MESA
MONITORING FOR ENVIRONMENT AND SECURITY IN AFRICA

Africa-EU Partnership

MONITORING for ENVIRONMENT and SECURITY in AFRICA

From Earth Observation to Policy Making - Advancing Sustainable Development in Africa

CONTINENTAL ENVIRONMENTAL BULLETIN

August 2014

HIGHLIGHTS

Persistent dry conditions were observed from May to July. This might lead to poor crop and pastoral production and impact negatively on food security for millions of people. Seasonal rainfall forecast indicates that the situation is not expected to improve for the rest of the season. Close monitoring of the area is highly recommended.

Bad start of the growing season is observed due to the delay and/or poor distribution of rainfall. Poor yields and below average biomass production are expected as rainfall forecasts indicate average to below rainfall during the remaining period of the season. Close monitoring is recommended.

Favourable conditions of vegetation growth resulting from good rains led to above average vegetation, reaching in some areas the historical maximum.

Flooding events due to heavy rains from June to August caused loss of lives and displacement of people, damage to infrastructure, properties, crops and livestock.

The coast of Senegal-Mauritania and parts of the Indian Ocean north of Madagascar were cooler than usual. Warming of the ocean surface is expected along some parts of the African coast which has the potential for reducing biological production in the major fishing grounds.

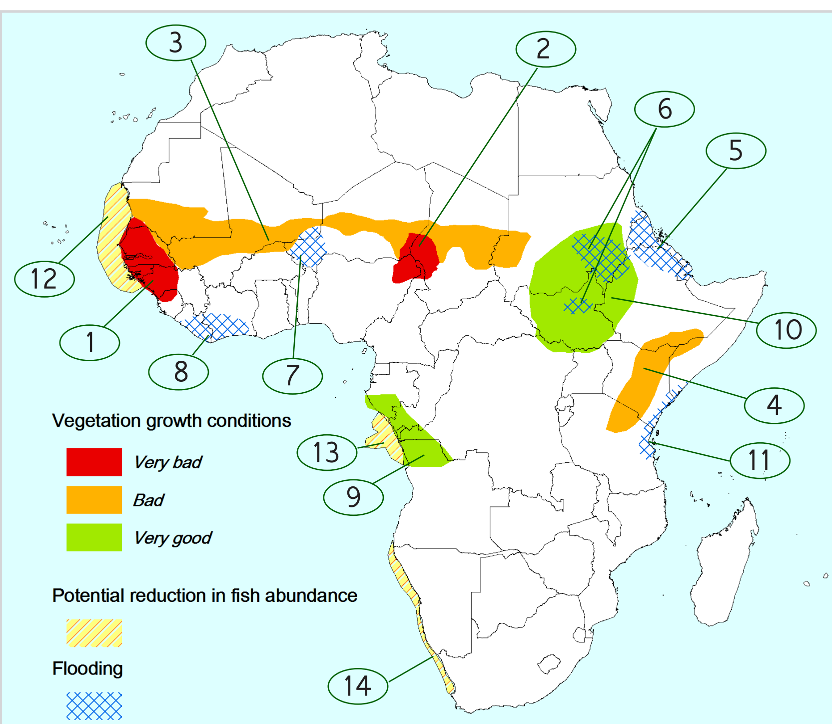

Figure 1. Map of the main events

CONTENTS

RAINFALL CONDITIONS

From March to June 2014, above average sea surface temperatures (SST) were observed in the Eastern Equatorial Pacific. Recently, SST was above average in the Eastern-most and Western Pacific and below average in the East central . An evolution towards weak to moderate El Niño conditions is expected by the end of 2014.

The outlooks from global climate models suggest up to 60% likelihood for El Niño conditions to occur between September and November, rising to as high as 70% for November to February period (IRI, and CPC ENSO update, August 2014). It is anticipated that a weak to moderate El Nino event is most likely to occur. Hence, the expected impacts could result in near to above average rainfall over eastern Africa and near to below average over much of southern Africa.

In the Sudano-Sahel region, well below average precipitation was generally observed from May to July over Senegal, Mauritania, Burkina Faso, Niger, Northern Cameroun, Northern Eastern Nigeria and Western Chad (fig. 2a, **Area 3 on the map in Figure 1**).

This situation is worse for Senegal, South Mauritania, Gambia, and western Guinea (Conakry) and in the Lake Chad Basin (fig. 2b., **Area 2**) which recorded less than half of the long term average in the region.

During the last two dekads of August, above average precipitation was recorded within the Sahelian band from Senegal to Chad.   However, seasonal forecast (ACMAD, August 2014) indicates below average rainfall for the rest of the season. The observed conditions this year are similar to the analogue years of 2002 and 2004 which were characterized by below average rainfall and disruption in distribution of rainfall leading to severe food crisis (Bulletin inter-reseaux , Mai 2012).

