Republic of Sudan

Monitoring and Mitigation of Drought and Flood hazards in Sudan

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Addis Ababa, Ethiopia

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General background

Sudan hazard

- Sudan is a disaster prone country.
- Floods, Drought, and desertification are the most common environmental hazards.
- There are another hazards and disasters either man-made or natural disaster such as civil conflicts, pest infestation, epidemics, these have had immense devastating impacts on the social structure and the economies of the country
- Rainfall is the first limiting factor to crop production in mechanized and traditional sectors in eastern and western parts of Sudan .
- Yields of sorghum and millet (the stable food) depends on water available during the growing season, beside the total rainfall amount available, the timing of rainfall relative to the developmental stage of the crop is also critical.

Seasonal Progress

- In general, it is possible to recognize 5 distinct rainy zones; desert the rainfall amounts ranges between 0 to below 50mm, arid (50-200mm), semi-arid (200-500 mm), sub-humid (500-800mm), humid (above 800mm).

- The duration of the rainy season and the amounts of rainfall vary considerably within these zones.

- The length of the growing season varies from more than 4 months in the extreme south-western of Sudan to less than two months in the northern and river Nile states in the north of Sudan .

Seasonal Rainfall in 2017 by Late July

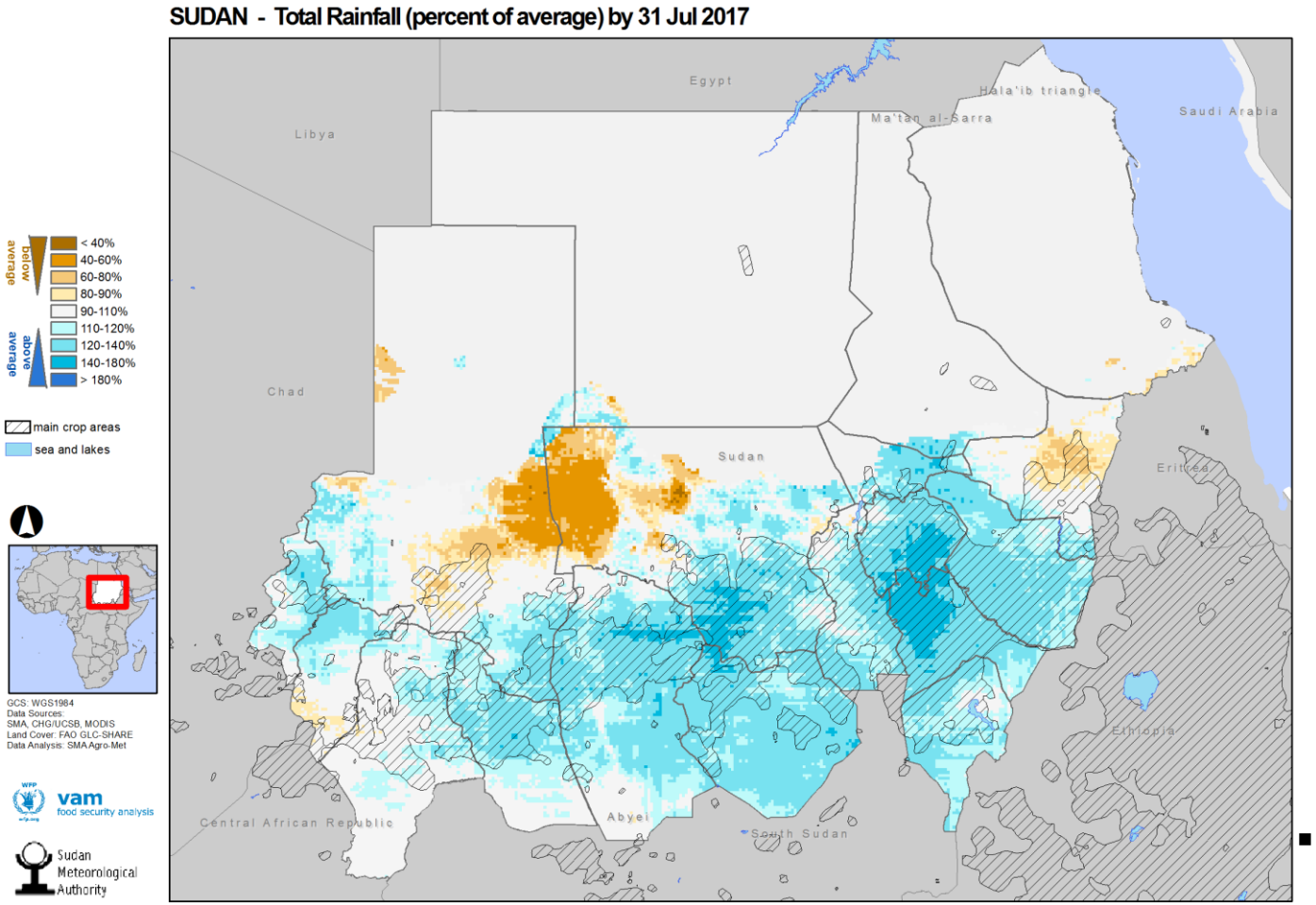


Fig 2a: Total Rainfall (percent of average) by 31-July 2017

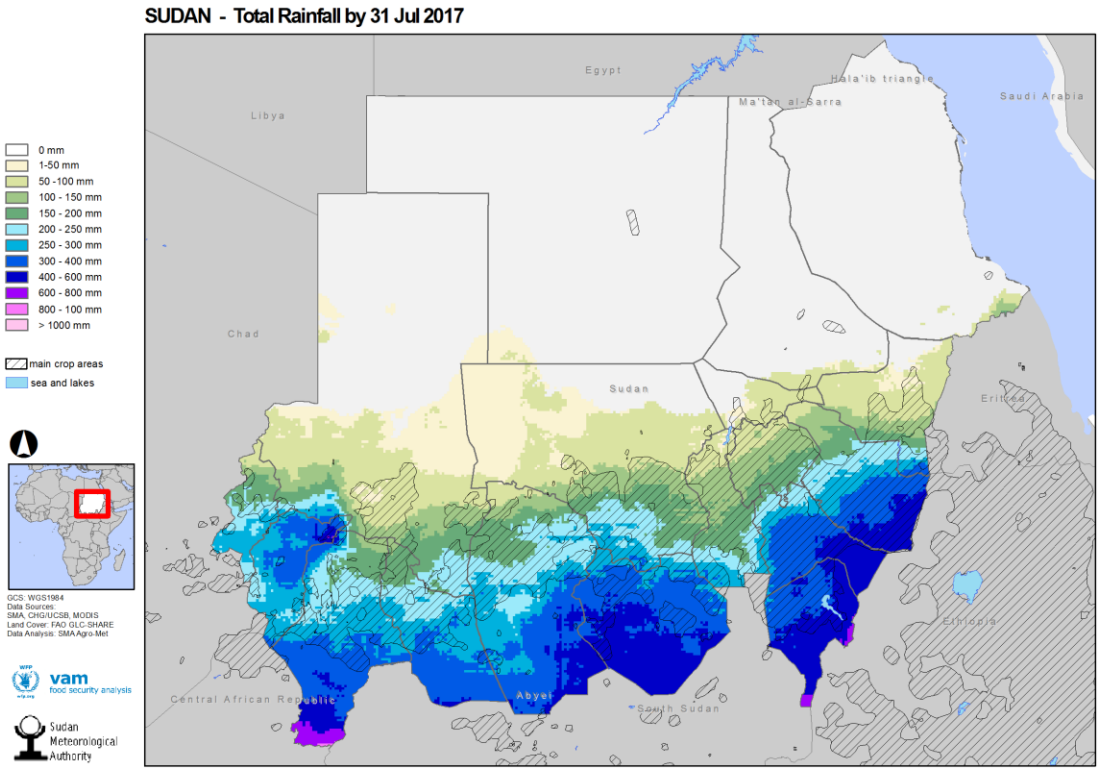


Fig 2b: Total amount of rainfall by late July

- By 31 July, cumulative rainfall across Sudan was broadly on to above average (*Fig 2a*).
- Kassala, east of Northern Darfur and west of Northern Kordufan states experienced below average total rainfall. (*Fig 2a*)..
- Higher than 400 mms registered east of Sennar, south of Southern Kordufan, Gadaref and Blue Nile states (*Fig 2b*).

Vegetation Cover Status in 2017

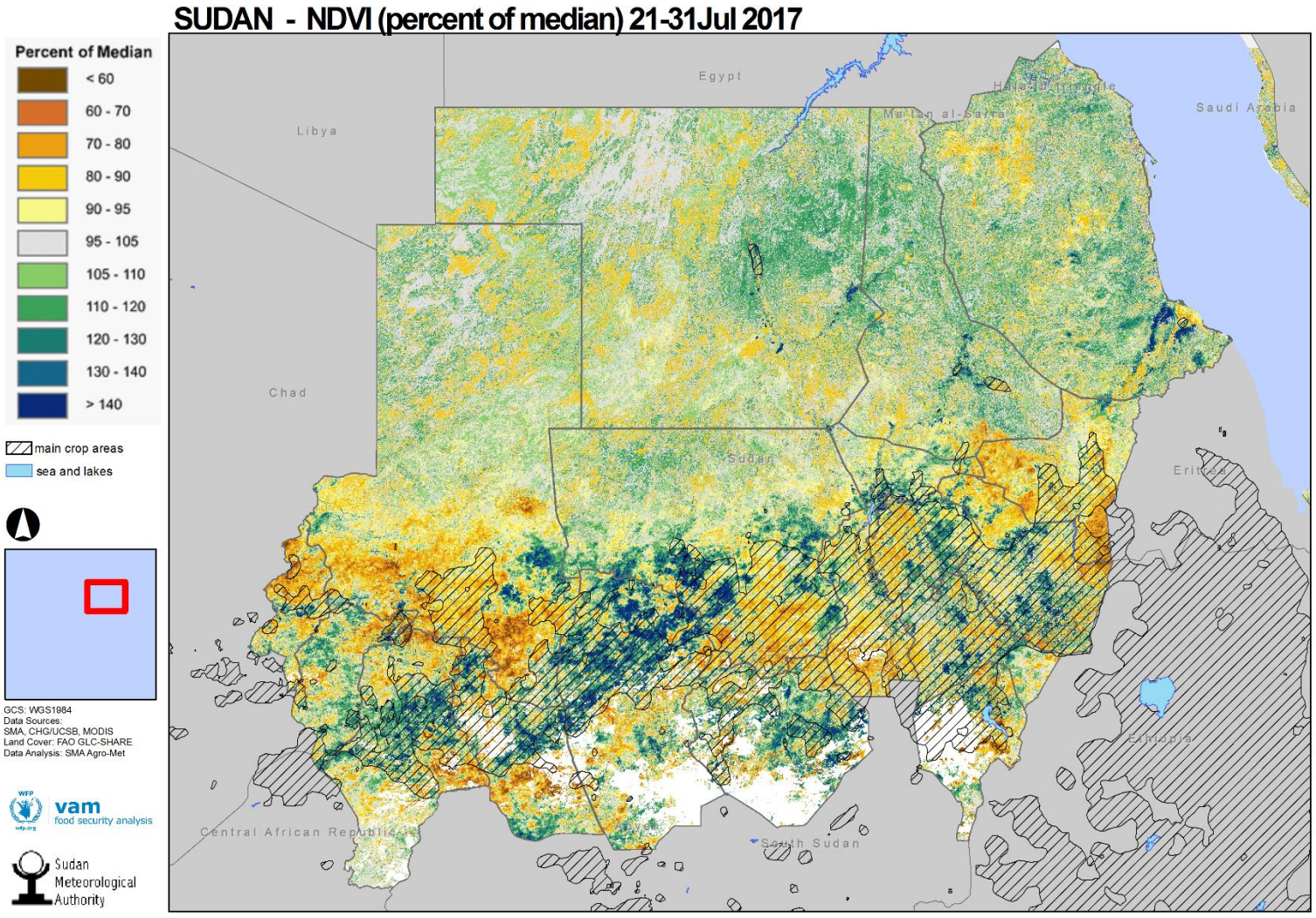


Fig 3: Vegetation Conditions as NDVI Percent of Median by 31-July

- Vegetation patterns are very variable, with areas of below and above average vegetation cover close to each other.
- Above average vegetation noticed over the western area of Northern Kordufan, east of Southern Kordufan states and scattered areas in Southern Darfur , Southern Kordufan, Gezira, Sennar and Gadaref states, elsewhere, below average vegetation conditions noticed by the end of July *(Fig 3)*.

