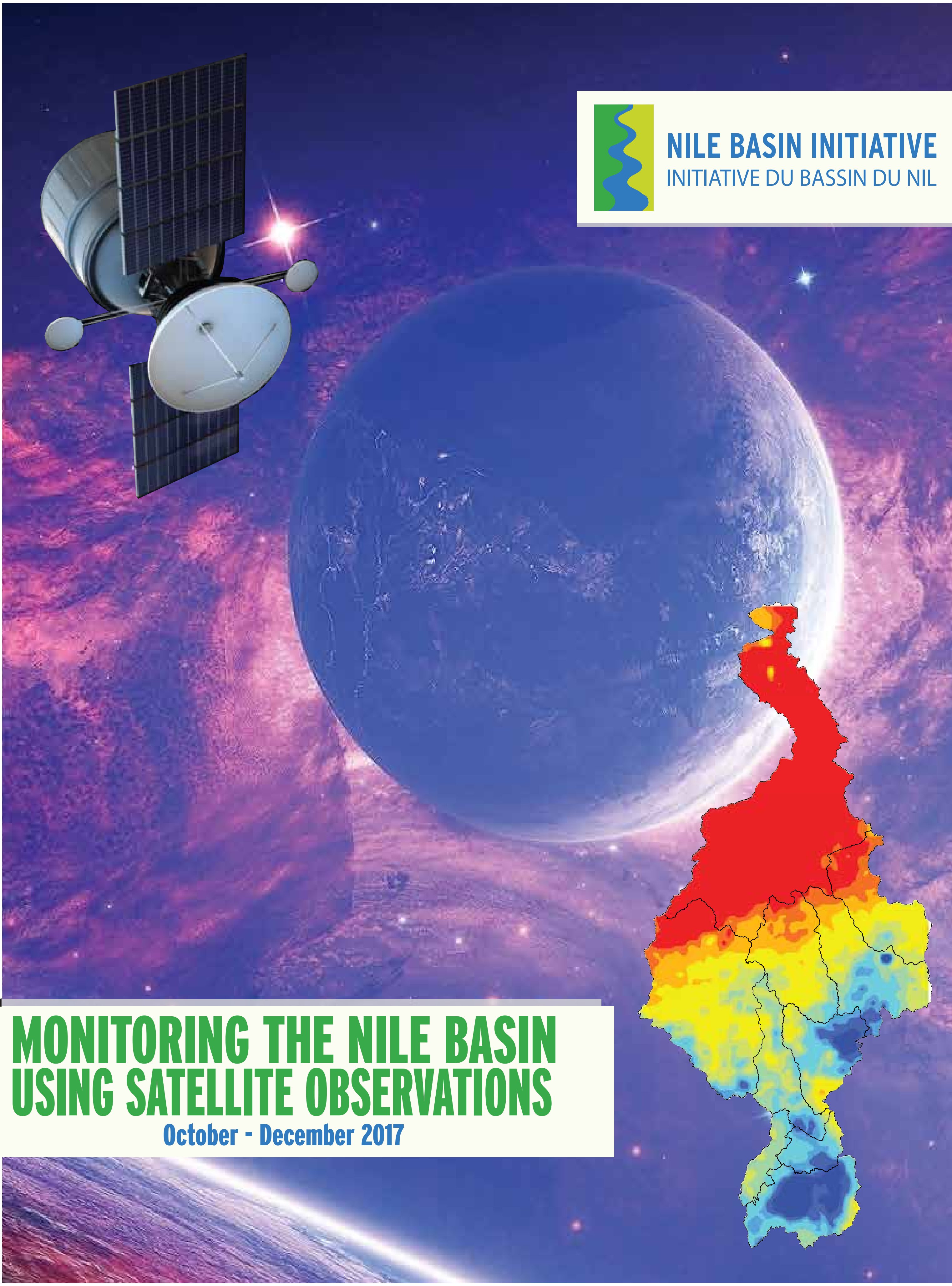

NILE BASIN INITIATIVE
INITIATIVE DU BASSIN DU NIL

MONITORING THE NILE BASIN USING SATELLITE OBSERVATIONS

October - December 2017

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October - December 2017

The Nile Basin Initiative (NBI) is an intergovernmental partnership of ten Nile riparian countries that is seeking to manage and develop the common Nile water resources in a cooperative manner and promote regional peace and security.

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Executive Summary

The Nile cuts across diverse climatic zones with its sources in the humid regions and encountering arid conditions as it flows downstream across the arid regions in the desert of Sudan and Egypt with changes in annual and seasonal rainfall over the ten major sub basins of the Nile basin region.

The NBI aims at promoting evidence-based decision making and has analyzed rainfall distribution, actual evapotranspiration distribution and changes in water levels in the large lakes during 2017 as compared to the long term average using satellite observation data. The results are presented in this second issue of quarterly basin monitoring bulletins.

Minimum rainfall is seen to be less than 50mm/year in the arid areas in the northern part of the basin and the maximum rainfall estimates are observed in the equatorial lakes region in the areas around Lake Victoria and the Ethiopian Highlands at over 1000mm/yr. The high altitude areas of the basin such as the Ethiopian highlands, Rwenzori Mountains in Uganda and Mount Elgon are considered to be the water towers in the basin receiving rainfall over 1500mm/yr.

In 2017, monomodal rainfall pattern was experienced during June - September (JJAS) in the Ethiopian plateau especially in the Blue Nile and Tekeze subbasins, April - October in Bahr el Ghazal and May - October in White Nile, Baro Akobo Sobat, and Bahr el Jebel subbasins.
Bimodal rainfall pattern was experienced during March - May (MAM) and September -November (SON) in the equatorial lakes region especially in the Lake Victoria, Lake Albert, and Victoria Nile sub-basins. The highest seasonal rainfall occurs over the Blue Nile and the lowest over Tekeze Atbara.

During the second wet season of 2017, Lake Victoria Subbasin exhibited more rainfall as compared to the long term average by 30% in Sep, 33% in Oct and by 23% in Nov. During the second wet season of 2017, Lake Albert subbasin exhibited more rainfall compared to long term average rainfall, especially during July (by 35%), August (by 29%), and September (by 20 %).
During the second wet season of 2017 ,Victoria Nile subbasin exhibited more rainfall compared to long term average rainfall during August (37%) and September (23%). During the wet season of 2017 Bahr el Ghazal subbasin exhibited more rainfall from May to September (May 16%, Jun 29%, Jul 13%, Aug 9%, and Sep 22%) compared with the long term average rainfall. During the wet season of 2017, Bahr el Jebel subbasin exhibited more rainfall compared to long term average rainfall during August (37%) and September (35%). During the wet season of 2017, Baro Akobo Sobat subbasin exhibited more rainfall compared to long term average rainfall during September and October. Rainfall over White Nile subbasin during 2017 was more compared to long term average rainfall, especially during May (35%), June (25%), and September (14%).
Rainfall over the Blue Nile subbasin during 2017 was above the long term average rainfall, especially during the rainy season in Jul (by 9%), Aug (by 7%), and Sep (by 27%). Tekeze Atbara subbasin during 2017 exhibited more rainfall compared to long term average rainfall during May (by 41%), July (by 7%), and August (by 8%). The long term average rainfall over Main Nile subbasin during July (-24%) was more than the rainfall of 2017 for the same month. However, August (14%) showed more wetting during 2017 compared to the long term average.

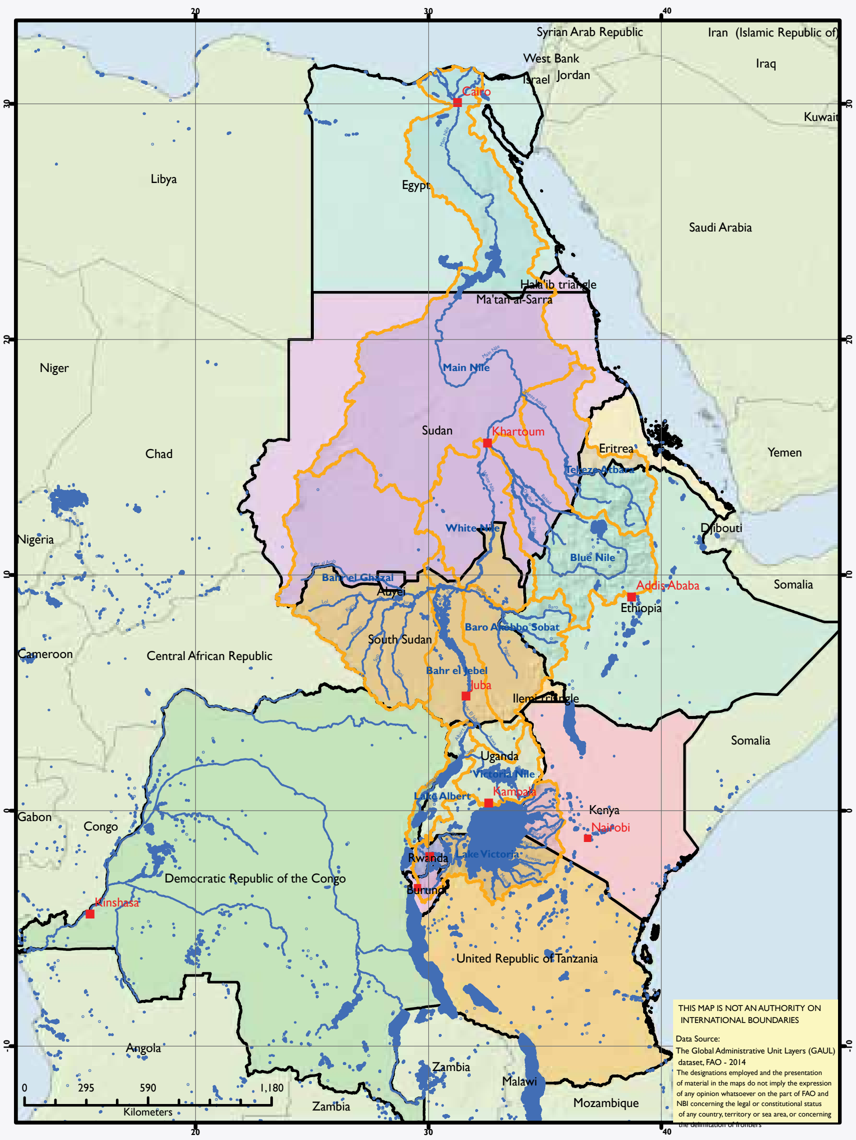
The rainfall anomaly during DJF 2017 exhibited dry condition over the equatorial region (Lake Victoria, Lake Albert, Victoria Nile subbasins). The rainfall anomaly during MAM 2017 experienced wet condition over the central parts, and dry condition over the boundary parts. The Blue Nile subbasin exhibited more rainfall during the low season MAM.
The rainfall anomaly during rainy season in the northern hemisphere in JJA 2017 exhibited much rainfall over Tekeze Atbara, Blue Nile, White Nile, and north part of Bahr el Ghazal subbasins. The dry season (JJA) over the equatorial subbasins recorded more rainfall.
The rainfall anomaly during SON 2017 experienced more rainfall over the eastern part of Baro Akobo Sobat, Victoria Nile, and Lake Victoria subbasins.

