Improved Drought Early Warning and FORecasting to strengthen preparedness and adaptation to droughts in Africa

(DEWFORA Project)

DEWFORA END OF PROJECT WORKSHOP REPORT

31st October 2013, Whitesands Hotel, Dar es Salaam, Tanzania

December 2013

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1. DEWFORA PROJECT

1.1 Introduction

Improved Drought Early Warning and FORecasting to strengthen preparedness and adaptation to droughts in Africa, DEWFORA, is a collaborative Project funded under the EU Seventh Framework Programme (EU-FP-7).

The DEWFORA project aimed at development of a framework for the provision of early warning and response through drought mitigation for Africa. The project was designed to achieve three key targets: Improved monitoring: by improving knowledge on drought forecasting, warning and mitigation, and advancing the understanding of climate related vulnerability to drought – both in the current and in the projected future climate, Prototype operational forecasting: by bringing advances made in the project to the pre-operational stage through development of prototype systems and piloting methods in operational drought monitoring and forecasting agencies and Knowledge dissemination: through a stakeholders platform that includes national and regional drought monitoring and forecasting agencies, as well as NGO's and IGO's, and through capacity building programmes to help embed the knowledge gained in the community of African practitioners and researchers.

The DEWFORA project had a clear focus on the testing and implementation of existing and developed methodologies on drought monitoring and forecasting. Four regional case studies; the Eastern- Nile basin, the Limpopo basin, the Niger Basin, and the Oum-er-Rbia basin, as well as one pan-African case study played an integral role in the project by providing direct interaction with end-users, highlighting the needs for improvement of the existing systems and challenging the application of the methods developed in the project in real terms operational settings.

The project consisted of Seven Work Packages. The structure of the project Work Packages reflects the clear focus on implementation and operational testing of the science developed. Therefore one of the main tasks under WP-7 of the project was to ensure effective dissemination of the project research and results to the broader public.

1.2 DEWFORA Work Package Seven – WP 7

According to the DEWFORA project document, the Work Package related to the workshop is Work Package 7.

The objectives of this Work Package are:

- To promote and organize stakeholder participation and facilitate knowledge exchange between stakeholders and the project
- To build capacity in the region through dissemination of the results in collaborative research between European and African partners and interactive development of course materials
- To embed knowledge gained in this project in existing knowledge networks and communities and practice
- To ensure effective dissemination of the project research and results to the broader public

To this end, a continental workshop was held as the final event of DEWFORA to present the final results of the project.

2. End-of- Project Workshop

2.1 Workshop Objectives

The DEWFORA end of project workshop was held in order to disseminate the final results of the project. The outcome from the comparative case studies were presented in the workshop addressing needs and possibilities for changing policies in Africa and Europe to strengthen preparedness and adaptation to droughts. This event was therefore targeted to national policy makers such as ministry officials involved in water management and international stakeholders.

The workshop was organized as a one-day side-event of the 14th WaterNet-WARFSA-GWP symposium held from October 31 to November 2, 2013. The workshop therefore attracted regional participants through the established networks in Southern Africa – both at national and international levels.

This workshop was organized by partners of the project consortium members; WaterNet, in collaboration with, Deltares, with the support of all the consortium members

2.3 Workshop Programme

The program was structured into four sessions. The first session was designed to present an overview of the project and to highlight to the participants the existing drought forecasting, mitigation and adaptation practices in Africa. European developments on drought monitoring and early warning systems were also presented. The highlight of this session was a Pan-African map viewer for drought. This tool provides crucial information that may be used for example by regional and international relief agencies and NGO'S such as the International Red Cross and the Global Disaster Alert and Coordination System.

The second session was the key highlight of the event and involved a round table discussion with key policy makers in the water sector of different countries in Africa. A science policy brief was first presented to the policy makers. The policy brief highlighted key results from the case studies and recommended policies that governments can take up. An interesting discussion ensured ending up with a summary and wrap up.

