



Eastern Nile Flood Risk Mitigation (EN-FRM) Project



Flood Prone Areas Institution Consultation and Field Visit to Tuti Island, Omdurman and Jebel Aulia in Sudan Mission Report

**Country Visited - Sudan
Mission 23-28 January 2023**

Eastern Nile Subsidiary Action Program

Eastern Nile Flood Risk Mitigation (EN-FRM) Project

Flood Prone Areas Institution Consultation and Field Visit to
Tuti island, Omdurman, and Jebal Aulia in Sudan Mission
Report

ENTRO

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Abbreviations

DA – Development [AGI]Agents

DEWS – Drought Early Warning System

DHI - Danish Hydraulic Institute

EN – Eastern Nile

ENTRO – Eastern Nile Technical Regional Office

NFFC – National Flood Forecasting Center

FFEW - Flood Forecast and Early Warning

MoIWR - Ministry of Irrigation and Water Resources, Sudan

NCCD - National Council for Civil Defense, Sudan

NCCR - Nile Cooperation for Climate Resilience

WP2 – Work Package 2

CCD – Council for Civil Defense

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Summary

The objective of this visit was to consult at least (3) flood prone areas institution and one community (20 peoples) in Sudan flood prone areas in order to (a) enhance the usability of flood related services that ENTRO regularly provides, (b) strengthen the working relationship between EN countries flood forecasting centers, communities and ENTRO and (c) identify improvement areas, and produce and disseminate this field report. The salient findings of the field visit are given below.

In general, the sources of floods and hazard in Sudan are:

- Ethiopian Highlands: Source of Nile Flood (Blue Nile, Atbara Rivers and major tributaries that originates from Ethiopian highlands – Dinder, Rhad (to Blue Nile), Goang, Angerb (to Atbara))
- Sudan: Source of Flash floods (local rainfall)
- The White Nile since 2020 has shown an unprecedented flow with a 70% increase (possibly Climate Change effect)
- Worst cases: Synchronization of peaks (E.G. Nile River flood and flash flood town)
- Human interference: Development (urbanization) in flood plains and even in the Nile corridor

Sudan adopts structural and non-structural flood Management as described below.

The structural method includes:

- Embankment: along the Nile corridor in flood-prone areas (e.g., Tuti Island)
- Dams: Designed for irrigation and not for flood control. Due to low capacity and siltation problems, the practice in Sudan is to pass the flood water (Jul-Aug) and to start filling when the water is relatively clear (Sep). However, in critical cases, dams are used to attenuate flood peaks.
- Diversion of flood water to lowlands (lack of detailed studies)

The non-structural method includes:

- Sudan Flood Early Warning System (Sudan-FEWS): the system makes use of the lead time between rainfall events and runoff at the border as well as travel time (2-3 days at the border (Deim) up to 7 days at (Dongola)). ENTRO forecast is also received and are considered as a complementary input when decision is made during critical time.
- Warning dissemination: Daily at 10 a.m. the Forecast Center issue is disseminated to the coordinated body (National Council for Civil Deference-NCCD), the Media (Sudan News Agency-SUNA), and to other concerned bodies (e.g. NGO's) through email, WhatsApp, Facebook, Sudan TV, MoIWR web page.
- MoIWR issues a daily bulletin of Nile levels and flows compared to the day before and the corresponding day in the highest (1988) and the driest year (1984)

Further to above floodplains management (planning and monitoring) and awareness creation are done with rooms for improvement.

The following are the outcomes of the consultation with local authority and communities:

i) Indigenous flood forecasting

- Presence of certain types of migrant birds (*Ciconia nigra*) indicates that the rainy season is approaching.
- Very cold winter might indicate a wet rainy season.
- During autumn when the day is very hot it is an indication that it's going to rain.
- Location of rain-bearing clouds can be defined by the location of lightning.
- In the evening if the lightning appears at the horizon it indicates that it will rain at morning but if appears higher than horizon indicates it will rain in the same night (hours)
- Locally Autumn is divided into 10 zones each zone 13 days. Each zone has its own characteristics (<https://www.alrakoba.net/1053801/-إلى-القبلي-وبرق-الضراع-من-الخريف-من-الضراع-وبرق-القبلي-إلى-1053801>)
- (العوا)
- Sign by wild animals for example donkey's shaping their ear at the back and running is an indication of heavy rain coming.
-
-

ii) Warning generations and decision of evacuation

- Warning generated officially by the government (MoIWR-NCCD) and disseminated locally when the water approaches the local watermark (e.g., mark on trees)
- Evacuation decisions are taken by officials in coordination with local community.

iii) Early Warning Message; Risk awareness and education

- concerning the course of actions, the local people depend on their experience and on their local task force (known as EL Taya in Tuti). No Training made available.

iv) Communication channel and means

- Officially: MoIWR to NCCD to Localities
- Local community: directly from the civil defense officer at the site, or through media (TV-Radio-Facebook, WhatsApp, mobile messages from relatives upstream)

v) EN Warning reachability, Useful Warning Lead-time?

