Sudan Meteorological Authority

Extreme Hydro-Climatic Events Assessment and Monitoring in Sudan

NASA IDS Second Participatory Workshop

Addis Ababa

28-29 July 2015

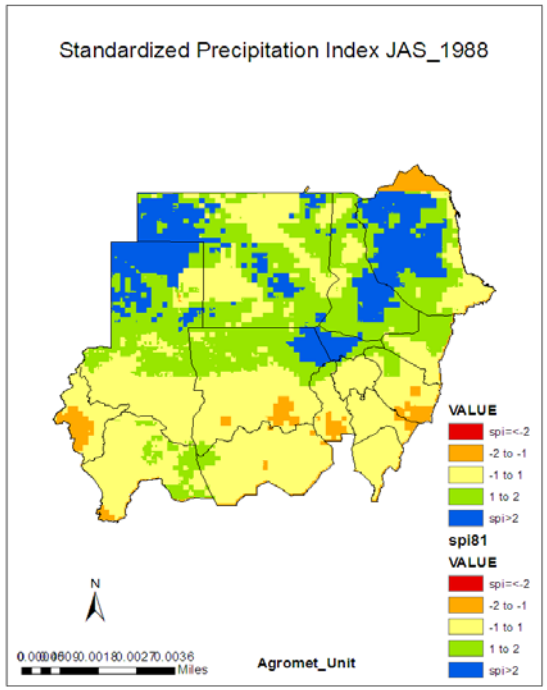
Amel Mohamed Abdalla

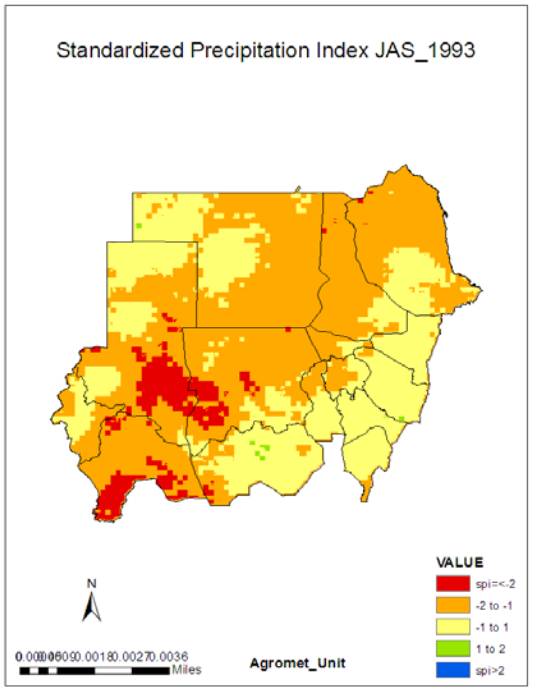
Sudan Meteorological Authority

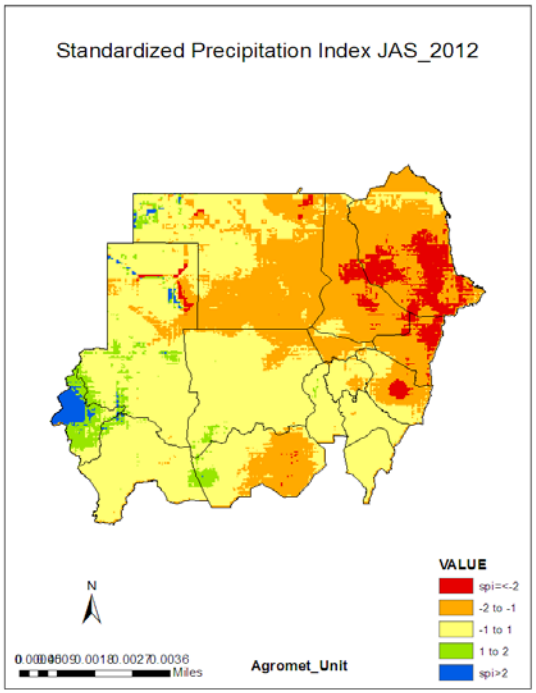
Extreme Drought & Flash Flood Assessment & Monitoring in Sudan

African countries face a growing threat of hydro-meteorological disasters (HMDs). Droughts, floods, water-related epidemics, storms and cyclones are increasingly reducing opportunity and wrecking havoc in communities (United Nations Development Program (UNDP), 2008).

The increasingly variable climate in Sudan seen rising numbers of extreme flood and drought events during the last few decades, whether correlated with global anthropogenic climate change or weaker safety nets and social protection.







Extreme Drought

Understanding drought's hydro-climatic causes, frequency and severity, and producing reliable predictions are of critical importance for impact assessments, disaster mitigation, and future projection.

