



**NILE BASIN INITIATIVE**  
INITIATIVE DU BASSIN DU NIL



# Flood Forecast in the Eastern Nile

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ENTRO

# Major Flood Events

- In the past decades, many severe floods frequently occurred in Eastern Nile region caused many losses and significant destruction of infrastructures
- Movement of population into floodplains have increased the vulnerability areas in the region
- Historic Flood Profiles: 1878, 1946, 1988, 1998, 1999 , 2001, 2003 & 2005, 2006, 2013, 2014, 2017, 2018,2020  
➔ Combined effect of Riverine Flood & Flash Flood

# Flood activity

- ❑ March 2001, ENCOM requested funding to advance work in the EN flood management;
- ❑ October 2004, ENCOM decided to fast-track the FPEW project;
- ❑ 2006 , ENSAPT decided to phase the implementation of FPEW as Phase I and Phase II;
- ❑ The FPEW I grant agreement was signed in 2007 and concluded during the period 2007-2010. FPEW I – focused on building the institutional capacity and developing critical baseline information to enhance the readiness of EN countries to implement subsequent FPEW phases
- ❑ The FPEW II project document finalized in Jan 2007 and distributed to different stakeholders and donors for funding

# FPEW Phase I

1. Establishment of the **regional flood coordination unit** at ENTRO and the National flood forecasting centers in the three EN countries;
2. Development of **real-time flood forecasting systems** for Lake Tana floodplains in Ethiopia and the Blue/Main Nile River System in Sudan;
3. Strengthen the Capability of the Nile Forecast Center in Egypt;
4. Development of emergency response and preparedness plan for selected pilot communities

# Bridging the Gap -Phase I & II

- ❑ Assessment of the Impact of Regulation on the Floodplains of the Blue Nile River Systems in Sudan
- ❑ Flood Season Monitoring Activities
- ❑ FPEW phase I - Knowledge Base Development
- ❑ Web-Based Communication Platform for Flood

# 2010 Flood Season Monitoring

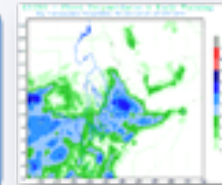


- The EN Flood Season Monitoring program was operational since 2010 with objective to
  - Enhance regional collaboration and improves national capacity in the mitigation, forecasting, early warning, emergency preparedness, and response to floods in the EN basin countries
- Pilot flood-prone areas: Lake Tana and Gambella floodplains, Baro-Akobo-Sobat (BAS) and Blue and Main Nile river systems

# FSM-Regional Cooperation

## Rainfall Forecast- Eastern Nile Basin

- Produce Daily and Weekly rainfall Forecast for Eastern Nile basin



## Lake Tana Flood Plain - Ethiopia

- Produce Daily and Weekly Forecast Report for Lake Tana Floodplains (WRF weather forecast model, combined flood forecasting models)



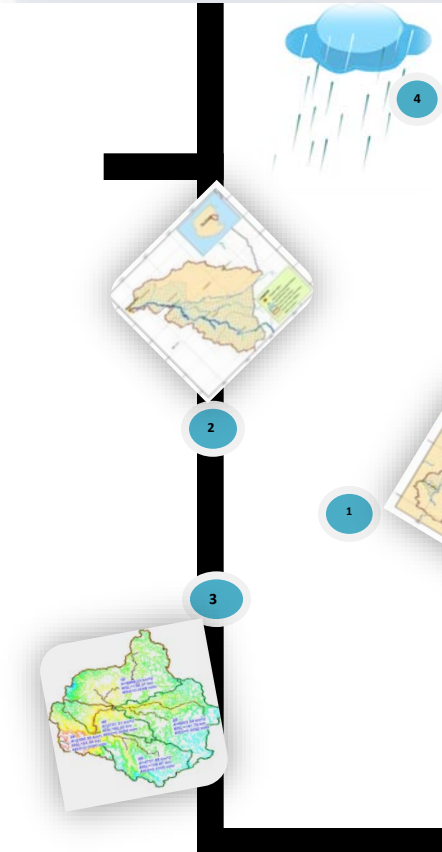
## Main/Blue Nile - Sudan

- Produce Daily and Weekly Forecast Report for Blue and Main Nile System in Sudan (Sudan FEWS)