- All regional forecasts (ENTRO, IGAD...) received and processed and incorporated in MoIWR for Forecast Issue.

vi) Flood-affected areas topography and infrastructure, evacuation localities and shelter areas.

- Affected areas and escape/evacuation routes have not been delineated.
- Shelter for evacuated peoples is mainly of public (e.g. schools)

vii) Real-time water level floodplain and gaging sites flow data shared

- No mechanism exists for feedback or warning from the community to MoIWR.
- Community directly contacts the nearest CCD focal point/representative in case of risk.

As the way forward, it is noted that strategic flood management study should be commissioned and implemented including:

- Developing different flood zones and rules of infrastructure development,

- Determining the elevations of facilities in relation to the Nile River water level(s),
- Development of community emergency plan manuals and conducting regular drilling, and
- Identification of location and types of warning signals, evacuation routes, and location of emergency shelters.

1. INTRODUCTION^[AG2]

The Nile Cooperation for Climate Resilience (NCCR) Project is planned to be implemented by NBI centers and other stakeholders with the support of the World Bank. The Project development objective is to improve mechanisms for cooperation on water resources management and development in the Nile Basin.

NCCR Project components implemented by ENTRO will support ENTRO in promoting cooperation among Eastern Nile (EN) riparian countries by focusing primarily on providing flood and drought risk services, strengthening dam safety, and continuing to strengthen the network of youth and professionals in the sub-basin. It builds on ENTRO's achievements in flood forecasting and dam safety capacity building and seeks to deepen activities where information tools are regionally relevant. The major thematic areas under NCCR are:

- Platform for Cooperation
- Dam safety capacity building
- Water Quality Investment Planning and Prioritization
- Information services for climate-resilient investment planning
- Flood and **drought risk** mitigation

The **Flood and Drought Risk Mitigation** support will enhance flood forecast models for the EN region, joint development of basin-wide drought monitoring and forecasting models, information dissemination platforms and capacity building for flood risk mitigation investment planning. The work implemented by ENTRO and supported under this component will include: (i) enhancement of riverine Flood Forecast and Early Warning (FFEW) System for the EN region; and (ii) development and operationalization of a basin-wide drought early warning system (DEWS) that includes both monitoring and forecasting components. These tools will be developed with the aim of enhancing the robustness of existing models and expanding geographical coverage.

This report presents the findings of the institution and community consultation made in Sudan flood prone areas with objective of enhancing the usability of flood related services that ENTRO provides.

2. Rationale for the field visit

Under the NCCR project, the Eastern Nile Flood Risk Mitigation (EN-FRM) Project has been issuing Flood Forecast and Early Warning in rainy seasons 2021 and 2022 using the updated Danish Hydraulic Institute (DHI) company software^[AG3] based flood modelling system. No recent feedback (in the last three years) was collected from the FFEW institutions and communities located in the Flood Prone Areas to enhance the usability of flood related information.

Thus, the focus of this consultation was to get feedback from the institutions located in the flood prone areas regarding:

- (a) The way (the timely and relevance of) the flood early warnings transmitted from central office,*
- (b) Whether warning messages reach community members and/or the community understand and interpret correctly,*
- (c) To find EW dissemination path to the flood affected community (ENTRO warnings and their own),*
- (d) Lead time required to save livelihoods and assets from flood disasters,*
- (e) Options to take the necessary preparedness action by the government and the community, and*
- (f) To identify areas for improvement in forecasting and dissemination.*

This rapid assessment will be used as an input to the enhancement of the ENTRO FFEWS (WP2).

3. Objective of this visit

The objective of this visit was to consult flood prone areas institutions (3) and at least one local level community consisting of 20 peoples to enhance the usability of flood related services that ENTRO provide to the EN countries and strengthen the working relationship between EN countries flood forecasting centers, communities, relevant institutions and ENTRO and identify improvement areas and produce and disseminate this field report to concerned bodies.