Analysis of Actual evapotranspiration estimates shows variation in spatial and temporal distribution among the ten major subbasins. Lake Albert sub-basin seems to have the highest Evapotranspiration to Rainfall ratio (almost 90%) of all water generating sub-basins. AET/Rainfall ratios are highest in the drier areas of northern Sudan and Egypt reflecting the fact that any moisture available evaporates. In the wetter basins of the Nile Equatorial Lakes region, the ratios are about 0.5. In the vast plains of South Sudan and around Lake Albert, the ratios are close to 1.0

The NBI aims at providing a shared understanding of patterns of the water cycle components using satellite data observations so as to promote evidence based decision making.

INTRODUCTION

THE NILE BASIN COUNTRIES



The River Nile Basin covers about 3,176,541 square kilometers, which represents about ten percent of Africa's land mass area. The river presents an array of opportunities for a sustainable future. This can only be realized if riparian countries can jointly plan, manage and develop the shared resources in a coordinated manner. Since time immemorial, the river plays a central role in human settlement and in the development of a rich diversity of cultures and livelihoods. The basin includes world class environmental assets such as river Nile being the longest river in the World, Lake Victoria being the second largest Fresh water lake by surface area; and the Sudd wetlands in South Sudan being one of the largest in the World.

It was with this realization that the Nile Basin countries established the all-inclusive Nile Basin Initiative (NBI) on February 22, 1999 with the shared vision objective: 'To achieve sustainable social economic development through the equitable utilization of, and benefit from, the common Nile Basin water resources.

According to the its 10 year Strategy (2017-2027), NBI aims at strengthening evidence-based transboundary water resources planning and management through improved joint monitoring of the Basin.

The current monitoring system with in Nile Basin countries is inadequate with many significant portions of the Nile Basin either un-gauged or very sparsely gauged even for basic hydrological parameters. Therefore NBI in collaboration with its member states has designed a regional Hydro-Met monitoring system to enhance basin monitoring. In addition, use of satellite data has been identified as one way of supplementing the existing monitoring system.

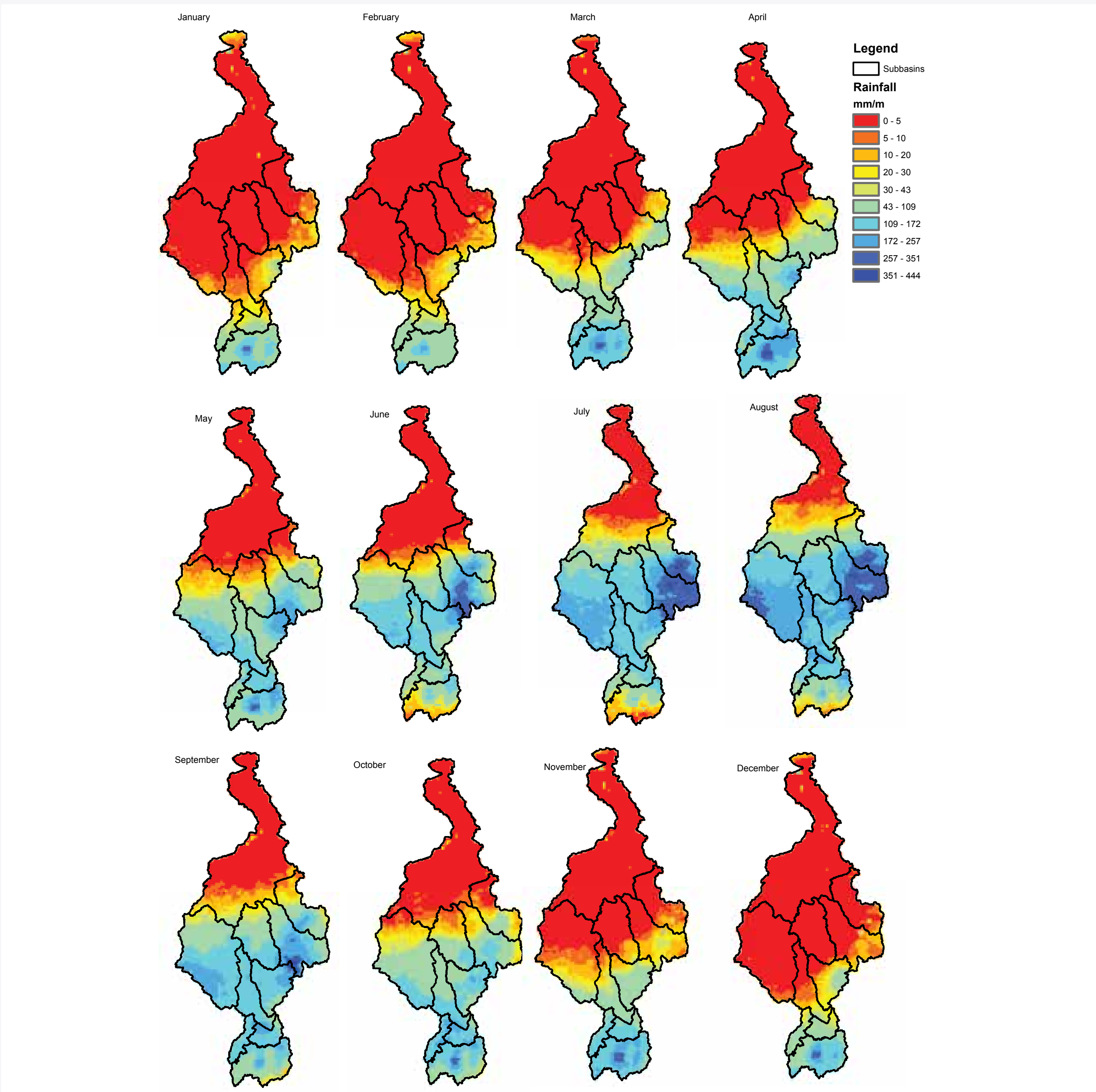
This Basin Monitoring bulletin therefore, aims at providing a shared understanding of patterns of some of the water cycle components in our changing environment based on satellite data. Estimates of water cycle parameters provide insights on available opportunities for water use, water conservation and thereby enhance water use efficiencies.

This issue provides an analysis of Rainfall, Actual Evapotranspiration in the sub-basins, and an analysis of Water levels in large lakes in from October to December 2017 and a seasonal analysis of the 2017 estimated rainfall over the Nile basin.

RAINFALL OVER THE NILE BASIN

Rainfall in the Sub-basins of the Nile Basin has been estimated using NASA's Tropical Rainfall Measuring Mission (TRMM)_3B42 daily rainfall and 3B43-v7 monthly rainfall product. TRMM is a joint U.S.-Japan satellite mission to monitor tropical and subtropical precipitation. The purpose of 3B43 algorithm is to produce the best-estimate of precipitation rate (in mm/hr) and root-mean-square (RMS) precipitation-error estimates from TRMM and other data sources. The algorithm combines multiple independent precipitation estimates from the TRMM Microwave Imager (TMI), Advanced Microwave Scanning Radiometer for Earth Observing Systems (AMSR-E), Special Sensor Microwave Imager (SSMI), Special Sensor Microwave Imager/Sounder (SSMIS), Advanced Microwave Sounding Unit (AMSU), Microwave Humidity Sounder (MHS), microwave-adjusted merged geo-infrared (IR), and monthly accumulated Global Precipitation Climatology Centre (GPCC) rain gauge analysis.

Analysis of TRMM estimates has been done for all the 10 major sub-basins of the Nile basin and compared to Actual evapotranspiration long term average.

