments with the lead-time necessary to implement drought management policies and reduce impacts at all levels.

DROUGHT MONITORING AND PREDICTION

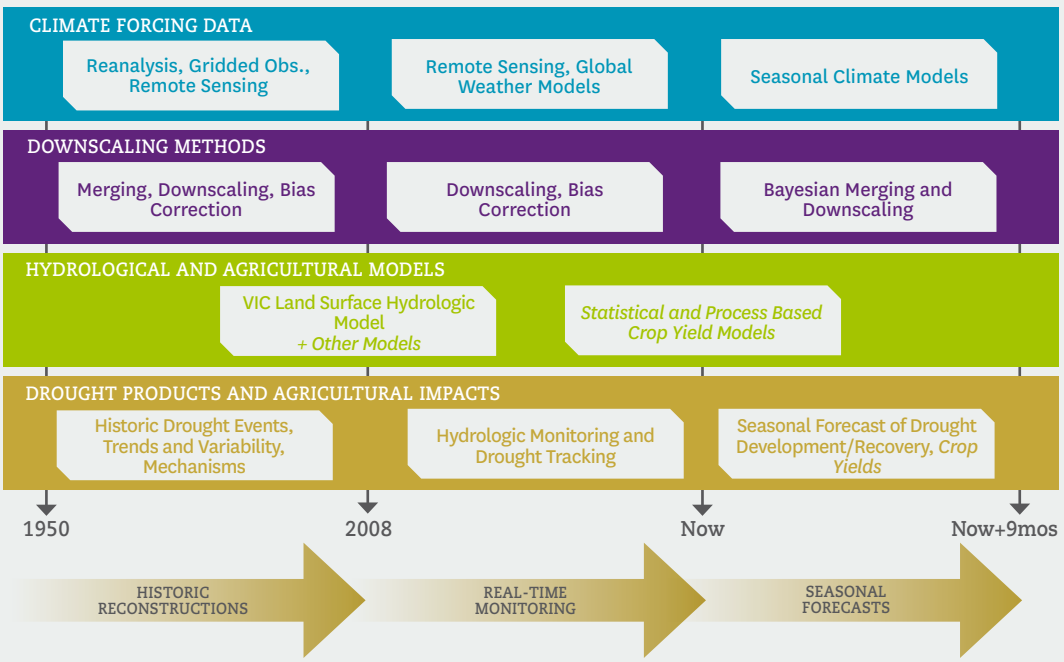
In collaboration with IHP, Princeton University has developed an experimental drought monitoring and forecast system for sub-Saharan Africa. The system merges climate predictions, hydrological models and remote sensing data to provide timely and useful information on drought in developing regions where institutional capacity is generally lacking and access to information and technology prevents the development of systems locally. Key elements of the system are the provision of near real-time evaluations of the terrestrial water cycle and an assessment of drought conditions.

Current approaches to drought monitoring in developing regions have generally been limited, in part because of unreliable monitoring networks and limited national capacity. Operational seasonal climate forecasts are also deficient and often reliant on statistical regressions, which are unable to provide detailed information relevant for drought assessment.

The wealth of data from satellites, real-time telemetry, and recent advancements in large scale hydrological modeling and seasonal climate model predictions have enabled the development of state-of-the-art monitoring and prediction systems that can help address many of the problems inherent to developing regions. Satellite remote sensing in particular is capable of overcoming differences in data availability across political boundaries that have historically hindered monitoring of regional phenomena such as drought.