4. Scope of Work

5. Flood prone areas institution visited.

ENTRO conducted a brief consultation in close collaboration with the National Flood Forecasting Centers by visiting key flood prone areas in Khartoum and surrounding areas affected by Blue Nile, White Nile and Nile rivers limited to the assessment of the usability of the flood related information that ENTRO has been issuing and identify improvement areas. The full consultation works will be conducted in the upcoming “Work Package 3 - Support in Establishing Flood Community Awareness and Preparedness”.

Major institutions consulted and participated in the field visit include:

- Ministry of Irrigation and Water Resources, Sudan
- National Council for Civil Defense (NCCD), Sudan
- Tuti Island County City Administration (White Nile + Blue Nile Rivers interaction)
- Omdurman City Administration (Nile River flooding)
- Jebel-Aulia City Administration (White Nile River backwater flooding)

6. Composition of the field Visiting Team and Schedule

6.1 The Visiting Team

Table 1: Sudan flood prone areas - the visiting team members and institutions

No	Name	Position	Institution
1	Dr. Salih Hamid	Executive Director	ENTRO
2	Mr. Yilma Seleshi (Prof.)	Flood and Drought Risk Mitigation Project Regional Coordinator	ENTRO
3	Mr. Assefa Gudina	Regional Social and Environmental Officer	ENTRO

6.2 The Schedule

Table 2: Field work schedule (Sudan floodplains)

No	Activity	Date	Participants and details	Place and time
1	Trip to Khartoum	23 Jan 2023 morning (Monday).	ENTRO (2)	Khartoum arrival
2	<p>Consultation with MoIWR, NCCD, on FFEW dissemination and usability.</p> <p>Discussion on detail field work plan in (Tuti Island and Omdurman, White Nile and Blue Nile interactions – backflow flooding areas – Jebel Aulia).</p>	<p>Tuesday 24 Jan 2023, morning</p>	<p><u>ENTRO (3), MoIWR (3) and NCCD (1)</u> <u>Sudan FFC experts (6)</u> <u>General discussion</u></p> <ul style="list-style-type: none"> - Explanation by Dr. Salih / Prof. Yilma on the FFEWs this field visit introduction and the FRM project status. - 2022 flood situation explanation by -Eng. Mustafa H AL Zubair / Eng. Abdelrahman; <p><u>Parallel session – consultation (No.1):</u></p> <ul style="list-style-type: none"> - Experts MOIWR – Eng. Abdelrahman and Eng. Redwan Abdelrahman [Yilma] – At Khartoum - MoIWR - NCCD (TBA) [Dr. Salih, Mr.Assefa] – At Khartoum – MoIWR. 	<p><u>At the MoIWR Khartoum.</u></p> <p>9:00 – 10:30 am</p> <p>11:00 to 12:30 am</p>

No	Activity	Date	Participants and details	Place and time
			Afternoon – making detail discussion and planning Discussion on detail field work plan in Khartoum (Tuti Island and Omdurman, White Nile and Blue Nile interactions – backflow flooding areas) flood plains and arranging logistics.	2:00 pm-4:30 pm
3	Consultative meeting at Tuti Island flood areas.	Wednesday 25 Jan 2023 (10 am to 1 pm) Return to Khartoum	20 Community and their institutions + <u>[ENTRO (3), MoIWR (2) and NCCD (1)]</u> General introduction by Yilma / Salih on FFEWS – 60 minutes and discussion – listening what the floodplain stakeholders need – improvement areas. [Tuti Island Mayor office (2-person), district offices flood affected (4-person) community representatives (14 persons)] Parallel interview flood affected stakeholders: <ul style="list-style-type: none"> • Tuti Island Mayor office (2) – Salih / Assefa and Abdelrahman • District and community - Yilma and NCCD, Field visit to frequently flood affected areas in Tuti Island by the Blue Nile River. <u>[ENTRO (4), MoIWR (1) and NCCD (1)] and two admins from Tuti Island joins]</u> General discussion on 2022 flood conditions in Tuti Island with local peoples at the site.	Tuti Island 9:00 – 10:00 am 10:30 – 12:00 am (City mayor office hall) After 2:00 pm.
4	Consultative meeting at Omdurman flood areas.	Thursday 26 Jan 2023 (10 am to 1 pm) Return to Khartoum	20 Community and their institutions + <u>[ENTRO (4), MoIWR (2) and NCCD (1)]</u> General introduction by Yilma / Salih on FFEWS – 60 minutes and discussion – listening what the floodplain stakeholders need – improvement areas. [Omdurman district Mayor office (2-person), district offices flood affected (4-person) community representatives (14 persons)]	Omdurman 9:00 – 10:00 am