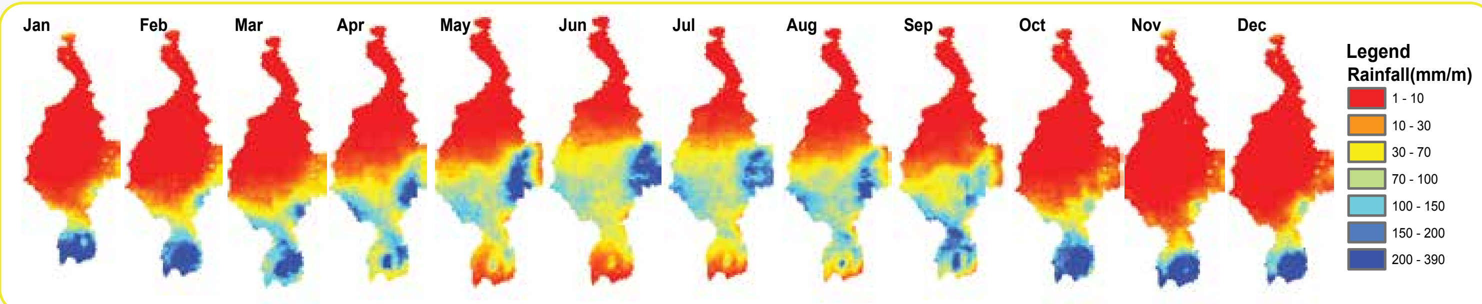


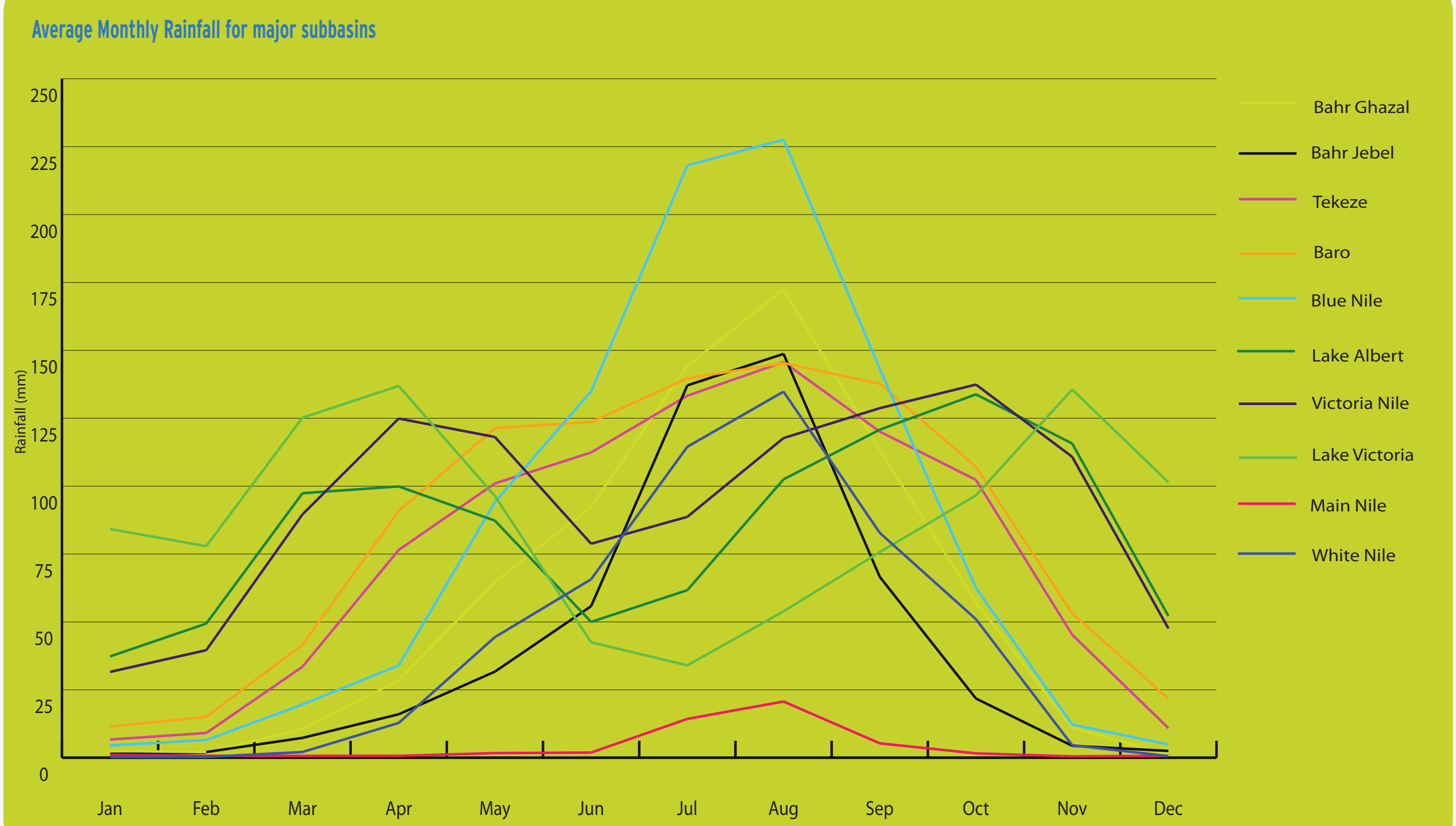
Rainfall (mm): monthly average

SPATIAL AND TEMPORAL DISTRIBUTION OF RAINFALL IN THE NILE BASIN

Overall, TRMM rainfall estimates indicate a wide rainfall variability in the basin. This is also confirmed by ground observations. Minimum rainfall is seen to be less than 50mm/year in the arid areas in the northern part of the basin and the maximum rainfall estimates are observed in the equatorial lakes region in the areas around Lake Victoria and the Ethiopian Highlands at over 1000mm/yr. The high altitude areas of the basin such as the Ethiopian highlands, Rwenzori mountains in Uganda and Mount Elgon are considered to be the water towers in the basin receiving rainfall over 1500mm/yr.

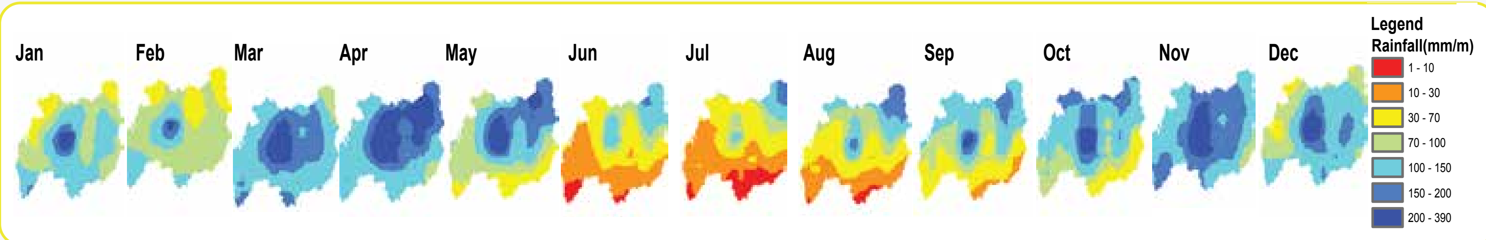
Monthly distribution of rainfall over the basin is characterized by monomodal rainfall patterns (June - September (JJAS)) in the Ethiopian plateau especially in the Blue Nile and Tekeze subbasins, April - October in Bahr el Ghazal sub-basin, and May - October in White Nile, Baro Akobo Sobat, and Bahr el Jebel Sub-basins. The bimodal rainfall pattern (March - April - May (MAM) and September - October - November (SON)) in the equatorial lakes region especially in the Lak e Victoria, Lake Albert, Victoria Nile sub-basins

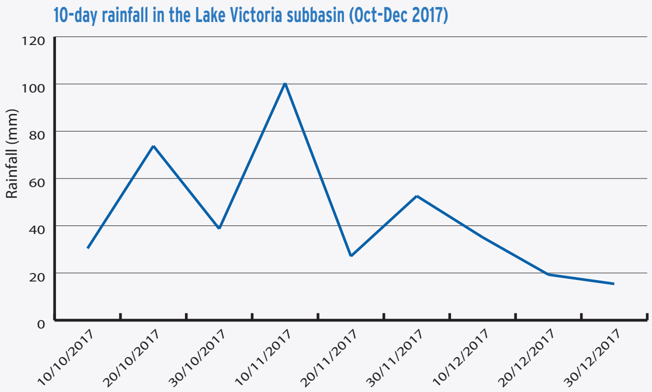


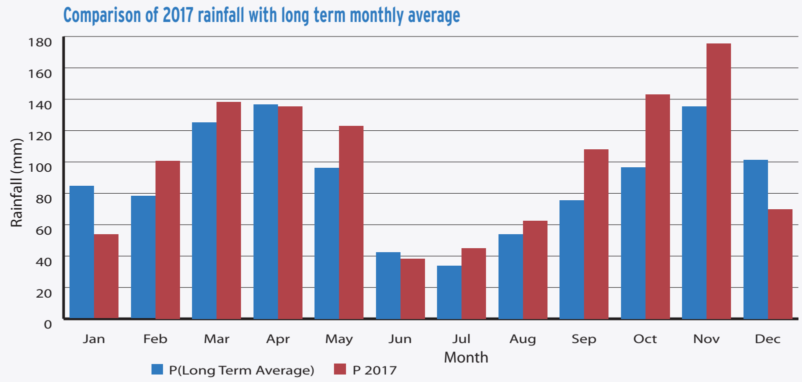


RAINFALL OVER LAKE VICTORIA SUBBASIN

The Lake Victoria subbasin portrays a bimodal rainfall pattern with the main dry season occurring during June to August. The 10 day accumulated rainfall of TRMM data during 2017 showed two spikes at the mid of October and beginning of November. December showed little rainfall especially especially mid- month and towards the end of the month. When comparing the rainfall of 2017 with the long term average, 2017 generally was more wet than the long term mean except January and December. During the second wet season of 2017, Lake Victoria Subbasin exhibited more rainfall as compared to the long term average by 30% in Sep, 33% in Oct and by 23% in Nov.





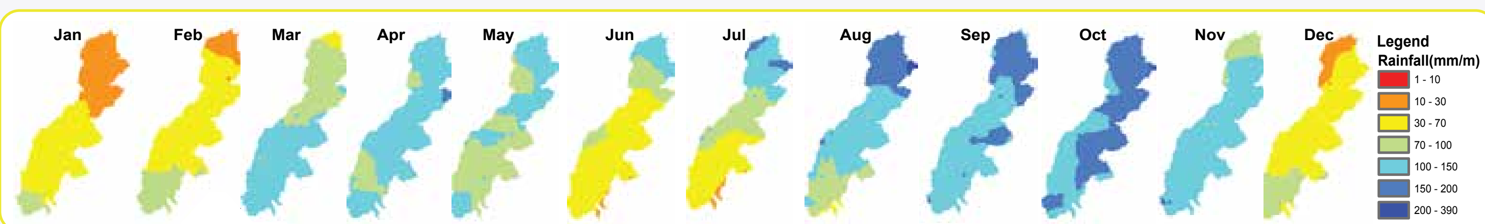


Percentage change of 2017 rainfall from the long term monthly average over Lake Victoria subbasin

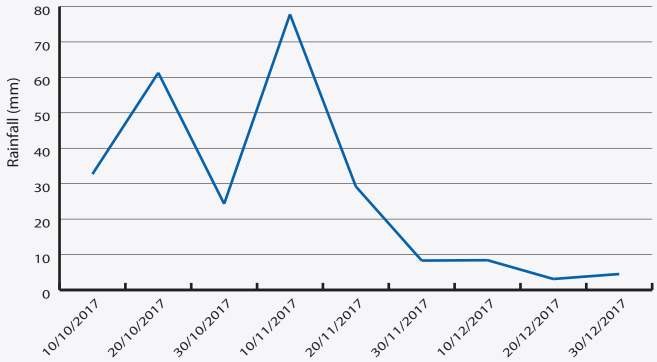
Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
%change over LV	-58	23	10	-1	22	-11	25	14	30	33	23	-45

RAINFALL OVER LAKE ALBERT SUBBASIN

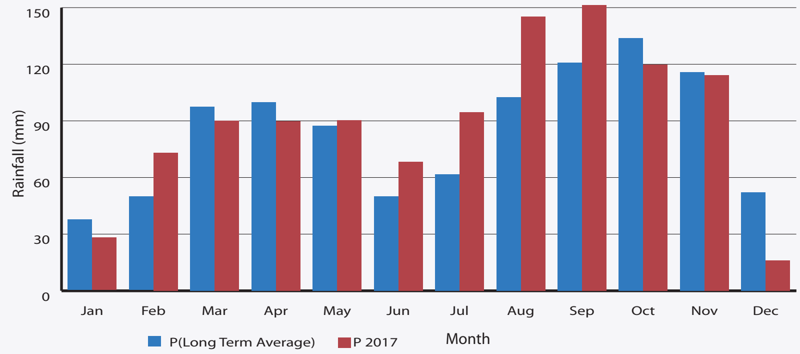
Lake Albert subbasin as the other equatorial subbasins also has a bimodal rainfall. The subbasin registers high values during June and July. The second wet season of August – November is higher than the first wet season of March-May. The 10 day pattern of rainfall during 2017 experienced two spikes at the mid of October and November, and almost no rainfall in December. During the second wet season of 2017, Lake Albert subbasin exhibited more rainfall compared to long term average rainfall, especially during July (by 35%), August (by 29%), and September (by 20 %).



10-day rainfall in the Lake Albert subbasin (Oct-Dec 2017)



Comparison of 2017 rainfall with long term monthly average

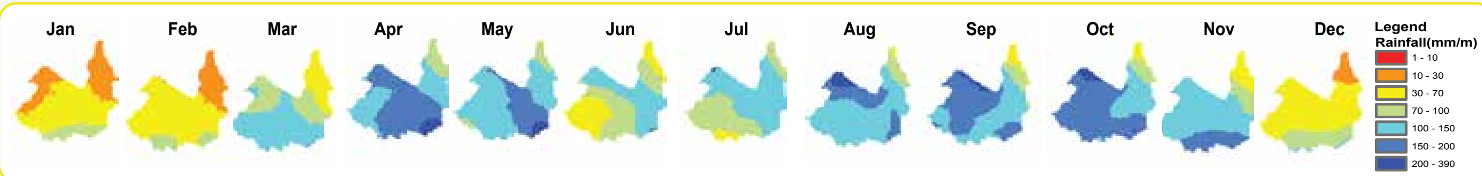


Percentage change of 2017 rainfall from the long term monthly average over Lake Albert subbasin

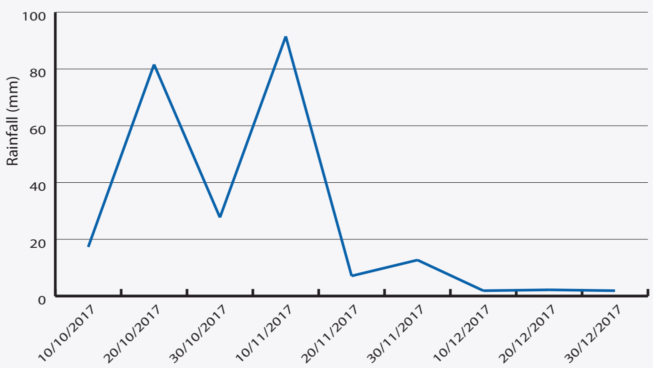
Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
%change over LA	-35	32	-8	-11	3	27	35	29	20	-12	-1	-226

