

Situation Analysis Report

Floods in Sudan, August 2016

Prepared by
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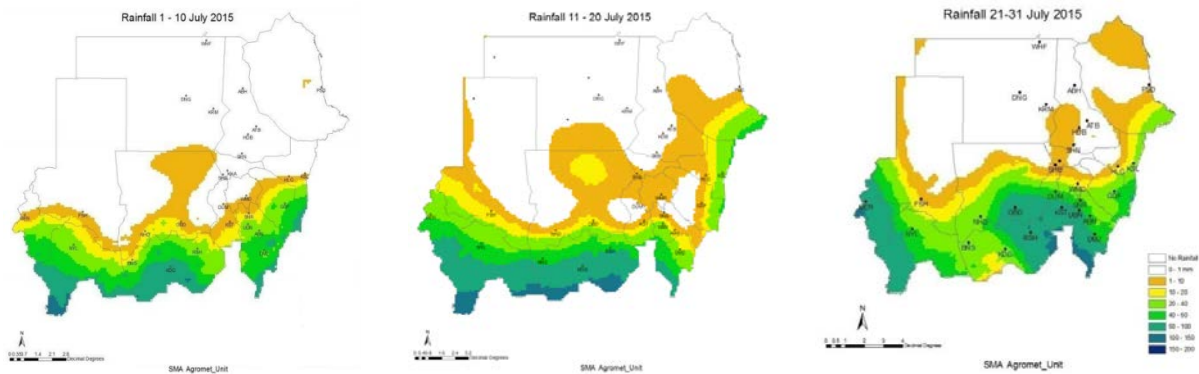
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Situation Overview

The current rainy season in Sudan, which started in early June and is expected to continue until November this year, has resulted in torrential rains that heavily impacted several parts of the country, causing about 114 deaths and affecting more than 161,700 people. 14,700 houses were destroyed and another 10,800 damaged nationwide ([UN OCHA, 14 Aug 2016](#)).

According to the UN Office for the Coordination of Humanitarian Affairs (UN OCHA), floods are common in Sudan during the rainy season. The predominant types of floods are localised floods caused by exceptionally heavy rains (flash floods), and widespread floods caused predominantly by overflow of the Nile and its tributaries, as well as the Gash River. Though flash floods are generally short in duration, these events can cause major damage to villages, urban and agricultural areas located in catchment and drainage zones.

The current rainy season, however, brought a 2.5 times higher rainfall during the month of July 2016 compared to the same month in 2015. UN OCHA and Sudan's Meteorological Authority anticipate that flooding will continue throughout the rainy season.



Rainfall accumulation over Sudan during the month of July 2016. Source: [Sudan Meteorological Authority](#).

Following a request from UN OCHA Country Office, UNITAR-UNOSAT activated the International Charter on Space and Major Disasters on 08 August 2016 to assist with satellite based impact assessment covering the flood affected areas. Priority Areas of Interest (AOIs) for satellite imagery acquisition have been selected based on information about the situation on the ground received from UN OCHA in Sudan and the Government of Sudan.

The present situation analysis report exposes the possible **flood water and saturated/wet soils** in the States of Kassala, Khartoum, River Nile, El Gazira and Sennar. This report provides a summary of combined satellite-based analyses undertaken by UNITAR-UNOSAT from 08 August to 23 August 2016, according to the availability of suitable post-crisis satellite imagery.

Analysis was conducted by comparing the post-crisis satellite imagery with available pre-crisis imagery.

- For **El Gazira State**, the post-crisis image for **El Gazira** area was acquired from Radarsat-2 (Radar) at 12m resolution on 18 August 2016 and water expansion computed based on the difference from pre-crisis image acquired from TerraSAR-X at 3m resolution on 10 October 2009; the post-crisis image for **Wad Madani** was acquired from Radarsat-2 (Radar) at 12m resolution on 18 August 2016 and water expansion computed based on the difference from pre-crisis image acquired from Radarsat-2 at 50m resolution on 22 November 2009.
- For **River Nile State**, the post-crisis image for **Abu Hamad** area was acquired from SPOT-6 (Optical) at 1.5m resolution on 14 August 2016 and water expansion computed based on the difference from pre-crisis image acquired from Sentinel-1 at 10m resolution on 29 May 2016.
- For **Khartoum State**, the post-crisis images were acquired from TerraSAR-X (Radar) at 3m resolution on 11 August 2016 and SPOT-7 (Optical) at 1.5m resolution on 15 August 2016 and water expansion computed based on the difference from pre-crisis image acquired from TerraSAR-X at 3m resolution on 10 October 2009.
- For **Sennar State**, the post-crisis image was acquired from Radarsat-2 (Radar) at 12m resolution on 12 August 2016 and water expansion computed based on the difference from pre-crisis image acquired from Radarsat-2 at 50m resolution on 22 November 2009.
- For **Kassala State**, the post-crisis image was acquired from Landsat-8 (Optical) at 30m resolution on 08 August 2016 and water expansion computed based on the difference from pre-crisis image acquired from Landsat-8 on 05 June 2016.