No	Activity	Date	Participants and details	Place and time
			<p>Parallel interview flood affected stakeholders:</p> <ul style="list-style-type: none"> • Omdurman Mayor office (2) – Salih/ Assefa and Abdelrahman • District and community - Yilma and NCCD, <p>Field visit to frequently flood affected areas in Omdurman by the Blue Nile River. [ENTRO (4), MoIWR (2) and NCCD (1)] and two people from Omdurman sub-city joins]</p> <p>General discussion on 2022 flood conditions in Omdurman with local peoples at the site.</p>	<p>10:30 – 12:00 am</p> <p>(City mayor office hall)</p> <p>After 2:00 pm.</p>
5	<p>Consultative meeting at White Nile flooding from Khartoum Junction to Jebel – Aulia</p> <p>(Backup caused by Blue Nile)</p>	<p>Friday 27 Jan 2022 (9 am to 1 pm) 2 pm to 5 pm</p>	<p>Field visit to frequently flood affected areas in White Nile flooding from Khartoum Junction to Jebel – Aulia. [ENTRO (4), MoIWR (2) and NCCD (1)] and two people from Jebel – Aulia]</p> <p>General discussion on 2022 flood conditions with local peoples at the site.</p>	<p>10:00</p> <p>10:30 – 12:00 am</p> <p>After 2:00 pm</p>
6	<p>Return to Addis Ababa from Khartoum</p>	<p>Saturday 28 Jan 2022</p>	<p>ENTRO (3)</p>	

7. Consultation findings at MoIWR and NCCD

This section presents consultation findings at the National levels based on the discussion held guided by the questionnaire prepared.

Table 3: MOIWR and NCCD - key consultation participants (National Levels):

Name	Sex	age	Education	Tel / email	Position / responsibility /	Physical address
Eng. Mustafa H AL Zubair	M	60	PhD	+249 912356489 , +249 1234 94484 Harith Mustafa <harith33@yahoo.com>	Water Resources Technical Organ (WRTO) Ministry of Irrigation and Water Resources	Khartoum
Al Matari Ahmed Almatri	M	50	Brigadier General	0123006554; almatriahmed@gmail.com	Head for Flood Emergency, NCCD	Khartoum
Eng. Abdelrahman Saghayroon	M	50	MSc	Ministry of Water, Irrigation and Electricity, Sudan a.saghayroon@gmail.com , +249-123494480	Director, Nile Water Member of High Committee for following flood	Khartoum
Saied Magzoub Saied	M	40	MSC	0912665186 hrs_saied@yahoo.com	Executive secretary; Nile Organ. Ministry of Water, Irrigation and Electricity, Sudan	Khartoum
Eng. Redwan Abdelrahman	M	52	PhD	redwanma@yahoo.com , 0122110074	National Coordinator of Flood Preparedness and Early Warning (FPEW) Project	Khartoum
Asma Abdela	F	45	BSc	0123481985 iznsm@yahoo.com	Dams	MoIWR
Mohamed A Hassen	M	29	BSC	0900998169	Head Modeling FFC,	MoIWR
Mshaert Eltayeb	F	46	PhD	0914046835 Mshear12001@gmail.com	Dams Operation	MoIWR
Gasmalla Ali	M	48	MSc	gasmallaaly@hotmail.om	Dams Operation	MoIWR

Joint occurrences of riverine flood and flashflood in Khartoum and surroundings

On 24 January 2023, the visiting team (Table 1) consulted with MoIWR and NCCD senior staffs (Table 3). It is noted that in the Khartoum area major floods occurred due to riverine floods (Blue Nile, White Nile and Nile rivers) and by direct rainfall-based sheet flows and flash floods with minor creeks joining the Nile River. If both occurred at the same time (higher water level in the Nile / overflowing and flash floods) a worst disaster occurs. The back flow waters from the Nile River will flow into the residential areas damaging houses, roads, groundwater wells, other critical service infrastructures.

Forecast dissemination: The MoIWR transmits forecast message to the NCCD, and then NCCD disseminates the forecast message to its network of staffs located at critical centers of breach in flood prone areas. The local NCCD staff together with the local authority mobilize the community in case evacuation or reinforcing flood defense structures (dykes) are required. National radio and television are often used for disseminating the warnings.

The Ministry FFC indicated that the WRF forecast they receive from ENTRO is providing often gives better prediction than quantile based general rainfall forecast they receive from the Sudan Meteorological Agency.

ENTRO flood forecast information is used as an input as additional forecast of the Nile flood. Sudan FFC forecast is then compared the forecast they produced to the ENTRO forecast for further analysis and decision.