RAINFALL OVER VICTORIA NILE SUBBASIN

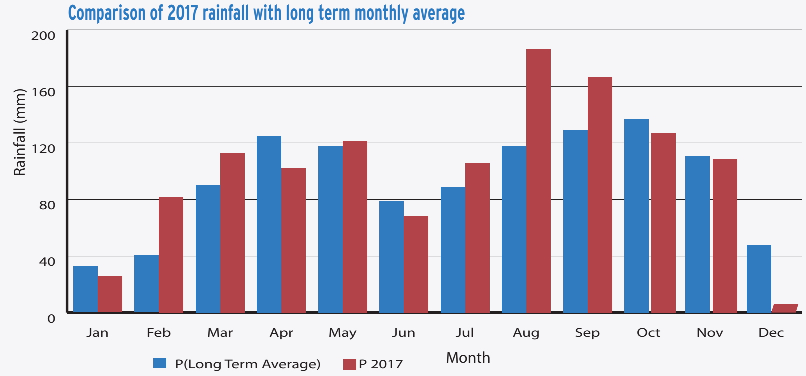
The Victoria Nile subbasin depicts bimodal wet rainfall seasons with the lowest rainfall amounts during Dec – Feb. The subbasin registers high values during June and July. The second wet season of August – November is higher than the first wet season of March-May. The 10 day pattern of rainfall during 2017 experienced two spikes at the mid of October and November, and almost no rainfall in December. During the second wet season of 2017 ,Victoria Nile subbasin exhibited more rainfall compared to long term average rainfall during August (37%) and September (23%).



10-day rainfall in the Victoria Nile subbasin (Oct-Dec 2017)



Comparison of 2017 rainfall with long term monthly average

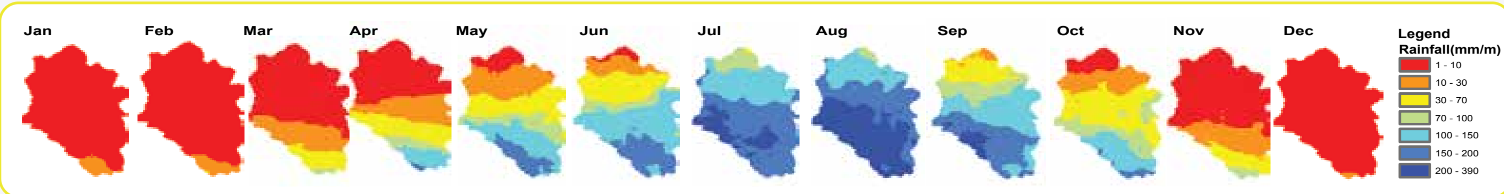


Percentage change of 2017 rainfall from the long term monthly average over Victoria Nile subbasin

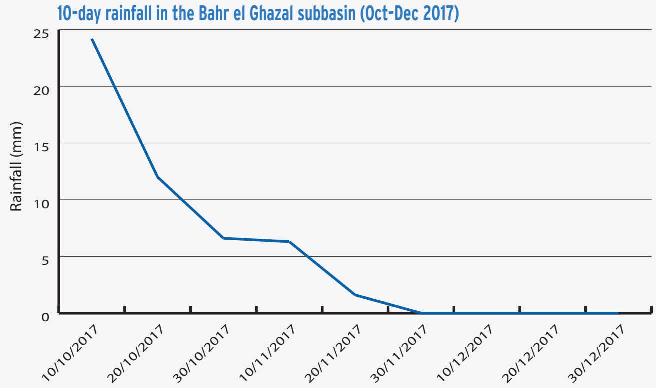
Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
%change over VN	-27	51	21	-22	2	-16	16	37	23	-8	-2	-696

RAINFALL OVER BAHR EL GHAZAL SUBBASIN

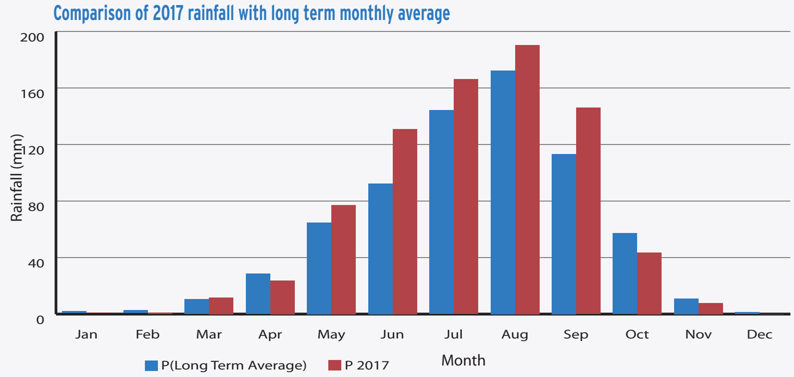
The rainfall in Bahr el Ghazal subbasin exhibits a monomodal wet season between April-October and the rest of the year (November to March) is generally dry. However, the northern part of the basin which lies in Sudan is dryer than the southern part of the basin in South Sudan. The 10 day rainfall during 2017 decreased gradually from the beginning of October to the mid of November, and after that the basin recoded no rain until the end of December. The rainfall during 2017 exhibited more rainfall from May to September compared with the long term average rainfall. During the wet season of 2017 Bahr el Ghazal subbasin exhibited more rainfall from May to September (May 16%, Jun 29%, Jul 13%, Aug 9%, and Sep 22%) compared with the long term average rainfall.



10-day rainfall in the Bahr el Ghazal subbasin (Oct-Dec 2017)



Comparison of 2017 rainfall with long term monthly average

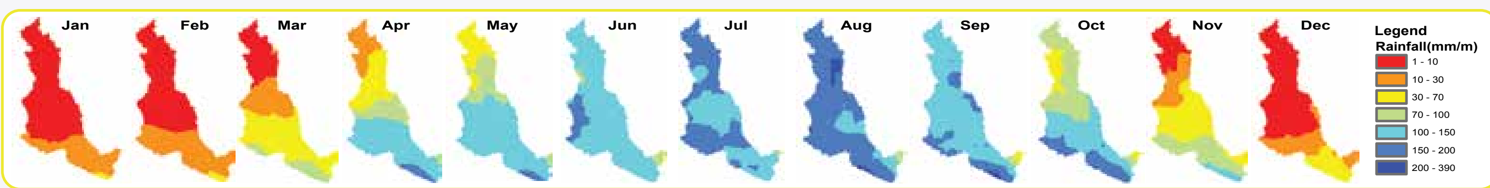


Percentage change of 2017 rainfall from the long term monthly average over Bahr el Ghazel subbasin

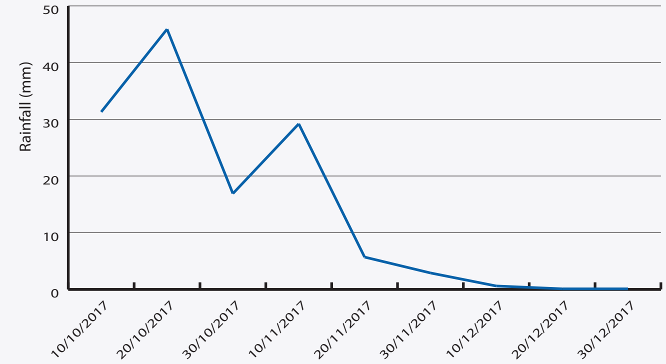
Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
%change over BG	-	-	11	-20	16	29	13	9	22	-31	-39	-

RAINFALL OVER BAHR EL JEBEL SUBBASIN

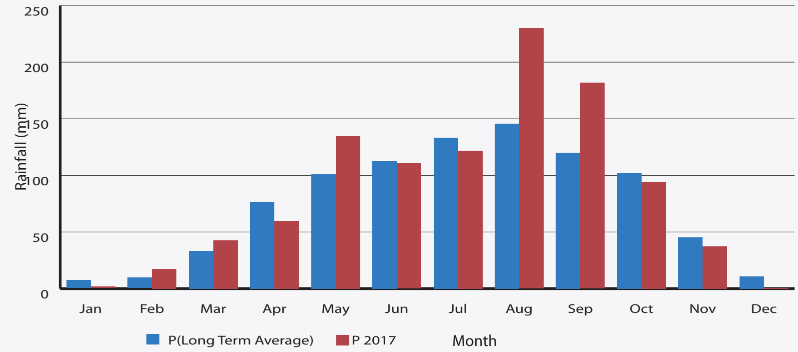
Unlike the upstream equatorial subbasins, Bahr el Jebel sub-basin shifts from a bimodal rainfall pattern to a monomodal rainfall pattern. The wet season extend from May – October, and the dry season extends between Nov. - April. The subbasin indicates fairly low monthly rainfall variations. The 10 day decreasing pattern of rainfall during 2017 experienced two spikes at the mid of October and November, and almost no rainfall in December. The rainfall during 2017 exhibited in general more rainfall compared to long term average rainfall during August (37%) and September (35%).



10-day rainfall in the Bahr el Jebel subbasin (Oct-Dec 2017)



Comparison of 2017 rainfall with long term monthly average

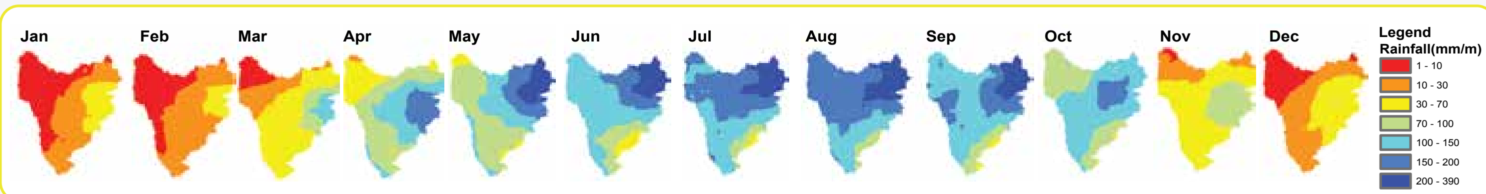


Percentage change of 2017 rainfall from the long term monthly average over Bahr el Jebel subbasin

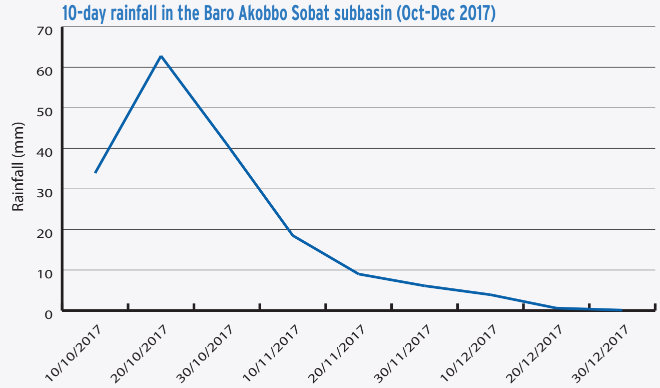
Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
%change over BJ	-	47	21	-28	25	-2	-10	37	35	-8	-22	-

RAINFALL OVER BARO AKOBO SOBAT SUBBASIN

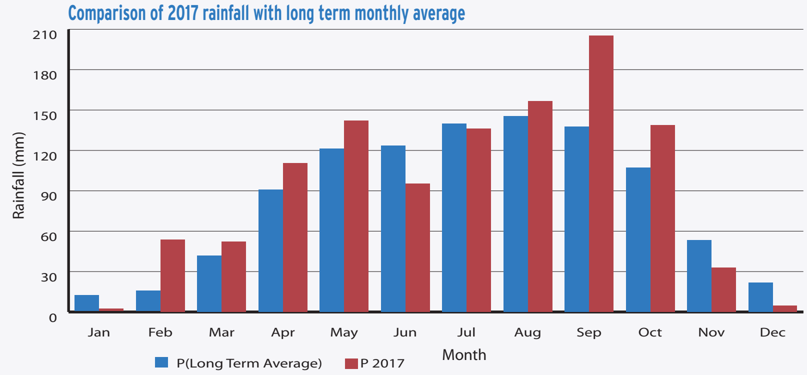
The Baro Akobo Sobat subbasin exhibits a monomodal wet season between May – October. The rainfall extends almost during the whole year with high varying temporal amounts, especially during the wet season. The 10 day rainfall during 2017 increased during the mid of October and experienced after that a large reduction up to the mid-November and recorded little rainfall after that up to the end of December. The rainfall during 2017 exhibited in general more rainfall compared to long term average rainfall during September and October.