Start of the 2017 Season

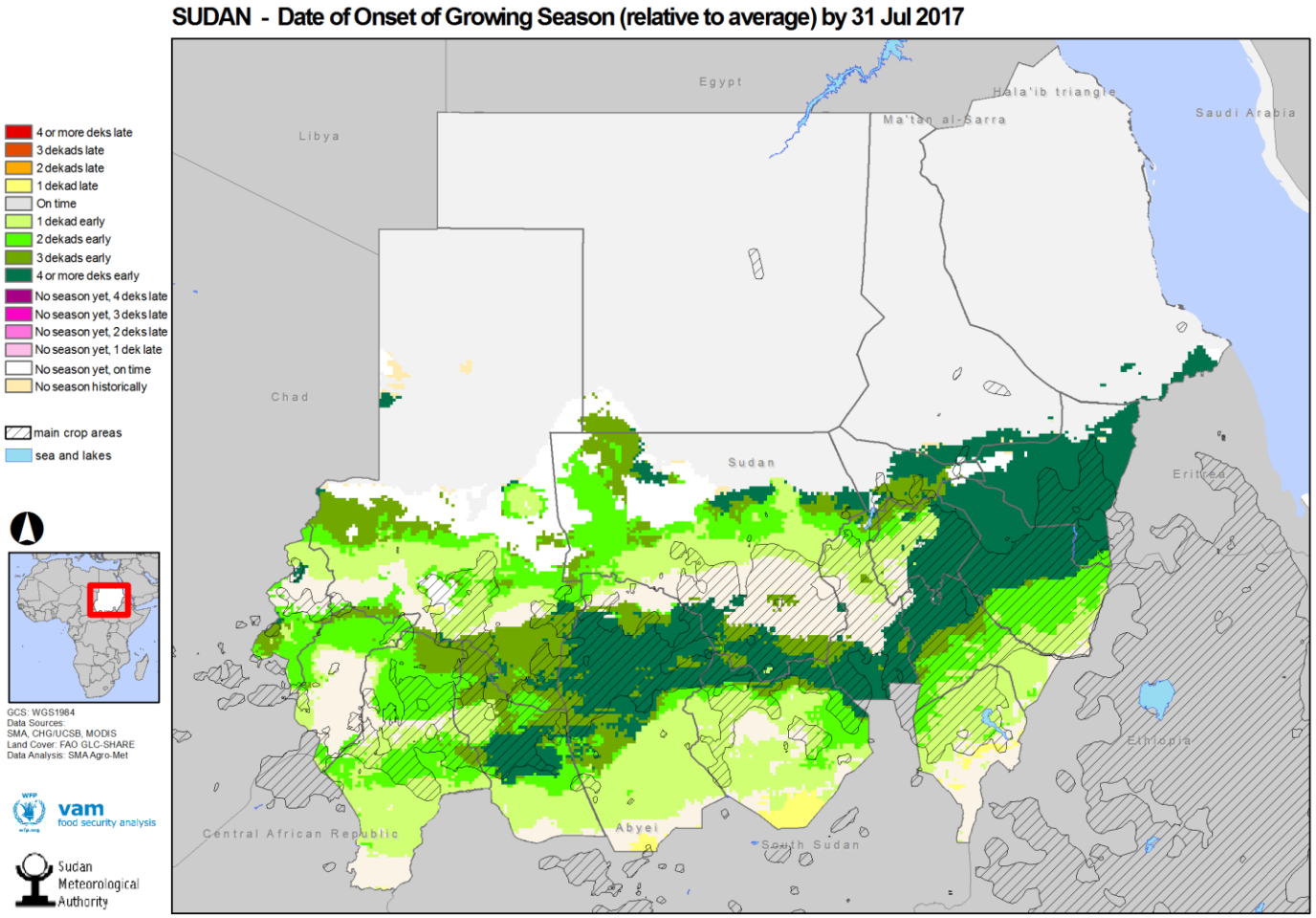


Fig 4a: Date of Onset of Growing Season (relative to average) by 31 Jul 2017

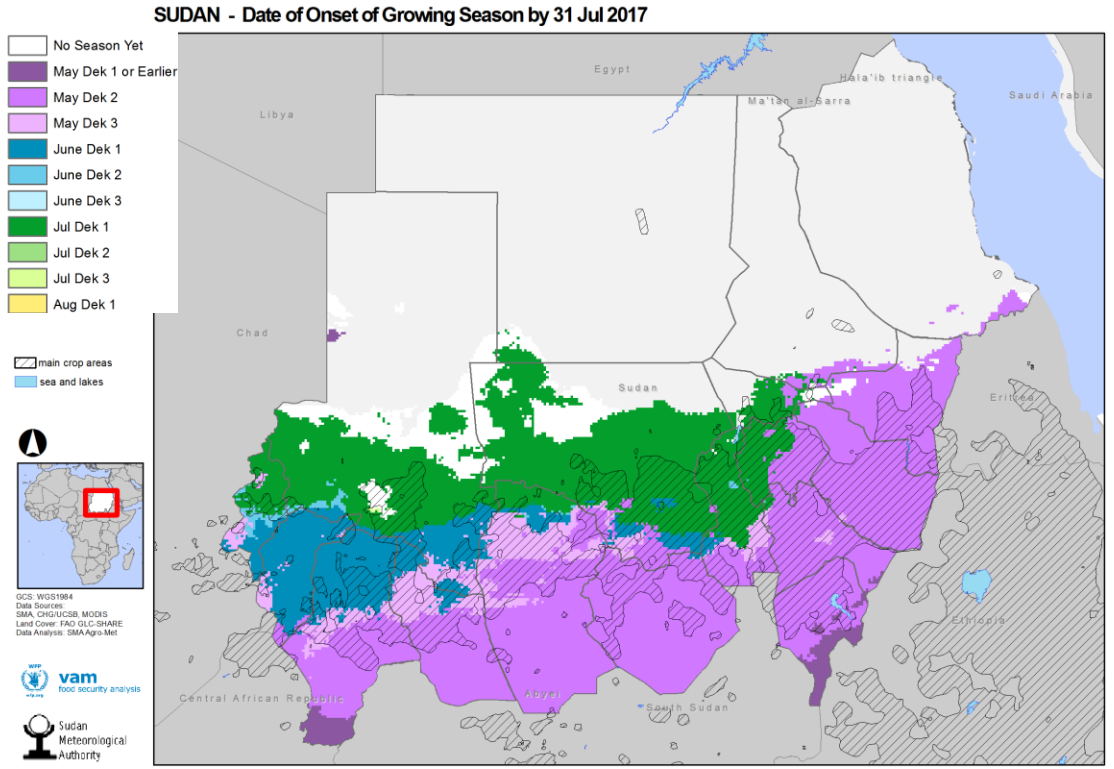
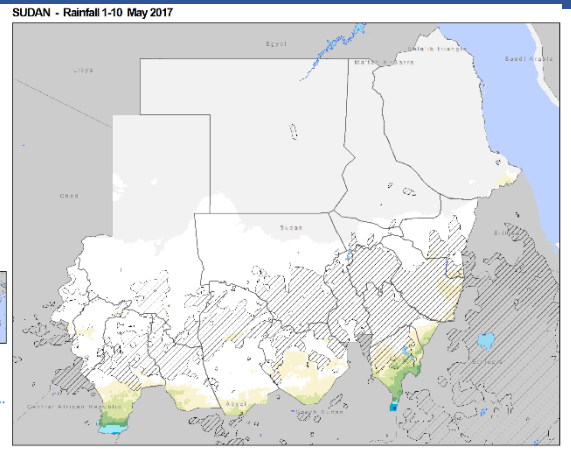
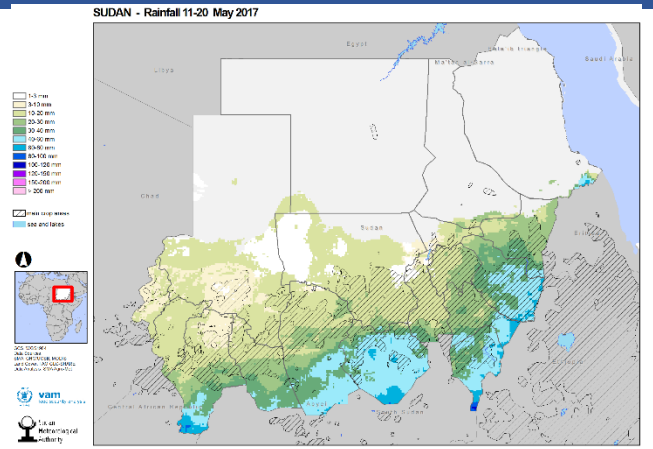


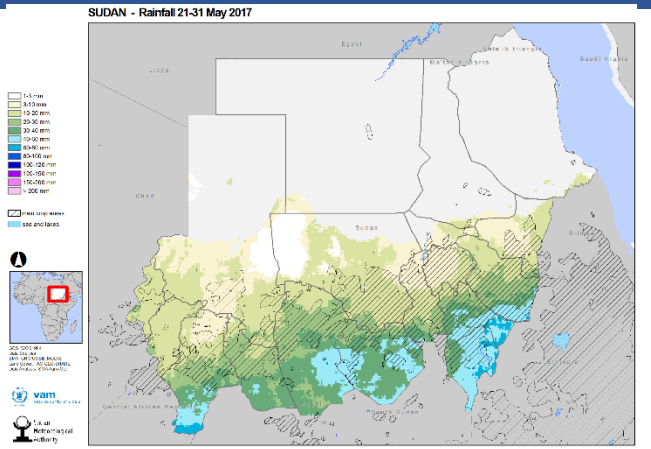
Fig 4b: Date of Onset of Growing Season by 30 Jul 2017

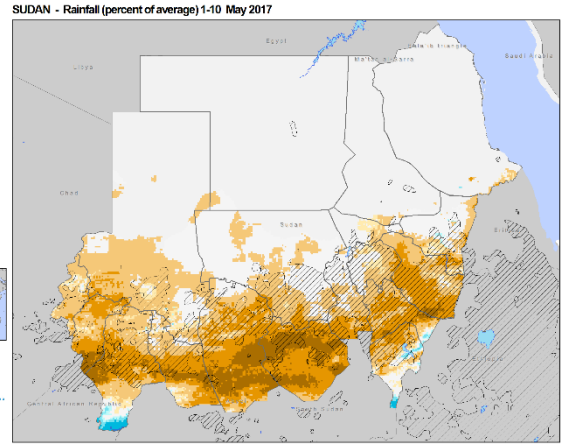
- Start of the season takes place when enough rain accumulates to allow the start of planting activities *(Fig 4b)*.
- Comparing the start this season with an average of the last 30 years, we can see that over most of the country, the season started timely or earlier than usual (green shades in the map) *(Fig 4a)*.
- This corresponds to the wetter than average season till mid June as shown in the rainfall maps.