The forecast of the national FFC disseminate in two forms: relative and absolute. The relative forecast of water level for example, “today flood level in the Nile River at Khartoum Soba is greater than x cm amount than yesterday, or after 3 day the water level in the Nile River at Khartoum Soba rises by about x cm from today; also indicating at the same time the maximum historical water level they have experienced in the forecast dates and the level difference is also noted”. So, residents living adjacent to the Nile River will take the required action utilizing their past practices as benchmark. The absolute water level forecast – that is today water level is x m is useful for planners and other decision makers.

Awareness creation and creating livelihood options: When flood prone communities are requested to move to temporary shelter, their response is mute, as they often suspect their land might not be secured when they return. Sustained awareness creation and provisions of livelihood options are thus required.

8. Consultation findings at the Tuti-Island 25 January 2023

This section presents consultation findings at the district and community levels based on the discussion held on 25 Jan 2023 at Tuti Island municipality, Khartoum State Ministry of Physical Planning, guided by the questionnaire prepared. Tuti island is the oldest part of Khartoum situated at the confluence of Blue and White Niles.



Photo: Consultation at Tuti Island 25 January 2023.

Table 4: Tui-Island - key consultation participants (District/ Sub-city Level, 25 January 2023):

Name	Sex	age	Education	Tel / email	Position / responsibility /	Physical address
Mohamed Abdulahe	M	35	MD	0912519220	Politician	Tuit-Island
Ammar M.M. Zaki	M	69	PhD	0906924901	Economics	Tuit-Island
Mohammed Eid	M	55	Sec	09129749243	Trader	Tuit-Island
Mhammed A.A. Midis	M	65	Sec	0912226800	Trader	Tuit-Island
Abdulrahim Hamed	M	70	Sec	0912308395	Community Leader	Tuit-Island
Maimana Oman A.	M	53	Diploma	011224149	Company	Tuit-Island
Idrees Babiker Idris	M	47	Diploma	0912226800	Teacher	Tuit-Island
Alaa Khagali Ali	M	55	H. Sec.	0123413125	Director Admin	Tuit-Island
Yosif Abdulla	M	50	H. Sec.	0121948014	Trader	Tuit-Island
Hamid Fadul	M	47	-	-	MD	Tuit-Island
Sabri Idrees	-	-	-	-	-	Tuit-Island

Issues on the Titi-Island flood

On 25 January 2023, the visiting team (Table 1) consulted with Tuti-Island city admins, traders, community leaders and local CCD staff (Table 4). Tuti-Island has operational Flood Committee since 1956 and has an emergency response system with twelve sub-local divisions to watch the flood level and place flood barriers (e.g., sandbags) to plug low lying areas, where the Nile River may breach.



Photo: An aerial view shows buildings and roads submerged by the Nile floodwaters [El Tayeb Siddig/Reuters, <https://www.aljazeera.com/news/2020/9/9/we-lost-everything-thousands-homeless-as-sudan-battles-floods>]BLue Nile water level reached 17.58 m.

During flood emergency time, people move to the Tuti Island center which is located at high ground (~20 m higher than Nile Riverbank level). The community established a flood watch team

to look for the Nile water level rise 7/24 hours at critical breach areas. Once Tuti-bridge went operational, heavy earthmoving machines moved in and structural measures for flood protection (dykes) have been employed and improved the situation in the Island. The community also observed the positive impact of GERD in reducing flood level at the Island (2021/2022).

They also noted that the Khartoum newly built highway raised the Nile River left bank crest level and reduced the flood plain areas, which exacerbating the flooding on Tuti-Island.



Figure 1: Location of Tuti Island (~ 5 km² area), Tuti-Bridge and the Main Highway; and cross-section along the red-dotted line.

It is noted that the community raised strong interest that the government build concrete barrier (along the ~ 10 km perimeter) together with pump system to protect the Island for possible Nile flooding. The pumps are required to drain the Island direct rainfall induced flood in case both Nile flood and local flood occur concurrently.



Photo: Tuti Island, 25 Jan 2023, where gully created by Nile River wave action is plugged by large stone in preparation to the July-Oct 2023 flood

Forecast dissemination: The MoIWR transmits forecast message to the NCCD, and NCCD disseminates the forecast message to its network of NCCD staff located at the Tuti Island. Flood prone areas. People are called to Mosques to receive emergency announcement. Big drums are also used to alert communities if an emergency is foreseen.



Photo: The visiting Team with Tuti Island Admins and community leaders, 25 Jan 2023.