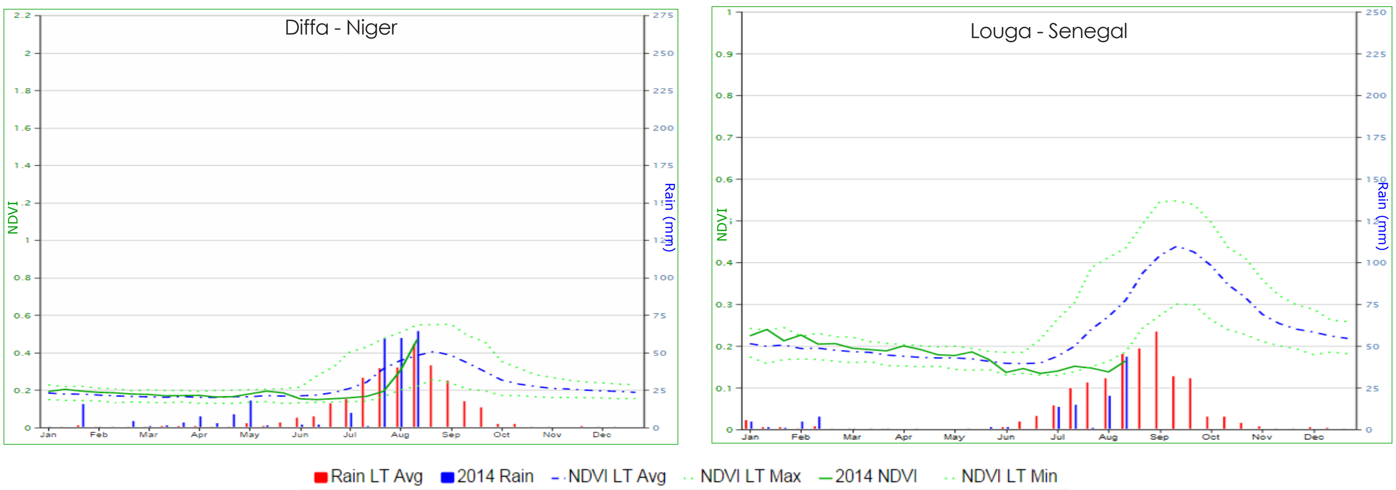

Figure 2. NDVI and rainfall time series (a) left: representative of ***Area 3*** *(Niger). (b) right: representative of* ***Area 1*** *(Senegal).*
In Figure 2a and subsequent types of figures, the red vertical bars represent Long Term average rainfall (mm), the blue vertical bars the actual rainfall (mm) up today. The bold green curve is the current vegetation index NDVI, the two dotted green curves are the Long Term minimum and maximum, while dotted blue curve is the averaged NDVI.

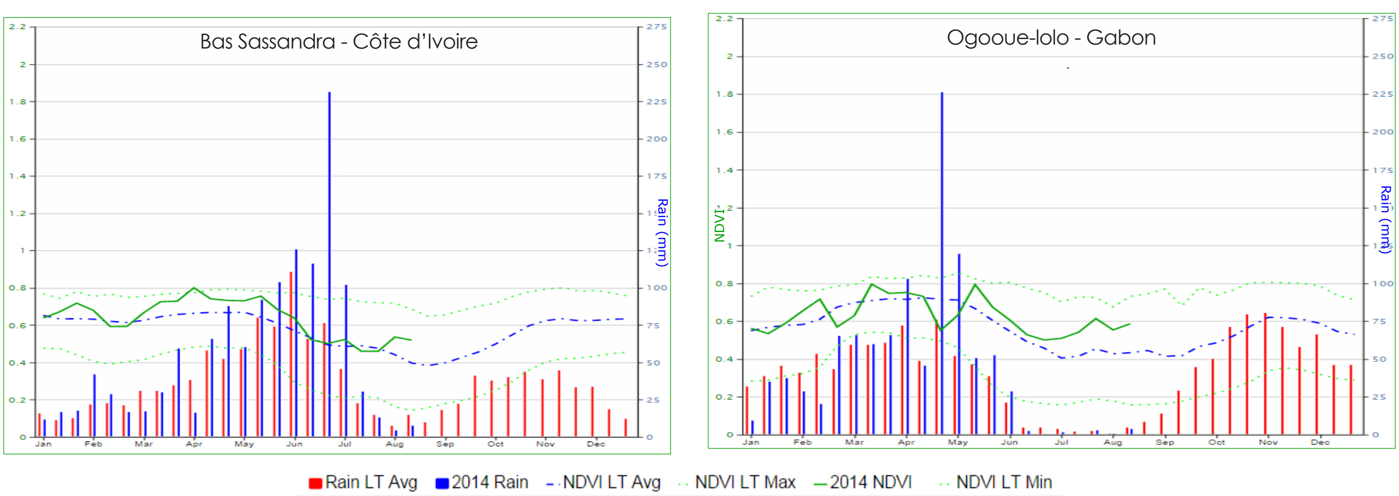

Figure 3. NDVI and rainfall time series (a) left: representative of ***Area 8*** *(Côte d'Ivoire). (b) right: representative of* ***Area 9*** *(Gabon)*