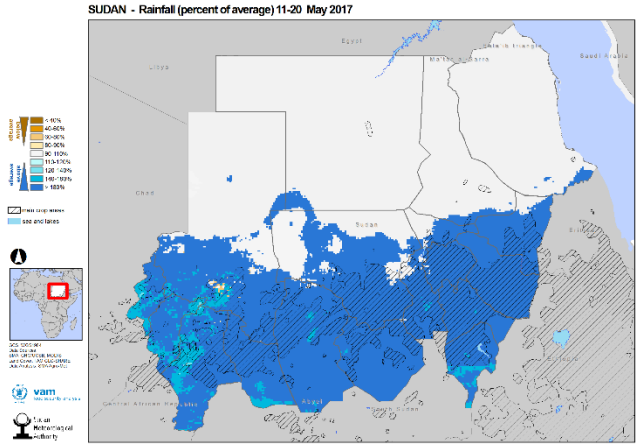
The 2017 Season: Month by Month

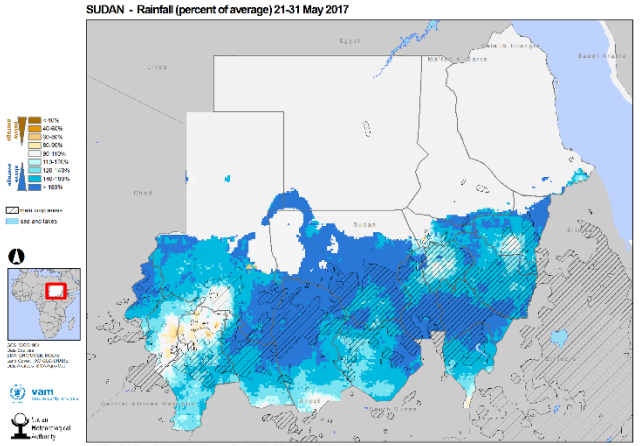


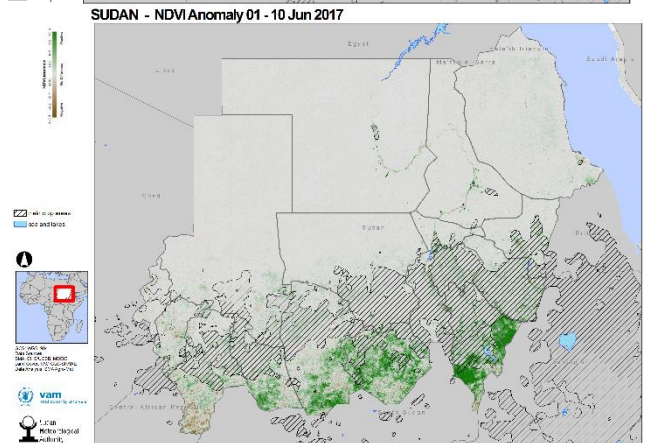








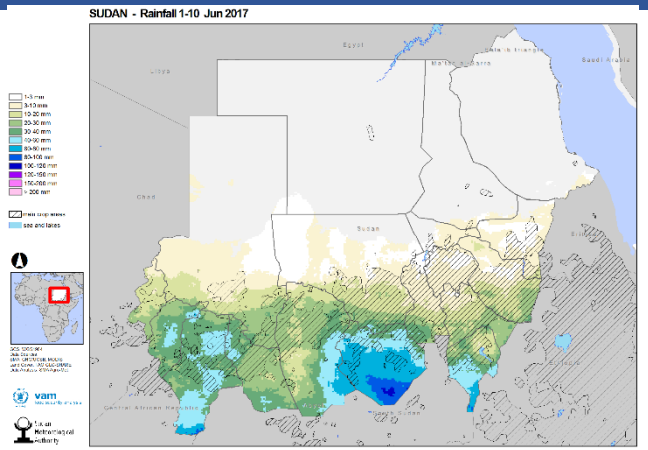


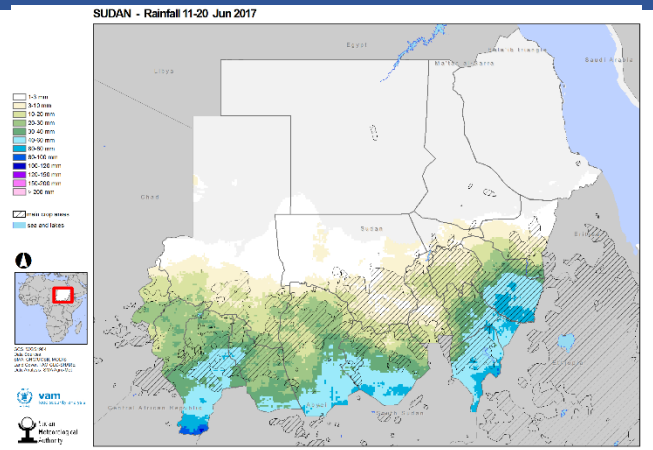


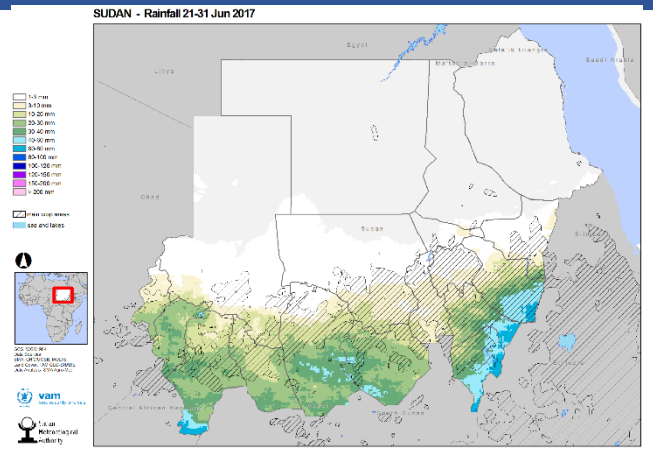
MAY 2017

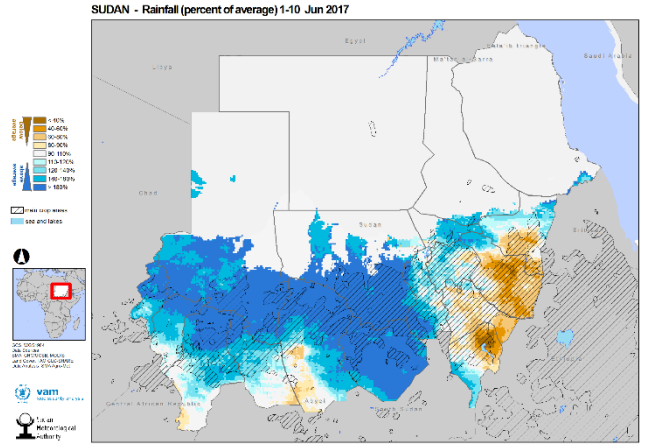
Drier than average conditions during early May across the country, and highly better situations for the rest of the month countrywide, with good early rains in Great Kordofan and Blue Nile state corresponding spike in greenness during early June.

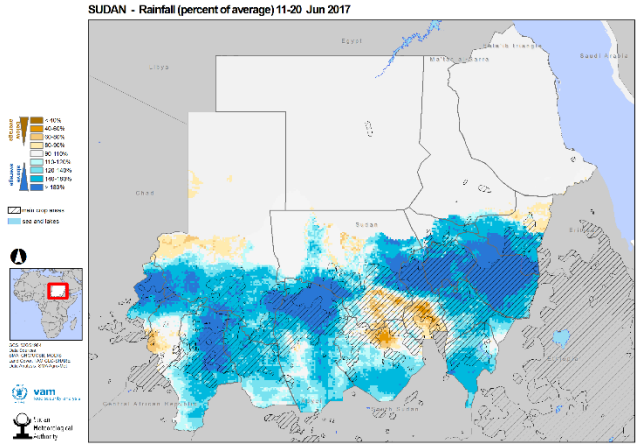
The 2017 Season: Month by Month

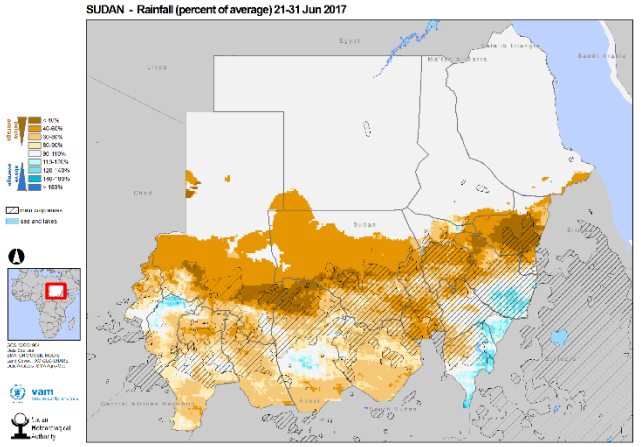


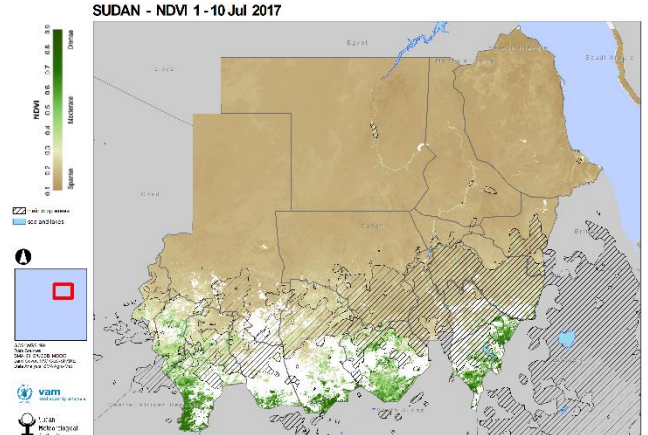








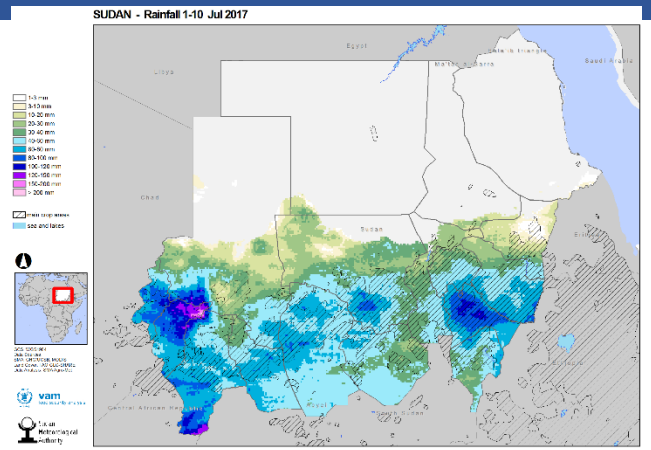


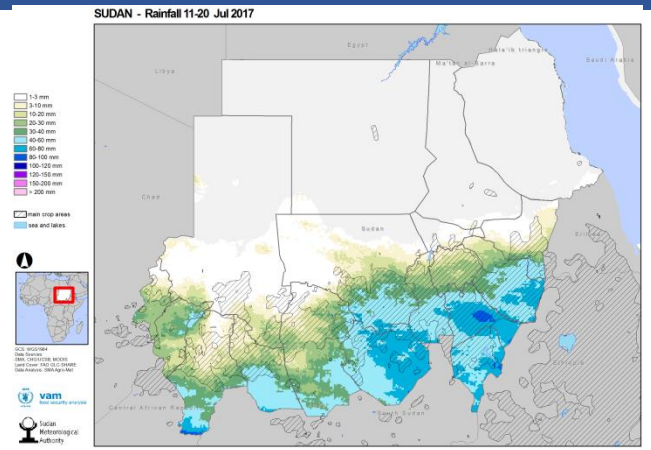


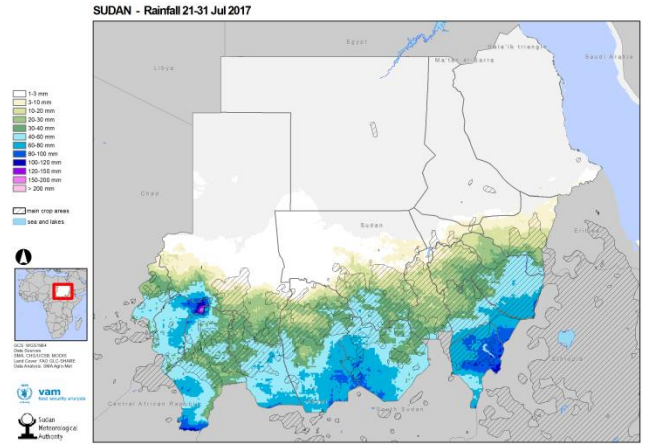
JUNE 2017

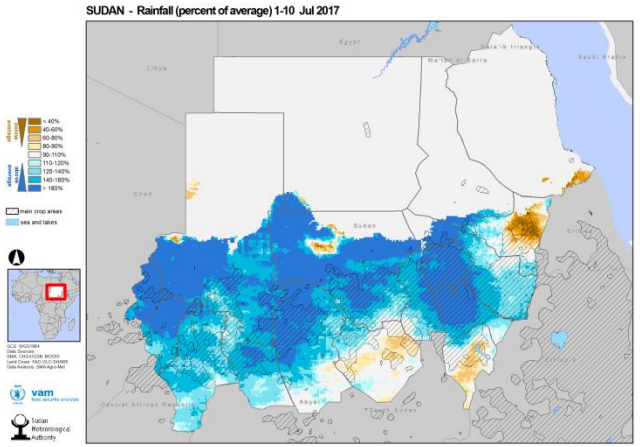
Mostly wetter than average in early Jun over Greater Kordofan and Darfur unlike the eastern region with below average rainfall . Mid Jun characterized by above average rainfall across the country, the exception was scattered areas in White Nile and central Kordufan. Drier than average conditions prevailed in late Jun what may distress the vegetation cover development as noticed in early Jul NDVI map.

