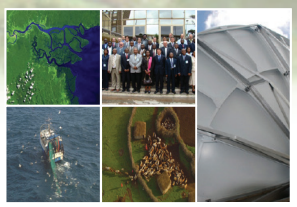
African Monitoring of Environment for Sustainable Development

AMESD



AMESD Continental Environmental Bulletin

November 2012

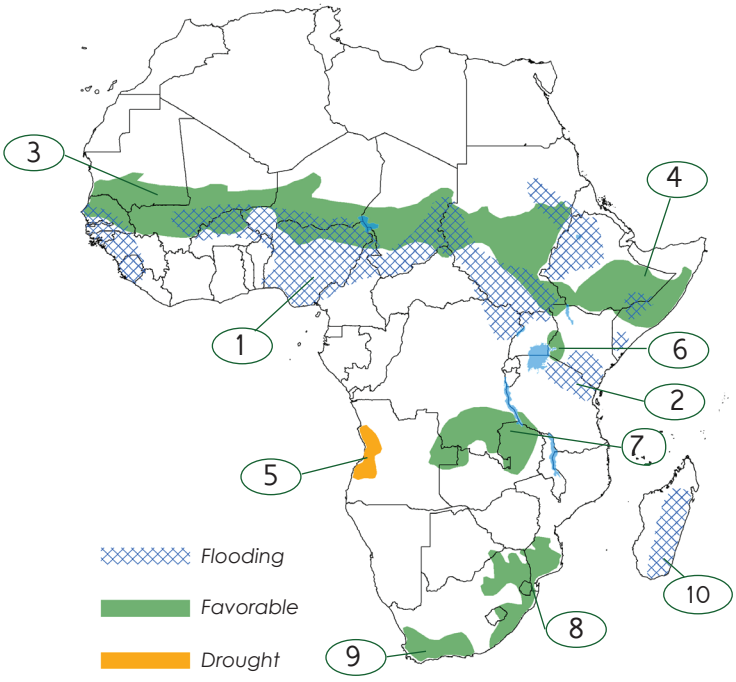


Figure 1. Spatial distribution of the main events

Summary

- In the Northern Inter-tropical region (1, 3), the season was characterized by above average rainfall and heavy rains. In many places, floods affected millions of people. Nigeria experienced the worst flood in 40 years.
- In the Sahel (3), the growing season is ending. Above average agro-pastoral conditions were observed throughout the season leading to very satisfactory harvests in most parts. However the area is under threat of desert locust.
- In the Southern part of Kenya and Northern Tanzania (2), heavy rainfall in end of October and beginning of November led to flooding and landslides affecting thousands of people.
- In Eastern Africa (4), the food security has improved, but humanitarian assistance remains crucial. Currently, a satisfactory start of the growing season is observed and should prevail acording to the seasonal climatic forecast.
- In the coastal area of Angola (5), drought conditions during the last season led to poor agricultural production. Currently the start of the season is good, however according to the climatic forecast close monitoring is required.
- In southern Africa (6,7,8) an early start of the growing season is observed. However, close monitoring of the vegetation is needed especially in area 8 which is expected to receive normal to below-normal rainfall.
- In the Cape of South Africa (9), the just ended season was generally good. But, the heavy rains in Mid- October caused flooding damaging critical infrastructure.
- In Madagascar and other Indian ocean islands, flooding and landslides events affected hundred thousands people. The region is expected to receive above normal to normal rainfall, increasing flooding risk.

Content

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- Vegetation conditions
- Fires
- Rainfall and vegetation anomalies images
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Rainfall Conditions

Enso-neutral conditions continue (58% probability), however, weak to moderate El nino conditions may prevail (40% probability) up to early 2013 (IRI, Nov 2012). In East Africa, El Nino events lead to wetter than normal condition while in Southern Africa, it increases the probability of dry spells in areas prone to dryland. In West Africa, it has no significant effect.

In the Sahel, the start of the rainfall season was good; the temporal rainfall distribution was satisfactory (figure 2a). Consecutive heavy rainfall events (270 mm above the average in Nigeria) were observed (figure 2a,b), leading to flash floods (Nigeria, Niger, Mauritania, Senegal, Mali, Ghana, Chad, Burkina Faso) affecting millions of people. In Nigeria alone, between July and the end of October, more than 7 million people were affected by floods. This is the worst flooding event in more than 40 years (source: OCHA 2012). The intertropical convergence front is moving downwards marking the end of the rain season in the region.