The third session consisted of scientific presentations such as probabilistic monitoring and forecasting of meteorological droughts and seasonal hydrological forecasts. A key presentation in this session was 'A structure path to disseminate flood forecast information to serve communities in Mali.'

The workshop ended with a poster session highlighting the application of the DEWFORA drought early warning framework and discussions of the implications of built and planned hydraulic infrastructures on hydrological regime in the Niger Delta. Appendix A includes the workshop program.

2.4 Participants

The participants for this workshop come from the different countries, and included participants representing the Project consortium members from Africa and Europe. Five policy makers were invited from different countries representing different water management ministries. Other participants were part of the 14th WaterNet symposium invited guests. The total number of participants who attended this workshop was 42. A list of invited policy makers and other attendees is provided in Appendix B.

3. Workshop Activities and Progress

3.1 Organization and Management

The event was organized by WaterNet in collaboration with Deltares of the Netherlands (the DEWFORA project coordinating Institute), and the consortium members.

3.2 Workshop progress

Opening session

The DEWFORA project coordinator, Dr Micha Werner introduced the workshop and stated that the main objective of the meeting was to bring to the attention of stakeholders the final results of the DEWFORA project. Immediately the program proceeded as per the workshop program – as shown in Appendix A.

The workshop was chaired by Micha Werner. The moderators for the different sessions were Ana Iglesias, Jean Marie Kileshye-Onema and Dimme Hendriks. The Rapporteur was Ms. Tatenda Tsiko of WaterNet.

Figure 1: Presenters during the workshop

Presentations

Overview and Progress of the DEWFORA Project by Dr. Micha Werner (Deltares) Project Coordinator

Micha introduced and gave a review of DEWFORA to the stakeholders. He stated that DEWFORA is a Seventh Framework EU Research Project – part of EU-African call. DEWFORA spanned over 3 Years (2011-2013). The principal aim of DEWFORA is to develop a framework for the provision of early warning and response through drought impact mitigation for Africa. This framework covers the whole chain from monitoring and vulnerability assessment, to forecasting, warning, response, and knowledge dissemination

The forecasting and warning timeline was highlighted as involving monitoring, analysis, notification, decision making, warning and action (mitigation).

The DEWFORA partners were introduced and case studies were presented. Other projects related to DEWFORA are, WAHARA, Afromaison, Waterbiotech, Healthy Future, and GLOWASIS.

Drought Forecasting and Management in Africa, Bright Chisadza and Washington Nyabeze, WRNA

Bright discussed the results from Work Package 2. An inventory of drought monitoring and forecasting systems in Africa was presented.

Current systems for drought early warning in Africa include global modelling systems, national modelling systems, local knowledge systems and indices.

Drought early warning information at regional level is provided through Southern Africa Regional Climate Outlook Forum (SARCOF), SADC Climate Services and South African Weather Services (SAWS). Famine early warning information is provided through FEWSNET.

The current problem being faced in Africa is that there is a decline in the number of rainfall observation stations due to inadequate financial resources and this limits production of indices meteorological data. Further, extrapolation of rainfall over large areas may result in large errors due to high variability of rainfall. It is therefore important to develop a method of predicting drought indices for areas without observed rainfall data.

Other limitations of existing drought monitoring and forecasting systems in Africa include reliance on the internet, published material and contacts for information especial at national and local levels.

The most common drought mitigation actions implemented in the basins include food aid (Limpopo), seed supply (Oum er Rbia) and public awareness campaigns. The other drought mitigation actions include IKS (in the Limpopo and The Oum er Rbia) and public awareness campaigns. In the Oum er Rbia, drought management remains mainly reactive and ineffective and drought mitigation strategies and action stay very scarce and uncommon.

The major limitation in terms of monitoring drought in the basins includes poor data quality which is a problem because of missing data or an inadequate length of record. The high cost of data limits their application in drought monitoring, preparedness, mitigation and response. Moreover, information delivered through early warning systems is often too technical and detailed, limiting its use by decision makers.