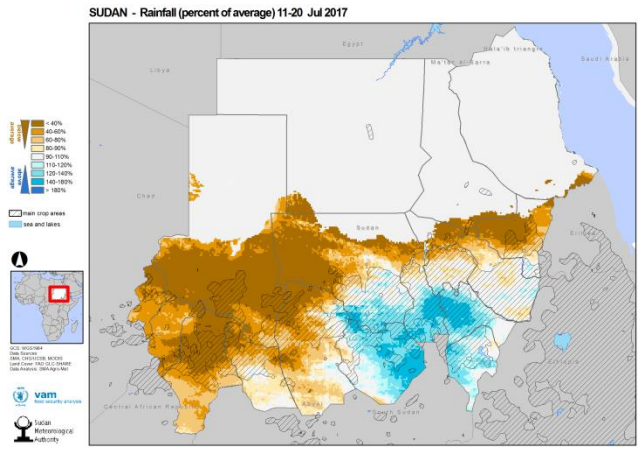
The 2017 Season: Month by Month

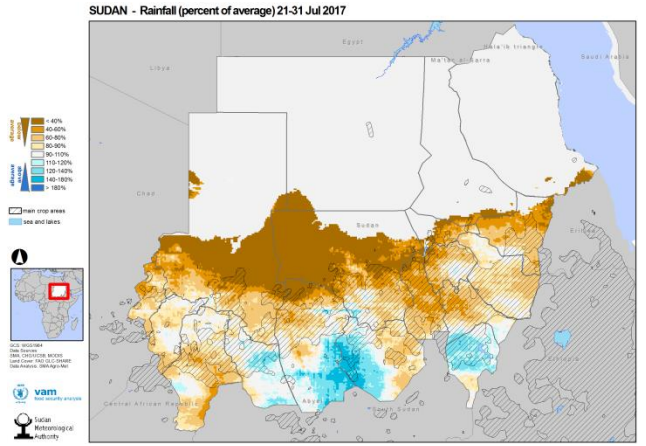








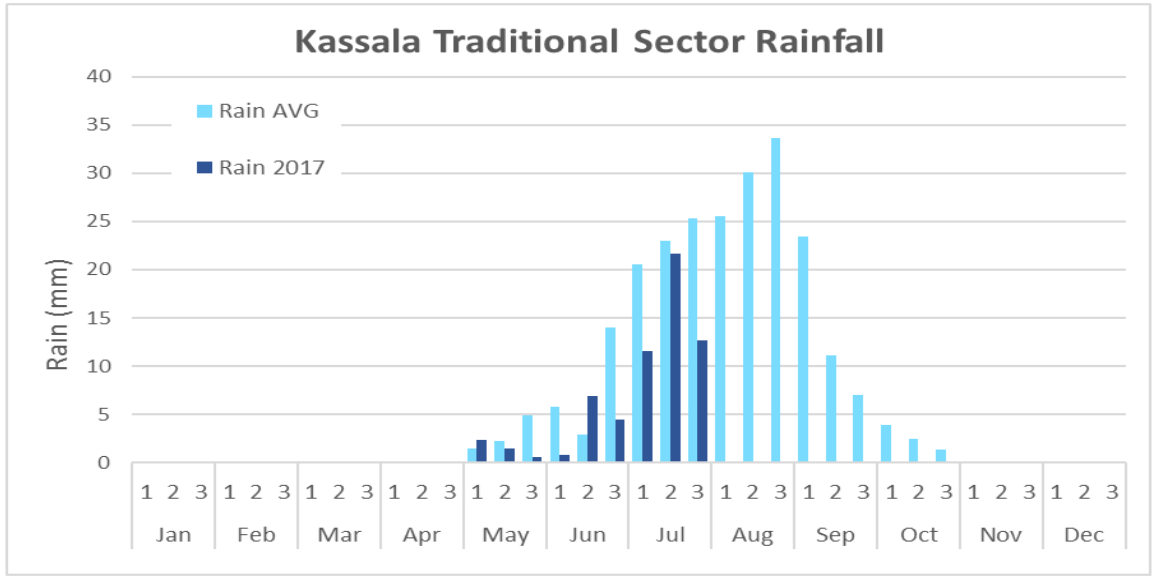


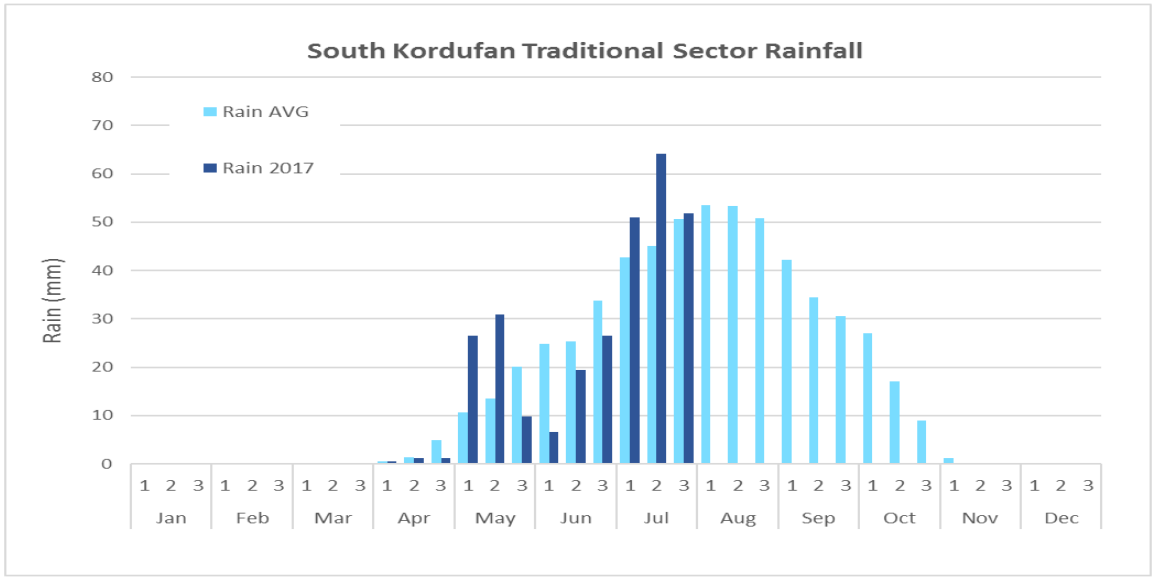


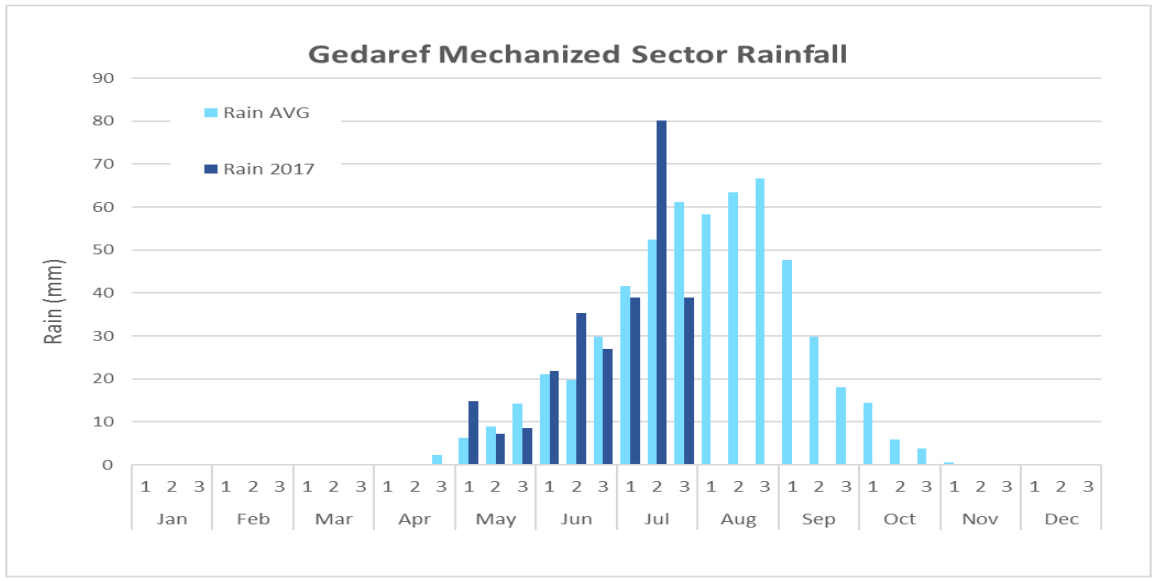
JULY 2017

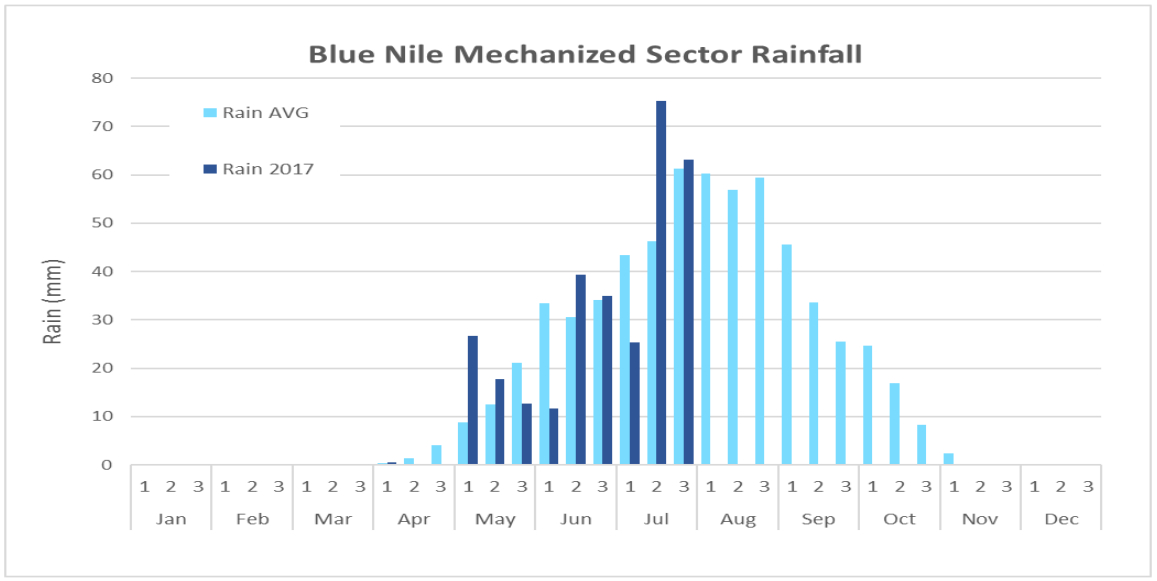
Wetter than average condition in early July across the country, unlike east of Kassala and the southern parts of Blue Nile and Southern Kordufan states with average to below average rainfall amounts. Mid July characterized by below average rainfall except scattered areas in White Nile, Sennar, Blue Nile and central Kordufan. Drier than average conditions prevailed in late July what may affect crop progress and pasture growth, but expected to improve with August rains.