In East Africa, Northern sector, (Sudan, South Sudan, Eritrea, Djibouti, Northern Ethiopia, and Northern Somalia), the rain season (June to October) was characterized by average to above average rainfall (figure 3b). In central and western Ethiopia, Sudan (upper Nile), consecutive above average rains associated with some extreme rainfall events caused flooding which affected tens of thousands of people (OCHA, Nov 2012).

The equatorial sector of the East African region (Kenya, Uganda, Rwanda, Burundi, Uganda, North Tanzania, Somalia) received high amount of rainfall (in October and November) which resulted in some localized flooding and landslides (figure 3a) affecting population, livestock, crops and infrastructure (OCHA, Nov 2012).

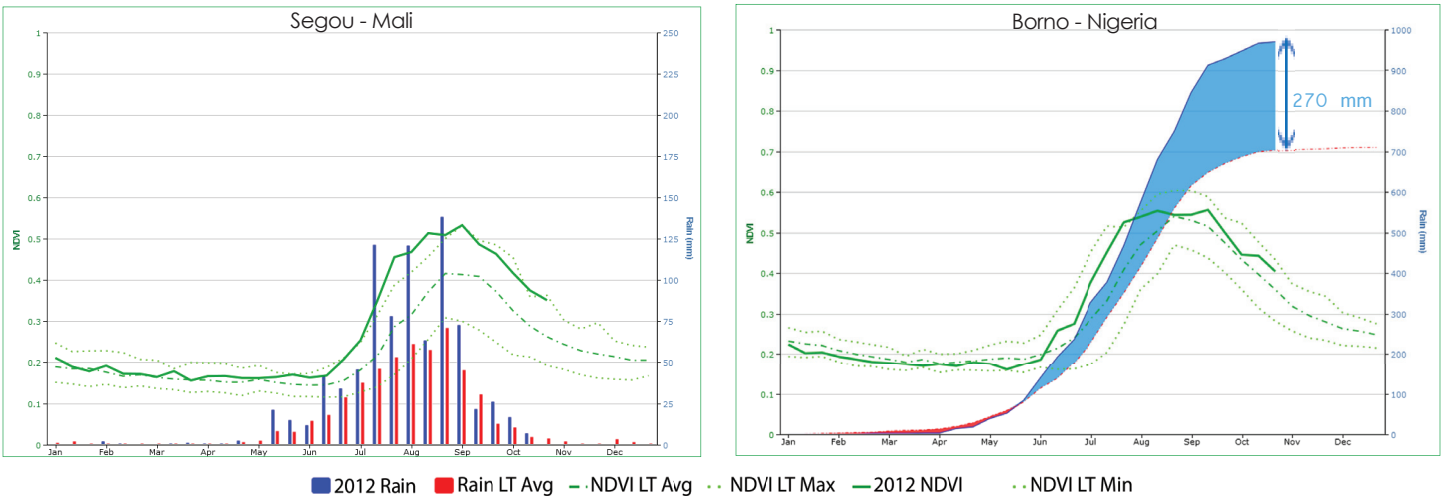


Figure 2. NDVI and rainfall time series (a) left: representative of Area 3 (Mali). (b) right: representative of Area 1 (Nigeria). In Figure 2a and subsequent types of figures, the red vertical bars represent Long Term average rainfall (mm), the blue vertical bars the actual rainfall (mm) up today. The bold green curve is the current vegetation index NDVI, while the three dotted green curves are the Long Term minimum, maximum and averaged NDVI. In figure 2b, the red dotted line is the Long Term average cumulate rainfall (mm), the red/blue polygon represent the rainfall cumulate loss/gain from January to November 2012