10-day rainfall in the Baro Akobbo Sobat subbasin (Oct-Dec 2017)



Comparison of 2017 rainfall with long term monthly average

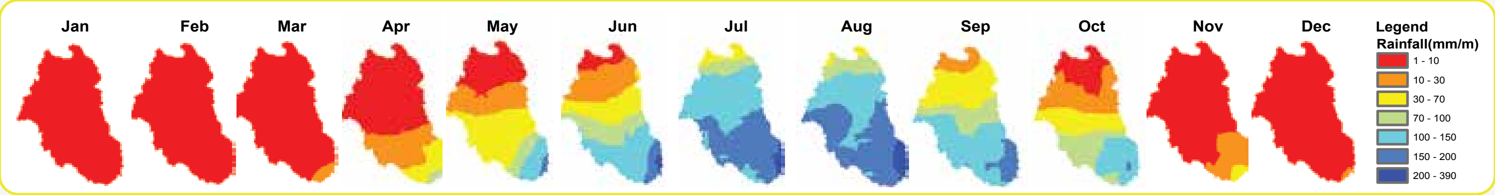


Percentage change of 2017 rainfall from the long term monthly average over Baro Akobbo Sobat subbasin

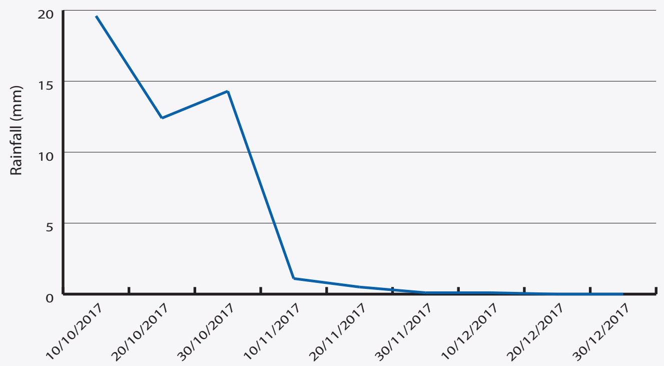
Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
%change over BAS	-	72	20	18	15	-30	-3	7	33	23	-63	-

RAINFALL OVER WHITE NILE SUBBASIN

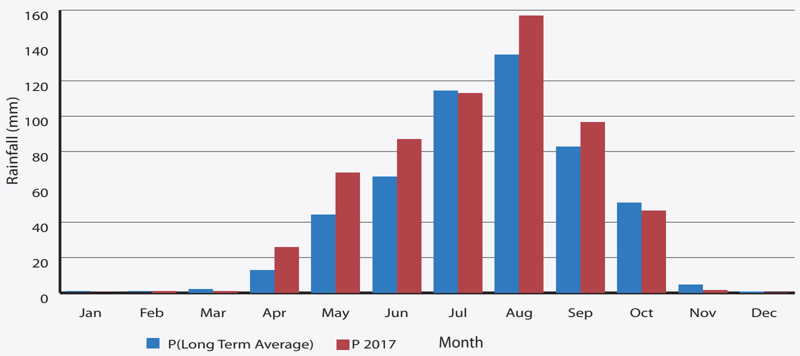
The White Nile subbasin rainfall reduces gradually northward. This basin covers parts of north-eastern South Sudan, a small part of south western Ethiopia and the south part of Sudan. There is generally low rainfall recorded in the monomodal wet season; May – October with more rainfall of the southern part and almost negligible rainfall recorded in the north part of the sub-basin. The 10 day rainfall during 2017 was decreasing during October, and almost no rain during November and December. The rainfall during 2017 exhibited in general more rainfall compared to long term average rainfall especially during May (35%), June (25%), and September (14%). .



10-day rainfall in the White Nile subbasin (Oct-Dec 2017)



Comparison of 2017 rainfall with long term monthly average



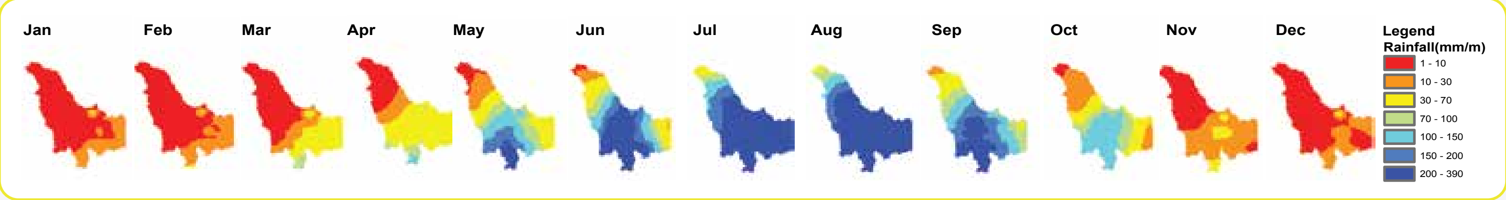
Percentage change of 2017 rainfall from the long term monthly average over White Nile subbasin

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
% change over WN	-	-	-	51	35	25	-1	14	14	-10	-	-

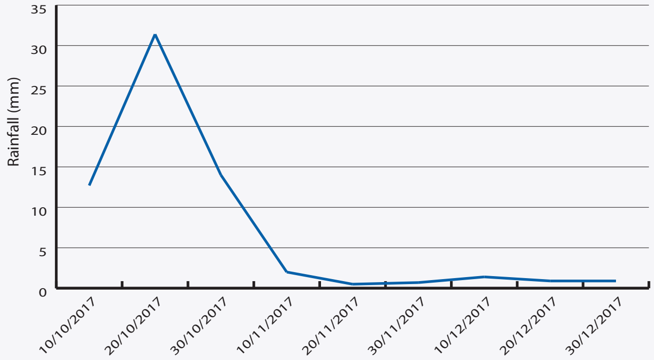
RAINFALL OVER BLUE NILE SUBBASIN

There is high spatial variability between the rainfall in the upper catchment in Ethiopia and the lower catchment in Sudan. The upper part of Blue Nile received rainfall almost the whole year in different amounts but the main season extends between May to October. In the downstream catchment in Sudan, the amounts of rainfall recorded diminishes until the wet season (June to September). The 10 day rainfall during 2017 increased at the mid of October and decreased sharply up to the beginning of November. From the mid of November to the end of December the upper catchment of the Blue Nile at Ethiopia received a little rainfall.

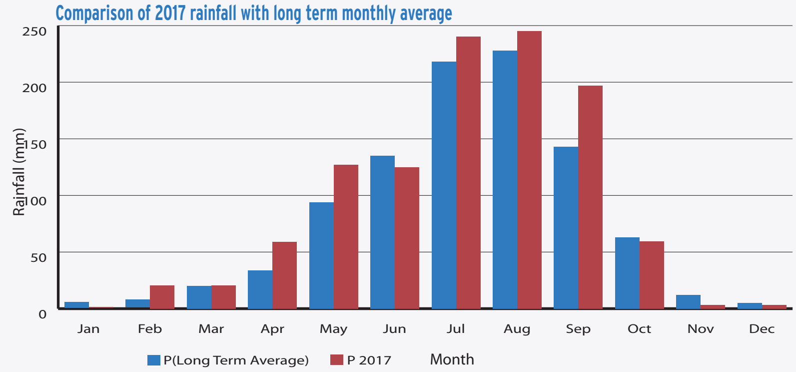
The rainfall during 2017 was above long term average rainfall, especially during the rainy season. Rainfall over the Blue Nile subbasin during 2017 was above the long term average rainfall, especially during the rainy season in Jul (by 9%), Aug (by 7%), and Sep (by 27%).



10-day rainfall in the Blue Nile subbasin (Oct-Dec 2017)



Comparison of 2017 rainfall with long term monthly average

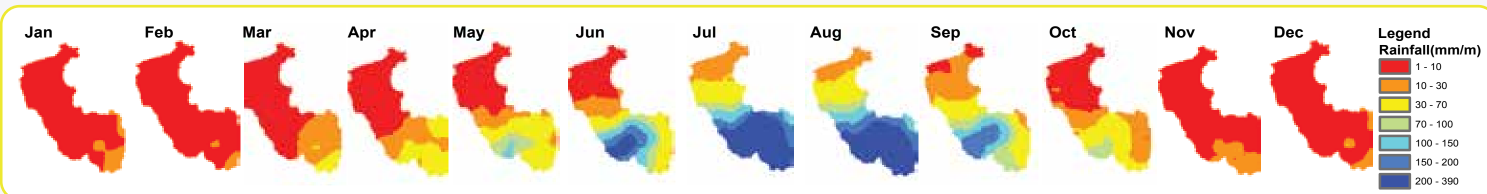


Percentage change of 2017 rainfall from the long term monthly average over Blue Nile subbasin

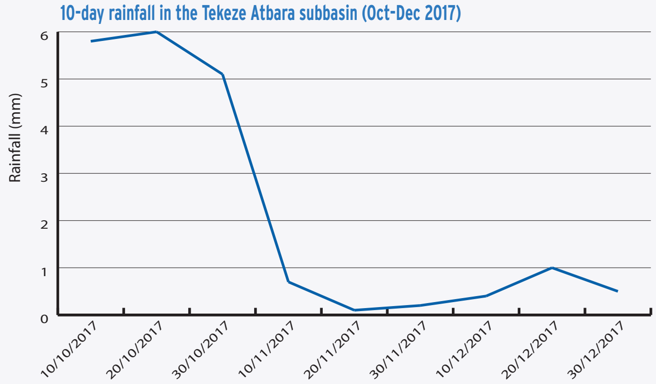
Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
%change over BN	-	-	5	43	26	-8	9	7	27	-5	-	-

RAINFALL OVER TEKEZE ATBARA SUBBASIN

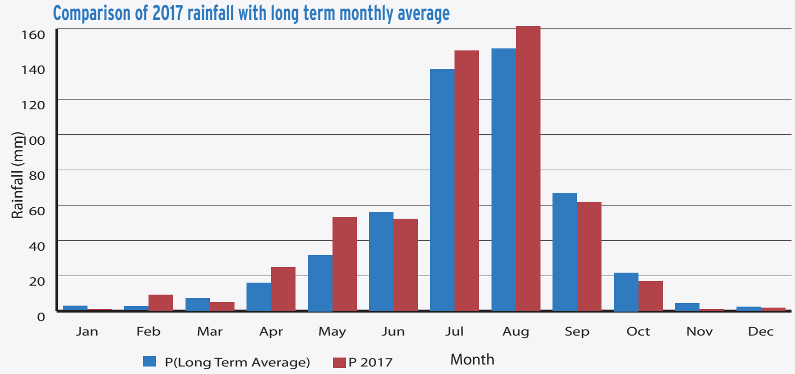
The Tekeze Atbara subbasin exhibits rainfall in its upper catchment in Ethiopia with little amounts during July and August, and is almost dry during the rest of the year. The lower catchment in Sudan is mainly dry with very few rainfall amounts recorded in the wet season. The 10 day rainfall during 2017 recorded little rainfall during October, and almost no rainfall during November and December. The rainfall during 2017 exhibited in general more rainfall compared to long term average rainfall during May (by 41%), July (by 7%), and August (by 8%)..