Consultation findings at the Omdurman 26 January 2023

This section presents consultation findings at the district and community levels based on the discussion held on 26 Jan 2023 at Omdurman, guided by the questionnaire prepared.



Photo: Consultation at Omdurman Mayer Office, 26 January 2023.

Table 5: Omdurman - key consultation participants (District/ Sub-city Level):


Flood Prone Areas Institution Consultation to enhance the usability of flood related services that
Sudan Flood Prone Area Field Visit 23rd– 28th Jan 2023
Blue Nile Flood prone areas (1stvisit)
List of Participants

No	Name	institution	Mobile	Email	Signature
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3	Yilma Seleshi	ENTRO	0911222440	yseleshi@nilebasin.org	[Signature]
4	Almatri Ahmed	NCCD	0182006554	almatriahmed@gmail	[Signature]
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20	يوسف عبد الله محمد	محافظة الواد / مدينته	0122737895		✓
21	صالح محمد عبد الله	محافظة الواد / مدينته	0122737895		✓

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25	محمد عبد الوهاب محمد	محافظة الواد / مدينته	091226800	Mohd.A.wahabAhmed	✓
26	احمد ابراهيم احمد محمد	محافظة الواد / مدينته	0110921928		✓
27	طارق فضل محمد القادر	محافظة الواد / مدينته	012229490	Fathma@outlook.com	✓
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30	Saved Magzoub	ENSPPT-Sudan	0114852180	Sahwa@outlook.com	✓
31					

Issues on the Omdurman flood

On 25 January 2023, the visiting team (Table 1) consulted with Omdurman city admins, traders, community leaders and local CCD staff (Table 5). A major issue is that people increasingly settled near and along the wadis in flood prone areas (e.g., Figure 2) exposed to series flood hazard. Sandbags are often used for flood protection. As Khartoum city has small gradient (plainland), and heavy storms induced flashflood causing damage in Omdurman especially on housing units constructed from mud. It is noted that strategic flood management study be commissioned and implemented including:

- Developing different flood zones and rules of infrastructure development,
- Determining the elevations of facilities in relation to the Nile River water level(s),
- Development community / new emergency plans manuals and drilling plans, and
- Identification of location and types of warning signals, evacuation routes, and location of emergency shelters.



Figure 2: Location of Abu Anga Creek (example) crossing the Nile Highway – backwater from the Nile River occasionally causes damage to livelihoods of the local people residing in/ vicinity of the Wadis.

9. Consultation findings at the Jebel Aulia 27 January 2023

This section presents consultation findings at the district and community levels based on the discussion held on 27 Jan 2023 at Jebel Aulia, guided by the questionnaire prepared.



Photo: White Nile River at Jebel Aulia city - river bank (+ dyke) protecting houses (27 Jan 2023).

It is noted that, when the water level at White Nile River is high, and flash flood occurs in the Jebel Aulia city, then maximum damage will occur. About 23 km long dyke built on the right bank of the White Nile River; and every year its maintenance is done. They are protecting the low-lying houses of Jebel Aulia (see photo above top right). As in the Omdurman City, in Jebel Aulia people establish new livelihood in high flood risk areas every year nearer to the river. Drainages of wadis that collect flood from the city is also a major challenge when White Nile River water level is high. Civil Defense office at Jebel Aulia has 13 local centers at low lying suspected breach sites to closely monitor the stability of dykes and water level. Communities know that when the White Nile River water level reaches at the top of main tree trunk (the old tree - see at the background of

the photo above), they prepare for the worst (by strengthening of dykes, moving properties to high ground from the low lying areas).

In case the Blue Nile River flow is $> 100 \text{ Mm}^3/\text{day}$ ($1200 \text{ m}^3/\text{s}$), characterized by high depth and velocity, creates backwater in the White Nile (high water level) and raises the tailwater level of Jebel Aulia dam. Thus, the releases from the Jebel Aulia dam are reduced and the reservoir water remain at elevated level for a considerable time during major flood events.

There is no established risk map for the Jebel Aulia city and flood prone areas.