RAINFALL CONDITIONS (2)

In West Africa region especially Gulf of Guinea, well above average precipitation (three times the average amount in 10 days) was observed in June and July over parts of coastal Cote d'Ivoire (fig. 3a, **Area 8**) which resulted in flooding causing loss of life and properties.

In Abidjan 39 people were killed, 2,500 ha of banana and 17,000 ha of rubber destroyed (Cote d'Ivoire Service de Protection Civile, July 2014). Flooding in several parts of Niger affected more than 36,000 people and killed 18 people in the areas of Tillabéry Dosso, Maradi and Tahoua OCHA, Aug 2014).

In East Africa, above to well above average precipitation was observed from June to August over Djibouti, Eritrea, Ethiopia, Sudan and South Sudan (fig. 4a, **Area 6**) led to flooding that cost lives and properties. In Sudan for example, around 44,000 people in the states of Khartoum, Nile, Kassala, North Kordofan, South Kordofan, White Nile and Sennar were affected and 39 people killed; and in South Sudan around 93,000 were affected (OCHA Aug 2014).

In the coastal areas of Kenya and Tanzania (fig. 4b, **Area 11**), well above average precipitation was also recorded and resulted in flooding around Tanga, Pwani and Dar es Salaam regions of Tanzania and in coastal Kenya which destroyed roads and infrastructure and damaged crops (OCHA July 2014).

In the southern African region, the period covered by this bulletin is a dry season except for the Cape Province of South Africa. The previous season was generally above normal except Southern Mozambique, South Madagascar and Western part of Angola.

The rainfall outlook for the coming season is going to be better compared to last year for most parts of the region. The southern African region is likely to receive normal to above-normal rainfall for the period October to December 2014.

However, northernmost Democratic Republic of Congo (DRC), northern Madagascar and Mauritius are more likely to receive normal to below-normal rainfall (SARCOF, August 2014). Close monitoring of the evolution of the season in the areas predicted to receive normal to below-normal rainfall is needed.

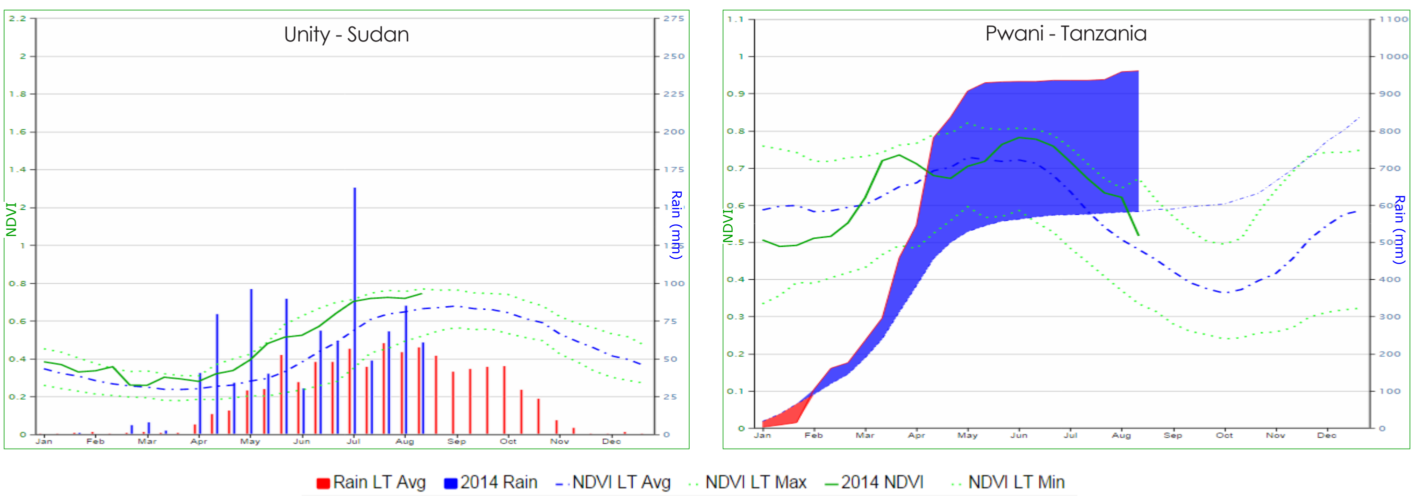

*Figure 4 (a) left: NDVI and rainfall time series representative of **Area 6** (Sudan).*
*Figure 4 (b) right, representative of **Area 11**. The red dotted line is the Long Term average cumulative rainfall (mm), the red/blue polygon represent the rainfall cumulative loss/gain from January to August 2014.*