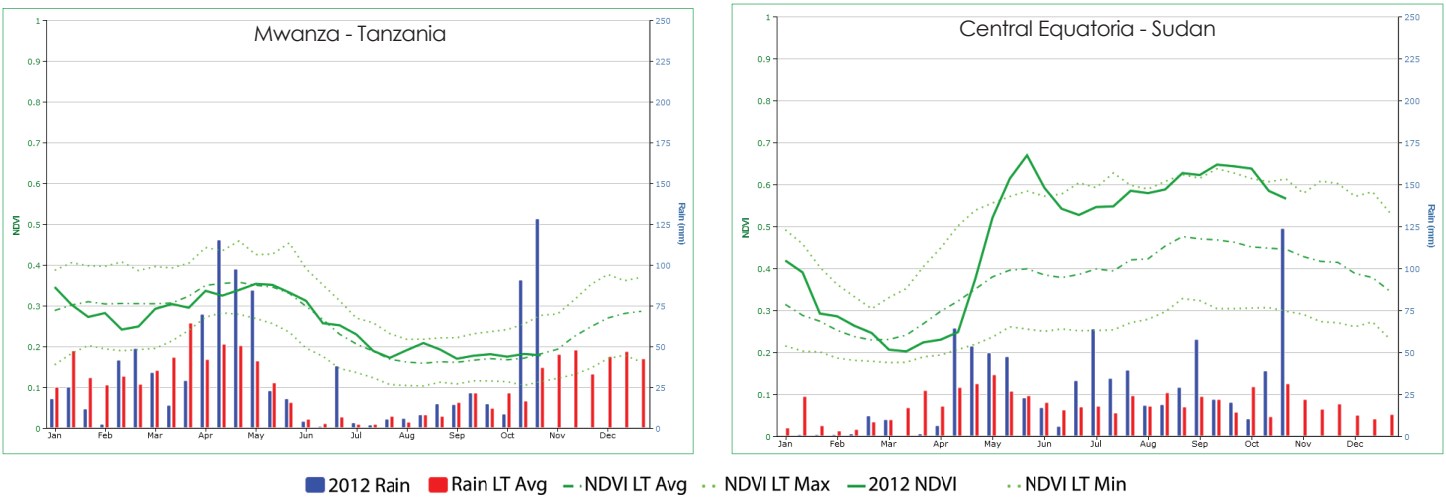


Figure 3. NDVI and rainfall time series (a) left: representative of Area 2 (Tanzania). (b) right: representative of Area 3 (Sudan)

Rainfall...

In Southern Africa, the rainfall season has begun in most parts of the region and is ending in the Cape of South Africa. In the Southern and central part of Mozambique, Northern Zambia and Angola, central parts of Zimbabwe, Northern Tanzania and North Eastern part of South Africa, an early start (one month) of the season is observed and characterised by heavy rainfall events (fig. 4b). In Kagera, Mwanza provinces of Northern Tanzania (fig. 1, area 2), heavy rainfall resulted in flooding and damage to infrastructure. Significant floods were also experienced in Eastern Cape province in mid October with damage to critical infrastructure.

In the Indian Ocean islands (especially in Madagascar and Comoros), an active Inter-Tropical Convergence Zone, combined with tropical cyclones and tropical storms, brought heavy rains specifically during the June to September period (fig. 5b) which resulted in massive floods and landslides in the Eastern part of Madagascar and Comoros, affecting hundred thousands of people and damaging infrastructure (OCHA, Sep 2012).

In the Central African region, high amount of rainfall was registered during the whole season (fig. 5a) especially in the Northern part of Cameroon, Democratic Republic of Congo (DRC) in the Province Orientale and Equatorial Guinea. In some areas flooding events were observed which damaged crops, infrastructure and houses leaving more than 3000 families homeless in DRC and more than 60,000 in Cameroon (OCHA, Sep 2012)