FLOW CHART OF THE AFRICAN DROUGHT MONITOR AND FORECAST SYSTEM

The system comprises three parts: 1) Historic reconstructions of the terrestrial hydrological cycle that is derived from simulations of the VIC land surface model forced by a hybrid reanalysis-observational meteorological dataset. The datasets are used for a variety of applications including analysis of historic drought events, estimation of trends and variability, and investigation of drought mechanisms. 2) Real-time monitoring component that updates the model run to 2-3 days from real-time forced by bias-corrected and downscaled TMPA satellite precipitation and GFS analysis fields of temperature and wind speed. There is also potential to force other impact models such as crop models. 3) Seasonal hydrological forecast component that uses bias-corrected and downscaled CFSv2 climate forecasts of precipitation and temperature to drive the model and provide ensemble predictions of drought conditions, for precipitation, soil moisture and stream flow. Existing components are shown in normal font, while potential future components are in italic font.

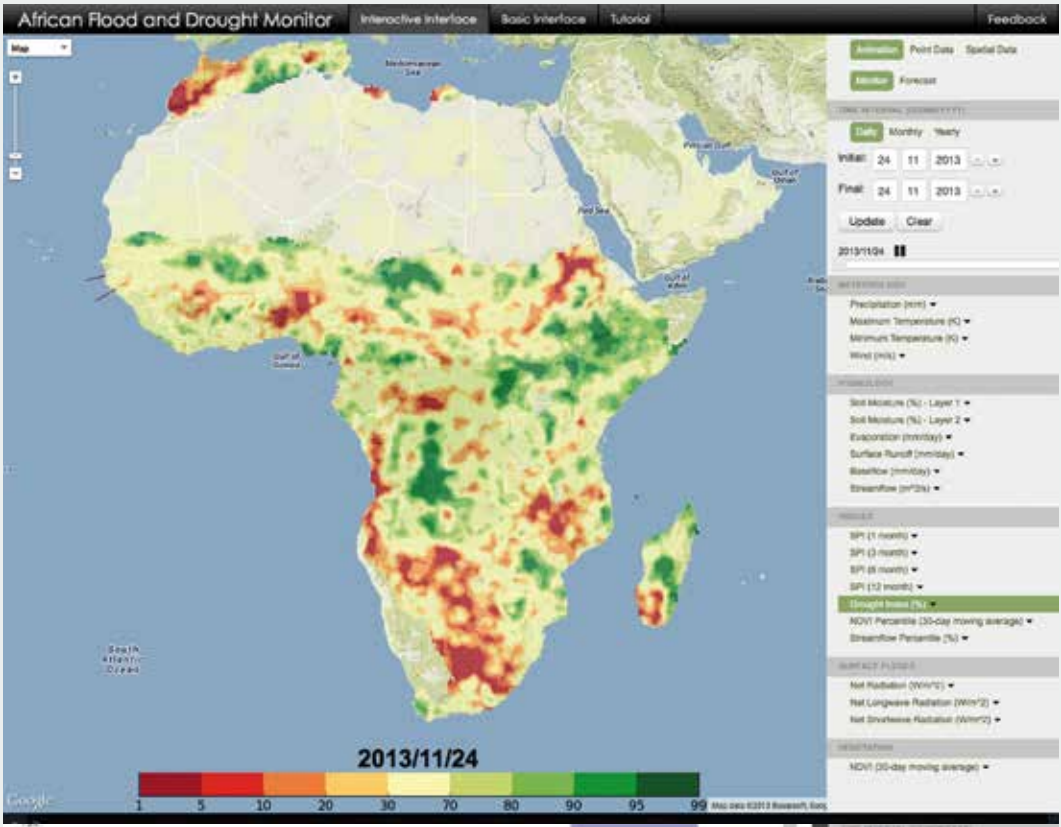


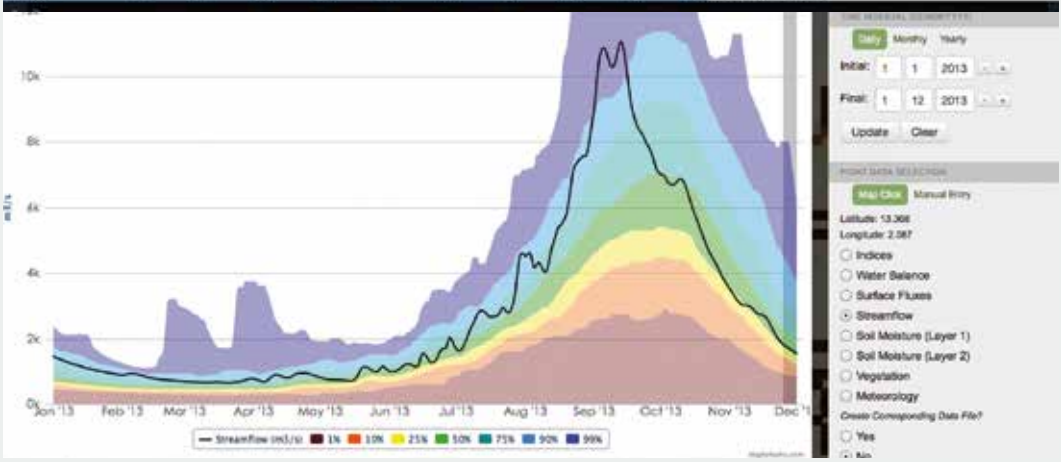
AFRICAN DROUGHT MONITOR

HOW IT WORKS

The African Drought Monitor uses available satellite remote sensing and in-situ information, a hydrologic modeling platform and a web-based user interface for operational and research use in Africa. The monitor, developed by Princeton University, is available in English, French, Spanish, Arabic and Chinese. Based on macro-scale hydrologic modeling, the system ingests available data to provide real-time assessment of the water cycle and drought conditions, and puts this in the context of the long-term record dating back to 1950.

http://hydrology.princeton.edu/monitor





The data, made available online for drought research and operational use, augments on the ground drought assessments.

Hydrological and drought forecasts are provided out to 6 months. The predictive skill of the system has been evaluated for 30 years of historic hind casts and shows potential for providing useful forecasts of developing drought conditions, particularly for the first month.

GENDER MAINSTREAMING IN DROUGHT MANAGEMENT