VEGETATION CONDITIONS

In the West African region and Sudano-Sahel region in Senegal, Mauritania, Mali, Burkina, Niger, Chad and Nigeria, a delay in the start of the season and well below average and disruption in the distribution of precipitation were observed. This negatively impacted on growth and development of the vegetation (fig. 2a, 5a).

However in some areas of the region in Mali (Kayes, Koulikoro, Ségou, Bamako, Sikasso), south east of Senegal (Tambacounda and Kolda) and in Guinea Conakry (Kankan, Faranah and Labé) a good start of the season is observed but followed by a fall of growth in July due to deficit in rainfall (fig. 5b).

In the Eastern African region, good growth and development of the vegetation is observed (Sudan, South Sudan, Eritrea, Ethiopia and Djibouti) as a result of above average and well distributed rains (fig. 6a).

A good start to the vegetation season is observed in some parts of the Rift Valley, but followed by a deficit of precipitation which negatively impacted on the vegetation development (fig. 6b). This area is to be closely monitored since the seasonal forecast for the coming season predicts average to below average precipitation (ICPAC August 2014).

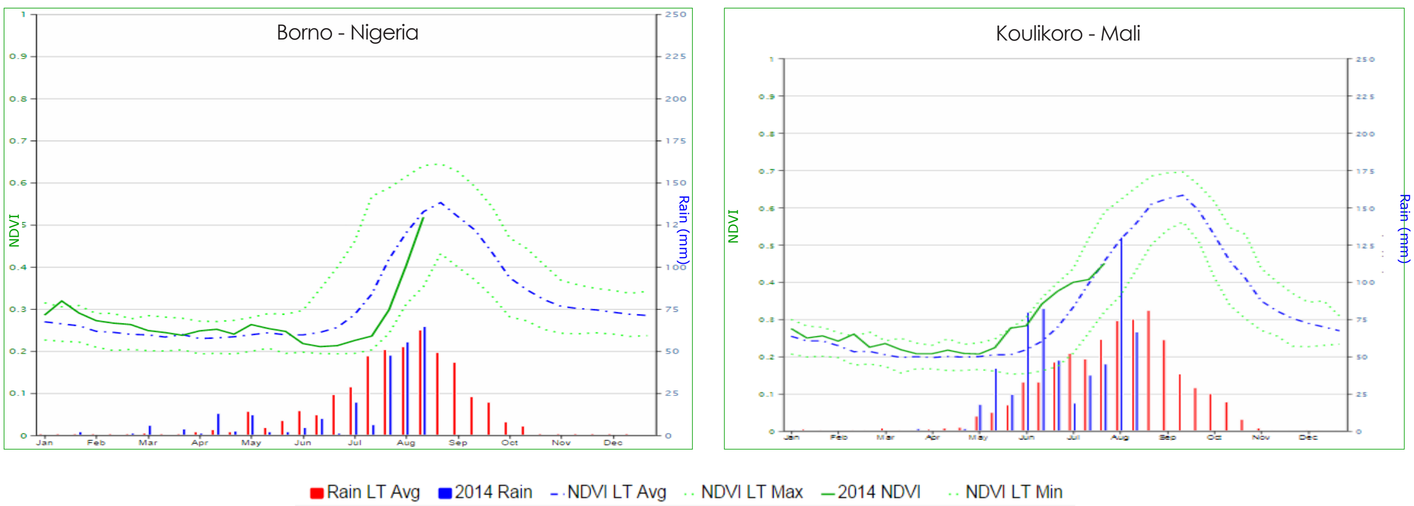

*Figure 5. NDVI and rainfall time series (a) left: representative of **Area 2** (Nigeria). (b) right: representative of **Area 3** (Mali)*