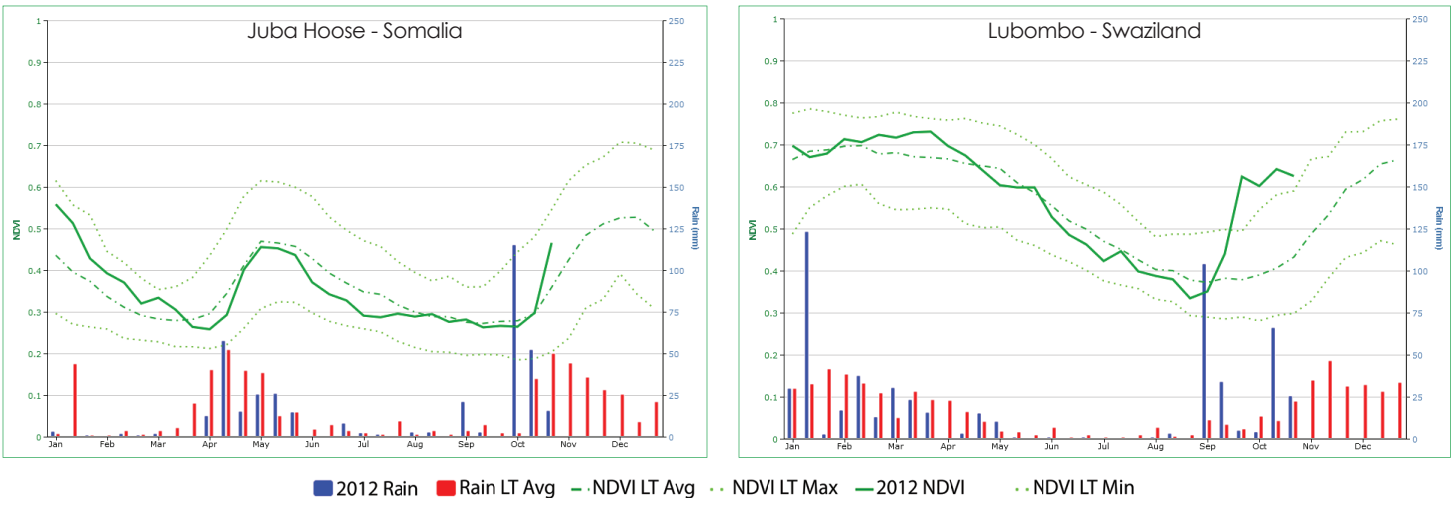


Figure 4. NDVI and rainfall time series (a) left: representative of Area 4 (Somalia). (b) right: representative of Area 8 (Swaziland)

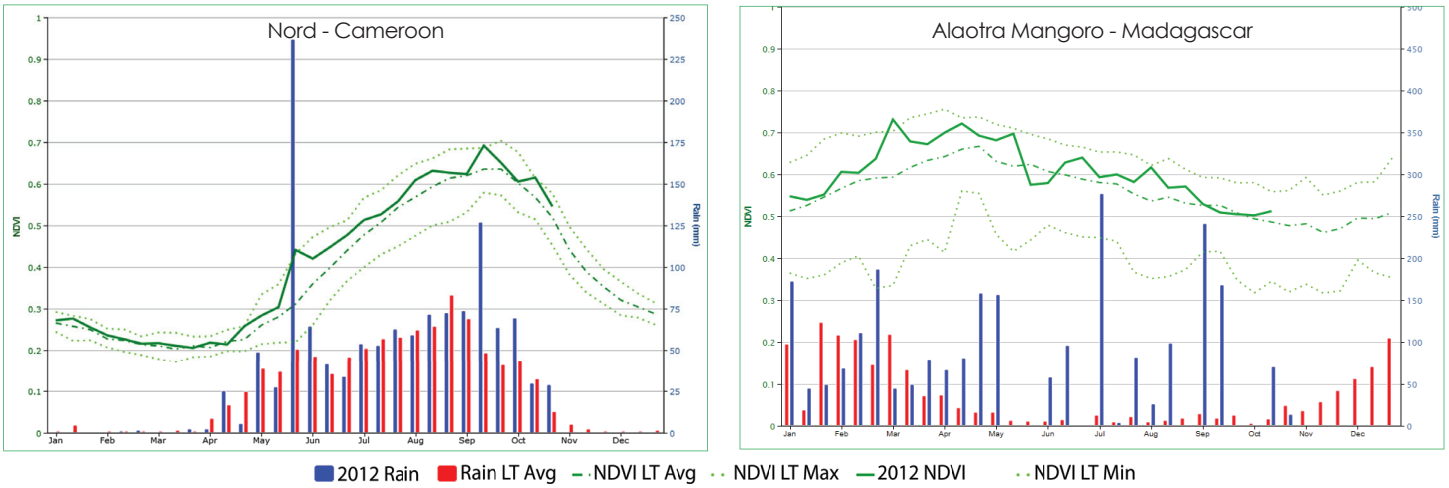


Figure 5. NDVI and rainfall time series (a) left: representative of Area1 (Cameroon). (b) right: representative of Area 10 (Madagascar)

Vegetation Conditions

In West Africa, the temporal and spatial distribution of rainfall allowed above average vegetation conditions and in some areas overpassing the observed historical maximum (since 1998) (Fig. 2a, 6b). In general, the early start of the season in Senegal, South Mauritania, Mali, Niger, Nigeria, Burkina Faso and Chad favored the agro-pastoral conditions leading to better crop and livestock production; consequently improving people livelihoods.