Agricultural Sector Monitoring

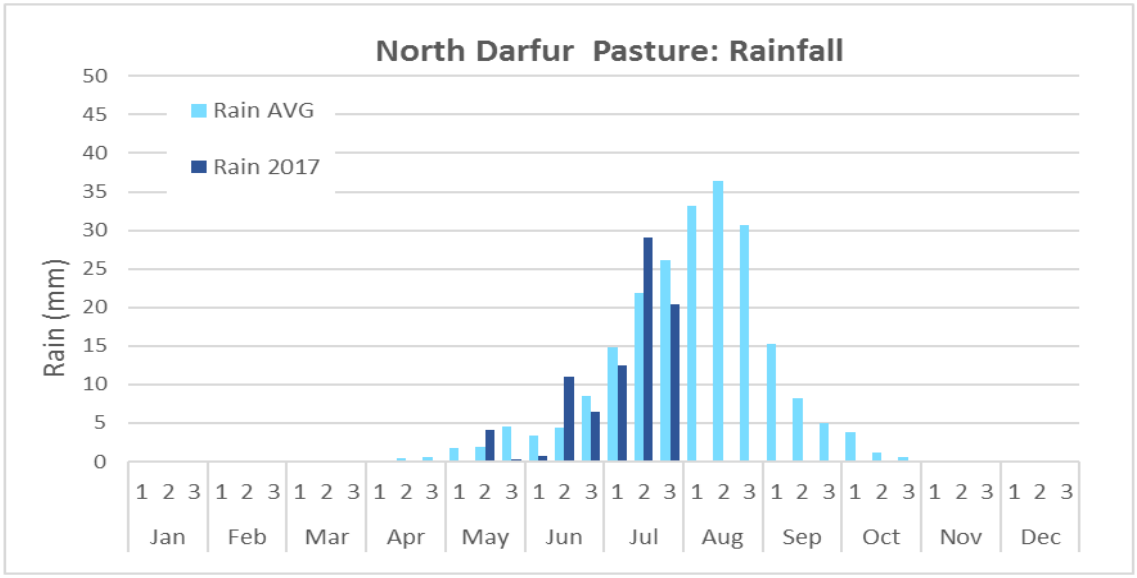


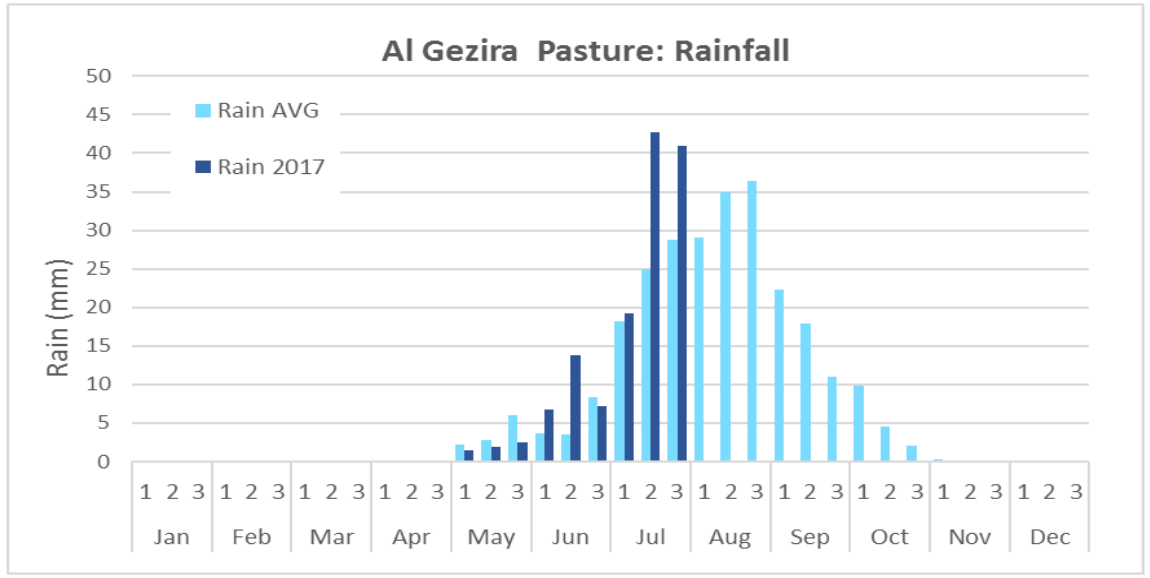


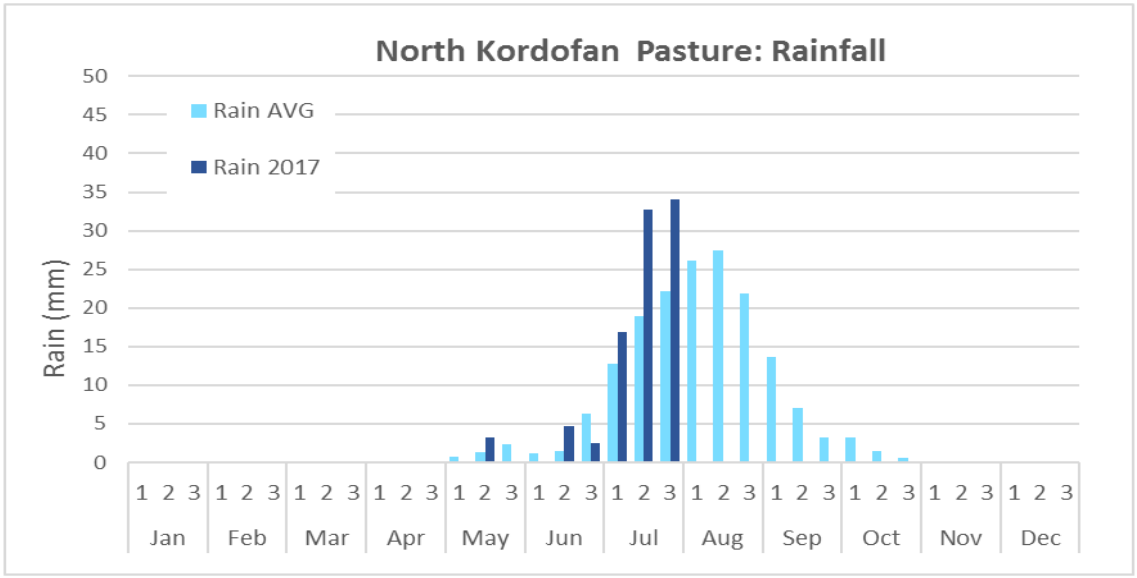


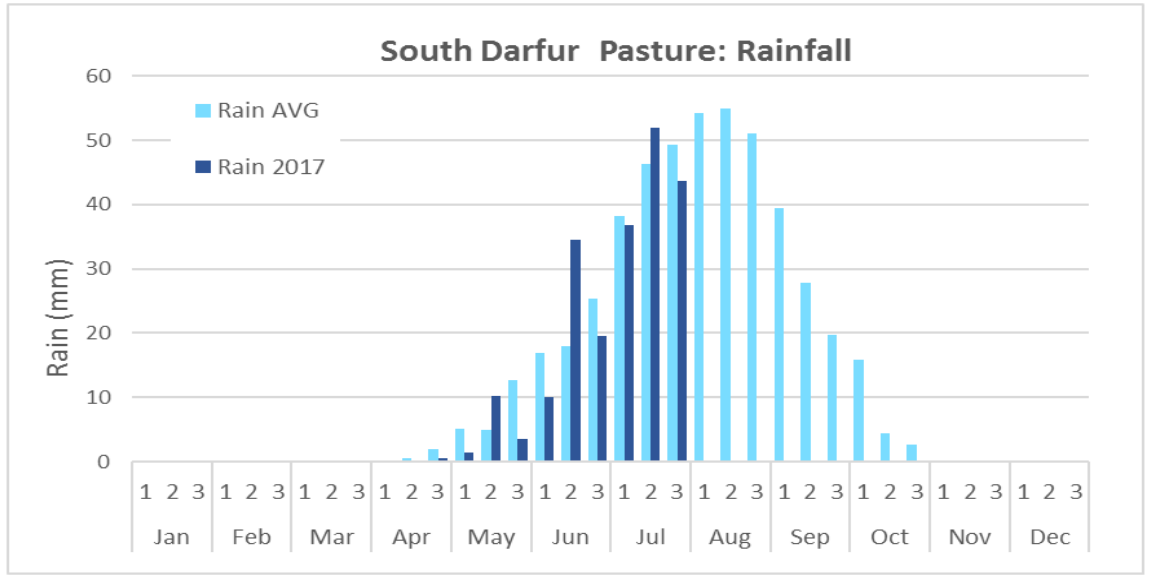


Pastural Sector Monitoring









Seasonal calendar for typical year

	Months															
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
land pre+ planting(sorghum + millet)																
growth cycle (sorghum + millet)																
harvest (sorghum + millet)																
lean season																
wheat l.pre+ planting + harvest																
growing cycle (Wheat)																
rainy season																
autumn grazing areas (moving north)																
summer grazing araes (moving south)																
conflicts (herders + farmers)																
drought + dry spells																
flooding																

Sudan has a unimodal rainy season with peak occurring during July-August and September , where more than 70% of the annual rainfall occurs during the growing season.

Drought

- **With the growing impacts of climate change, existing threats to community resilience are being significantly exacerbated and increasing the vulnerability of those already at risk.**

- The refilling of watering points guarantees an adequate water supply for watering animals and engaging in farming and income-generating activities.

- New vegetative growth is improving the availability of pasture for animal herds on their movement towards rainy season grazing areas in North Kordofan and North Darfur states as well as Butana Plains .

- The combined effects of good rainfall conditions, good grain availability on domestic markets and affordable prices have strengthened food security conditions in farming areas.

- good performance of rainy season help insured the normal growth and development of planted crops, with most millet and sorghum crops in the flowering stage and grain filling stages.

Crop Production in the Rain fed Sector

- Crop production in the rain-fed sectors exhibits very wide annual fluctuations as a result of unreliable rainfall amounts and distribution which can result in late sowing, long dry spells, flooding from intense downpours, the necessity to re-sow.

- The situation in the irrigated sector, however, is much more predictable. Nevertheless, viewed globally, yields are generally low in all sectors for various reasons as well as rainfall.

- These include, inter alia, a shortage of efficient, well-maintained farm machinery, a shortage of credit and working capital, the use of low-yielding crop varieties, inadequate maintenance of irrigation canals, inefficient irrigation pumps, and poor agricultural practices such as weed and pest control.

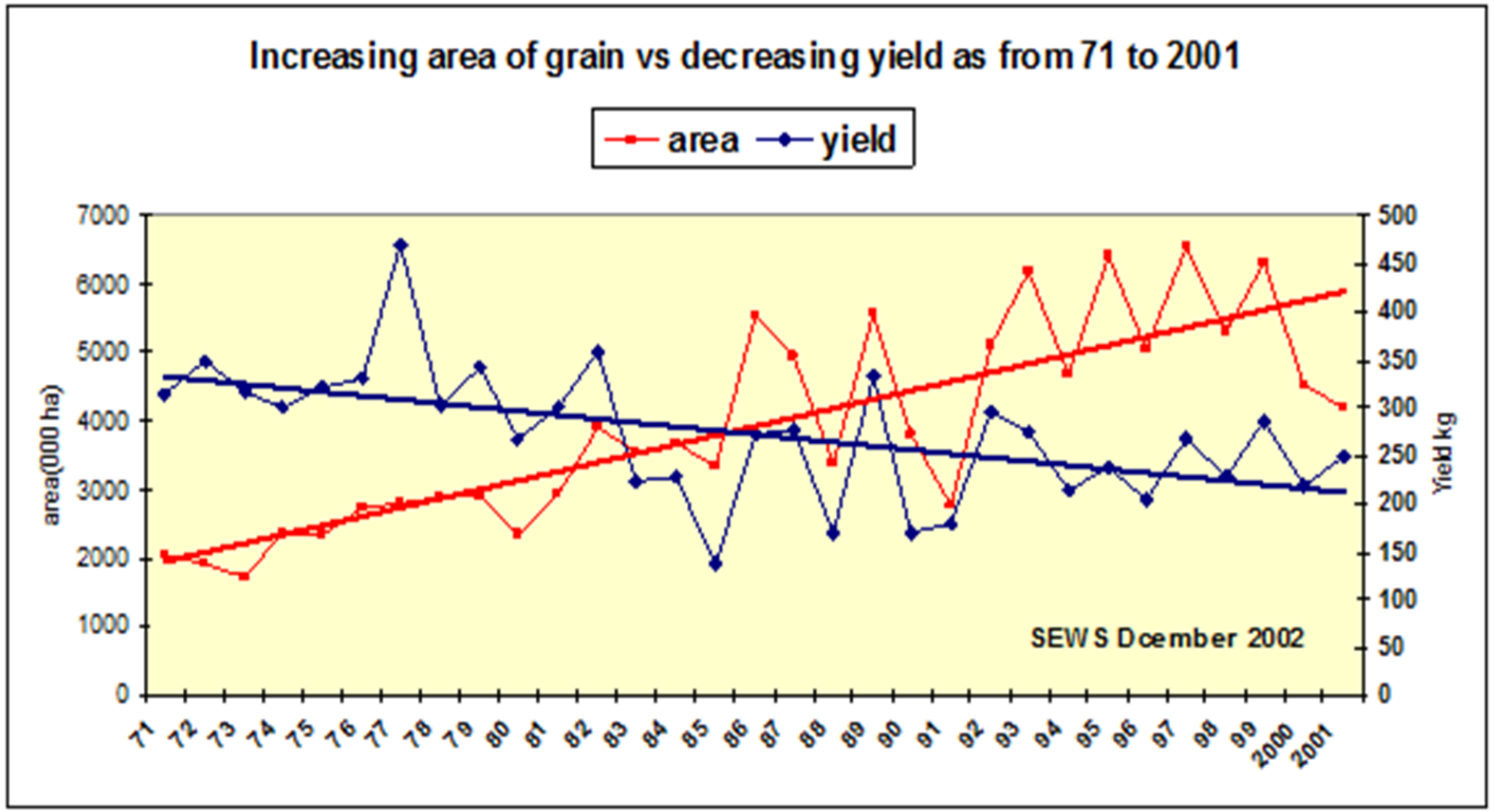
Factors affecting the severity of drought

- **Although the impact of late onset and early end of the rainy season on agricultural production may be only moderate, this will hides large pockets of household food insecurity.**

- **water shortages have been known to trigger increased competition for natural resources, thereby creating situations where conflict can escalate.**