Forecasts are often unreliable on the seasonal timescale and lack specificity, reducing their usefulness for agriculture and other sectors. Drought indices are sometimes inadequate for detecting the early onset and end of drought. Impact assessment methodologies which are a critical part of drought monitoring and early warning systems, are not standardized or widely available, hindering impact estimates and the creation of regionally appropriate mitigation and response programmes. Delivery systems for disseminating data to users in a timely manner are not well developed, limiting their usefulness for decision support.

The need to link IKS to formal forecasting methodologies was discussed. Traditional/local knowledge plays a significant role in Africa's adaptation efforts, but is usually neglected in academic, policy and public discussions on climate change and adaptation. Traditional/local knowledge systems are poorly documented and they have not been tested by scientists. Attention is given to scientific methods of early warning and forecasting at the expense of traditional forecasting systems.

Further, scientific methods do not give adequate information at local level. Endless cries from the majority of rural subsistence farmers each time a drought occurs is an indicator that techno-science based methods on early warning and forecasting have not worked well.

There is need for traditional/local knowledge systems to be considered at the same level as conventional techno-science based methods on early warning and forecasting of droughts in determining mitigation measures. Indigenous Knowledge Systems being used by farmers however, must be investigated.

Assessing drought vulnerability: Kenya and Oum Er Rbia Basin, Morroco – Emmah Mwangi and Marta Faneca, ICPAC, Deltares

Emmah and Marta discussed drought vulnerability in Kenya and in the Oum Er Rbia basin in Morroco. The objective of the study was to define a drought vulnerability index for the case study areas and map it to maximal possible resolution.

The methodology for the study involved selecting indicators for Drought Vulnerability that are important; normalizing the indicator values with respect to some common baselines; combining the sub-component indicators within each category by weighted averages and quantifying climate Drought Vulnerability Indices as the weighted average of the components.

The indicators used included: Social Capacity, (capacity of a society to develop knowledge and awareness); Natural Capital (reliability and vulnerability of water resource systems to confront water scarcity); Technological efficiency (capacity to develop, export and use eco-efficient technologies); Economic Capacity (capacity of a system to make investments in development industry, food security and income

stabilization). Limitations of the data included incomplete datasets; different spatial resolutions and different time of acquisition.

Overall, the method was seen as appropriate for drought vulnerability calculations. However, spatial resolution affects results because weighting should be region dependent. Results would improve if datasets were complete. Correlation amongst indicators was considered important for drought vulnerability calculations. It was noted that culture influences correlation of indicators with drought vulnerability.

Drought Forecsting and Warning: The DEWFORA approach - Ana Iglesias and Luis Garrote, Technical University of Madrid

Ana and Luis highlighted the aims of the DEWFORA project which are to improve the knowledge on drought forecasting, warning and mitigation, and advance the understanding of climate related vulnerability to drought, prototype operational forecasting and knowledge dissemination.

To achieve these objectives, it is important to go down the whole forecasting chain, from monitoring and forecasting, that are related to drought hazard and are addressed through physical sciences, to warning and response that are related to drought damage and societal response and correspond to the area of socio-economic science.

A framework has been developed to address the design and implementation of drought early warning systems. The framework responds to four major questions:

1. *What is the science available?* This first question is answered by the fact that there is plenty of science available, covering all the range of topics from drought characterization to monitoring and forecasting.
2. *What are the social capacities?* A comprehensive institutional analysis is required in order to understand to what extent social agents are ready to react to a warning or to a forecast.
3. *How can society benefit from the forecast?* This is a never-ending discussion On the one hand, scientists complain of the barriers such as access to the required data, whilst decision makers do not understand probabilistic language, etc. On the other hand, the institutions have limitations on assimilating scientific output, and many decision makers are reluctant to act based on science.