Table 6: Jebel Aulia - key consultation participants (District/ Sub-city Level):

Name	Sex	age	Education	Tel / email	Position / responsibility /	Physical address
Abul Yasmin Mohamed	M		Engineer	01237753623 Kukandy-gsm@gamil.com	City Admin	Jebel Aulia
Mohamed Amin Salih	M		Engineer	0123423419	Flood Management	Jebel Aulia
Shukra Alula Mon	M		Captain	0918058235	CD Jebel Aulia	Jebel Aulia
Al Matari Ahmed Almati	M	50	Brigadier General	0123006554; almatriahmed@gmail.com	Head for Flood Emergency, NCCD	Khartoum
Eng. Abdelrahman Saghayroon	M	50	MSc	Ministry of Water, Irrigation and Electricity, Sudan a.saghayroon@gmail.com , +249-123494480	Director, Nile Water Member of High Committee for following flood	Khartoum
Saied Magzoub Saied	M	40	MSC	0912665186 hrs_saied@yahoo.com	Executive secretary; Nile Organ. Ministry of Water, Irrigation and Electricity, Sudan	Khartoum
Eng. Redwan Abdelrahman	M	52	PhD	redwanma@yahoo.com , 0122110074	National Coordinator of Flood Preparedness and Early Warning (FPEW) Project	Khartoum




Figure 3: Location of Jebel Aulia City visited site – upstream of the new bridge crossing White Nile. Notice the foam on the river, which indicates new flood is coming (10/16 2022 Google Earth image)

10. MoIWR sample of FEWS data and information



Daily statement of the flood commission

August 31, 2021 AD



Revenue at the border: **.1**

- . Blue Nile 598 million cubic meters per day
- . Atbara River 146 million cubic meters per day
- day. White Nile 130 million cubic meters per day

Stations that recorded critical levels **.2**

- . Khartoum recorded (17.20m) less than the highest recorded level (17.66m) by 46 cm. Shendi scored 17.98m, 46 cm lower than the highest recorded level (18.44m).

Discharges behind dams in millions of cubic meters **.3**

the difference	yesterday	today	Mr.
2-	555	553	Roseires
5-	572	567	Sennar
5-	132	127	Mountain of the saints
6-	83	77	Upper Atbara and Setit
25-	68	43	The village's fury
27-	741	714	irrigated

4. Storage continues at the Upper Atbara and Setit dam complex, and storage started today at Khashm al-Girba reservoir. 5. Discharges behind Roseires continue at around 550 million cubic meters per day until further notice.

6. Forecasts of levels at the stations for the coming days

The following table shows the levels of the different stations today and expected for the next three days

Highest record level		expected level (Meter)			attributed today (Meter)	station
the date	level (m)	2021 9-03	2021 9-02	2021 9-01	2021 8-31	
2020/08/13	17.79	16.38	16.41	16.45	16.47	And Dalais
1946/08/30	21.00	19.39	19.40	19.42	19.44	
2020/09/06	17.66	17.17	17.20	17.23	17.20	Khartoum
2020/09/11	18.44	17.91	17.97	17.98	17.98	Shandi
2001/08/29	16.64	15.20	15.25	15.30	15.32	fragrant
2001/08/26	15.93	14.40	14.85	14.88	15.02	Dongola

7 Water levels in sectors
All sectors are stable

Citizens in all sectors should take all necessary precautions

M. M. Abdul Rahman Saghiroon,
Head of the Flood Committee

M. Radwan Abdel-Rahman Mohamed Ahmed,
Rapporteur of the Flood Committee

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11. NASA Sudan 2020 flood assessment as compared to 2016.

The following NASA Sudan 2020 flood assessment as compared to 2016 is presented below. The source is: <https://earthobservatory.nasa.gov/images/147288/record-flooding-in-sudan#>

“A wetter-than-usual rainy season has devastated communities across Sudan in 2020, as the Nile River and some of its tributaries reached their highest levels in 100 years.