Favorable ecological conditions in the desert locust breeding areas led to the most serious threat since 2005. This event coincides with the harvest period in these areas. More than 50 million people could be affected in Chad, Mali, Mauritania and Niger (FAO, November 2012).

In East Africa, in the Northern sector, the average to above average rainfall observed in Sudan, South Sudan and North Ethiopia allowed satisfactory vegetation growth reaching the historical maximum in some areas (fig. 3b). Good production can be expected in this region.

In the Horn of Africa, the food security has improved, but humanitarian assistance remains crucial.

In the Southern sector (Kenya, Uganda, South Ethiopia, South Somalia, Tanzania, Burundi and Rwanda), the start of the season is progressing well and is generally favorable. Good vegetation growth (average to above average) are obseved between October and November (Fig. 4a).

In Central Africa region, the vegetation growing conditions were generally very favorable during the season. The vegetation development was above average thoughout the season (Fig. 5a).

In Southern Africa, in general, the vegetation growing season shows an early and good start of the season (above average). In some places, the vegetation development is above its historical maximum (figure 4b).

In the coastal area of Angola (Fig. 1 area 5) severe drought conditions during the last season led to poor agricultural production affecting more than 1.8 million people (OCHA 2012). Despite the good start of the season (Fig.6a) , close monitoring in this area is needed due to predicted poor rainfall during the next part of the season (SARCOF, Sep 2012).

In Southern Mozambique, Central Zimbabwe, Eastern half of Botswana, North Lesotho, North Eastern South Africa and Swaziland, an early start of the growing season is observed (Fig. 4b). However, close monitoring of the vegetation is needed due to predicted poor rainfall throughout the season.

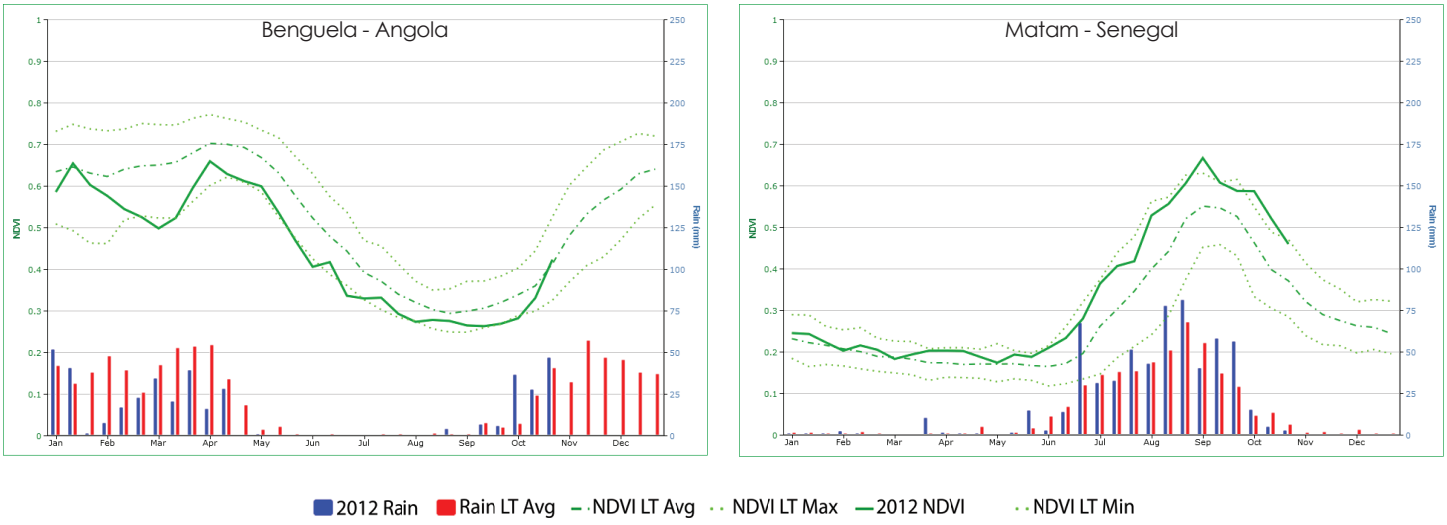


Figure 6. NDVI and rainfall time series (a) left: representative of Area 5 (Angola). (b) right: representative of Area 3 (Senegal)

FIRES

In the Northern hemisphere of Africa the fire season has just started in some places.