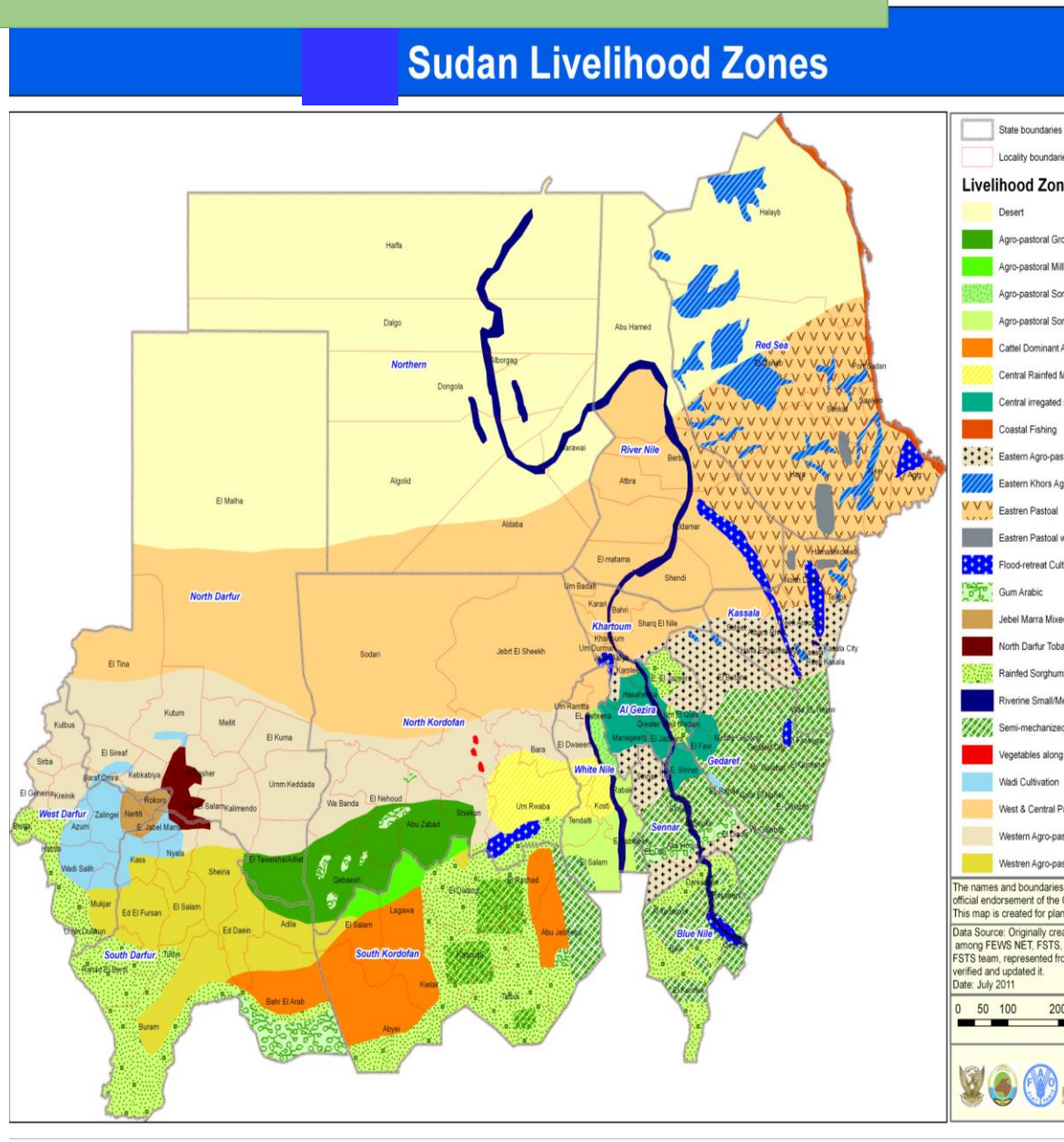
- **significant long-term increase in livestock density on *rangelands* that are reducing accessibility and quality of pasture, the observed net result is overgrazing and land degradation.**

- **There is alarming tendency in declining crop yields in the semi-arid region of the Sudan, while demand is rapidly increasing. The decrease in area of sorghum produced mainly in the mechanized sector is due to the more than one month delay and uneven distribution. Yield is also anticipated to be less as a response to rainfall shortfall.**



livelihood strategies in Sudan

- Based on livelihood strategies Sudan rural population can be classified into 4 major groups:
  - Subsistence sedentary crop-rearing societies in traditional rain fed sectors
  - transhumant livestock-rearing societies in traditional sector
  - owners of and labours on mechanized agricultural sectors
  - societies in irrigated sector
- Most of the recorded local conflicts between the first two groups: fighting over access to land and water in traditional sector.



The impact of drought on food security

- Reduced income for farmers and agricultural labour.
- Decrease in prices of livestock as farmers are forced to sell, because increase in the cost of pasture and purchased food.
- Increase prices of stable food.
- Inability of certain groups within the population to afford increased food prices, result in:
- Switch to cheaper and sometimes wild food
- Reduction in overall food intake
- Selling assets to raise purchasing power
- Migration in search of employment opportunities.
- Migration to where relief food is being distributed.
- Competition for access to water resources may lead to increased incidence of local disputes, tribal conflicts
- Water shortages during long drought periods may have an impact on the quality of water, resulting in sanitation problems and an increase of diarrhea diseases.

Early Action

- **Building Strategic Reserve: The Strategic Reserve Corporation Cereals Stock till early August was estimated at one million tons.**
- **Expansion of cultivated areas in irrigated sector: Increased areas under sorghum in irrigated sector in Geziera scheme from 400.000 feddan as planned earlier to more than 700.000 feddan to compensate the decrease in sorghum areas in the mechanized rainfed sector .**
- **The government planned to import about 2 million tones of wheat through the commercial channel to bridge the expected gap.**

Preparedness and Mitigation measures

- **Diversification and integration of pasture management, livestock and crop production; Diversified income sources will made households more resilient to climate variability**

- **Identifying and strengthening local breeds of livestock that have adapted to local climatic stress and improving local genetics through cross-breeding with heat and disease- tolerant breeds**

- **Introducing drought resistant varieties of sorghum**

- **Reduction of livestock numbers, a lower number of more productive animals lead to more efficient production.**

- **Improved management of water resources through the introduction of simple techniques for localized watering accompanied by infrastructure for water harvesting**

Flood

There are two main types of flood in Sudan:

1. **Flash floods generated by torrential rainfall**

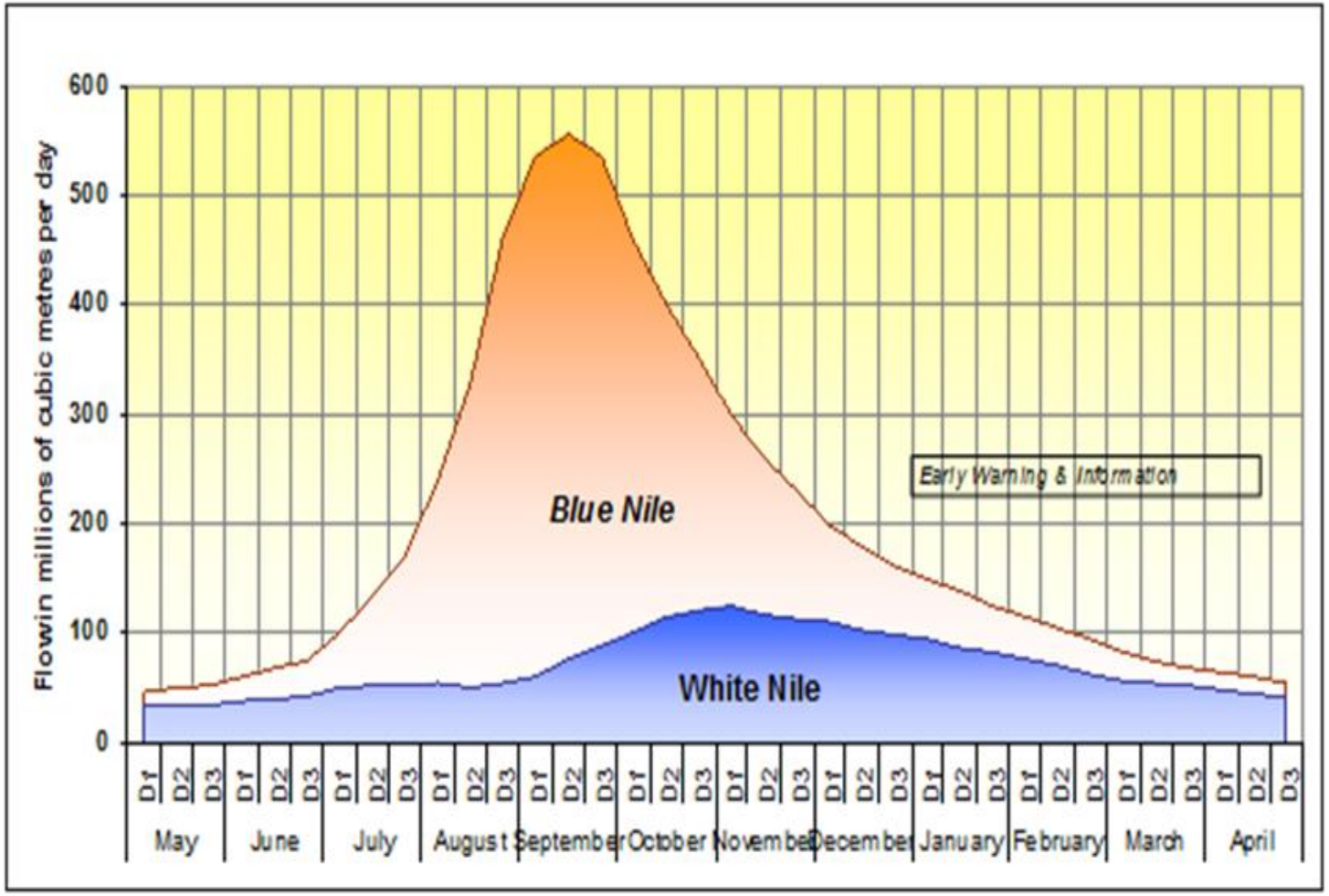
   Flash floods are formed from excess rains falling on mountainous areas and upper streams and run to the lower parts with high speed and force, often resulting in losses of human life and property

2. **River floods which takes place along the River Nile and its tributaries.**

   During the rainy season, the Blue Nile and tributaries create severe flood risks.

Riverine flood

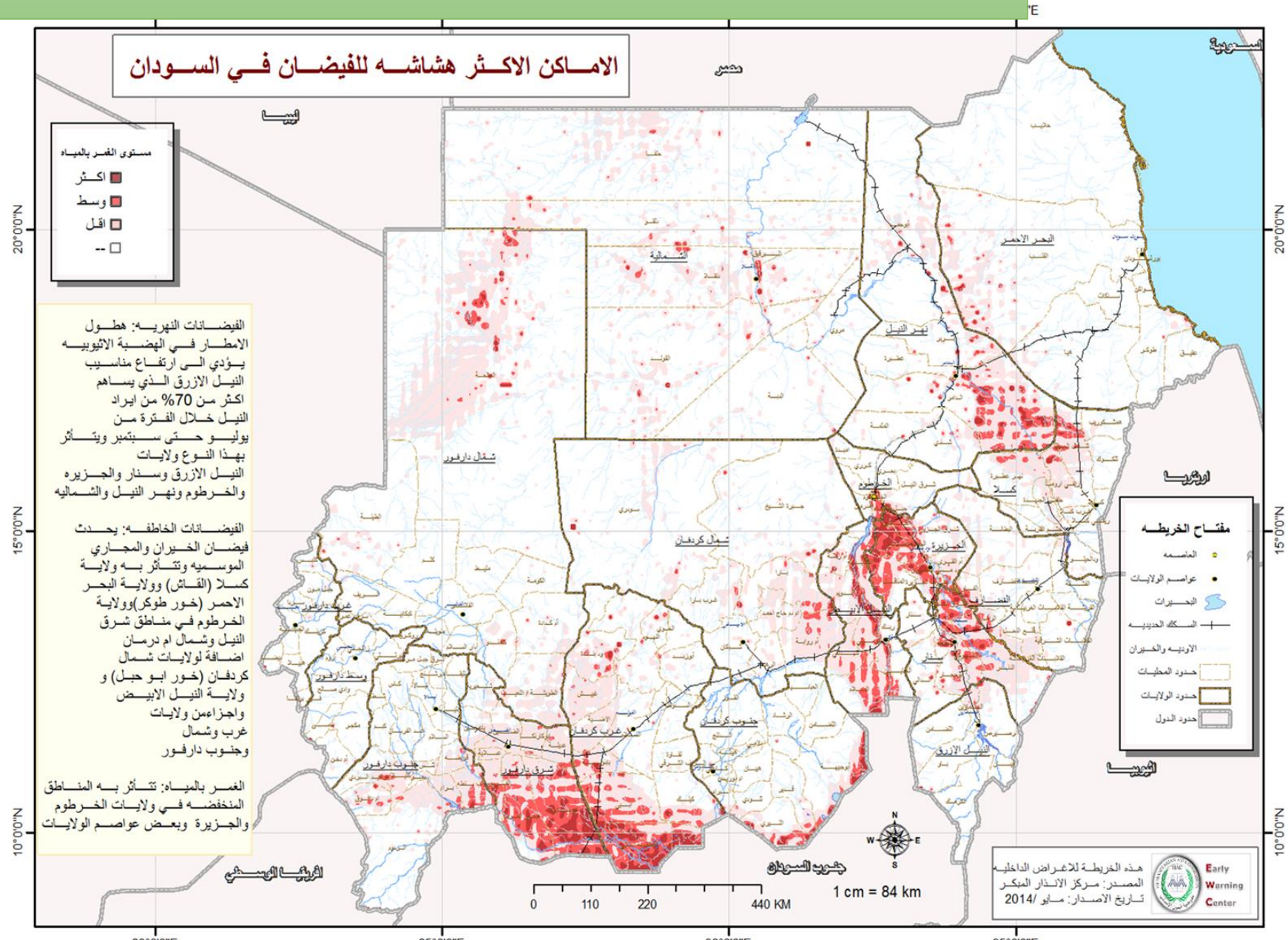
- The Nile's water started to increase in July due to the heavy rainfall that occurs in the Ethiopian highlands.
- When the Nile is at its lowest levels throughout April and May, the White Nile actually supplies the river with over 80 percent of its water.
- The Blue Nile is somewhat responsible for the flooding that occurs in Sudan in August and September. Levels start to rise in June, reaching their maximum level in Khartoum in mid August.
- By August the rivers level averages more than 16 m at Khartoum. Fortunately, when the Blue Nile is flooding it holds the White Nile back.
- At this stage the White Nile is responsible for contributing 10%, the Atbara river for 20% and the Blue Nile for 70%.