10-day rainfall in the Tekeze Atbara subbasin (Oct-Dec 2017)



Comparison of 2017 rainfall with long term monthly average

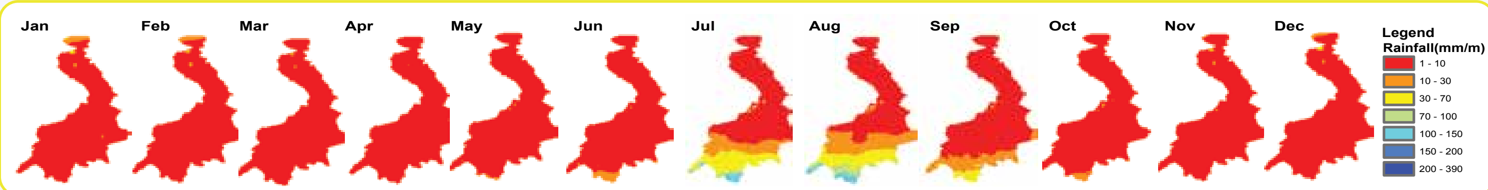


Percentage change of 2017 rainfall from the long term monthly average over Tekeze Atbara subbasin

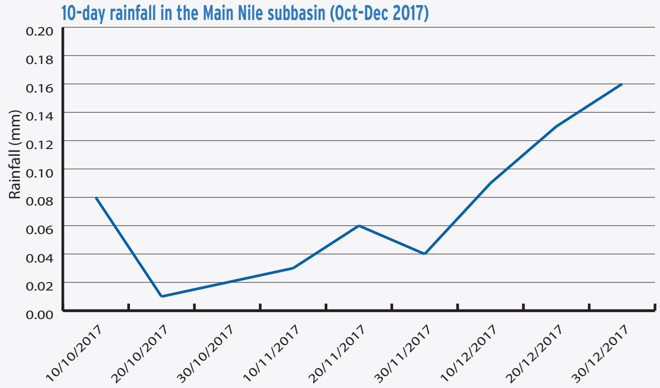
Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
%change over TA	-	-	-49	35	41	-7	7	8	-6	-29	-	-

RAINFALL OVER MAIN NILE SUBBASIN

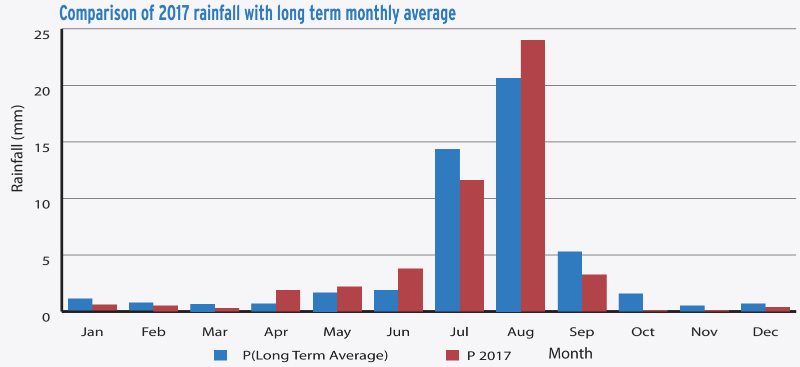
The Main Nile subbasin experiences the driest climate over the entire Nile Basin with very little rainfall amounts recorded mainly in July and August. The Delta region which is close to the Mediterranean Sea exhibits more rainfall. The 10 day rainfall during 2017 over the Main Nile subbasin records very little rainfall. The long term average rainfall during July was more than the rainfall of 2017 for the same month. However, August (14%) showed more wetting during 2017 compared to the long term average.



10-day rainfall in the Main Nile subbasin (Oct-Dec 2017)



Comparison of 2017 rainfall with long term monthly average



Percentage change of 2017 rainfall from the long term monthly average over Main Nile subbasin

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
% Change over MN	-	-	-	63	24	50	-24	14	-63	-	-	-

SEASONS IN THE NILE BASIN

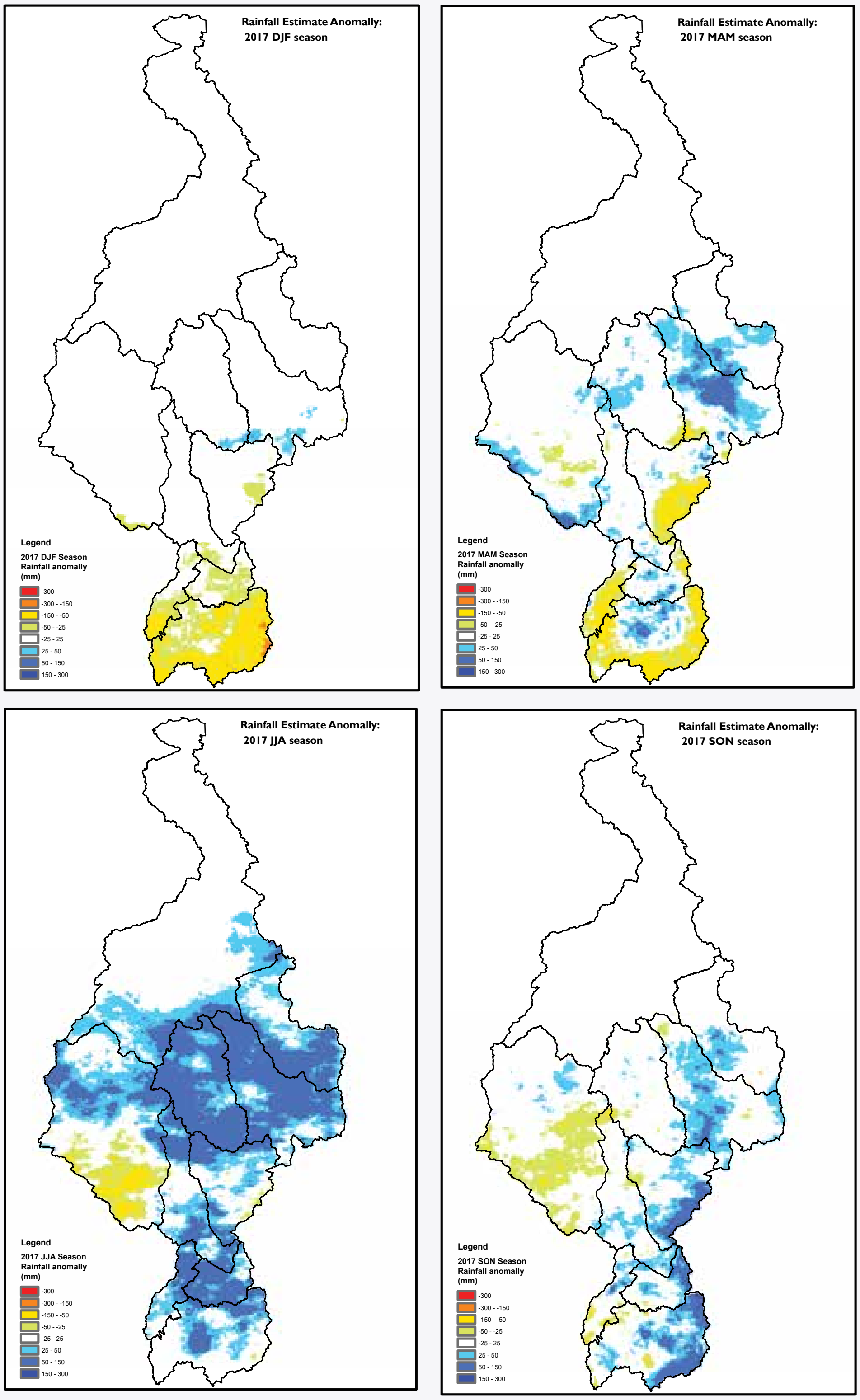
Seasonality in the Nile basin region is determined by the position of the ITCZ with moisture sources from the Indian and Atlantic oceans. In Sudan and south sudan DJF and JASO are the wet seasons while MAMJ is the dry season.

In the Blue Nile region JJAS is the main wet season, MAM is spring rains and ONDJF is dry season while in the Equatorial Lakes region MAM and SOND are the wet season with JJA in between as the dry season

Season anomaly maps based on 2017 TAMSAT rainfall estimates have been prepared against the 1983-2012 climatology.
The TAMSAT rainfall estimates and derived products are based on Meteosat thermal infra-red (TIR)
imagery provided by EUMETSAT. The TIR is calibrated against an extensive ground-based rain
gauge data archive.

The rainfall anomaly during DJF 2017 exhibited dry condition over the equatorial region (Lake Victoria, Lake Albert, Victoria Nile sub-basins). Moreover, the rainfall anomaly during MAM 2017 experienced wet condition over the central parts, and dry condition over the boundary parts. The Blue Nile subbasin exhibited more rainfall during the low season MAM. Furthermore, the rainfall anomaly during rainy season in the northern hemisphere in JJA 2017 exhibited much rainfall over Tekeze Atbara, Blue Nile, White Nile, and north part of Bahr el Ghazal subbasins. The dry season (JJA) over the equatorial subbasins recorded more rainfall. In addition, the rainfall anomaly during SON 2017 experienced more rainfall over the eastern part of Baro Akobo Sobat, Victoria Nile, and Lake Victoria subbasins.