In the Southern hemisphere of Africa, the fire season has ended and was characterized by above average fire density, especially, in the Northern part of the region. The positive active fire density anomalies (100% magnitude) for the 2012 season (Fig. 7) were observed in some localized areas such as in Northeastern part of Namibia. These areas have generally accumulated above average quantities of biomass during the previous vegetation season. In addition, the faster drying of the biomass resulting from the early onset of the dry season shifted the beginning of the fire season (Fig.8a).

The areas with negative fire density anomalies are mainly located in the Coastal area of Angola (Fig. 1, area 5). This situation can be explained by low biomass accumulation during the previous growing season (Fig. 6a,8b).

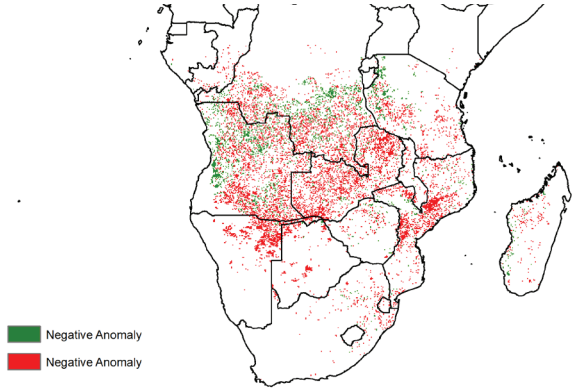


Figure 7. Hotspot of fire density positive and negative anomaly, calculated over the period April to September 2012 (South Hemisphere)

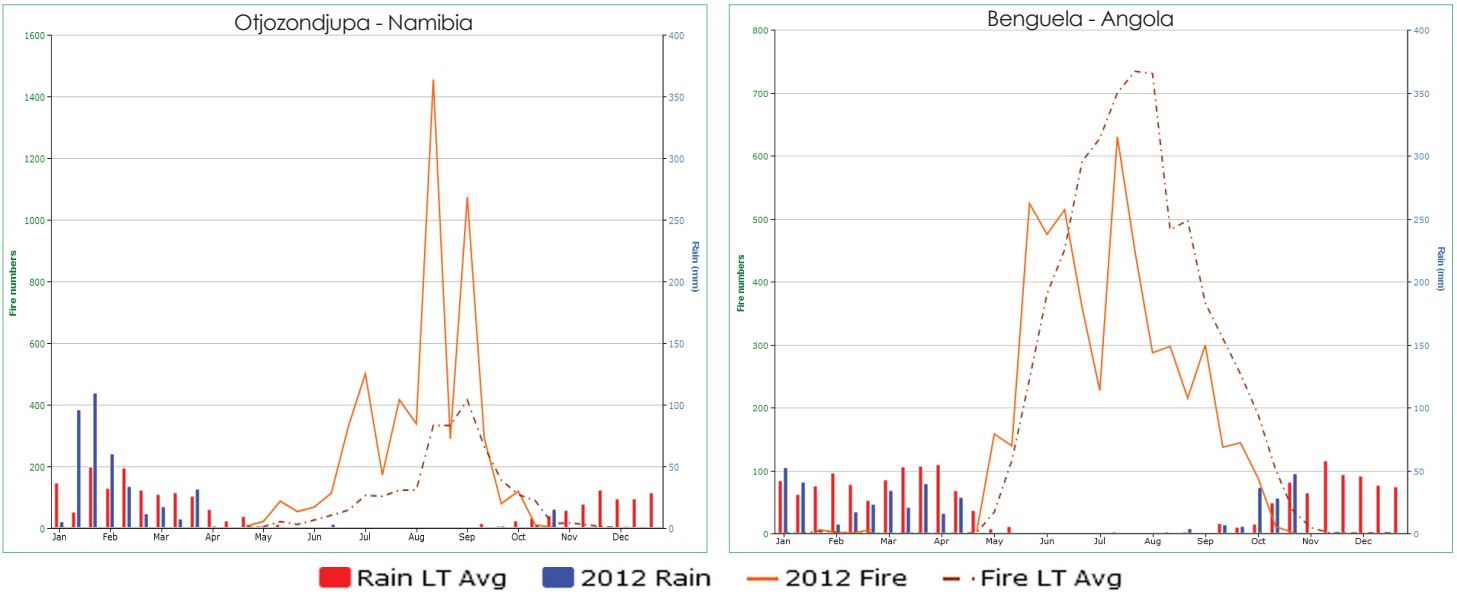


Figure 8. Left : Fire and rainfall conditions (a)left: representative of Namibia (b) right: representative of Angola.