With the availability of Geospatial Technologies these could easily be done through:

(1) understanding the physical mechanism and manifestation of drought events,

(2) estimation of drought frequency, spatial patterns, and seasonal to annual variability,

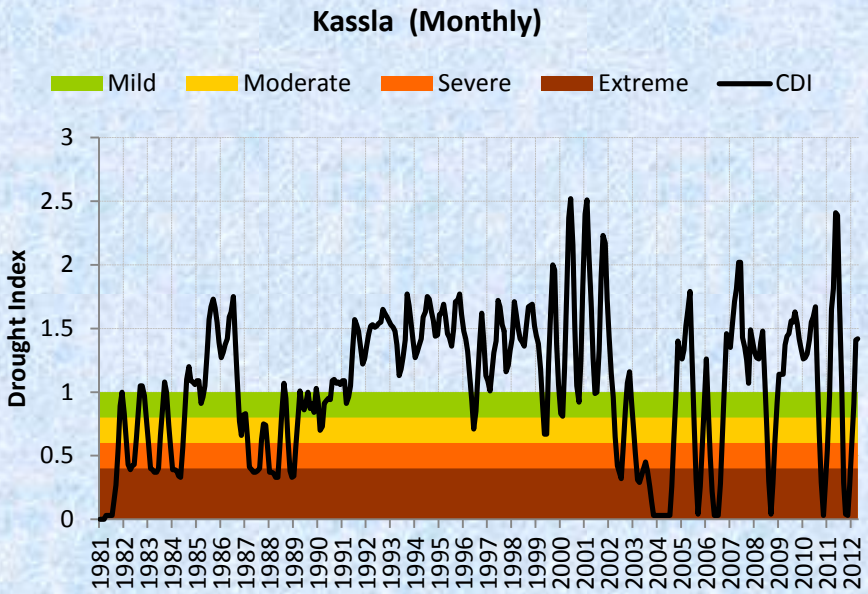
(3) probabilistic and deterministic modeling and forecasting,

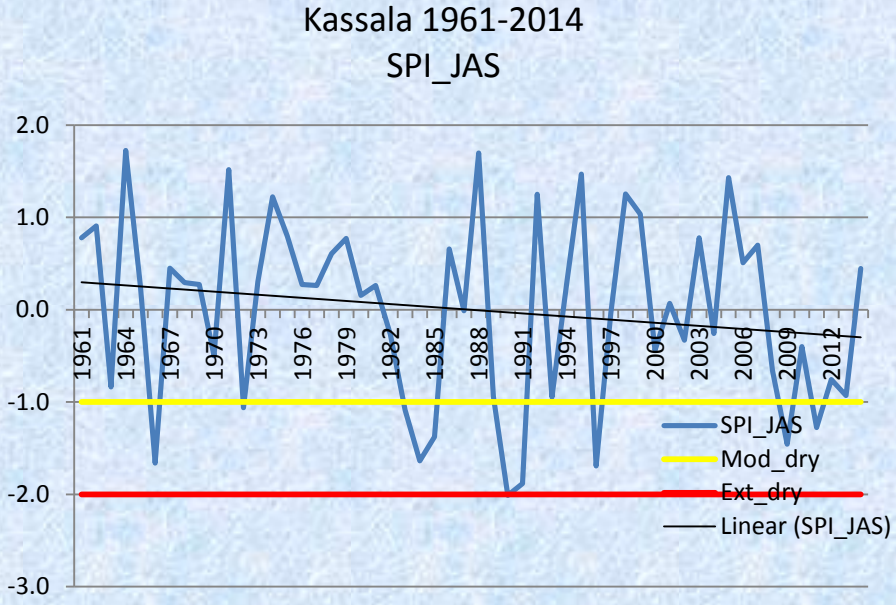
Severe droughts affecting the country were in 1886, 1913, 1940, 1967-1973, and 1980-1984. Successive years of drought in certain parts of the country in 1985-1993 caused severe shortage of food, social disruption and widespread health and nutritional problems. (Dr. Amna A. Hamid and Dr. Yahya H. Eltayeb Remote Sensing Authority – Sudan) .