4. *How can science be translated into practice?* The answer is that the use of scientific evidence should be promoted and decisions should be based on scientific analysis and not on preconceived ideas. Ideas should flow from the lower level, for instance in drought management plans to the level, of advising national drought policies

A Pan African Map Viewer for Drought Monitoring of Forecast, P Barbosa, JRC

Paulo introduced the Pan African map viewer developed for drought monitoring and forecasting. The ultimate objective of such a system is to assist decision makers in using scientific based information in decision making for drought risk management and mitigation.

The Pan-African Map Viewer integrates drought monitoring and seasonal forecasting information as well as vulnerability and risk maps derived from socio-economic indicators. The system is based (although not identical) on a similar system developed for Europe through the European Drought Observatory. This information can be a useful input for existing and future drought early warning systems in Africa.

The system is in a pre-operational phase, with a variety of tools and drought related products that are accessible to end users and stakeholders interested in drought information in Africa. A new version of the Map Viewer will improve the data loading performances without losing the functionalities of the current version. Although the DEWFORA project will finish in 2013 the map viewer will be maintained and improved with the support of a number of partners that participated in DEWFORA allowing stakeholders to test it on a voluntary basis.

European developments on Drought Monitoring and Early Warning Systems - Rodrigo Maia, University of Porto

Rodrigo highlighted the main drought events of Europe over the past decade. He discussed the water policy at EU level whose main focus is Integrated Water Resources Management at the river basin level, reflecting hydrological realities regardless of administrative and political boundaries (European Water Framework Directive 2000/60 (WFD)).

The key tools for the implementation of the Directive in the river basin districts are the River Basin Management Plans (RBMP), which include the possibility to develop Drought Management Plans (DMP). Nevertheless, the thresholds for declaration of a drought situation, based on adequate indicators, and the measures to be adopted in a drought situation must also be incorporated in the programme of measures of the RBMPs.

Initiatives related to the development of tools to support drought monitoring and forecasting are being implemented by different agents, centres and networks, including: Joint Research Centre - Institute for Environment and Sustainability (JRC-IES); Drought Management Centre for South-Eastern Europe (DMCSEE); European Drought Centre (EDC);European Expert Group on Water Scarcity and Drought; Euro-Mediterranean Information System on know-how in the Water sector (SEMIDE/EMWIS) and European Environment Agency (EEA).

At European Union level, there is a growing concern regarding water scarcity and droughts. In order to characterize the experience of Europe in drought monitoring and forecasting systems: the main developments and current tools in use were identified; the main weaknesses and strengths should be mentioned.

The strengths highlighted at EU level are that; there is a Directive for water protection, applied to all Member States. Each Member State has the possibility to implement its specific Drought Management Plans; The drought preparedness is focused at national, regional, and river basin level; Efforts are being developed in order to approve and implement an EU Droughts Directive, similarly to the Floods Directive (already in force); finally the implementation and ongoing development capabilities of the European Drought Observatory shall allow the permanent analysis of drought-relevant indicators, provide up-to-date information and give an overview of the situation in case of imminent drought.

Round table discussion session

The main highlight of the event was the round table discussion with policy makers. The round table discussion was moderated by Jean Marie. It was preceded by the presentation of the African Science Policy Brief by Tatenda Tsiko, WaterNet.

Implementing drought early warning systems in Africa: policy lessons and future needs, Tatenda Tsiko, WaterNet

Tatenda emphasized that the final declaration of the High level Meeting on National Drought Policy in Geneva (March, 2013) encouraged all governments around the world to implement national drought management policies and particularly to promote greater collaboration to enhance drought preparedness. The DEWFORA project fosters such collaboration thereby contributing to reducing vulnerability and strengthen preparedness to droughts across Africa.

DEWFORA gathered information on vulnerability so that early warnings can be issued at sufficient lead time and drought mitigation plans can be implemented at an earlier stage. There is need to issue drought warning before the effects of drought are manifested because drought is a creeping event whose onset is difficult to tell. The idea is therefore to anticipate a drought event much earlier so that you have more time to plan mitigation measures.