Definition of Environmental Indicators Used

Vegetation products

The vegetation environmental indicators are derived from the SPOT-VEGETATION NDVI (Normalized Differential Vegetation Index), representative of vegetation vigor, at 1km spatial resolution provided by DevCoCast (www.devcocast.eu)

- $aNDVI_t = NDVIt - avgNDVI_{dt}$

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.

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

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.

Fire products

The products are derived from the daily MODIS active fire (FIRMS). The FIRMS product detects fires in 1km pixel that are burning at the time of overpass under relatively cloud-free conditions. A contextual algorithm is used, where thresholds are first applied on the observed middle–infrared and thermal infrared brightness temperature. Then false detections are rejected by examining the brightness temperature relative to neighbouring pixels (Giglio, L. et al. 2003). Link: http://modis-fire.umd.edu/Active_Fire_Products.html. The considered data time series goes from January 2000 up to present.

- Seasonal fire density represents the activity of the fires during the fire season (6 months). It is computed as number of fires on the basis of a grid (0.25 x 0.25 degrees) from October to March for the Northern part of Africa and from April to September for the Southern part.

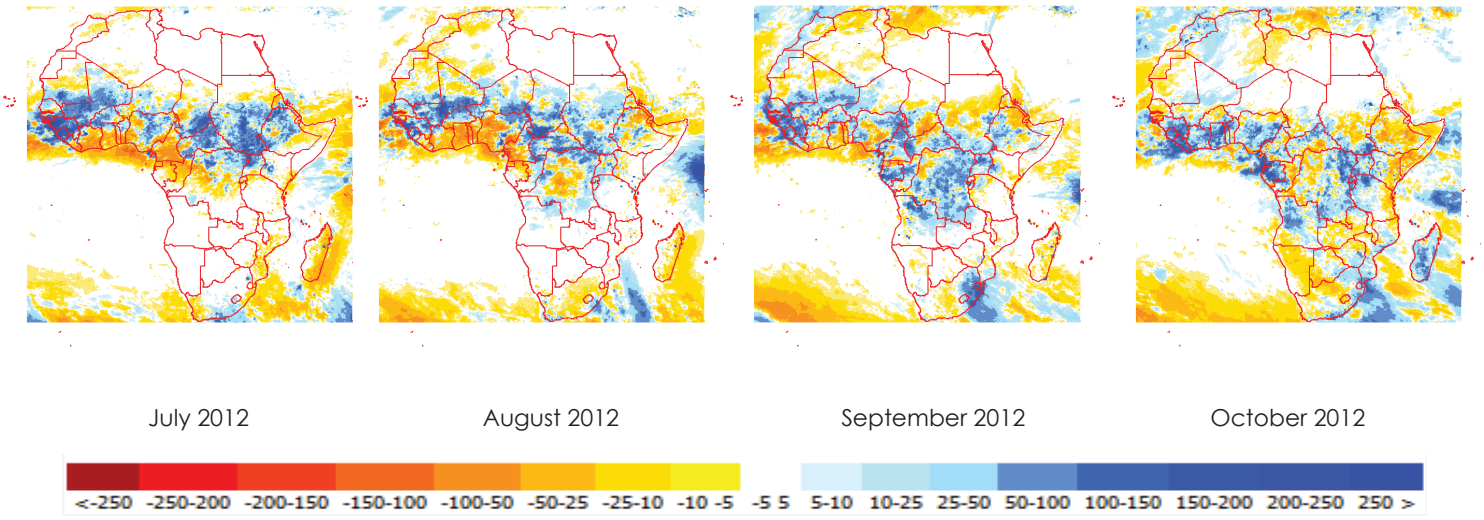
Rainfall products

The products are derived from the FEWSNET Rainfall Estimation (RFE) dekadal 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 so-called Long Term period (1995 to present). This product allows highlighting the location and the intensity of the rainfall anomaly. It is provided both in percentage and in mm.