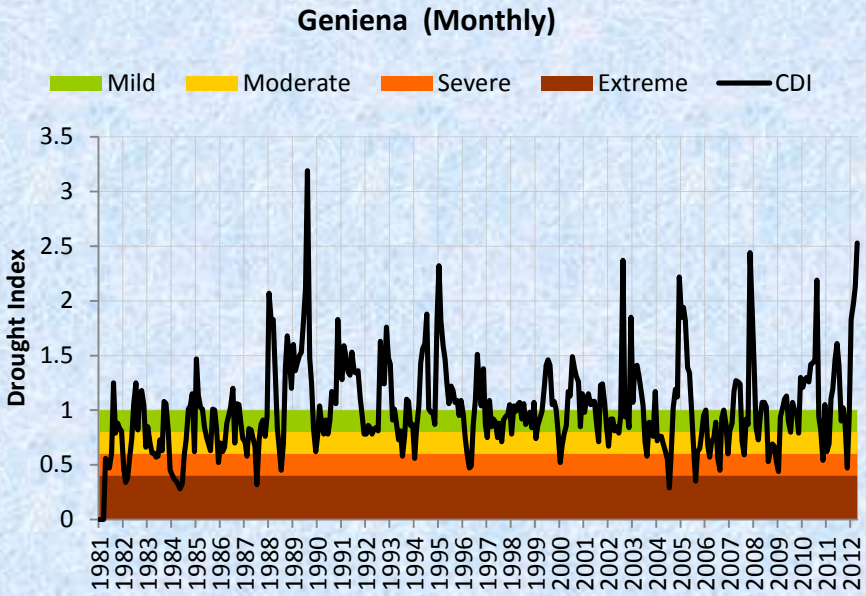
Drought Impact Situation in Sudan

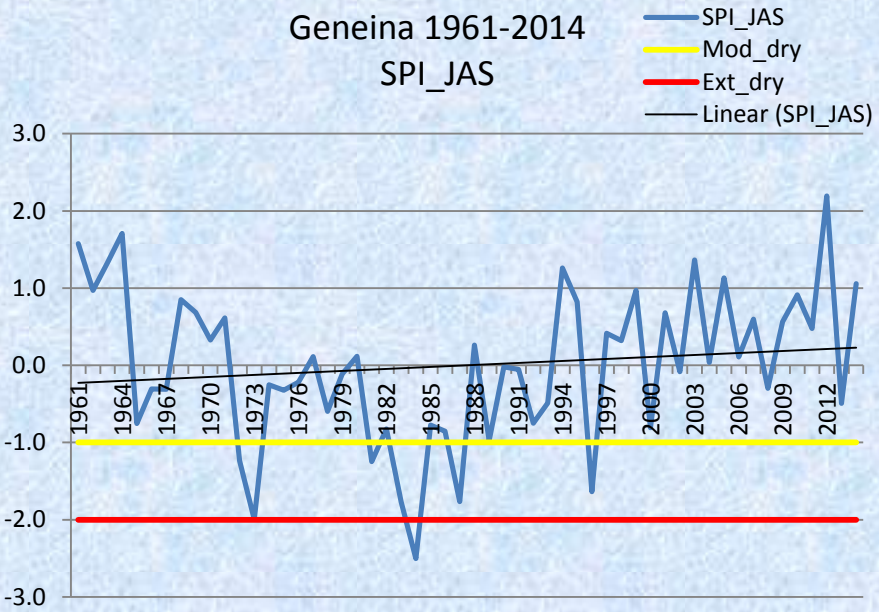
Year	Drought Coverage	Consequences
1886		
1906	Affecting all Sudan	Severe famine
1913	Localized (part of Sudan)	
1940	Localized (part of Sudan)	
1967	Localized (part of Sudan)	
1973	Localized (part of Sudan)	
1984/85	Localized (part of Sudan)	Severe famine
1989/90	Localized (part of Sudan)	
1997	Localized (part of Sudan)	
2000	Localized (part of Sudan)	
2003	Localized (part of Sudan)	food shortage in some areas
	Localized (part of Sudan)	
	Localized (part of Sudan)	
2008	Localized (part of Sudan)	
2009	Affecting part of South Sudan	Localized famine
2011	Affecting most of South Sudan	food shortage in some areas