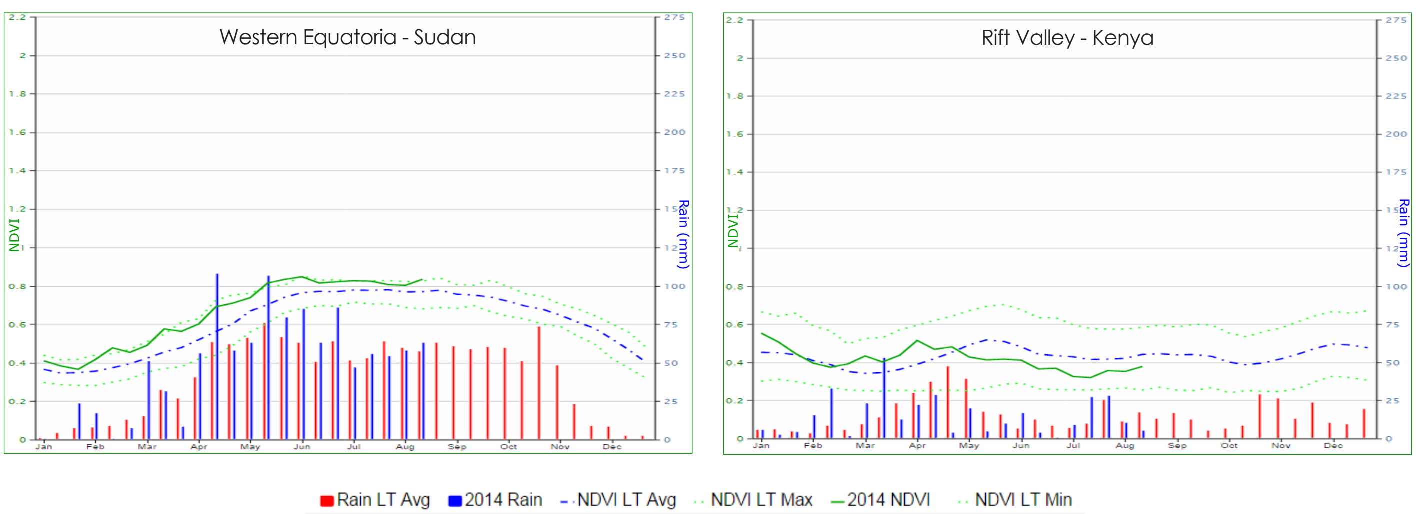

*Figure 6. NDVI and rainfall time series (a) left: representative of **Area 10** (Sudan). (b) right: representative of **Area 4** (Kenya)*

MARINE PRIMARY PRODUCTION CONDITIONS

The African continent is bounded by the Atlantic and Indian Oceans, and these oceans feature many upwelling systems within the Canary, Guinea, Benguela, Agulhas and Somali Large Marine Ecosystems (LMEs). Many of the coastal states along the African coast depend heavily on the fish resources which are greatly affected by large scale ocean processes, including upwellings that drive primary production.

Upwelling describes the process in which cold, nutrient-rich subsurface deep water ascends to the ocean surface. The resulting enrichment of the surface waters is observed as increased chlorophyll-a concentration in remotely sensed data. Upwelling can be easily seen in sea surface temperature (SST) data as cold waters very close to the coast.

In the Atlantic, in the north western coast of Africa for the period from January to June 2014 SST was below the multi-year average. However during the same period, chlorophyll-a concentration dropped in the oceanic regions, whereas in coastal waters it increased slightly.

The seasonal SST anomalies which are forecast[1] for August to September indicate warming in the Canary upwelling off the coast of Senegal and Mauritania (**Area 12**). This suggests phytoplankton abundance may further decrease along the coast of Senegal and Mauritania. The region is a major fishing ground for demersals (bottom dwelling fish) and small pelagics (upper ocean surface fish), and these results indicate that fish stocks could decrease.

In the upwelling regions of the coast of Cote d'Ivoire, Ghana and the Atlantic equatorial waters; SST remained the same with no corresponding increase in chlorophyll-a. It is anticipated that SST of the coastal upwelling region in the Gulf of Guinea will further increase which suggests a decrease in the upwelling intensity between July to September. It can be envisaged that artisanal fishers whose activities are confined to the coastal areas of the Gulf of Guinea may be affected.

SST off the coast from Gabon to northern Angola (**Area 13**) was warmer with a corresponding decrease in chlorophyll-a. Low chlorophyll-a concentration relative to the multi-year average suggests a possible decline in biological production.

The Benguela upwelling region (**Area 14**) was generally warm from January to June and is expected to decrease in the next few months when the seasonal upwelling intensifies. Seasonal forecast of SST anomalies indicate that the southern Benguela region will decrease suggesting increased biological production (Figure 7a,b).

The Western Indian Ocean was warm from January to June 2014. The region north east of Madagascar up to the Seychelles experienced an increase in SST. In the region of Somalia, a temperature increase was observed as well as an increase in the chlorophyll-a values compared to the 11-year average. The chlorophyll-a values in this region remain normal around the islands of Seychelles. The temperature is almost close to normal in the region around Comoros and west of Madagascar. In contrast, the region east of South Africa recorded a decrease in temperature where the eddies persisted (Figure 7a,b).