Water level stations monitored during the flood season

Flash flood

- occur as a result of heavy rainfall and it affects areas located on the slopes of the highlands and valleys and low-lying areas. This type of flood considered one of the most dangerous because it allows very short lead time



Vulnerability to Floods by State

- **Based on the worst scenario, states potentialities to flood risk are categorized as follows:**

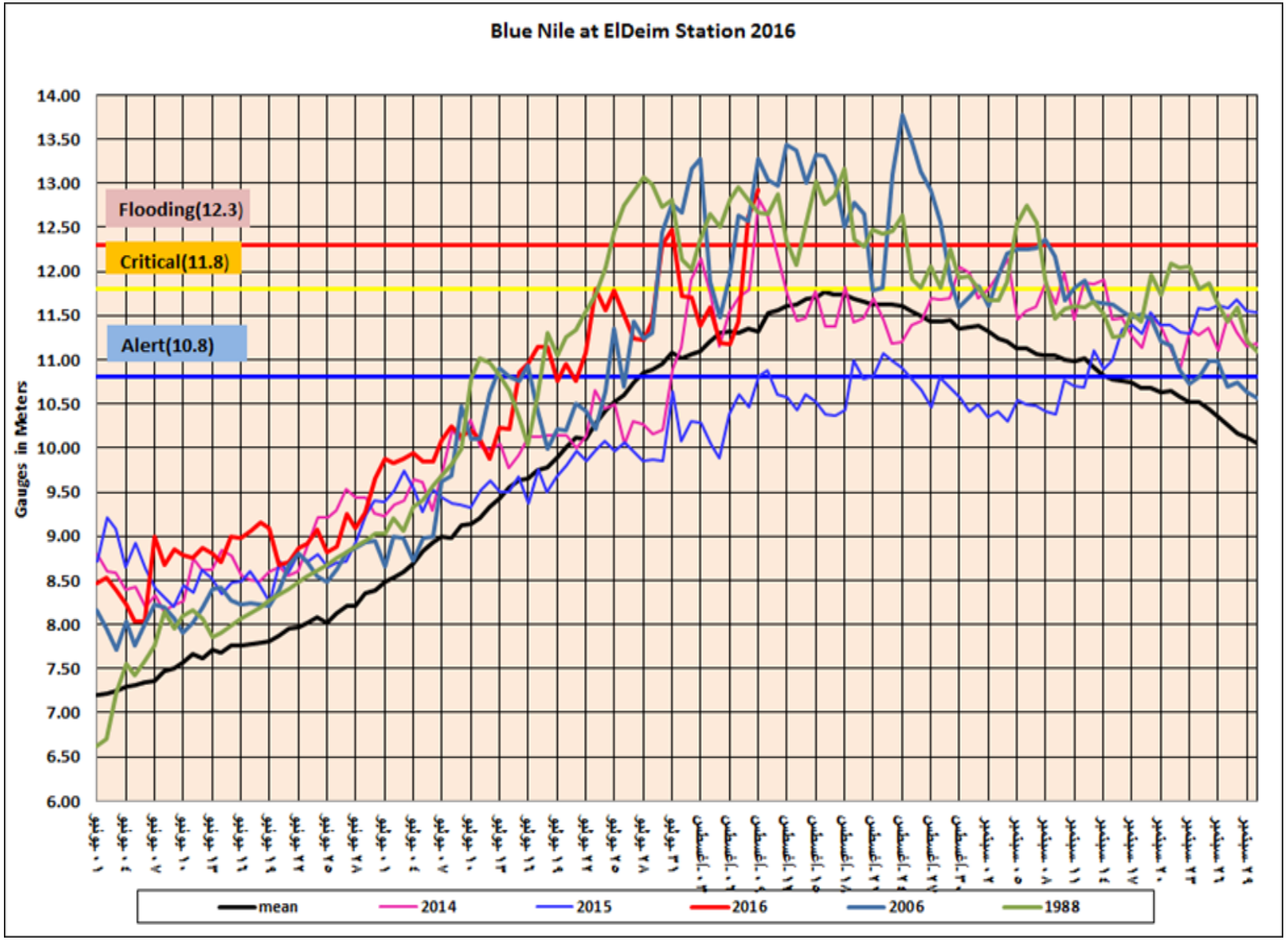
	States	Potential impacts	Flood impacts
	Khartoum, Gezera, Kassala	Very High Threat to Life and Property, numerous rescues, evacuations of and damage to homes/and public utilities	Disastrous
	White Nile, Sinnar	Major Damage :High Threat to Life and Property, several rescues, evacuation of and/or damage to several homes and public utilities	Severe
	South Darfur, Gedaref, Blue Nile, North Kordofan, Red Sea	(Considerable damage: Some rescues, evacuations, few houses/public utilities flooded	Moderate -minor
	West Darfur, South Kordofan, River Nile, North Darfur.	Light Damage: Numerous road closures, numerous creeks and streams flooding	Minor - moderate
	Northern state	Little or no damage: Few road closures, creeks and streams out of their banks	Little or no impacts

Flood and their humanitarian impacts

- In **2013** rains resulted in flood damage to varying degrees in all 18 states of Sudan with an estimated **500,000 people** affected throughout the country, Khartoum state was the most affected area, followed by Gezeira and Blue Nile states.
- In **2014**, heavy rainfall caused floods, affecting some **280,000 persons**
- In 2015 (el Nino), impact was limited: some **51,000 persons**
- In 2016 affected population was **216 000 persons**

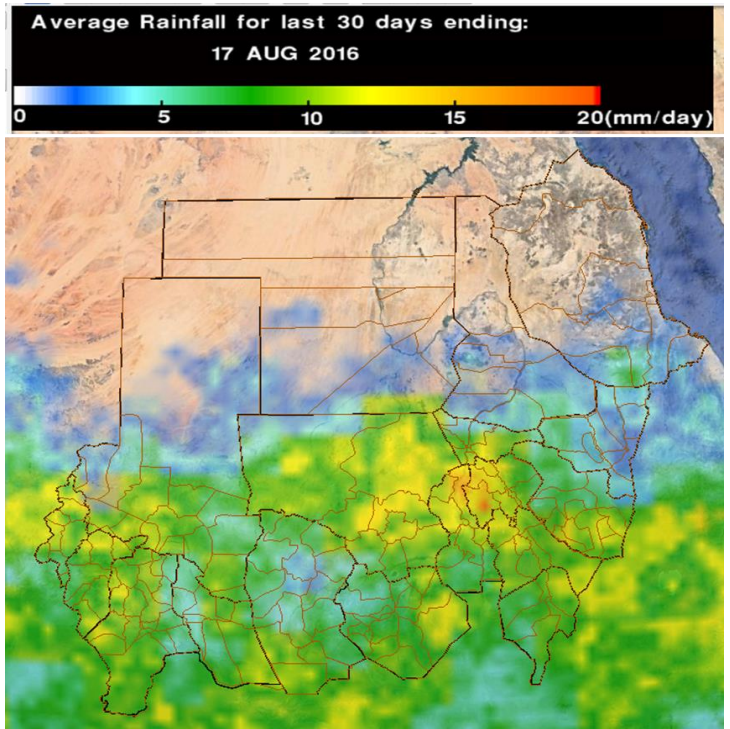
Early Warning- Ministry of Water Resources

- **The MoWR provided A daily sheet, daily report on water levels readings, covering Damazine- Sinnar monitoring unit; the Sinnar – Khartoum unit; Khartoum – Shandi; Khashm El Gerba – Atabra; Atabra – Marawi Dam.**
- **A separate Directorate focuses on El Gash flooding in Kassala State.**



Early Warning- HAC

- EWC of HAC in coordination with SMA and MOWR provides a **flood watch update** on 3 day basis including but not limited to rainfall prediction, rainfall performance for the previous 3 days, damages and losses and river water levels.



بسم الله الرحمن الرحيم

Ministry of Social Welfare

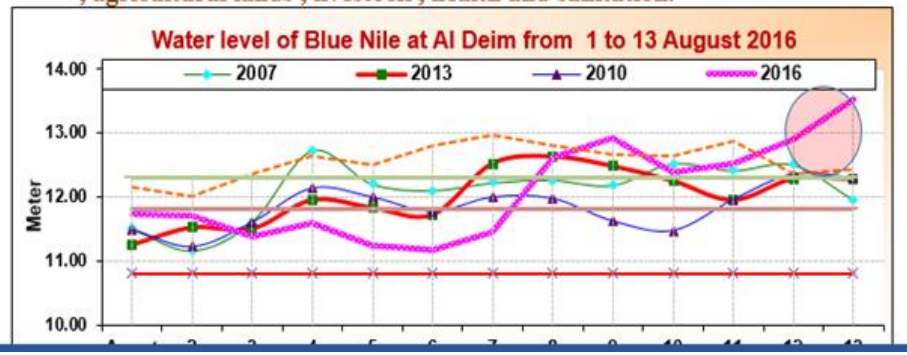
Humanitarian Aid Commission (HAC)

Multi-Hazard Early Warning and Mitigation Center (EWARN)

Vol 16 # 10	Flood Watch update	13/8/2016

Blue Nile River: Big wave coming, endangering Sennar, Gezera , Khartoum , River Nile, Northern and White Nile state

- As reported by MOWR , Blue Nile at Deim station reading for today 13th of August is 13.52 .This is indicate that the Blue Nile level at Deim station for today is 1 meter higher than the level registered on 11th of August .the level is 62 cm higher the the previous day , 1.1 m hi[Chart Title]n 1988 , 2.72 m higher than alert level and far above the flooding level by 1.22 m.
- The level of the Blue Nile and the main Nile will rise sharply during the coming two day to a Higher than the record level, endangering communities, along the banks of the Blue Nile , the main river Nile course and the white Nile River as well. Blue nile state, Gezera , Khartoum , River Nile, Northern and the White Nile state have to consider the seriousness of the imminent hazard and to take efficient preventive actions to reduce possible adverse impacts on human beings , properties , agricultural lands , livestock , health and sanitation.



Flood Management coordination - 2016

CONTINGENCY PLANNING

contingency plan targeted 350,000 affected individual all states		
Sector	**Targeted pop**	**Needs (Quantity)**
NFIs and Shelter	70000 hh	Blankets 140000
		Tents 14,000
		P.sheet 70,000
Nutrition	72800 individual	
Food Assistance	55000 HH	cerals MT 2250
		legumes Mt 600
Livelihood	65000 HH	Seeds targeted 14000 HH
		Fodder for 25000 head of livestock
		Provision of 800 small ruminants
		Agric hand tools for 8 000 HH
Health	100000 HH	Medicines and health services for 100,000 hh
WASH	160000 individual	Water tankering
	35131 HH	Rehabilitation of 11000 source of water in the affected areas
		Distribution of 800 Jerrecans ,
		Rehabilitation of 13600 latrines
		Training and sanitation activities
	tabs 200 unit	Provision of water purification

350,000 persons were estimated as a planning figure in 2016 according to which sector plans were developed

HAC - Emergency Operation cell (ToR)

The Government of Sudan is leading and coordinating the response, through many mechanisms one of them is the emergency operation cell of HAC, the main functions are:

- **Coordination**
- **Monitoring of Operations , management and facilitation**
- **Information sharing and record keeping**
- **Resource Management**
- **Forwarding of consolidated reports to all designated authorities**

FTF Approach

- **The FTF was established in 2006 encompasses representatives from line ministries, the Sudanese Red Crescent Society (SRC) and United Nations agencies/ sectors.**
- **A sectoral approach is used , sectors are mandated to coordinate the operational aspects of the response, the main sectors are :**
  1. **Basic Infrastructure and Settlement**
  2. **Education**
  3. **Food Security and Livelihoods**
  4. **Health**
  5. **Nutrition**
  6. **Non-Food Items and Emergency Shelter**
  7. **Water and Sanitation.**
  8. **Protection**

National Flood Task Force
RAPID FLOOD SITUATION REPORT

Date.....التاريخ Prepared by (اعداد): .... Organization (المنظمة): .....