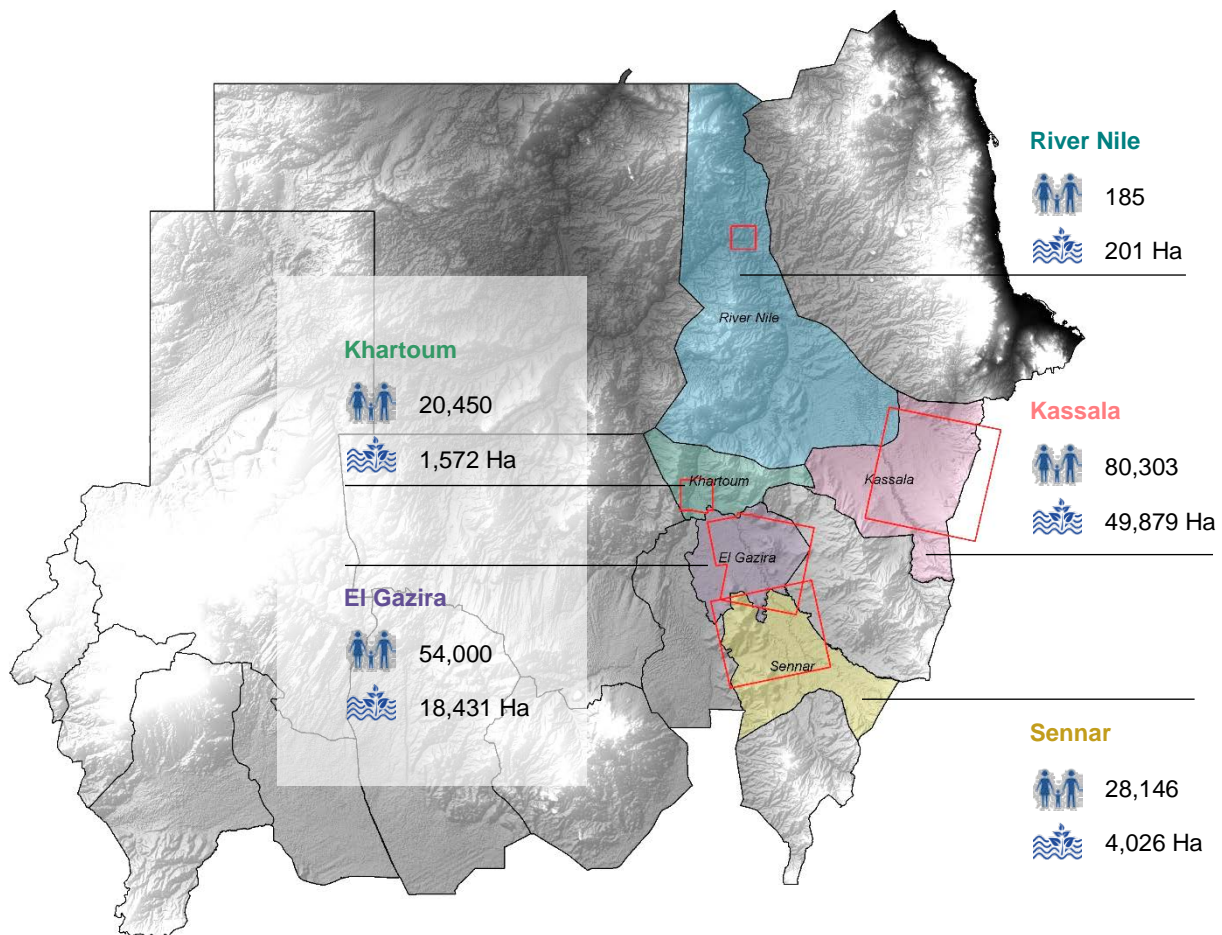
All the completed, current and future mapping activities done by UNITAR-UNOSAT as well as other satellite mapping groups can be viewed through [GDACS/SMCS](#).




All the maps and products of UNOSAT are available at: <https://www.unitar.org/unosat/maps/SDN>

Potential Impact on Population and Agricultural Areas per State within the Analysed Zones

UNITAR-UNOSAT analysed an area of about 7,290,000 Ha within the entire country, amounting to 4% of the total area of Sudan. The areas of interest selected cover the States of River Nile, Kassala, Khartoum, El Gazira and Sennar. Satellite derived analysis using the post-crisis water extent and population density from WorldPop shows approximately 183,000 people potentially affected by possible floods within the areas analysed. Potential impact on agricultural areas has been calculated by analysing the post-crisis water extent and land cover classification obtained from the European Space Agency (2009).