## BAS in Gambela/ Ethiopia and South Sudan

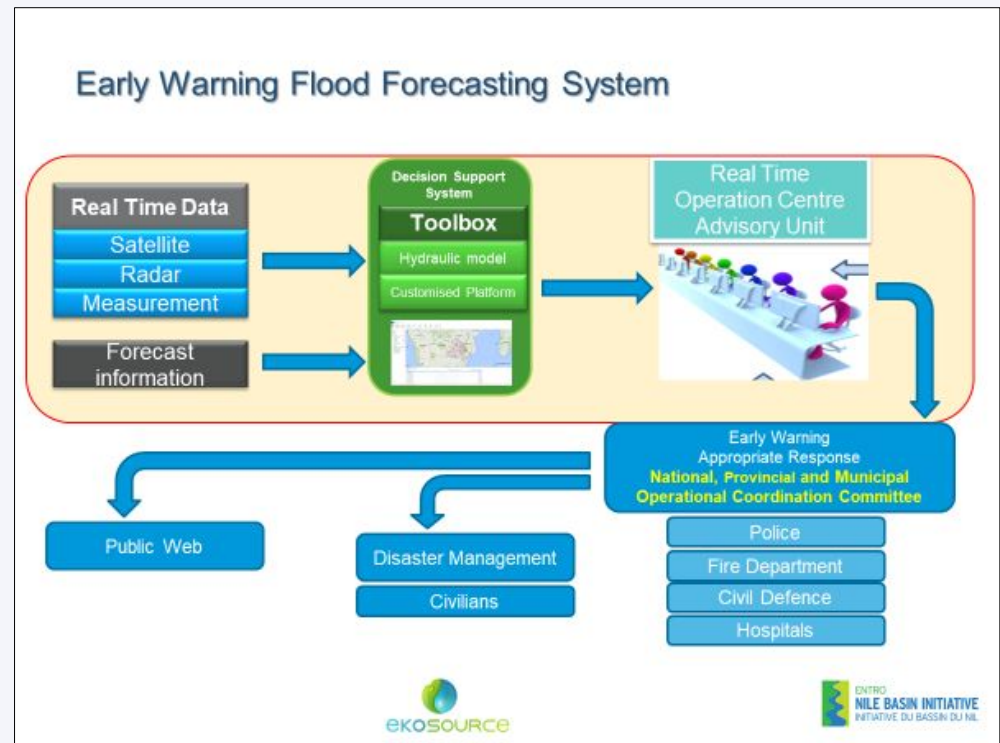
- Produce Daily and weekly forecast report for Baro-Akobo and Sobat floodplains



# 2018 FFEW Enhancement

## Activities:

- Upgrading the existing
- Replicate flood forecast system
- Flash flood assessment
- Web base early warning system
- Stakeholder mapping





# EN FFEW System

## Meteorological Forecasts

– WRF



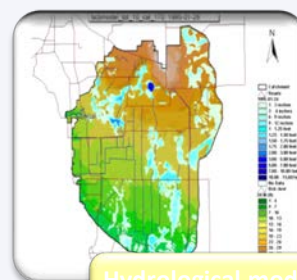
**Rainfall Forecast**

WRF  
Global products



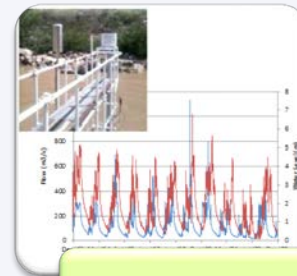
**Verification with Point measurements**

- Point raingauge measurements



**Hydrological model**

- NAM for Lake Tana, Blue Nile Sudan, BAS and TSA



**Verification with Measurement Stations**

## Flood Forecasts

– MIKE 11

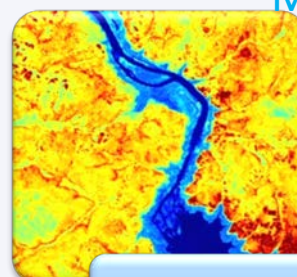


**Statistical analysis performed to determine probabilities of flood occurrences**



**Hydraulic modelling**

- Main channel modelled with Mike 11
- Overland flow modelled with Mike 21



**Satellite verification if data is available**



**Early Warning**

## Integrated Forecast System

– MIKE Operations

# Social Survey

## 1. Stakeholder mapping and survey for flood prone areas to identify actors and information needs

## 2. Country Level Actors

- Which agencies provide, receive and relay flood early warning and what is their specific mandate on flood early warning?
- How do they perform their function;