Drought contributes to poor hygiene and sanitation, food insecurity, malnutrition, famine and hunger, while also increasing the number of people who lack access to safe drinking water. Women and children – especially those living in rural areas – are most vulnerable to the effects of drought. They also represent the majority of people affected by water-related diseases caused by contaminated water.

Several cultural and traditional gender-discriminatory norms and practices contribute to the inequalities of women in access to, management and control of natural resources such as water, land, and other productive resources. Although women in indigenous and rural communities are holders of extensive traditional knowledge regarding water sources and their conservation and management, they are not involved in decision-making processes.

In 2013, IHP's African Drought Monitor project began to implement a gender and drought component focusing on reducing the vulnerability of women and girls to drought effects, and increasing the role and participation of women in water resources and drought management. This project also contributes to UNESCO's global priority on gender equality.

A multi-stakeholder workshop on "Gender Mainstreaming in Drought Management" took place in Niamey, Niger in October 2013 with the participation of diverse stakeholder groups, including representatives of government institutions, academia and universities, local communities, NGOs and youth organizations. Thematic presentations provided in-depth discussions on specific issues contributing to women's vulnerabilities to drought such as cultural factors, health, access to information and education, and policy making. Moreover the participants discussed how women can play an important role in drought monitoring and management. Presentations illustrated national and regional experiences with case studies from different countries. Workshop participants discussed key issues and challenges pertinent to mainstreaming gender equality in drought management in small groups and came up with the following recommendations.

Representatives of a women farmers community near Niamey share their experience with participants of UNESCO Workshop "Gender Mainstreaming in Drought Management" during a field visit.