[1] Forecast data for sea surface temperature anomalies are available from http://iri.columbia.edu/our-expertise/climate/forecasts/sst-forecasts/

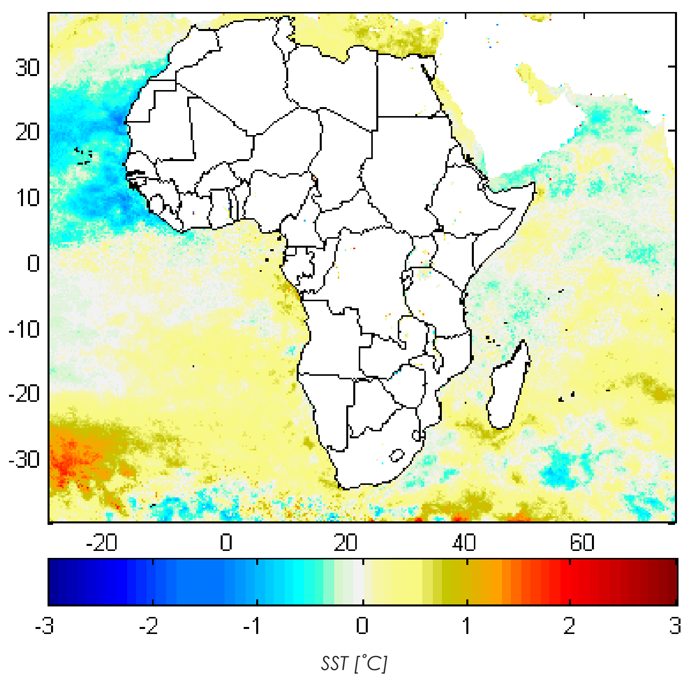

Figure 7a. Sea surface temperature anomalies, January to June 2014.

Blue indicates below average SST. Red indicates above average SST.

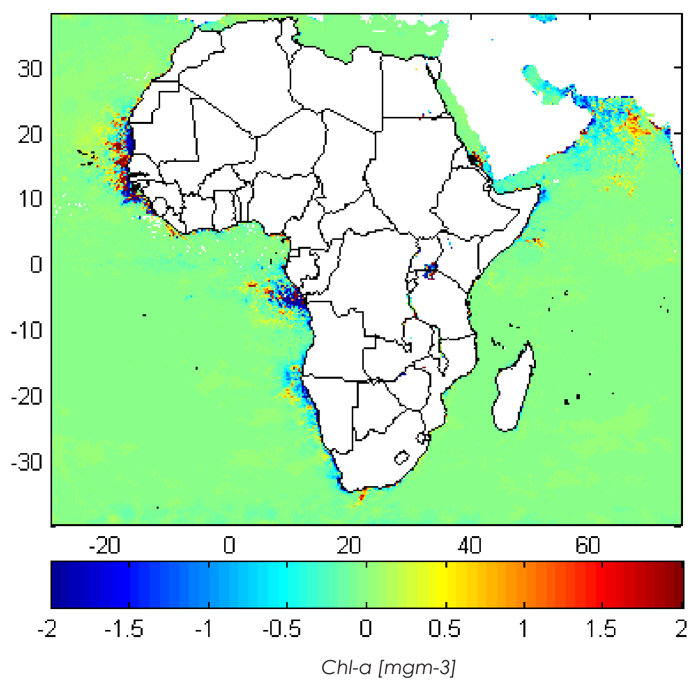

Figure 7b. Chlorophyll-a anomalies, January to June 2014.

Blue indicates below average Chlorophyll-a. Red indicates above average Chlorophyll-a.

RAINFALL AND VEGETATION ANOMALY MAPS

These are the primary sources of data used in the analysis of rainfall and vegetation, exported as maps from the eStation.