The analysis shows that population in the State of Kassala has been most potentially affected, and as well the one has suffered the most potential impact in terms of affected agricultural areas.



-  Potentially Affected Population Within Analyzed Area
-  Potentially Affected Agricultural Areas Within Analyzed Area
-  Areas Analyzed

Potential Impact on Population and Agricultural Areas per District within the Analysed Zones

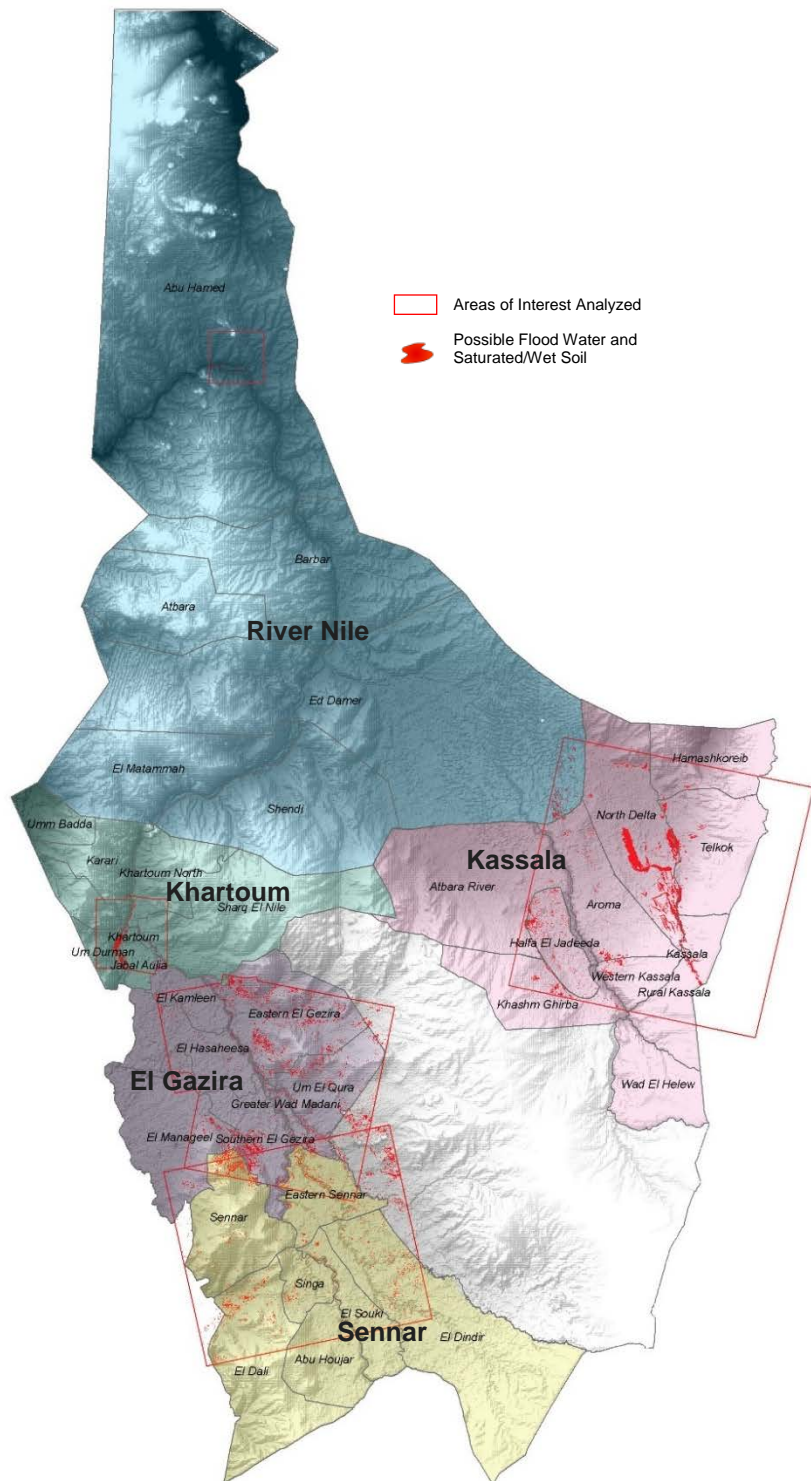
The analysis carried out by UNITAR-UNOSAT shows a total satellite detected water expansion of ~ 321,000 hectares (over the analysed areas), corresponding to ~ 0.2% of the total area of Sudan.

The image on the right depicts the possible flood water and saturated/wet soil detected from satellite imagery analysis performed within the specified areas of interest.

The analysis shows that the State most affected by the water expansion is Kassala, in particular the North Delta district.