## 3. Flood affected communities

- What communication means is mostly used in times of disaster

# Stakeholders and the Roles

## ■ Sharing of Information for Flood Forecasts

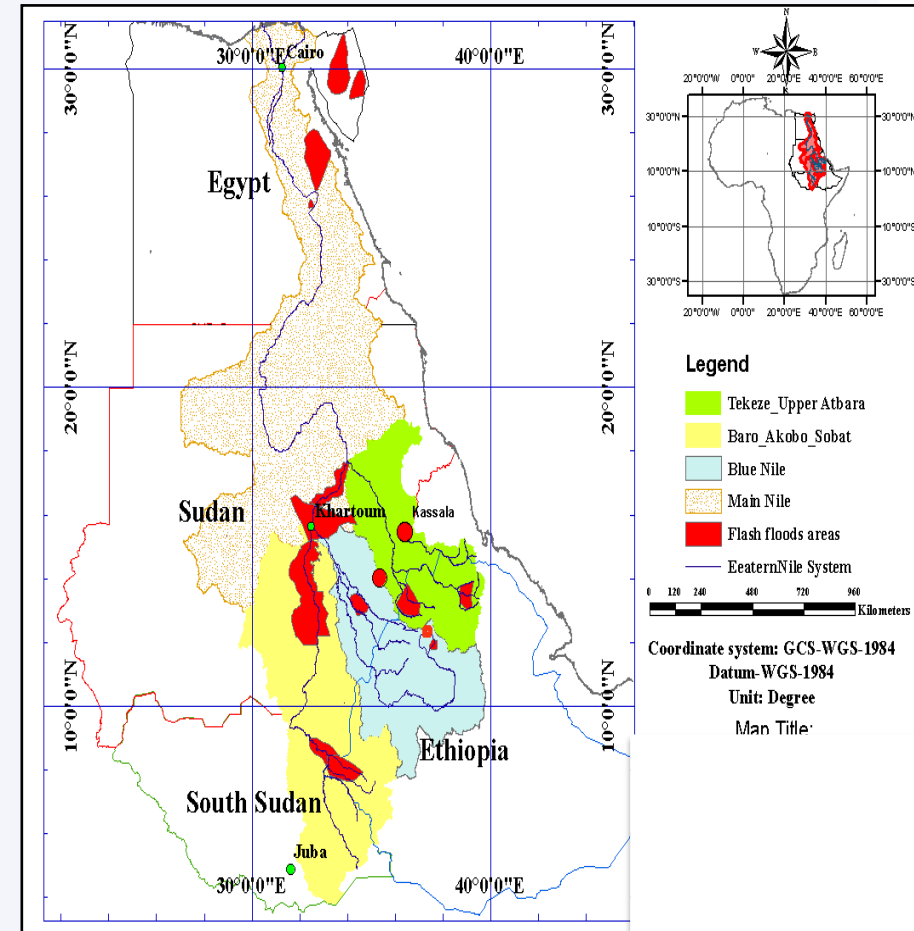
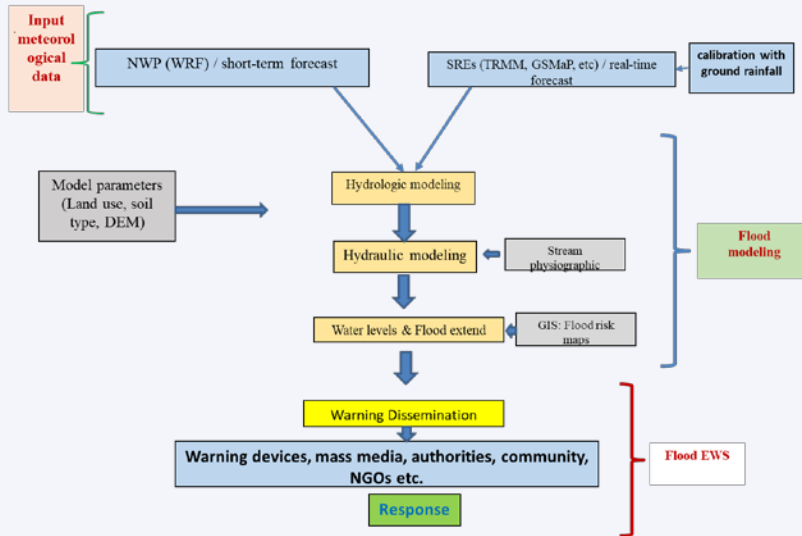
Information Type	Typical Sharing Entity	Type of Sharing	Purpose
Weather forecast	National meteorology agency	real-time	Ameliorate meteorological forecast
Hydro-meteorological data	Ministry of water, river basin authority	near-real-time	Adjust flood forecasts with data assimilation Build data repository for future model improvements
Historical hydro-meteorological data	Ministry of water, river basin authority	once off and when new datasets are available	Build sound data repository for models
Topography survey data	Ministry of water, river basin authority	once off and when new datasets are available	Improve hydrodynamic models with more accurate cross sections
Contact details of stakeholders	District authority, selected ministries, disaster management institution	once off and when new datasets are available	Ensure that dissemination paths are effective
Observations of extreme flood events on the ground	Designated locals in the districts, infrastructure operators	when an extreme flood occurs	Photos at landmarks, such as bridges support performance evaluation of models and forecasts
Feedback report on flood emergency response	District authority, disaster management institution, infrastructure operators	regularly during the flood season	Evaluate effectiveness of dissemination system