The focus areas of the four case studies were highlighted. The Limpopo basin (Southern Africa) case study focused on improving existing drought monitoring and forecasting capabilities, as well as institutions, policies, guidelines and procedures for management of the scarce water resources in the basin. The Oum er Rbia basin (Northern Africa) aimed at improving capabilities in the forecasting of agricultural drought and establishing guidelines on adaptation in agricultural practices to reduce vulnerability. Emphasis in the Nile basin (North and Eastern Africa) was on improved tools for forecasting of water availability and the impact of climate change and community scale adaptation. In the Niger basin (Western Africa), the focus was on mid-term climate forecasting and strengthening preparedness to droughts to improve food security and human welfare.

The key policy messages coming out of the African Policy brief are:

- Current drought management focuses on mitigation and relief, and less on adaptation. A shift towards a risk based drought management approach offers opportunities to move away from expensive relief actions. *This requires drought monitoring using suitable indicators, drought vulnerability assessment, seasonal meteorological and hydrological forecasts, a user friendly early warning, training and public awareness, and improved data sharing.*
- Clear institutional responsibilities are prerequisite to effective drought forecasting and warning. Institutions involved in drought mitigation and

adaptation should be connected to the formal frameworks concerning drought. *A continuous and efficient collaboration of institutions and services involved is required and this should not only be limited to drought periods.*

- Low level of technical and scientific personnel in most organisations issuing early warning products is a major constraint. *Capacity is required at all levels (researchers, meteorologists, technology transfer, farmers, policy makers, communities, etc.) for effective interpretation and usage of forecasting and early warning products.*
- Drought forecasts and warnings should be targeted to provide key information to users that they can take decisions on. Traditional knowledge can be integrated to supplement drought forecasts and early warning systems.
- Seasonal meteorological and hydrological forecasts have skill in predicting drought conditions in most regions across Africa; though this predictability varies across the continent, depending on the type of climate and scale.

Round Table discussion with key policy makers, Jean Marie Kileshye Onema

Five key policy makers were invited for a round table discussion. The invited delegates are:

- Mr Corneille Ahouansou, President of the Ministerial council, Benin;
- Dr Chris Moseki, Water Research Commision, South Africa
- Dr Obololokile Obakeng, Ministry of Water Botswana
- Mr Lambert Matange, Ministry of Water, Zimbabwe
- Prof Francis Mutua, University of Nairobi, Kenya

Figure 2: Policy makers during the round table discussion

The policy makers highlighted the key challenges facing their institutions and countries concerning drought management. They also proposed how they would take up some of the recommendations coming out of the policy brief.

Key discussion issues included the need to shift from mitigation and relief based to a risk based drought management approach to avoid “paracetamol” action during drought. Clear institutional responsibilities are also a prerequisite to effective drought forecasting and warning. Institutions involved in drought mitigation and adaptation should be connected to the formal frameworks concerning drought.

Inadequate financial, human and technical resources are an impediment to drought forecasting and warning. The discussion highlighted that data is mostly disseminated in a way not understandable to users. There must be correct targeting, to say, who is this information for?

The relevance of IKS was discussed at length because local people have a way of forecasting and means of surviving through a drought. There is need for integrating scientific information and IKS. The use of secondary indices of drought such as

poverty was recommended over the use of primary indices such as GDP because secondary indices are more in touch with the community.

It is interesting to note that often people do not also consider the pluses of drought. For instance, drought presents an opportunity to change our thinking e.g "what can we do in the future to become better farmers?", "How can we ensure efficiency and improve productivity?" Drought also teaches us to understand ways to live with risk.

It is important to realize that research alone is not enough; how do we get the information to those who need it, in a timely fashion, in ways they can use it?

After the round table discussion, Dimmie provided a summary and wrap-up.

Scientific session

During the course of the afternoon, Micha moderated the scientific session, were papers were presented. He highlighted the experiences and conclusions from the DEWFORA project. DEWFORA has contributed to developing a framework for drought forecasting and warning in Africa and also elsewhere. The framework illustrates the importance of integrating technology in forecasting – to policy in warning – and societal response. As a project, DEWFORA is coming to a close at the end of 2013 but there is more work to be done in terms of developing the science and moving science to operations.