Satellite derived analysis shows approximately 74,000 hectares of affected agricultural areas within the areas analysed. According to the analysis, the district with the most affected agricultural areas and the most affected population also is North Delta district Kassala.

The table that follows reports details about each district analysed, including percentage of potentially affected population, as well as potentially affected croplands in relation to the entire district area.



Potential affected population and agricultural areas per district within the analysed zones

Administrative Unit	% Analysed Zone	Affected Area (Ha) within Analysed zone	% Affected Area within Analysed Zone	Affected population within Analysed Zone	% Affected Population within Analysed Zone	Affected croplands (Ha) within Analysed Zone	% Affected Croplands within Analysed Zone
Kassala	55.14%	126,238	4.46%	80,303	5.76%	49,879	13.51%
North Delta	83.95%	67,791	10.29%	28,711	7.75%	27,526	23.54%
Halfa El Jadeeda	100.00%	15,427	6.48%	26,193	7.12%	10,869	5.31%
Khashm Ghirba	26.79%	7,292	5.60%	12,233	18.50%	206	1.40%
Telkok	100.00%	12,223	2.19%	5,967	2.70%	6,474	53.68%
Atbara River	12.55%	3,834	2.68%	1,861	3.79%	325	9.58%
Rural Kassala	66.53%	6,447	2.56%	1,530	2.59%	3,781	32.29%
Kassala	100.00%	942	21.17%	1,497	5.64%	511	24.22%
Aroma	99.57%	6,921	1.35%	1,382	1.18%	76	6.28%
Western Kassala	99.85%	4,152	2.53%	555	1.00%	18	2.51%
Hamashkoreib	37.42%	1,209	0.70%	375	0.62%	94	5.55%
El Gezira	72.00%	106,293	5.42%	54,000	1.92%	18,431	2.10%
Eastern El Gezira	80.98%	45,978	8.55%	18,126	5.34%	532	1.09%
Um El Qura	100.00%	19,929	5.11%	8,114	2.76%	605	0.70%
El Hasaheesa	65.18%	4,089	1.51%	7,362	1.66%	2,539	1.00%
El Manageel	36.98%	10,663	4.20%	6,260	1.36%	2,057	1.73%
El Kamleen	67.94%	1,765	1.42%	5,427	1.13%	647	0.60%
Greater Wad Madani	100.00%	3,248	5.54%	5,388	1.00%	145	2.03%
Southern El Gezira	100.00%	20,621	6.35%	3,324	1.26%	11,907	4.68%
Sennar	18.25%	72,493	3.52%	28,146	1.82%	4,026	2.26%
Sennar	100.00%	20,475	3.70%	12,480	1.79%	219	0.57%
Eastern Sennar	100.00%	16,861	5.20%	6,470	2.30%	765	1.26%
El Souki	60.21%	3,473	2.11%	2,863	1.73%	197	0.85%
El Dali	42.03%	14,129	4.16%	2,326	3.11%	2,246	11.83%
Singa	100.00%	4,381	2.54%	1,964	1.18%	190	1.35%
El Dindir	28.00%	12,648	3.16%	1,834	1.84%	332	1.60%
Abu Houjar	27.25%	526	0.50%	209	0.33%	77	4.70%
Khartoum	13.22%	14,719	5.25%	20,450	0.78%	1,572	8.26%
Um Durman	52.41%	8,012	12.54%	10,116	1.81%	188	23.65%
Jabal Aulia	60.15%	1,647	3.51%	6,465	0.90%	83	6.44%
Khartoum	100.00%	1,133	6.78%	1,502	0.29%	144	16.85%
Khartoum North	12.00%	1,653	4.31%	1,320	0.72%	797	11.93%
Sharq El Nile	6.36%	1,883	3.13%	723	0.29%	331	3.53%
Karari	6.45%	376	2.00%	323	0.17%	29	64.46%
Umm Badda	10.21%	15	0.04%	0	0.00%	0	0.00%
River Nile	1.22%	1,471	0.93%	185	0.69%	201	10.39%
Abu Hamed	3.16%	1,471	0.93%	185	0.69%	201	10.39%
Total		321,214	4.41%	183,085	2.18%	74,110	5.13%

DISCLAIMER

The analysis does not cover the entire area of each administrative division, hence the total affected hectarage depicts only the extent of the analysis, as shown in the maps above. The land cover used in this analysis is from 2009 and the analysis might not accurately portray the current extents of agricultural areas. Please note that the land cover used for the analysis of the State of Khartoum is obtained from the Ministry of Agriculture and Irrigation of Sudan (2011). It is also important to note that the analysis has been conducted using RADAR and Optical imagery and thus may not accurately estimate the water extent. The analysis has not been verified in the field yet; please send your comments to unosat@unitar.org.

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