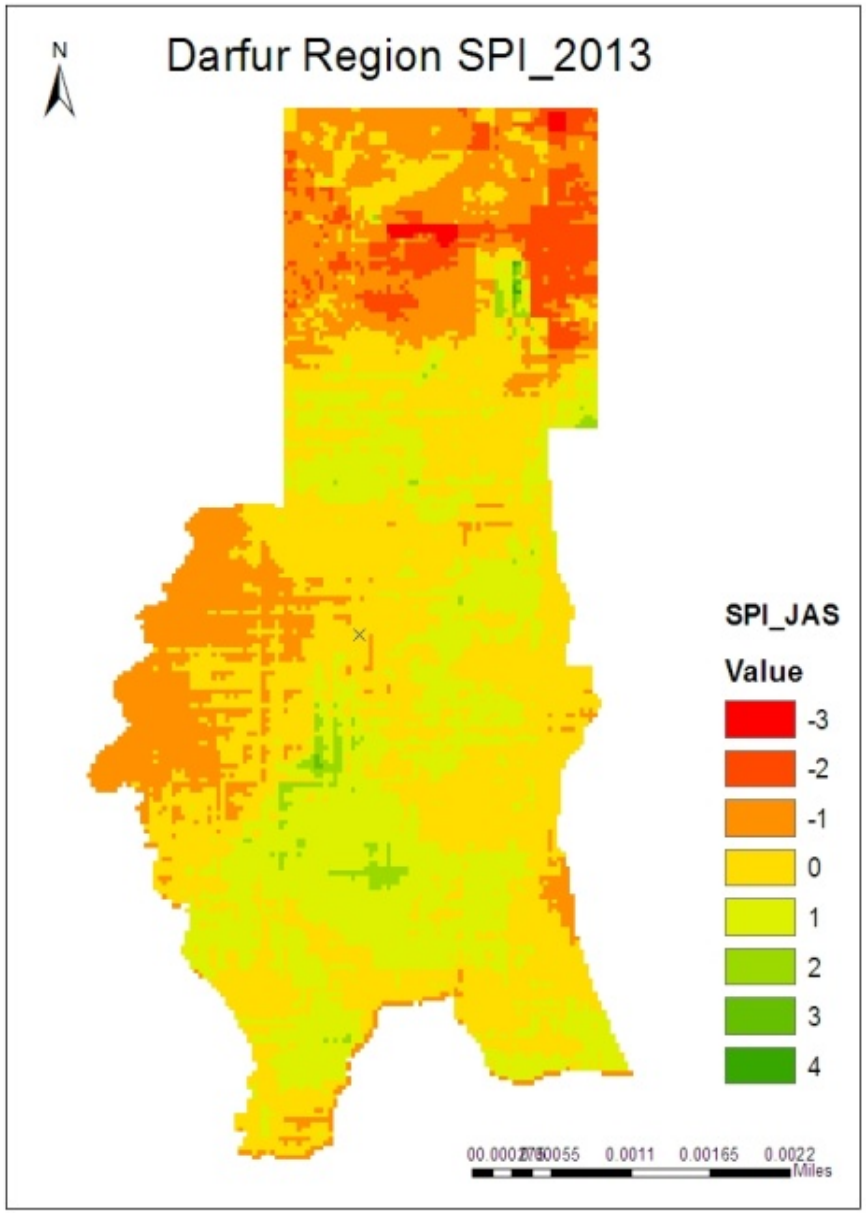
Dr. Amna A. Hamid and Dr. Yahya H. Eltayeb
Remote Sensing Authority - Sudan


Kassla (Monthly)
Mild
Moderate
Severe
Extreme
CDI
Drought Index
3
2.5
2
1.5
1
0.5
0
1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012

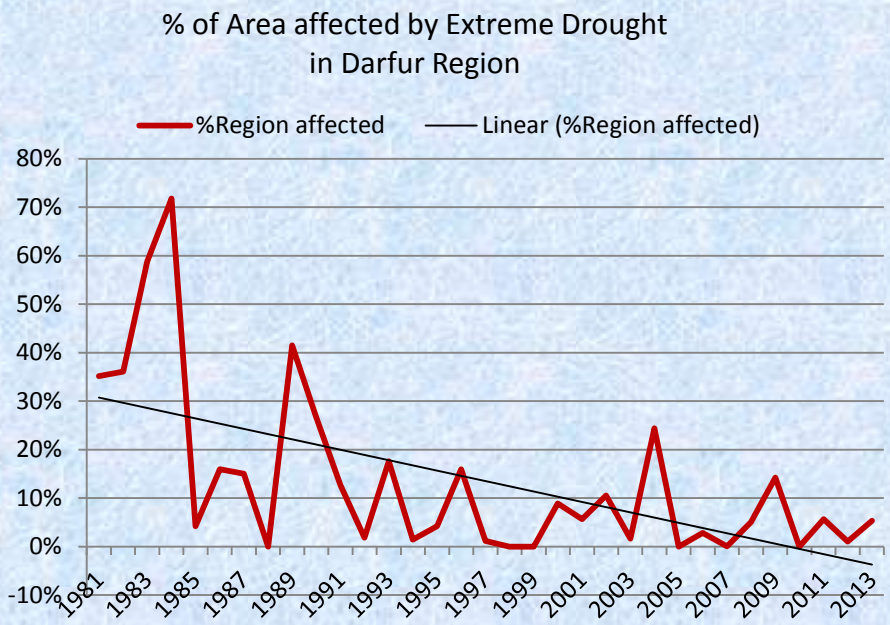

Kassala 1961-2014
SPI_JAS
2.0
1.0
0.0
-1.0
-2.0
-3.0
1961 1964 1967 1970 1973 1976 1979 1982 1985 1988 1991 1994 1997 2000 2003 2006 2009 2012
SPI_JAS
Mod_dry
Ext_dry
Linear (SPI_JAS)