Season anomaly maps for 2017 are shown below

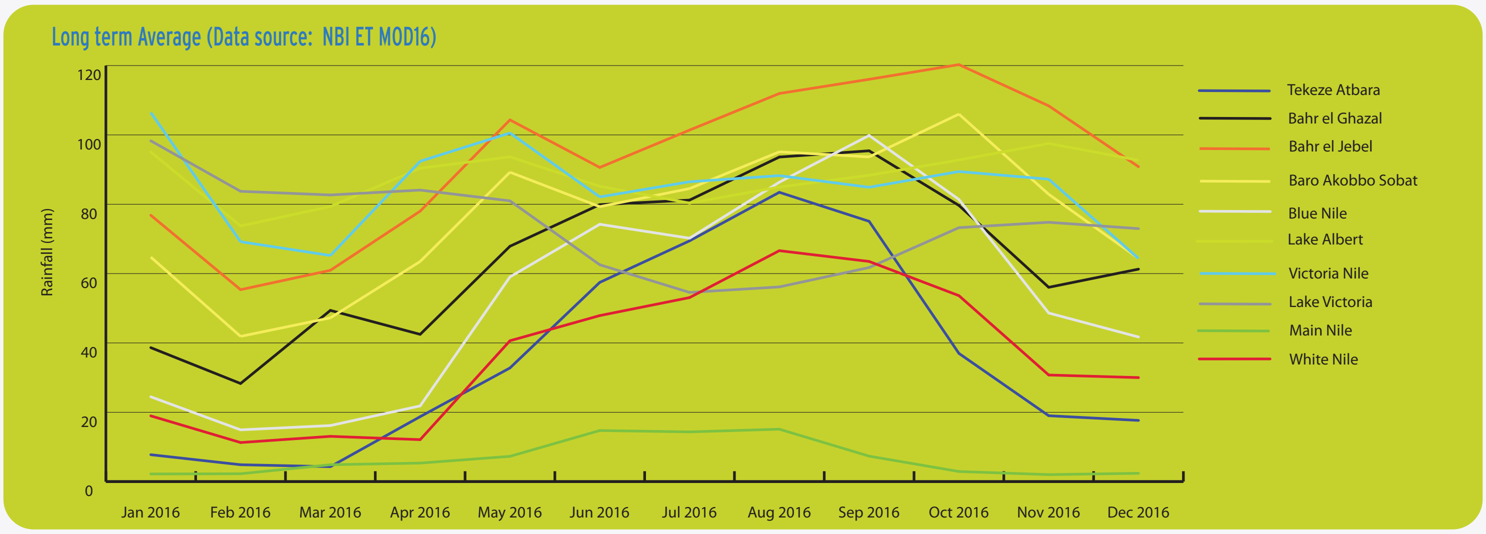


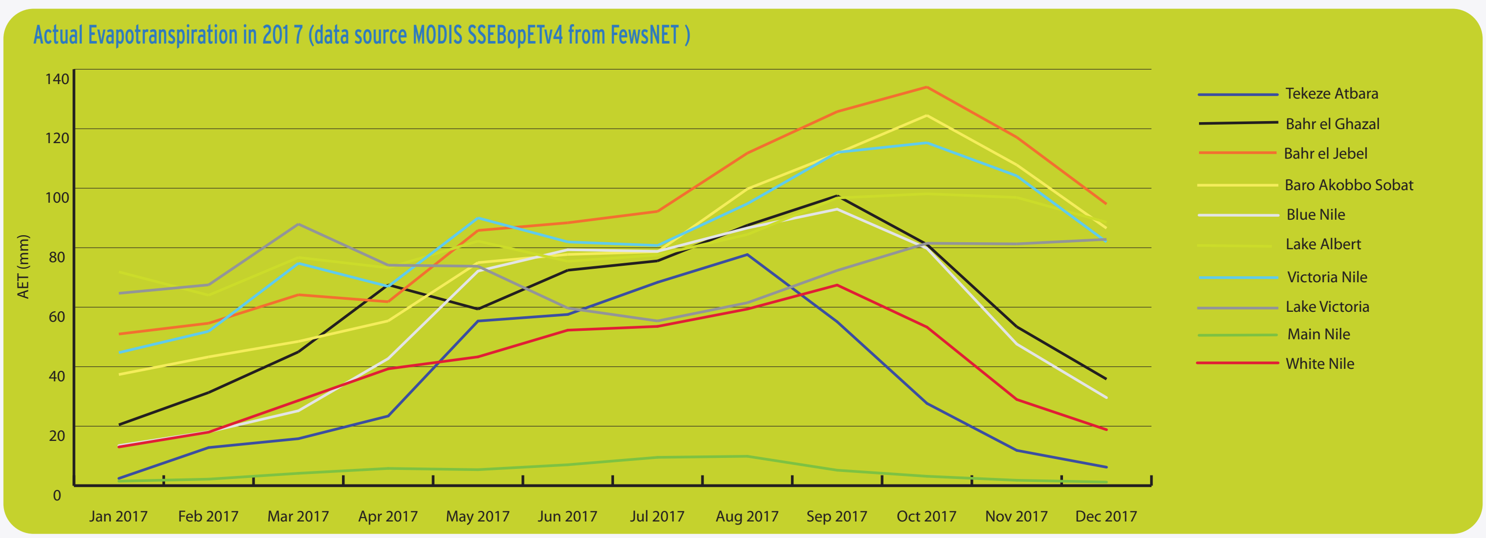
ACTUAL EVAPOTRANSPIRATION OVER THE NILE BASIN

Actual Evapotranspiration is a major component of the water balance of the Nile basin. NBI Secretariat generated Operational Actual Evapo-Transpiration estimates over the Nile Basin countries based on the global MOD 16A2 ET product using an improved algorithm for the Nile Basin from January 2000 to 2014. The improved algorithm uses daily meteorological data and MODIS land surface dynamic datasets as input for daily ET calculations. To estimate the MOD16 ET for the Nile Basin, the major improvements were estimated not only over vegetated land surfaces but also over deserts, urban areas, inland water bodies such as rivers and lakes. This data was estimated for the Nile basin countries every 8 days, monthly, annually and is available freely to Nile basin Countries via the Nile Information System and upon request through email.

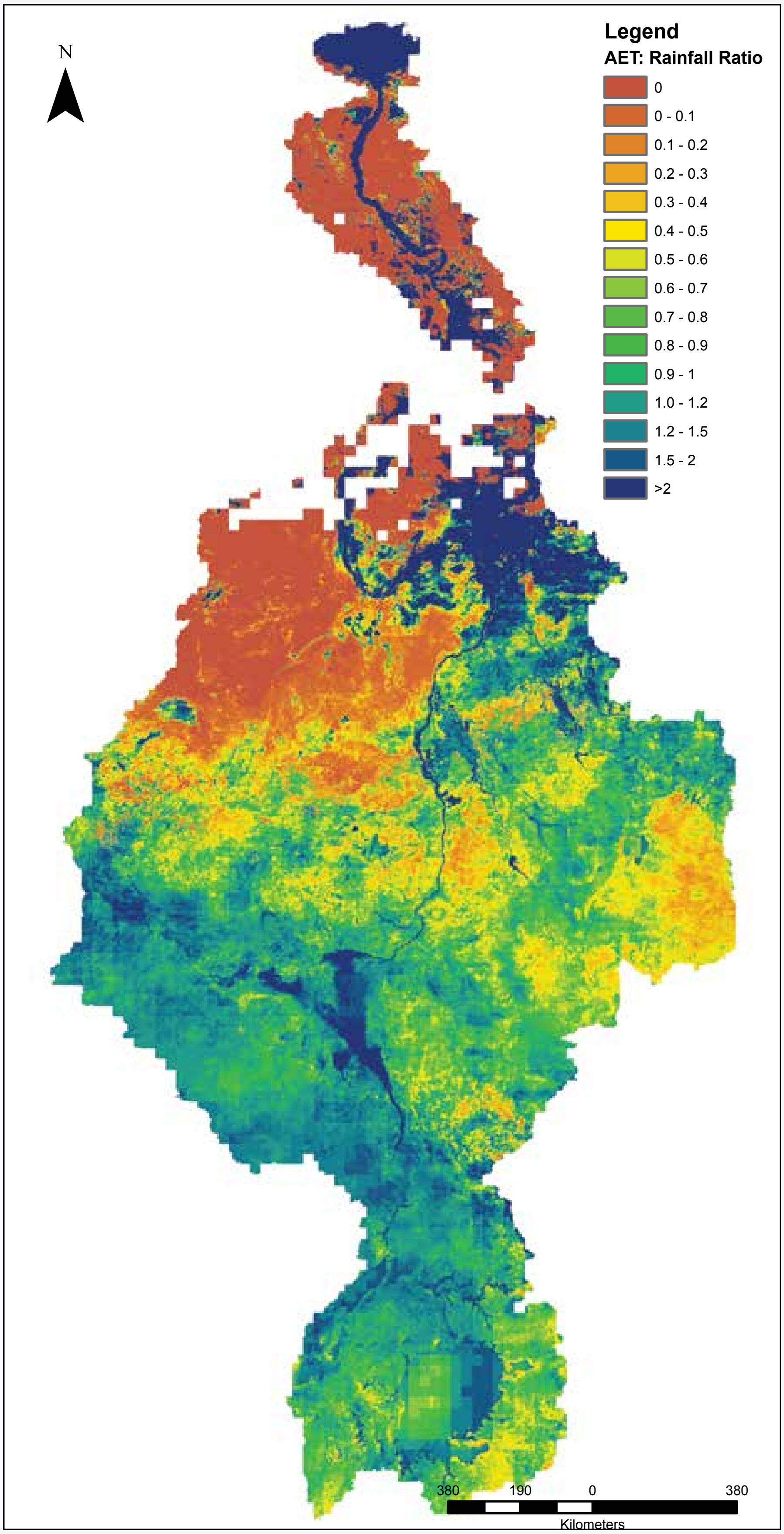
Analysis of Actual evapotranspiration estimates shows variation in spatial and temporal distribution among the ten major subbasins. Lake Albert sub-basin seems to have the highest Evapotranspiration to Rainfall ratio (almost 90%) of all water generating sub-basins. AET/Rainfall ratios are highest in the drier areas of northern Sudan and Egypt reflecting the fact that any moisture available evaporates. In the wetter basins of the Nile Equatorial Lakes region, the ratios are about 0.5. In the vast plains of South Sudan and around Lake Albert, the ratios are close to 1.0

Monitoring AET in the Nile Basin region has been supplemented by monthly AET data from FEWSNET early warning and drought monitoring data portal from 2014 to 2017 and the analysis is shown below





ET: P ratio in 2016 (based on TRMM annual rainfall and FewsNET AET for 2017)



The ratio of AET and Rainfall shows the conversion rate of available moisture to evapo-transpiration. When this ratio is less than one, there is room to generate runoff and/or charge groundwater from excess rainfall.
When the ET/P ratio is more than 1.0, it means that all locally generated and some of the transported water into the basin is lost and therefore those subbasins are points of such losses.
Whether such losses are beneficial or non beneficial depends on the nature of land use/cover through which water evaporates.
All the major lakes with in the Nile Basin lose water through evaporation more than they gain through rainfall except lake Victoria.

Photo: Kristy/flickr.com

Simien Mountains, Ethiopia

Water levels in major lakes in the River Nile Basin region basing on Satellite Altimetry

The River Nile and Lakes with in the Nile Basin region are extremely sensitive to changes in rainfall with variations impacting lake levels and river discharges.

The major lakes in the Nile basin system are Lake Victoria, Lake Kyoga, Lake Albert, Lake Tana, Lake Edward, and Lake Nasser. Numerous tributary rivers flow into the upper lakes and it is essential to monitor these differences in water levels.