Probabilistic Monitoring and forecasting of meteorological droughts- Emmanuel Dutra, ELMWF

Emmanuel discussed probabilistic monitoring by looking at available datasets; observations uncertainty; Construction of probabilistic SPI monitoring and comparison with other products.

Seasonal forecasting was also highlighted with a focus on merging of monitoring and seasonal forecasts of precipitation; evaluation of the forecasts; dynamical versus climatological forecasts and the importance of monitoring quality in forecast skill.

Results from the study indicated large uncertainty in near-real time monitoring of precipitation, in particular over the tropics: drop in the number of rain-gauges. The

use of ECMWF ensemble forecasts provides an alternative for precipitation monitoring, with comparable quality to ERA-Interim and TRMM. Probabilistic monitoring of precipitation provides uncertainty estimates of SPI that could be potentially useful in decision making.

It was noted that poor quality of the monitoring can reduce the skill of the forecasts significantly. Finally it was emphasized that we can only test the probabilistic monitoring since 2009 onwards; the global SPI forecasts provide a large amount of data: Further verification is needed, in particular focusing on case studies.

Statistical seasonal forecasting of hydrological drought in the Limpopo basin - Mathias Seibert

The aim of the study was to employ statistical methods for drought forecasting and analyse potential to support drought early warning. The study revealed that the runoff signal is complex and integrating all the catchment precipitation; has a memory past events and shows both water deficit and drought. Therefore predicting runoff is an indicator very valuable to water managers.

The employed indices for forecasting using teleconnections include ENSO, DMI, NAO an Darwin and Tahiti sea level pressure. Results of the study show that neural networks did not improve the forecasts, therefore long lease times can be modelled but have little skill.

Improving Estimation of Standardised Precipitation Index for drought Monitoring at local level - Livelethi Dlamini and Bright Chisadza, WRNA

Bright explained that a decline in number of rainfall observation stations due to inadequate financial resources to meet the maintenance costs has caused calculations of meteorological data based indices to become a challenge mainly due to the distribution of these stations. While areas with available rainfall data can be assessed, extrapolation to large areas without rainfall data may result in errors due to high variability of rainfall. It is important therefore to find a method of predicting drought in these areas without observed rainfall data.

The objective of the study was to develop a model for estimating SPI for catchments with limited rainfall data using remote sensing for improved drought monitoring. This was done through: evaluation of the performance of SPI , NDVI and VCI in identifying historical droughts and its severity using observed data for selected

sub-catchments of Luvuvhu/ Letaba Water Management area, computing and comparing the performance of the satellite-based indices NDVI, VCI and precipitation index SPI in identifying droughts and modelling the SPI using NDVI, VCI and topographical factors (aspect, altitude and slope).

Results from the study reveal that Bootstrapping analysis eliminated elevation as a significant variable and two models; one for the dry and one for the wet season were finally obtained. These models were further subjected to verification using the observed drought conditions at 5 widely-spread communities in the study area for year 2012. These matched the field observations reasonably well and considerably better than the drought monitoring maps provided by the South African Weather Services (SAWS) which are based on data from sparsely located rainfall stations.

By using the SPI model, it is therefore possible to zoom into local/community scale and determine the severity of drought with more confidence. Improved and informed decision making can be achieved based on the results of this study. Data from remote sensing has been applied and this technique has evolved with time and can only improve in future.

Droughts and floods over the Blue Nile and their connections to the timing of El Nino and La Nina events - Z. Modathir, Dinder Center for Environmental Research

Modathir presented this study which focused on the dependence of occurrence of droughts and floods in the upper catchment of the Blue Nile on the timing of El Nino and La Nina events. The study analysed the impact of this timing and temporal patterns on the Nile droughts and floods. It assessed discharge measurements (1965-2012) at the outlet of the upper catchment of the Blue Nile in relation to the El Niño index.