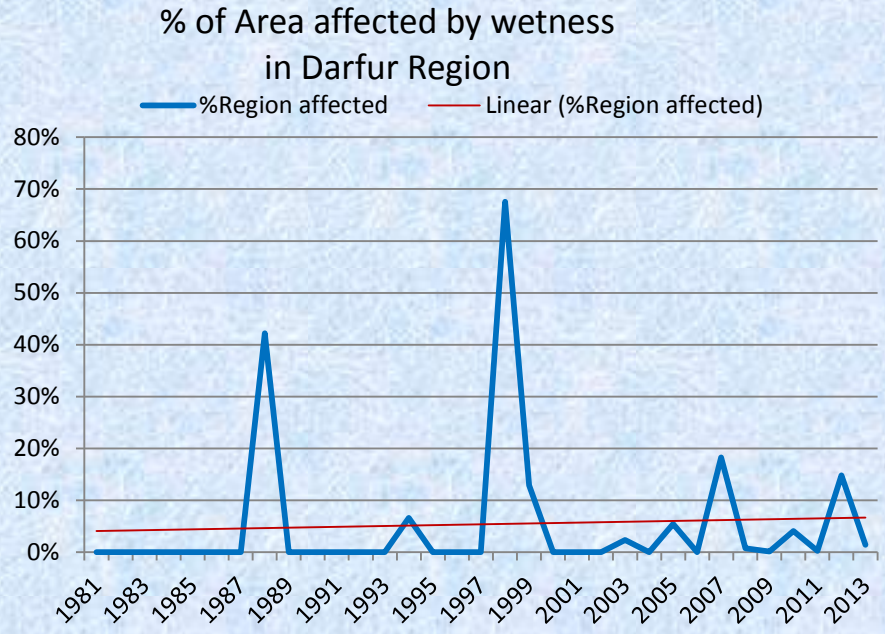

Geniena (Monthly)
Mild
Moderate
Severe
Extreme
CDI
Drought Index
3.5
3
2.5
2
1.5
1
0.5
0
1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012


Geneina 1961-2014
SPI_JAS
SPI_JAS
Mod_dry
Ext_dry
Linear (SPI_JAS)
3.0
2.0
1.0
0.0
-1.0
-2.0
-3.0
1961 1964 1967 1970 1973 1976 1979 1982 1985 1988 1991 1994 1997 2000 2003 2006 2009 2012



:Column1	%Reg_dry	%Reg_wet
1981	35.2%	0.0%
1982	36.1%	0.0%
1983	58.8%	0.0%
1984	71.8%	0.0%
1985	4.2%	0.0%
1986	16.0%	0.0%
1987	15.0%	0.0%
1988	0.0%	42.2%
1989	41.5%	0.0%
1990	26.7%	0.0%
1991	12.7%	0.0%
1992	1.9%	0.0%
1993	17.6%	0.0%
1994	1.4%	6.6%
1995	4.2%	0.0%
1996	16.0%	0.0%
1997	1.2%	0.0%
1998	0.0%	67.6%
1999	0.0%	12.9%
2000	8.9%	0.0%
2001	5.6%	0.0%
2002	10.6%	0.0%
2003	1.6%	2.3%
2004	24.4%	0.0%
2005	0.0%	5.4%
2006	2.8%	0.0%
2007	0.0%	18.3%
2008	5.1%	0.8%
2009	14.2%	0.1%
2010	0.0%	4.1%
2011	5.7%	0.2%
2012	1.1%	14.8%
2013	5.3%	1.4%





The computation of SPI, as well as its analysis, are performed as a foundation of drought database. It will also contain the trend and spectral analysis of the calculated SPI. At the end a prediction of eventual drought events will be generated.

Indicators such as the SPI, which is based on fitting meteorological parameters to Probability distributions, are more suitable for deciding on the exceptionality of drought events that may be a basis for providing aid such as emergency assistance, socio-economic development and crop insurance.

Flash Flood

Annual flooding during the July to September season in Sudan is a reoccurring challenge for many families in different parts of the country.

Flash floods tend to be phenomena of local range which are difficult to predict both in terms of location and magnitude of the hazard.