## ■ Dissemination of Flood Forecasts and Early Warnings

Target Group	Flood Information Type	Typical Dissemination Path	Dissemination Frequency	Typical Information Use
Selected ministries, river basin authority	Flood bulletin	e-mail	After every flood season	Understand and evaluate past flood season
Disaster management institution	Flood forecast as detailed as necessary	e-mail, SMS, web page	When a critical flood is forecasted	Mobilize flood response in affected districts
Infrastructure operator	Flood forecast as detailed as necessary	e-mail, SMS, web page	When a critical flood is forecasted	Mobilize flood response at infrastructure location
Affected community	Concise and simple flood alert	SMS, subsequently designated focal persons disseminate alerts through local means (e.g. VHF radio, megaphone)	When a critical flood is forecasted	Mobilize local flood response action according to practiced action plan
General public and media	Concise standardized flood forecast report	web page, e-mail to selected media outlets	When a critical flood is forecasted	Create public awareness

# Flash Flood in EN

- Flash Flood hot spots
- Road map to develop Flash Flood Forecasting System



# Dissaminating Early Warning



IKP- Nile Basing “Forecast and Monitoring” portal

Home / Data & Knowledge / Forecast and Monitoring

## Forecast and Monitoring

- Flood Forecast and Early Warning System
- River Flow Forecast System
- Drought Forecast and Early Warning System

Home Support Forecast Flood Mapping Reports



# Awareness & Capacity

## Flood Forum

Progress



## Stakeholder mapping



## Workshops



## Trainings



# Data and Model

- Hydro-meteorological observations on the ground (historical and real-time timeseries) - improve and make available
  - Rainfall at spatially well distributed weather stations
  - River flows and water levels at key gauging stations
- Topographical data
  - Cross sections in the hydrodynamic models currently derived from DEM
  - In the flat flood prone areas these need to be replaced with cross sections from surveys (terrestrial or LIDAR as far as necessary).
- Implications
  - Assess resource implications
  - Data sharing agreements (e.g. memoranda of understanding) need to be in place
- Downstream works...
  - revise, calibrate, and validate further
    - hydrological models
    - hydrodynamic models
  - to achieve the following
    - improve quality of results
    - ensure stakeholder trust

# Software and IT

- Current system with WRF and MIKE Operations is deployed on servers at ENTRO. Critical challenges to the reliability of the EN-FFEWS are:
  - Internet connectivity
  - Reliability of electric power supply
  - Computational capacities that could constrain system performance
- Improvement through migrating the system to the cloud
  - Significant advantages of deployment in the cloud
    - System robustness (system runs continuously 24/7)
    - Reliable connectivity
    - High data security
    - Smooth scalability
    - Flexible remote access
  - Cloud will incur recurring costs – e.g. yearly fees to the cloud service provider.



# Institutional arrangements and communication chain

- Strengthen national flood forecast centers
- Memoranda of understanding between ENTRO and national data providers (e.g. hydro-met institutions, regional climate centers ) for
  - Forecasts
  - Observed data
- Ensure that communities are informed timely and appropriately – improve information dissemination chain
  - Increased flood awareness in the affected communities
  - Effective flood response preparedness in the affected communities
- Improve response capability of the affected communities for
  - Understanding risks
  - Respecting warning services and knowing how to react
  - Disaster management plans (in place, well-practiced, tested)
- Awareness campaigns in communities on
  - safe behavior
  - available escape routes
  - how best to avoid damage and loss to property
- Engage local institutions with the communities to implement effective disaster risk reduction plans

# Next ...Flood Risk Mitigations

- *Strengthening FFEW system through- ground data, cross section*
- *Only two member countries including Ethiopia and Sudan have national flood forecast centre to issue flood alerts*
- *EN countries have no capacity to quickly respond to flood disasters due to lack of information on the near-real time flooded area*
- *Assisting people at risk at the community level, particularly rural and village communities in the flood prone areas*
- *Increasing the access and visibility of all the forecasting tools and warning alters*



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**THANK YOU!**