Results reveal that droughts in the Blue Nile are sensitive to the timing of El Niño, with 80% of drought cases when El Niño starts in AMJ, JJA and JAS. We also find that in 67 % of the cases in which El Niño was followed by La Niña there were extreme floods in the Blue Nile. An important conclusion is that JJAS rainfall in the upper catchment of the Blue Nile is highly sensitive to the NINO 3.4 SST anomaly during the early season of AMJ in Nino 3.4. This season is recommended by this study to be used in the seasonal forecasting of the Blue Nile.

Structure path to disseminate flood forecast information to serve communities: the OPIDIN initiative in the Niger Inner Delta, Mali - Bakary Kone, NDS International Centre

Bakary presented the study which sought to explain the importance of predicting the maximum water level of the flood in the Inner Niger delta in Mali. The communities in this area depend on the flood to maintain their socio-economic development and maintain ecological integrity. The higher the water level per year, the higher the fish production.

OPIDIN is used as an early warning tool for early action in the area by all stakeholders living in the floodable zone including farmers,herders,fishermen, water managers, NGO's and IGO's

OPIDIN information is disseminated through flood maps, specific weekly bulletins and over the internet.

Session Posters

The workshop ended with four poster presentations as indicated in the program (Appendix A)

Figure 3: Some of the representatives of the DEWFORA consortium

APPENDIX A

Improved Drought Early Warning and FORecasting to strengthen preparedness and adaptation to droughts in Africa

(DEWFORA Project)

END OF PROJECT WORKSHOP

31st October, 2013
Whitesands Hotel Resort
Dar es salaam, Tanzania

Thursday, 31st October, 2013	
08:00 am - 08:30 am	**Participants Registration**
Opening Session (Moderator- Ana)	
08:30 - 08:50	**Opening and introduction, (M. Werner)**
08:50 - 09:10	**Drought Forecasting practice in Africa (W. Nyabeze)**
09:10 - 09:30	**Assessing drought vulnerability (M. Faneca/ Emma)**
09:30 – 09:50	**Drought Forecasting and warning: The dewfora APPROACH (A. Iglesias /L.Garrotte)**
09:50 – 10:10	**Developing a Pan-African map viewer for drought (P. Barbosa)**
10:10 – 10:30	**European developments on Drought Monitoring and Early Warning Systems (R. Maia)**
10:30 – 11:00	**Coffee Break**
Discussions (Moderator – Jean Marie)	
11:00 -11:45	**Implications and recommendations on Policy (Policy Brief), (Tatenda, Ana)**
11:45 – 12:30	**Round - table discussion with Policy makers**
12:30 – 13:00	**Summary and wrap-up (Dimmie)**
13:00 – 14:00	**Lunch Break**
DEWFORA Presentations (Moderator – Micha Werner)	
14:00 – 14:20	**A framework for drought forecasting and warning – experiences and conclusions from the DEWFORA project M.Werner, A. Iglesias, W. Nyabeze**
14:20 – 14:40	**Improving Estimation of Standardised Precipitation Index for Drought Monitoring at Local Level, L. Dlamini**
15:00 – 15:20	**Probabilistic monitoring and forecasting of meteorological droughts, E. Dutra**

15:20 – 15:40	**Statistical seasonal forecasting of hydrological drought in the Limpopo basin, M. Seibert**
15:40 – 16:00	**Seasonal hydrological forecasting for drought early warning in the Limpopo river basin, P. Trambauer**
16:00 – 16:30	**Tea Break**
16:30 – 16:50	**Exploring the potential of adapting to climate change through seasonal prediction of meteorological drought indicators, H. Winsemius**
16:50 – 17:10	**Droughts and Floods over the blue Nile and their connections to the timing of El-Nino and La-Nina events, Z. Modathir**
17:10 – 17:30	**Structure path to disseminate flood forecast information to serve communities: the OPIDIN initiative in the Inner Niger Delta, Mali, B. Kone**
Session Posters	• **Predicting and projecting drought and related impacts on livestock and crop yield over southern Africa, Z Dedekind** • **Implications of built and planned hydraulic infrastructures on hydrological regime and livelihood in the Inner Niger Delta under climate variability and change- S. Fournet** • **Evaluation of seasonal rainfall forecasts in the Limpopo River Basin, W. Nyabeze** • **Application of the DEWFORA Drought Early Warning Framework on the Limpopo River Basin - A Case Study, W. Nyabeze**