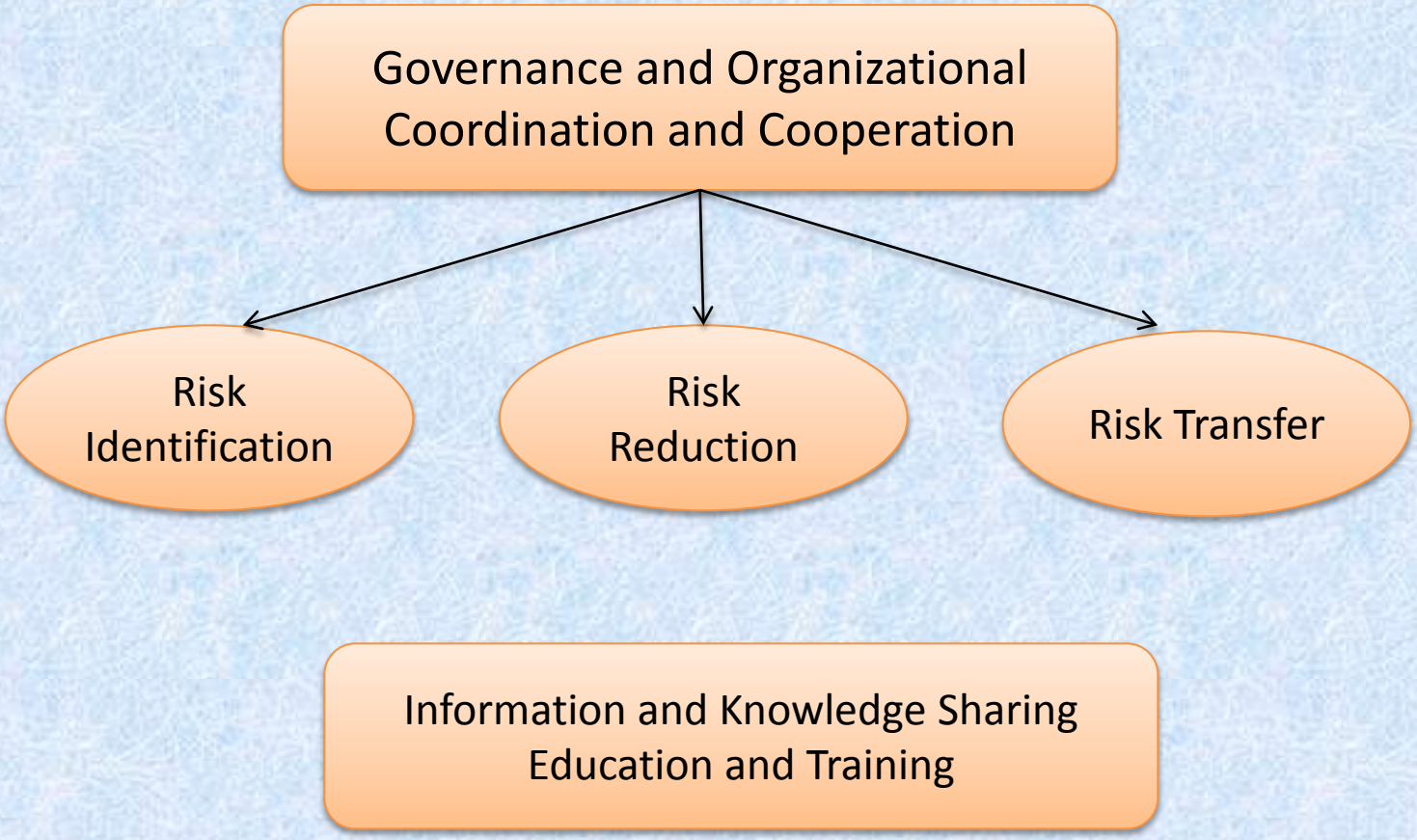
Flash flood management is a major Challenge for both governmental and non-governmental organizations mainly because of the difficulties associated with accurate forecasting and short lead time for issuing warnings.

Needs of Local flood monitoring network

NEEDS OF PROVIDING A TECHNICAL UMBRELLA FOR FLASH FLOOD FORECASTING AND WARNING

EXTREME	STATES	date	annual	%
107	Gedaref	aug-8-1996	610.4	18
125	Rashad	aug-2-1992	656.3	19
89	Geneina	jun-22-1985	430.9	21
108	Um_banien	aug-07-1998	501.9	22
167	Ed Damazine	jly-30-1994	692.1	24
143	Abu Naama	aug-8-1998	584.9	24
96	Nyala	aug-13-2008	383.4	25
88	En Nahud	aug-29-1985	349.6	25
176	Kadugli	sep-3-1995	687.7	26
95	El Obeid	jly-27-1999	348.8	27
138	Babanusa	jun-15-1987	501.1	28
125	Sennar	jly-24-2000	408.2	31
93	Wad Medani	aug-21-1985	286.3	33
118	Kosti	jun-30-2007	330.2	36
110	Ed Duiem	aug-05-1995	244.6	45
116	N-halfa	sep-26-2002	249.5	46
145	Kassla	jun-27-2007	235	62
132	El Fasher	aug-3-2005	193.4	68
64	Atbara	aug-4-1988	48	133
119	Shendi	aug-20-1998	74.9	159
201	Khartoum	aug-4-1988	120	167
163	Port Sudan	oct-27-1997	83.9	195
39	Karima	aug-9-1999	13.9	282
60	Dongola	jly-23-1994	8.2	732

Understanding and Prediction of Extreme Drought & Flash Flood:



Conceptual framework for effective disaster risk management at the national to Local levels, derived from the Hyogo Framework Action (HFA).
Source: World Meteorological Organization (WMO).

Where are we from the spectrum of effective disaster risk management in Africa?

For Reliable weather forecasts and outlooks; functioning warning systems for natural hazards, many questions arise:

1- Do we use climate information & weather forecasts for the prevention of weather-related disasters?