Recommendations include:

- Mitigate cultural and traditional gender-discriminatory practices that contribute to the inequalities of women in access to and management of water resources.
- Need to bridge indigenous and scientific information.
- Integrate gender affirmative action plans into country policy and rural development.
- Research should be more gender sensitive.
- Take concrete steps to ensure better linkage between science and policies.
- Raise awareness of policy makers in order to mitigate health issues related to drought.
- Advocate for gender mainstreaming in education and access to education in remote drought-prone areas.
- Integration of traditional knowledge in education programmes.
- Promote gender mainstreaming in drought policies by sharing good practices and lessons learned.
- Introduce user-friendly technologies for communities, especially women using GSM cellular phones.
- Promote equal access to decision-making and information by reducing legal and institutional barriers to women's participation.
- Address knowledge gaps in participatory ways that capture the ideas and knowledge of men, women, and young people.
- Clearly define why and how gender is framed in projects and programmes on drought management.
- Address the root causes of women's vulnerabilities to drought impacts.

The complexities of gender mainstreaming in drought, monitoring, mitigation and management require multidisciplinary research to further enhance the knowledge base on the different climate impacts on women and men, and their well-being, especially in agricultural and rural settings, to better understand the policies and institutional and regulatory mechanisms that will help women and men in poor communities become more climate resilient.

WORKSHOPS:
KNOWLEDGE TRANSFER AND CAPACITY BUILDING

A key element in the development of the system is the transition and testing of the technology for operational usage by African collaborators. In 2012 and 2013, workshops were held in two regional centers in sub-Saharan Africa, where the system was installed on center servers.

Local scientists were trained in the operational running of the system and interpretation of the data output. Feedback was also solicited from scientists and managers from national hydrological, meteorological and agricultural agencies and extension services, who are charged with managing local water resources systems and providing information to farmers.

The first workshop was held in January 2012 at the AGRHYMET (Centre Regional de Formation et d'Application en Agrométéorologie et Hydrologie Opérationnelle) regional center in Niamey, Niger, which provides information and training in support of improved agricultural production and food security for West Africa.

The second workshop was held in June 2012 at the Intergovernmental Authority on Development (IGAD) Climate Prediction and Applications Center (ICPAC) in Nairobi, Kenya, which disseminates data to countries within the Greater Horn of Africa. A future workshop is expected at the Southern Africa Development Community (SADC).

A third workshop was held in October 2013 at AGRHYMET, Niamey, Niger, in close cooperation with UNESCO's Africa Department to introduce an updated version of the drought monitor, as well as to discuss the gender dimension in drought management.

A fourth workshop was held in November 2014 at UNESCO Office, Santiago, Chile to introduce a Latin American and Caribbean Flood and Drought Monitor.

Feedback from the workshops and ongoing discussion with African collaborators has identified several challenges to continued development and utilization of the system. Confidence in the predictions is necessary to ensure uptake by users, and a validation and evaluation strategy has been developed to determine the accuracy of the system for tracking drought at local scales. Secondly, the continued and sustained use of the system depends on the mechanisms for updating and improving the system, as well as training local scientists in interpreting predictions. This requires mechanisms for sustained knowledge exchange and education, and eventual transfer of ownership into locally relevant systems.

NEXT STEPS

The implementation of this system is a key step forward in building capacity through technology and knowledge transfer and has the potential to reduce the impacts of droughts across Africa.

There is a need to join efforts at an international level through different mechanisms, such as the National Climatic Data Centre (NCDC), which is a Global Drought Monitor Portal. The Global Drought Monitor Portal provides information on drought activities at a global level and facilitates exchange of information between different research groups, institutions, media and the public.

The portal includes the African Drought Monitor, the US Drought Monitor, the European Drought Centre (EDC) established by the UNESCO FRIEND-Water Group, and the European Drought Observatory (EDO) established by ISPRA (Institute for Environmental Protection and Research) in Italy.

The establishment of a Drought Monitor Centre in Nairobi, Kenya and Harare, Zimbabwe will address these challenges by including traditional knowledge in drought risk management.

INTERNATIONAL HYDROLOGICAL PROGRAMME (IHP)

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