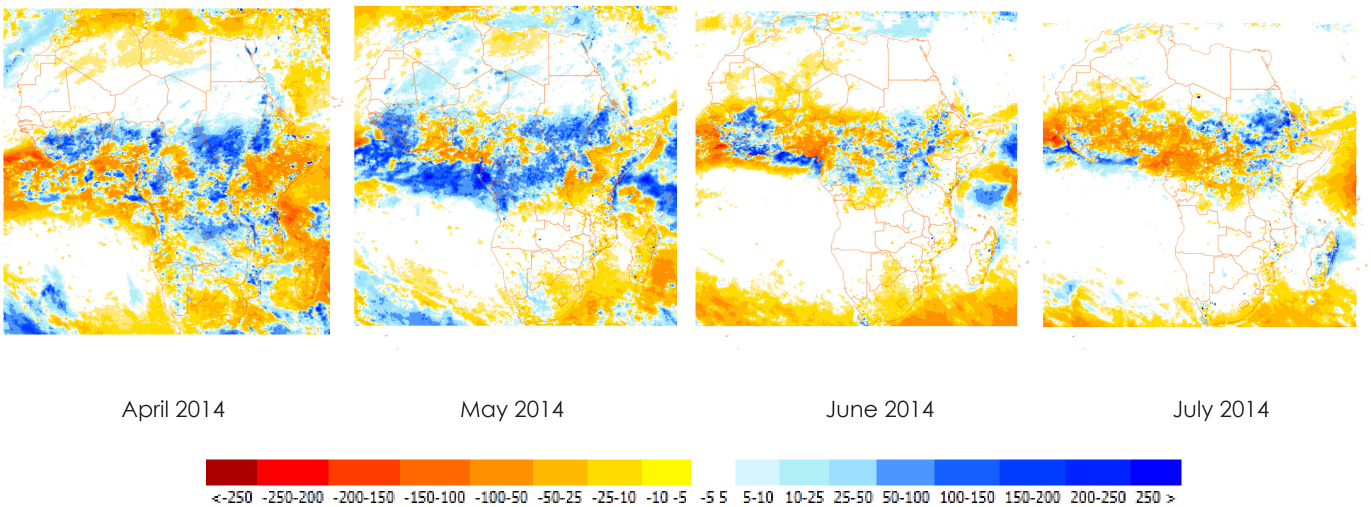

Figure 8. Situation of monthly-averaged rainfall anomalies (mm).
A positive rainfall anomoly means above average, a negative anomaly means below average.

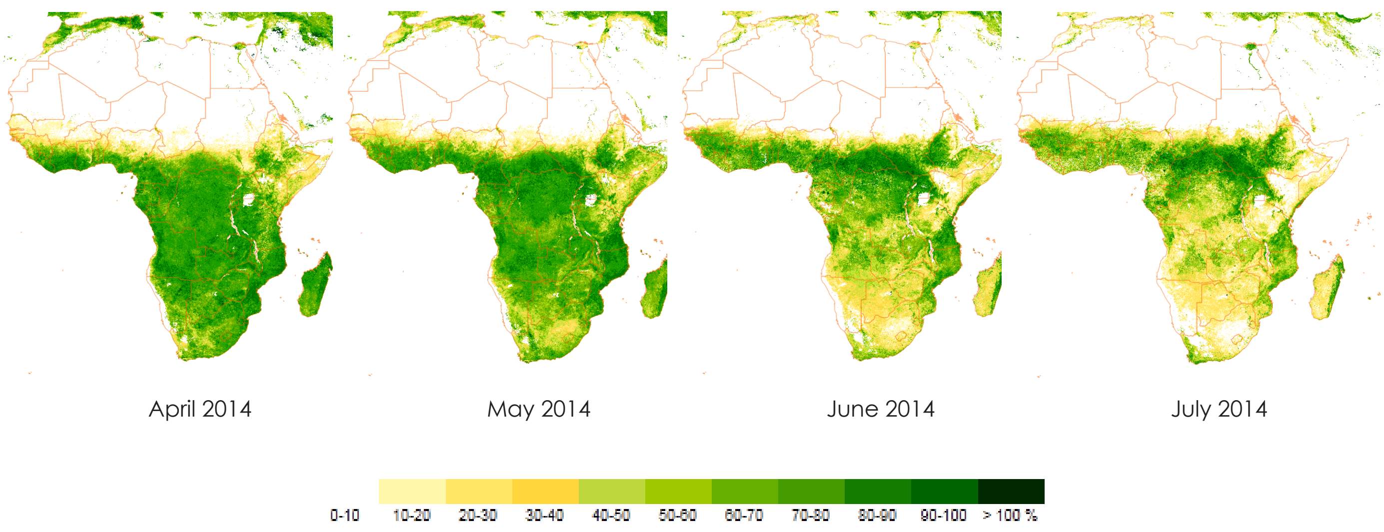

Figure 9. Situation of monthly-averaged vegetation Normalized Growth Index (%).
NGI is close to 0 when it is close to the historical minimum, and close to 1 when it is close to the historical maximum.