APPENDIX B –List of Invited Delegates to the Workshop

Attendees of the DEWFORA end of project workshop, October, 31 2013

Register

Name	Org + Country	email
1) Tatenda Tsiko	WaterNet, Zimbabwe	ttsiko@gmail.
2) Bright Chisadza	ZRNA, Zimbabwe	brightte@gm
3) Zane Dedekind	CSIR, South Africa	zdedekind@cs
4) Julie Fischer	USAID-EastAfrica (Kenya)	jufischer@usaid
5) RODRIGO MAIA	UNIVERSITY OF PORTO, PORTUGAL	rmaia@fe.up.p
6) TENDAI SAWUNYAMA	ICR WATER RESOURCES, RSA	tendai@waterres co.za.
7) Chris Moseki	Water Research Commission of South Africa	chrism@wrc.org
8) FRANK V. WEERT	WETLANDS INTERNATIONAL NETHERLANDS	frank.van WEERT @ WETLAN
9) Shreedhar Maskey	UNESCO-IHE	s.maskey@unesco-i
10) Patricia Trambauer	UNESCO - IHE	p.trambauer @unesco
11) Jean Simonis	Univ Zululand, RSA	simonisj@unizulu
12) Robert K.M. Sunday	Ministry of Water-Tanzania	rkituha04@yaho
13) Schalk [illegible]	UNESCO-IHE	S.vanandel@unesco-ihe.
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15) Emanuel Dutra	UK, ECMWF	emanuel.dutra@ecmwf.
16) Fredrik Wetterhall	ECMWF, UK	fredrik.wetterhall@ecmw
17) Lyla Mehta	IDS, UK	L.Mehta@ids.ac.
18) DEOGRATIUS MAIGA	UJ, SA	dmaiga2013@gmail.com
19) Modathir Zarouq	DCER, Sudan	modathir-23@yahoo.
20) ELIZABETH KARONGA	Zambezi River Authority Zambia	karonga@zaraho.org.zm li3karonga@yahoo.com
21) Ruth Beukman	GWPSA, SADC region	r.beukman@cgiar.o

22) Alanna Taylor — Dalhousie, Canada — a130650@dal.ca

23 Corneille AHOUANSOU — Ministère en charge de l'Eau, Bénin — ahounecille@yahoo

24) MASENGO ILUNGA (FRANCOIS) : ilungm@unisa.ac.za ; mifrancois@webmail.co.z

25) Francis Mutua - University of Nairobi : fmutua@uonbi.ac.ke

26) Aune Amwaama — NAMIBIA — Amwaama@gmail.com

27) Marta Faneca — Deltares, The Netherlands — marta.faneca@deltares.n

28) EMMAH MWANGI — ICPAC, KENYA — mwangiemmah@gmail.com

29) Jean-Marie KILESHYE ONEMA, WATERNET — Jmkilo3@yahoo.co.uk

30) ISNAENI M H — UNESCO-IHE, NETHERLANDS — i.hartanto@unesco-ihe.o

31) ALFRED OPERE — ICPAC — aopere@uonbi.ac.k

32) Berhanu F. Alemaw — University of Botswana / WaterNet — bfalemaw@gmail.com

33) Yasir Masih — UNESCO-IHE Netherlands — i.masih@unesco-

34) Gustavo Naumann — JRC-European Commission — gustavo.naumann@jrc.ec.europa

35) Florian Pappenberger — ECMWF — florian.pappenberger@ecmwf.

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