Yes. Starting from the seasonal rainfall/temperature forecast from different sources as (ECMWF), (IRI) and mainly the GHA Seasonal Rainfall Outlook through workshops at national level, one day workshop involving related different sectors such as:

Ministries of: Agriculture, Irrigation, Defense, Health…etc

Farmers Union, Food Security Institutions, Agricultural Insurance Agencies, Infrastructure devices, Higher Council for Environment and Natural Resources (HCENR), Humanitarian Aid Commission (HAC) and others.

Also via local level Community meetings and discussions in some production areas like Gadaref, Blue Nile and Western states.

2- what are our initiatives to generate effective EWS?

1- Risk knowledge

Creation of susceptibility maps for the natural hazards (Drought & Flash Flood)

2- Monitoring and predicting

By improving forecast capabilities and the use of technologies for weather and hydrological monitoring and forecast. Seasonal, monthly and 5-days rainfall forecast prepared for different sectors as demand.

3- Disseminating information through

a- Internet

*b- Regular meetings in committees comprising all specialists in the field of disaster risk reduction and disaster risk management pre /during the season (*Emergency Committee).

c- Decadal Bulletins for the rainy season assessment (rainfall and temperature) on daily basis. (Data center)

d- Monthly Bulletins. (Agro-met Unit)

4- Responding to warnings

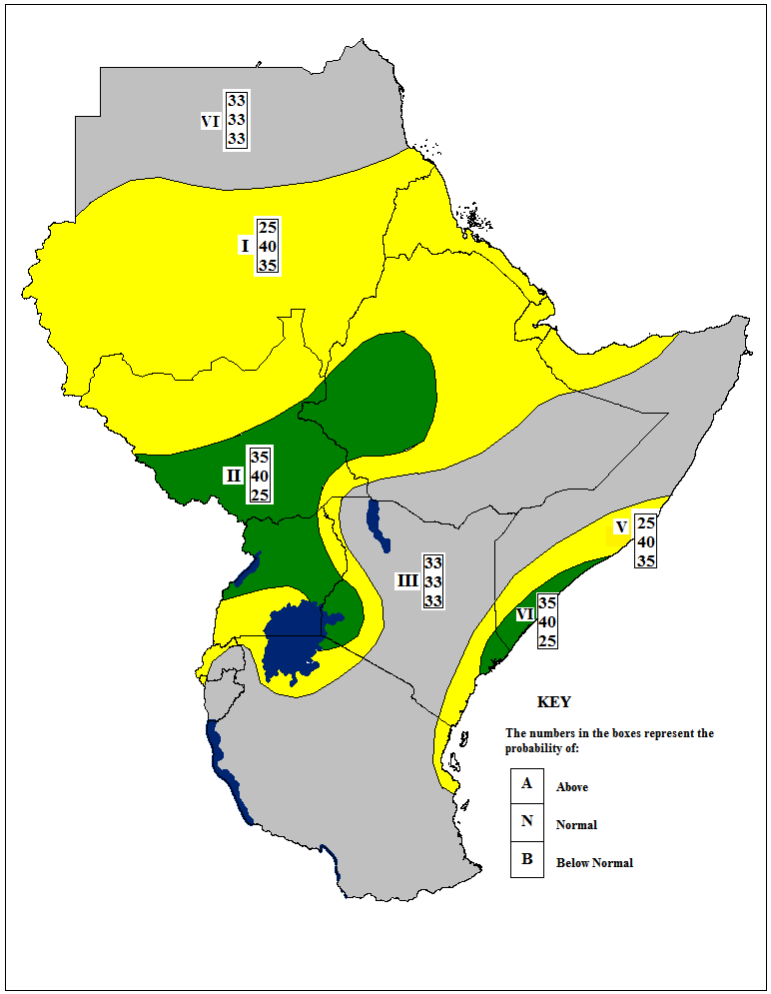
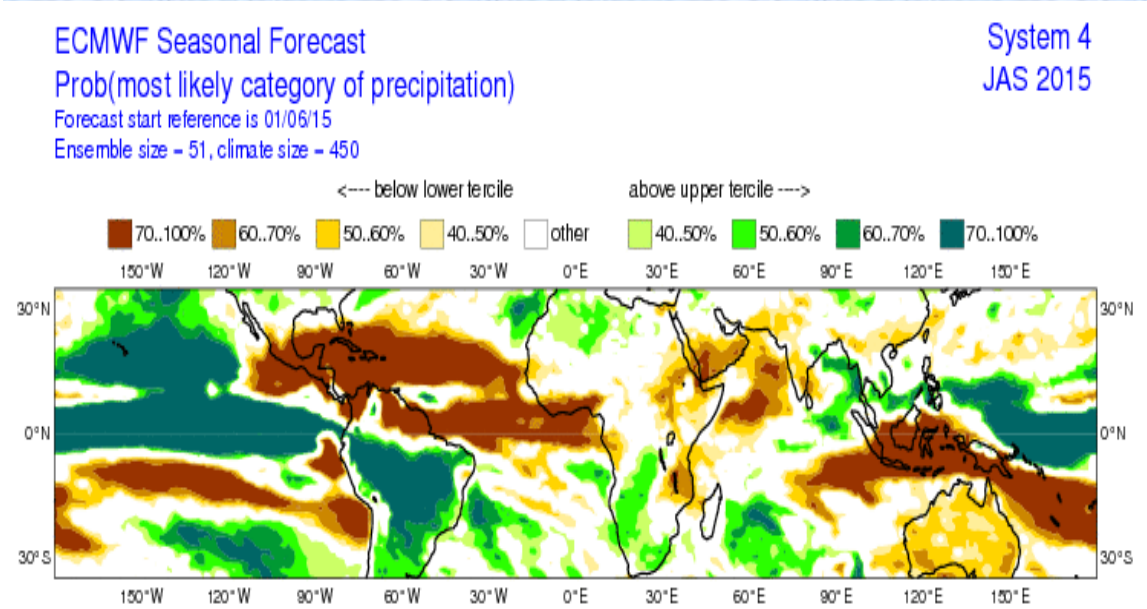
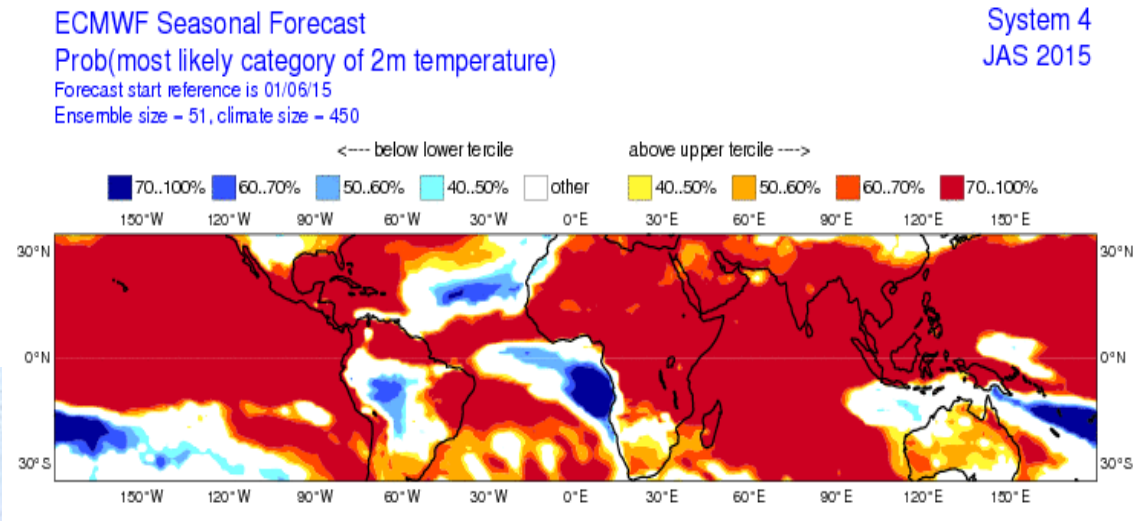