DEFINITIONS OF ENVIRONMENTAL INDICATORS

VEGETATION PRODUCTS

The vegetation environmental indicators are derived from the SPOT-VEGETATION and PROBA-V NDVI (Normalized Differential Vegetation Index), representative of vegetation vigor, at 1km spatial resolution provided by the Land Component of Copernicus Programme (http://land.copernicus.eu/global):

- $aNDVI_t$ = NDVIt – $avgNDVI_{dt}$

The NDVI anomaly represents the deviation of the NDVI value from the 10-year average ($avgNDVI_{dt}$) for the same period. A positive anomaly means an NDVI above the average and can be interpreted as a good or very good productivity period and/or an early growing season, and inversely for a negative value. This indicator is suitable for monitoring the growing season.

- NGI (or ICN)= 100*($NDVI_t$ – $NDVI_{min}$)/($NDVI_{max}$-$NDVI_{min}$)

The Normalized Growth Index represents the difference between the observed NDVI and the minimum NDVI, rescaled to the signal maximum amplitude. The formulation of the indicator is similar to the VCI, but min and max correspond to the absolute seasonal minimum and maximum computed over a 10-year time-series (called in the text Long Term (LT) time series). It provides information on the current vegetation conditions with respect to the potential growth and is suitable for monitoring the growing season.

The indicators used in this bulletin are from May to August 2014.

RAINFALL PRODUCTS

The products are derived from the FEWSNET Rainfall Estimation (RFE) dekadal (10 day) imagery. The RFE imagery combines Meteosat infrared data, rain gauge reports from the global telecommunications system, and microwave satellite observations to provide daily rainfall estimate in mm at an approximate horizontal resolution of 10 km. Link: http://earlywarning.usgs.gov/fews/africa.

- $aPcum_t$ = $Pcum_t$ – $avgPcum_{dt}$ (mm and %)

The Pcum anomaly represents the deviation of monthly cumulated rainfall estimation (Pcum) from the climatic monthly average ($avgPcum_{dt}$) computed based on a long Term period (1995 to present). This product allows highlighting of the location and the intensity of the rainfall anomaly. It is provided both in percentage and in mm.

The indicators used in this bulletin are from May to August 2014.

MARINE PRODUCTS

The products are derived from MODIS chlorophyll-a and sea surface temperature (SST) monthly datasets. Link: http://oceancolor.gsfc.nasa.gov

aSST = SSTm - SSTy

The SST anomaly represents the deviation of the average SST (SSTm) for January to June for 2014 from the 11-year average (2003-2013) for the same months (SSTy). A negative anomaly means SST is below average and can be interpreted as good conditions for biological production for upwelling regions, and vice versa.

- aChl = Chlm – Chly

The chlorophyll-a anomaly represents the deviation of the average chlorophyll-a (Chlm) for January to June for 2014 from the 11-year average (2003 - 2014) for the same months (Chly). A positive anomaly means chlorophyll-a above average and can be interpreted as good conditions for phytoplankton growth in marine ecosystems, and vice versa.

The products used in this bulletin are from January to June 2014.

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THE MESA PROGRAMME

MESA uses space-based and in-situ data to enable an improved management of the environment and food security at continental, regional and national levels in Africa. MESA consolidates and widens the operational environmental services developed in the AMESD (African Monitoring of the Environment for Sustainable Development) programme, and is a first contribution to the GMES-Africa initiative of the EU-Africa Joint Strategy.

The purpose of the MESA programme is to increase the capacity in information management, decision making and planning of African continental, regional and national institutions mandated for environment, climate and food security. This will be achieved by enhancing access to reliable, timely and accurate land, marine and climate data and information for Africa. MESA is exploiting Earth Observation (EO) data and technologies to promote socio-economic progress towards achieving the Millennium Development Goals.

USING EARTH OBSERVATION FOR ENVIRONMENTAL ANALYSIS

This bulletin is based on the analysis of environmental indicators derived from satellite imagery, alllowing cost effective monitoring of the environmental situation at the continental level. These earth observation indicators are complemented by seasonal climate forecasts and other sources of information.

The EUMETCast system provided by EUMETSAT routinely distributes Earth Observation data by satellite broadcasting, thus addressing the issue of data reception in areas with poor internet connectivity. The retrieving of Earth Observation data from the EUMETCast receiving station, and the computation of the environmental indicators is automatically performed by the Environmental Station, or eStation, software developed by the Joint Research Centre of the European Commission. The eStation is comprehensive remote sensing software distributed to all sub-Saharan African countries on the AMESD and MESA Stations, in the framework of the AMESD and MESA programmes.

2014 is the Year of Agriculture and Food Security in Africa.

This bulletin is the result of cooperation between MESA Regional and Continental Implementation Centres (from CEMAC, ECOWAS, IGAD, SADC, MOI, University of Ghana and ACMAD), MESA Headquarters at the African Union Commission, and the Joint Research Centre of the European Union. The MESA programme is funded by the 10th European Development Fund of the European Commission. For more information on this bulletin please contact info@hd-mesa.org.

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