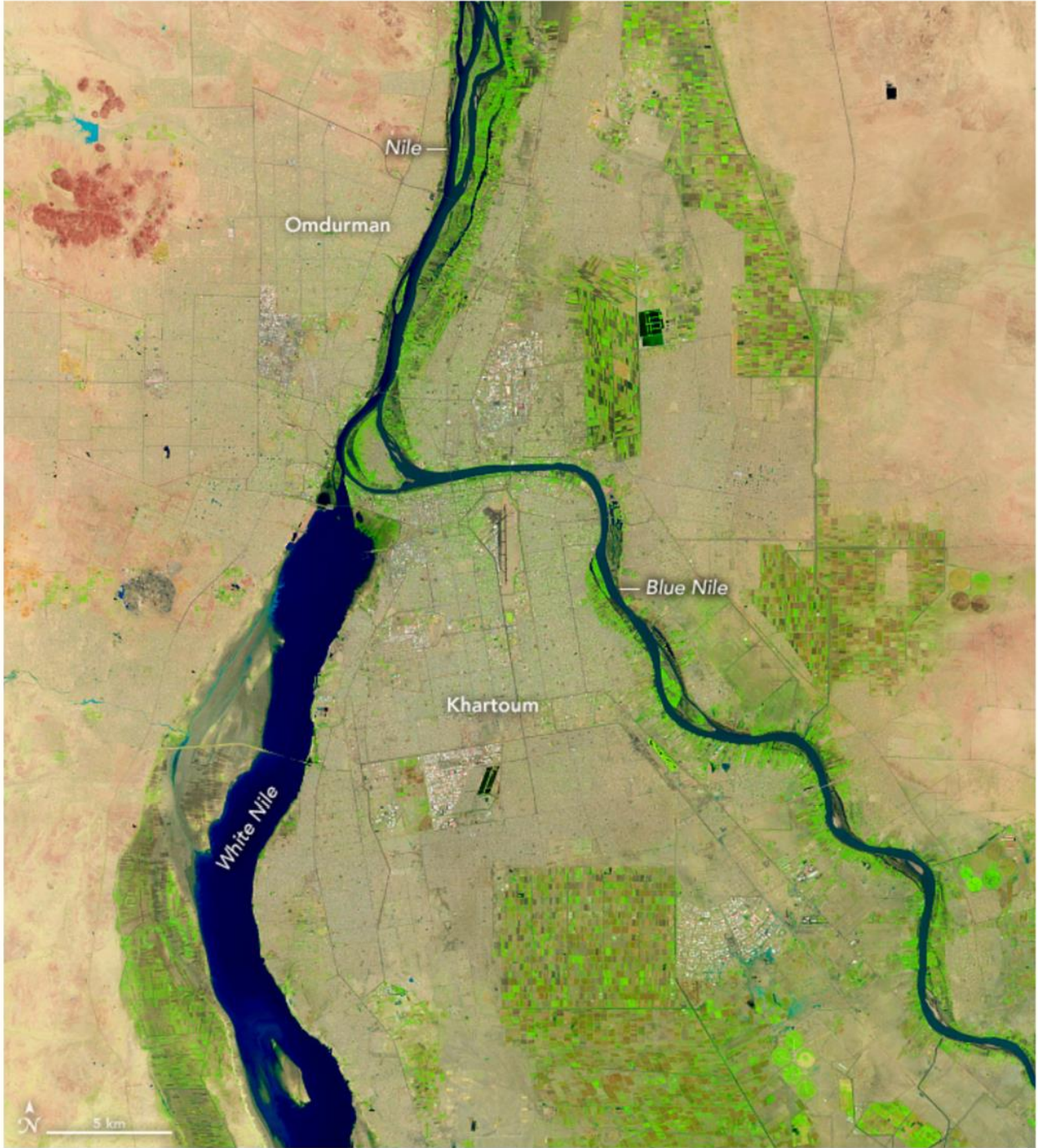
Widespread flooding has claimed at least 100 lives and damaged or destroyed more than 110,000 homes since mid-July 2020, according to United Nations Office for the Coordination of Humanitarian Affairs (OCHA). The office reported that more people have been affected by flooding in Sudan this year—more than 650,000—than any of the past seven rainy seasons. The Sudanese government declared a three-month national state of emergency on September 4.

The images below show flooding in Sudan’s capital, Khartoum, on September 2, 2020, compared to a more typical rainy season in September 2016. These false-color images, acquired with the Operational Land Imager (OLI) on the Landsat 8 satellite, use a combination of infrared and visible light (bands 6-5-4) to make it easier to see the boundary between water and land. Water appears navy blue and black; clouds are white or cyan; and vegetation is bright green.

Seventeen of Sudan’s eighteen states experienced flooding; Khartoum State was one of the worst hit. Heavy rain caused the White and Blue Nile to breach their banks in the capital city Khartoum and twin city Omdurman. The Sudanese Irrigation Ministry said water levels of the Blue Nile are higher than levels reached during the historic 1988 flood. The floods damaged thousands of homes and buildings and threatened a few UNESCO World Heritage Sites and the national museum of Sudan. The rates of floods and rain this season has exceeded the records set in 1946 and 1988.”

It is interesting to note that the 2020 August-Sept flood extent on Tuti Island, Omdurman City and Jebel Auli Cities as compared to 2016 flood.

Some details of Tuti Island and Nile River interaction can be seen at:
<https://storymaps.arcgis.com/stories/e145a4acb02848f39497e422b25f925c>



September 23, 2016

↓ JPEG



September 2, 2020

↓ JPEG