Figure 4: Greater Horn of Africa Consensus Climate Outlook for the June to August 2015 rainfall season





Having these profiles of forecasts, warnings should be provided for early preparedness to reduce the impacts of the drought risk.

Warning

Rain fed agriculture & Food security sectors :

As El Niño event is dominant during this season so, some delay in the onset of the season and declining in the growing season length is expected , so precaution is crucial to help mitigating expected adverse impacts, such as :

- Early forecasting of the main food crops production situation
- Identifying surplus and deficit areas to guide seasonal marketing operations.
- Carrying out pre and post harvest crop assessment

Livestock Sector:

Occurrence of extreme climate events such as droughts has severe impacts on the livestock, it is the drying up of water sources and declining forage resources for livestock which negatively affect the livestock as on animal health, production of dairy products, meat and reproduction. Implicitly, conflicts is expected internal and along the borders with the westerly, easterly and southerly neighbours as this seasonal drought is expected regionally, beside possibility of inflection of new animal diseases from there.

Water resources and risks associated with river flow

With strong El Niño occurrence and low rainfall amount expected, some actions in coping with drought impacts could help in fulfilling water consumption in the country and enhancing reserve, produce and distribute waters.

NEEDS

- Revising our DRR policies to clarify the role of the NMHS (provide opportunities such as increased recognition of the NMHSs by our government and stakeholders).

- Strengthening our strategic and operational partnerships with various DRR stakeholders across various sectors and levels (increased resources).

- Strengthening our core infrastructure for observation, telecommunications and operational forecasting.

NEEDS

- New gauges should be installed to fill gaps in coverage or replace old technologies (Rainfall Gauges & Stream flow Gauges).

- Providing high-resolution, real-time gridded rainfall estimation over a region of interest is essential (Weather Radar and Satellite data).

- Guidelines, as well as management and technical training in integrating sector specific Warning Messages after potential risk assessment.

Thank You