Objective: to briefly summarize, (i) Severity of the situation/flood and its impact (ii) Actions being taken locally (iii) Local coping capacities (including locally available resources) (iv) Immediate priorities for external relief required and approximate quantities for the same (v) Best logistic means for delivering relief (vi) Forecast of possible future developments including new risks.

State		الولاية	Locality		المحلية
Town/Village		القرية	GPS ____° ____' ____" شE ____° ____' ____" شN		الاحداثيات
HH AFFECTED:.....الاسر المتاثرة بالسيول		Under 5 years ..... اقل من 5 سنوات		Number of women.....عدد النساء	
Number of displaced HH عدد النازحين		Displaced from النزوح من		Current Location الموقع الحالي	
No of Injured..... جرحى		No of deaths ..... موتى			

Any **vulnerable individuals**/groups (elderly, disabled, chronically ill, unaccompanied/separated children, child-headed HH etc)? If yes, how many individuals per category

.....

Any current/planned **arrangements** for vulnerable individuals

.....

DAMAGE SUMMARY ملخص الخسائر

Damage caused by :سبب الضرر او الخسائر	Heavy Rain (أمطار غزيرة) Date.....التاريخ	Flash flood (سيول) Date.....التاريخ	River overflow (فيضان نهر) Date.....التاريخ
Out of a total number of..... .....homes	Out of a total number of .....latrines	Out of a total number of .....water-points	

National Flood Task Force
Rapid Assessment- Flood season 2016

General Site information					
G1. Take the GPS location		G2. Name of the data collector			
G3. Darfur State	G4. Locality	G5. Administrative unit	G6. Village council	G6. Village	
G7. Who is the key informant?					
Position/ responsibilities:			Geographic area:		
DAMAGE/Situation caused by ☐Heavy Rain		☐Flash flood ☐River overflow			

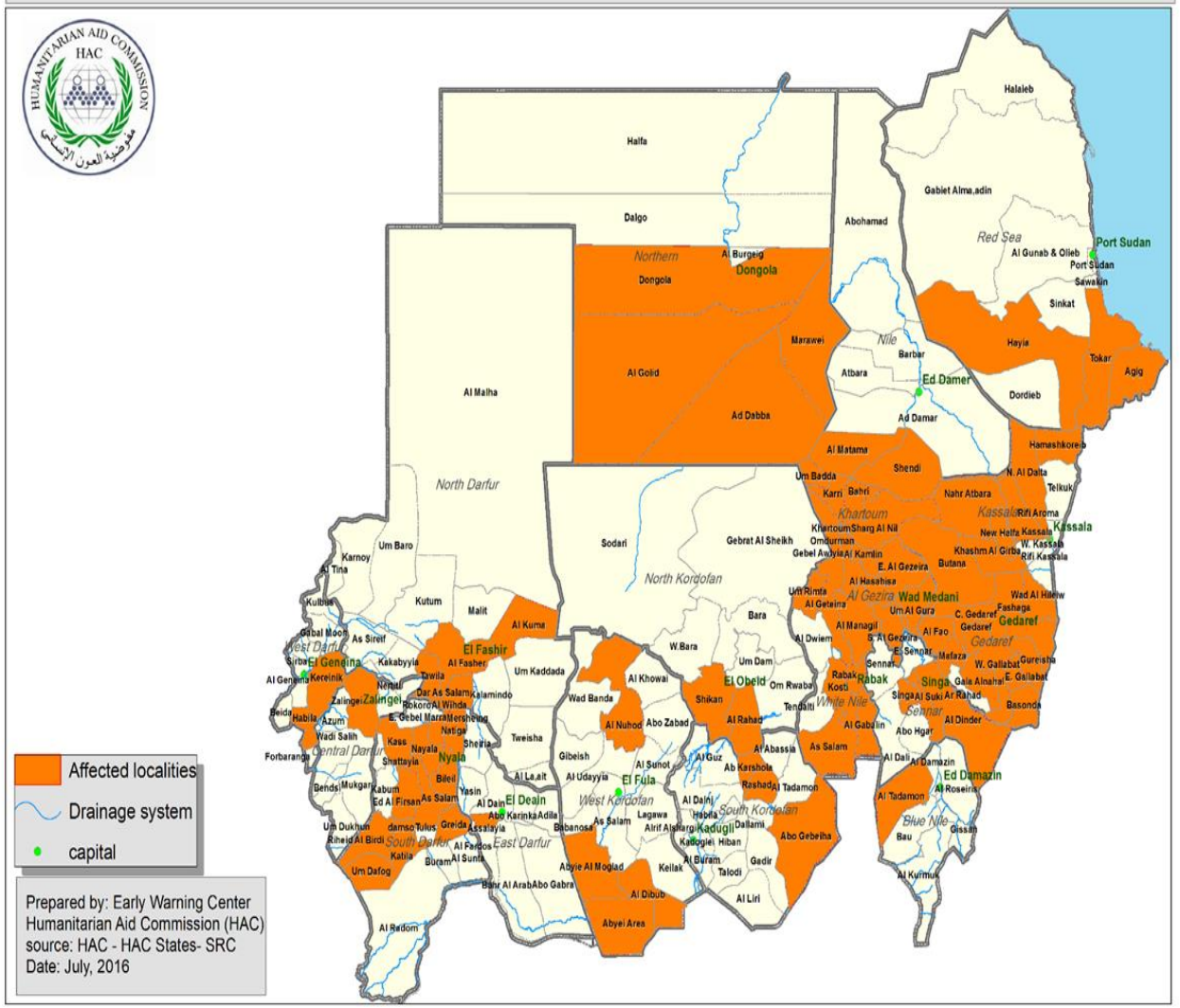
Quantitative Information on affected population		
Please note: The following questions on number of affected and/or displaced households are related only to the current flood. The displaced households by precedent events should be clearly marked as such and considered separately.		
Q1. Approximately, how many households in total are directly affected in this area? (includes IDPs and host community)	Q2. Approximately, how many households are displaced in camps?	Q3. Approximately, how many households are displaced in spontaneous gatherings?
Q4. Approximately, how many households are displaced in community buildings? (schools etc)	Q5. Approximately, how many households are displaced living amongst host community?	Q6. Estimated number of children under 5 years among the displaced HHs?
Q. Estimated number of children under 18 separated from family/without family support among the displaced population?	Q.8. Estimated number of women headed households among displaced population?	Q9. Estimated number of persons with disability/serious medical condition among the displaced population?
Q7. Do you have information about number of men/women among the displaced people?		
☐Approximately or above 70% more men than woman	☐Approximately or above 70% more women than men	
☐Men less than 30 % of total displaced	☐Women less than 30% of total displaced	☐Equal

SUDAN: FLOODING SNAPSHOT

Early June - 09 August 2016

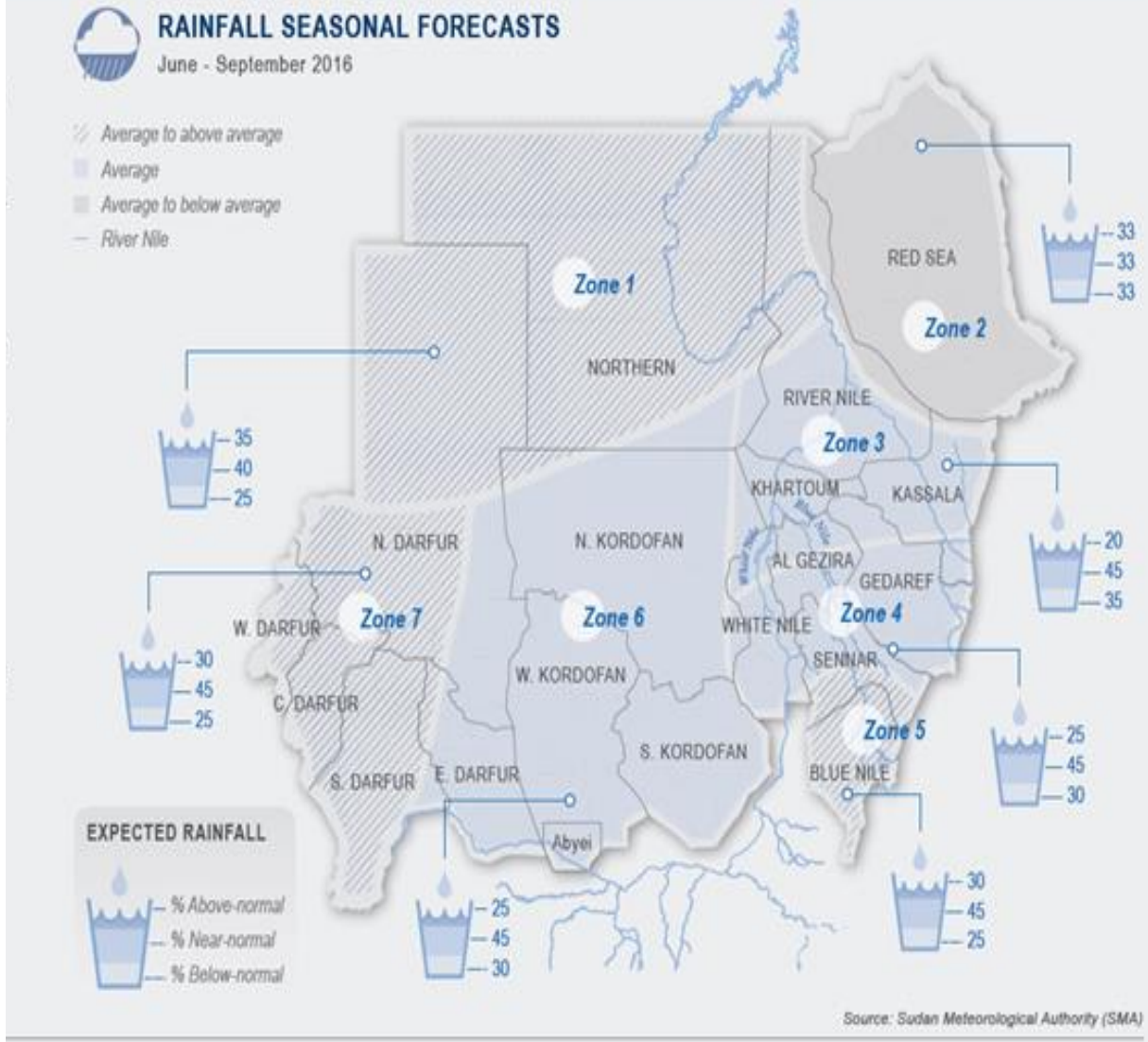
OCHA Sudan

Areas Affected by Flood in Sudan, update 22 August 2016



RAINFALL SEASONAL FORECASTS

June - September 2016



Source: Sudan Meteorological Authority (SMA)

Plan forward

priorities with regard to product and service development

- **Hazard analysis and risk assessment:** Development of a risk-based, multi-agency mechanism at the national and state levels to identify the needs and requirements for DRR services, such as:
  - Data products;
  - Hazard analyses (statistical and forward looking);
  - Forecasts and warnings;
  - Technical advice and operational support;
- Improvement of hazard-analysis products to support risk assessment, through:
  - Building capacities in areas of modeling in order to predict the level of water upstream;(data required are: slop, velocity of water and topography
  - Access to long time series of observations at national and regional levels, which should include

Priorities with regard to Multi-hazard Early Warning System

- It is necessary to develop an EW model based on the availability of climate data, soil analysis and climate water coefficient, this will help us to predict the impact o drought in real time using RS techniques and relationship between NDVI, rainfall and historical data of yield

- Sharing of good practices and transfer of knowledge and experience through workshops and training;

- Strengthening of comprehensive approach that meet the needs of DRM agencies and other stakeholders (in terms of lead time, national constraints,…etc

Thank you for your Attention