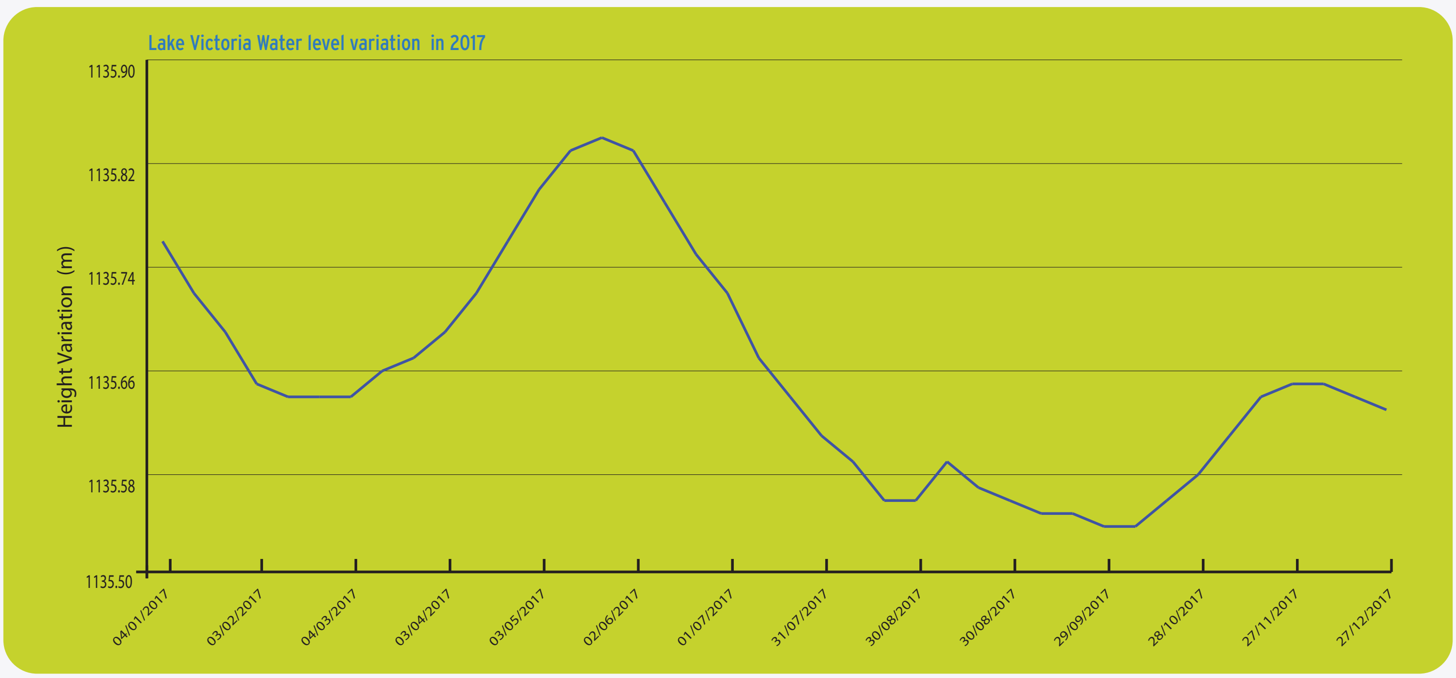
Relative lake height variations have been computed from TOPEX/POSEIDON (T/P), Jason-1 and Jason-2/OSTM altimetry with respect to a 9 year mean level derived from T/P altimeter observations for some of the lakes in the Nile Basin. The height variation time series has been smoothed with a median type filter to eliminate outliers and reduce high frequency noise.

Data source is USDA/NASA/SGT/UMD

Lake Victoria Water Levels

TPJOJ.2.3	: Data Processing Version ID
314 Victoria_1	: Lake database id number and name
-0.670 33.546	: Latitude and longitude (degrees East) of lake mid-point
-1.335 -0.019	: Latitude range of pass traversing lake at which data is accepted

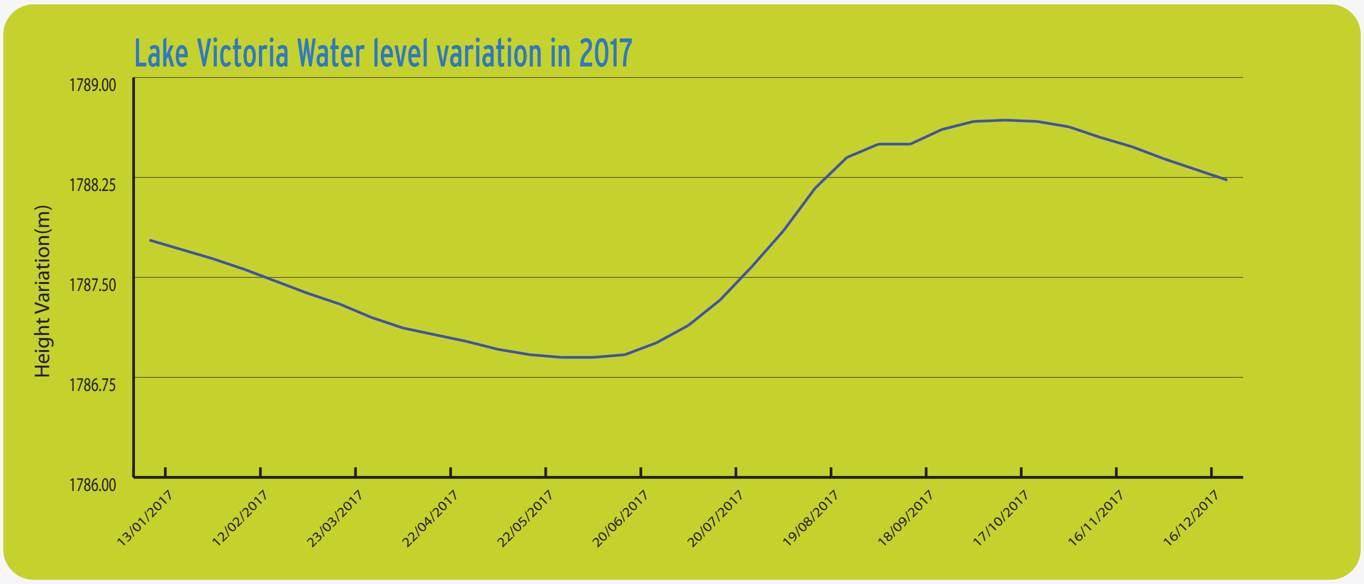
Lake Victoria Water Variation in 2017



Lake Tana Water Levels

TPJOJ.2.3	: Data Processing Version ID
402 Tana	: Lake database id number and name
12.117 37.404	: Latitude and longitude (degrees East) of lake mid-point
11.950 12.199	: Latitude range of pass traversing lake at which data is accepted

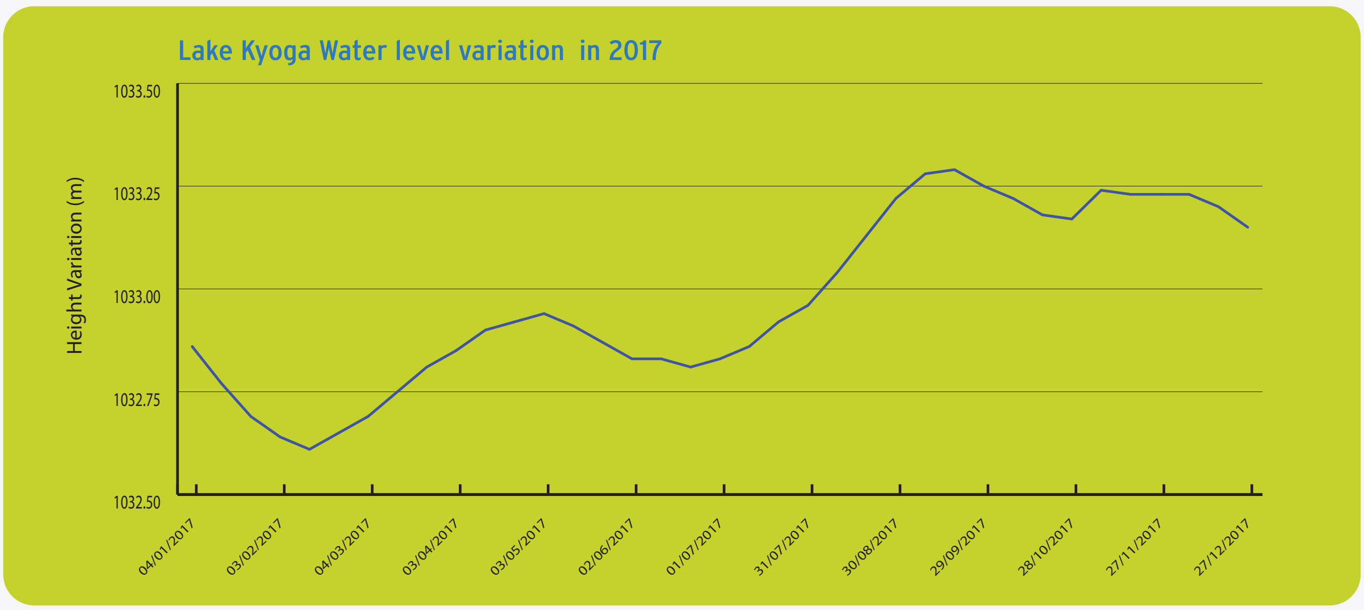
Lake Tana Water Variation in 2017



Lake Kyoga water levels

TPJOJ.2.3	: Data Processing Version ID
398 Kyoga	: Lake database id number and name
1.488 32.777	: Latitude and longitude (degrees East) of lake mid-point
1.418 1.551	: Latitude range of pass traversing lake at which data is accepted

Lake Kyoga Water levels in 2017



IMPLICATION FOR WATER RESOURCES MANAGEMENT

River basin management is a complex task. It involves several inter-dependent courses and processes. Sound transboundary water resources planning requires reliable data and information on the system features, characteristics and status. While the expertise of the professional water resources planners is essential, solid understanding of the system and governing phenomena plays an equally important role. This underscores the high importance of existing comprehensive data and information within the context of river basin management.

The process entails water resources availability assessment, water demands estimates, and a suite of planning options and alternatives for the entire river basin. Environmental, social, economic and other dimensions have to be appropriately considered. Hydro-meteorological monitoring systems are the most accurate source of real-time data and information. However, due to the fact that – for many technical, economic, and institutional reasons – parts of the Nile Basin are not sufficiently covered by hydromet networks, earth observations represent a viable source of information that well inform basin water resources planning and development.

Monitoring the Nile Basin using satellite observation provides key information on water availability and requirements; the two basic elements of the basin water balance. Satellite observations give comprehensive information on rainfall intensity, seasonal and inter-annual variability, and spatial precipitation rates as well as effective rainfall. Spatial and temporal distribution of rainfall over the Nile basin can be therefore determined. Seasonality in the Nile basin region, long-term variation for each sub-basin, and actual evapotranspiration could thus be estimated. Water levels in major lakes (and consequently water content estimates), wetlands extent, and soil moisture as well as some water quality parameters can be defined.

Although remote sensing data is no replacement for ground measurements and real time observation, it has a pivotal role in water management. Not only is data and information for sparsely gauged areas possible but also regions within the basin where topographical and accessibility restrictions hinder the ground observations could be included in the analyses.

A combination of ground and earth observations forms the most feasible basin monitoring system. Remotely sensed data and information complements the real time data records. Better understanding of the river basin regime and viable opportunities is thus achievable. Many fundamental questions are only answerable with combined utilization of both techniques. Satellite based observations provide extremely useful information of water resources availability and potentials, water demands, and inter-basin water transfer. Quantification of mid and long-term water resources management and development plans is readily possible.

NBI shall continue sharing remotely sensed data and information on Nile Basin hydrology and water balance for the main sub-basins; responding to current and future Countries' needs.

Photo: iStock

ONE RIVER ONE PEOPLE ONE VISION

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#NileCooperation; #NileBasin; #OneNile

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