Rainfall and Vegetation anomalies images



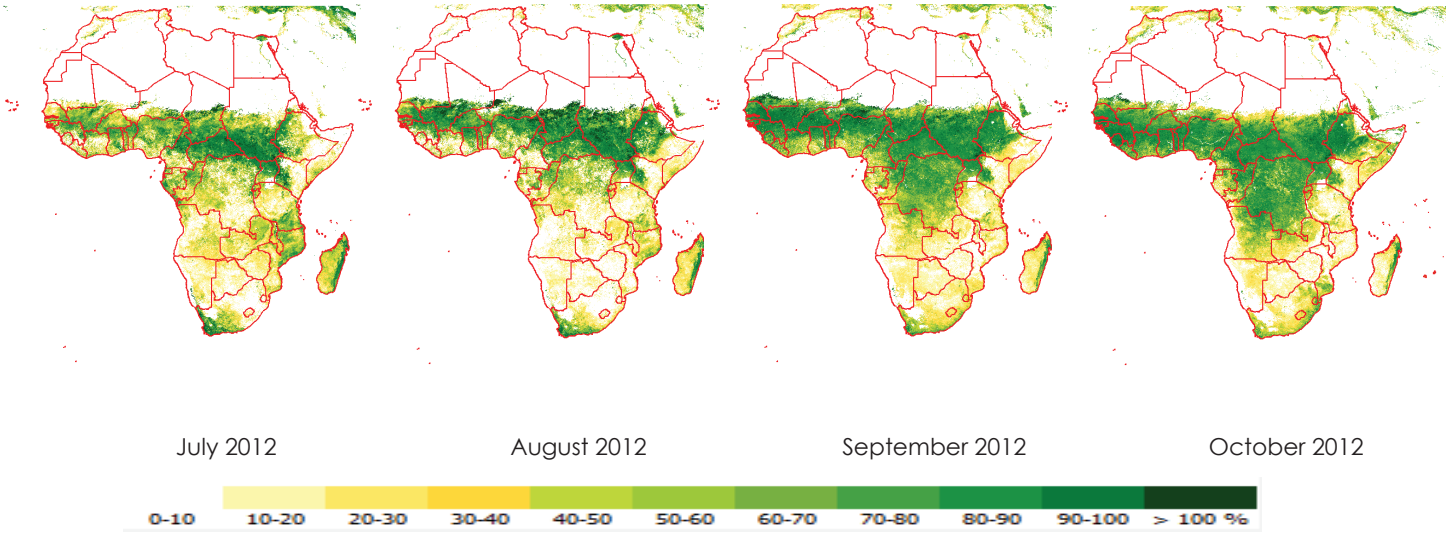


Figure 9. Situation of monthly-averaged rainfall anomalies (mm) and vegetation Normalized Growth Index (%)

African Monitoring of the Environment for Sustainable Development

The AMESD project

The AMESD program addresses the need for improved environmental monitoring towards sustainable management of natural resources in five regions of sub-Saharan Africa, namely CEMAC, ECOWAS, IGAD, IOC and SADC (RECs). There are 48 ACP countries in these Regional Economic Communities (RECs), home for many of the poorest people of the world, where economies and livelihoods are highly dependent on the environment, renewable natural resources and climate variability.

Five Regional Thematic Actions (THEMA) are being established by the RICs to develop appropriate information services, in order to address the already prioritized decision needs of the RECs in the fields of (i) water resources management; (ii) crop and rangeland management; (iii) agricultural and environmental resources management; (iv) mitigation of land degradation (including forest exploitation) and conservation of natural habitats and; (v) marine and coastal management.

The program is implemented under the coordination of the African Union Commission with the support of the European Union.

The eStation

This bulletin is exclusively based on the analysis of remote sensing imagery and of derived environmental indicators. Despite of its intrinsic limitations, remote sensing is the only cost effective approach allowing a continental monitoring of the environmental situation.

The EUMETCast system routinely distributes Earth Observation data by satellites broadcasting. It adequately addresses 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 so-called Environmental Station, or eStation, developed by the Joint Research Centre of the European Commission. The eStation is a comprehensive remote sensing system distributed to 47 National Centres in all sub-Saharan African countries, in the framework of the AMESD project.

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