Nile Basin Initiative (NBI)
Eastern Nile Technical Regional Office (ENTRO)

Hydromet Needs and Opportunities - the Nile Context

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Outline

1. Overview of the Nile
2. History of NBI – ENTRO
3. Features of Eastern Nile basin
4. Hydromet needs and opportunities
5. Ongoing activities on Flood and Drought forecast
The Nile Basin

- Africa’s largest river basin by area
- Area: 3.25 Million Km² (10% of Africa)
- Length: 6,695 Km (The longest in the world)
- Main Tributaries: **White Nile & Blue Nile**
- Population: 232 Million (within NB)
- Mean annual discharge 84 BCM
- Huge Water Loss in the System
The Nile Basin is shared by 11 countries:
- All except Eritrea are members of the Nile Basin Initiative (NBI).
Nile Basin... a water scarce region

(Long-term) annual flow at High Aswan Dam 84 BCM

- Ethiopian highlands (86 %)
- Nile Equatorial Lakes region (14 %)
The Need for a Regional Organizations

Cooperation on the Nile (Pre – NBI)

1. Hydromet Survey:
   - In 1963-1964 the equatorial floods lead to the hydro-met data sharing agreement that was signed in 1967 by Egypt, Sudan, Uganda and Rwanda, Zaire, Central African Republic

2. TECCONILE: Technical Cooperation for the Promotion and Environmental Protection of the Nile Basin
   - Started in 1993 by Egypt, Sudan, Uganda and Tanzania, Zaire
   - Ethiopia, Kenya, Eritrea as observer

- Though not inclusive these two activities promoted interaction and shared understanding of basin issues among experts and recommended an all inclusive cooperation mechanism to address common challenges.
- Following this recommendation the NBI was established in 1999.
Nile Basin Initiative (NBI)

The Foregoing provide the rationale for Nile Basin Cooperation which took two parallel tracks of a Strategic Action Program which were hoped to complement each other!

→ The Cooperation Track (NBI) – via
  → Shared Vision Program
  → Subsidiary Action Programs

→ The Negotiation Track (CFA) – Negotiation to build a New Legal Regime
After the establishment of the NBI

- The basin wide Shared Vision Program (SVP) was launched to build trust, capacity, knowledge base and analytical tools.

- The Subsidiary Action Program (SAP) was launched to undertake concrete actions on the ground at sub-basin levels of the Eastern Nile (ENSAP) and Nile Equatorial lakes (NELSAP).

- The Eastern Nile Technical Regional Office (ENTRO) was established in 2001 to implement the ENSAP.
• ENTRO (Eastern Nile Technical Regional Office) is one of the three Centers of the Nile Basin Initiative, (NBI) established by Eastern Nile Countries (Egypt, Ethiopia, South Sudan and Sudan).

• ENTRO is a technical arm of ENSAP whose overall objective is the cooperative development and management of the water resources of the Eastern Nile sub-basin in a sustainable and equitable manner.
ENTRO Mandate

ENTRO provides permanent platform for:

• Facilitating cooperation
  - Confidence Building.
  - Development Communication.

• WRM & Planning
  - Information and Knowledge Development and dissemination.

• Water Resources Development.
  - Identification and Preparation of Transboundary Investment Projects.

• Institution Building
  - EN Institutions and Professionals Capacity Building.
  - ENTRO capacity strengthening.
Eastern Nile Basin
Eastern Nile Sub-basins

- Contributes majority of the water to Eastern Nile system
- Sediment flows are high
- Hydrologic variability is high
- Gezira Irrigation
- Significant potential for economic development. Dam potential (GERD recently initiated)

Sub-basin | Area (km²) | Flow (BCM) | Annual rainfall (mm)
--- | --- | --- | ---
Main Nile | 656,398 | 84 | 0 – 200
Baro-Akobo-Sobat | 205,775 | 13 | 500 – 1750
Blue Nile | 311,548 | 54 | 500 – 1800

- Water availability is highly variable
- Little water infrastructure (except for new Tekeze hydropower dam and largely silted Kashm-el-Girba dam)
- Sediment flows are high
- Potential for small and medium-scale projects

**Main Nile**
- Very low rainfall
- The Aswan High Dam and Lake Nasser
- Extensive irrigation systems
- The Nile delta

**Tekeze-Setit-Atbara**
- Important wetland areas
- Complex ethnic and tribal context
- Little water infrastructure

**Abay-Blue Nile**
- Contributions to Eastern Nile system
- Sediment flows are high
- Hydrologic variability is high
- Gezira Irrigation
- Significant potential for economic development. Dam potential (GERD recently initiated)
Challenges & Opportunities of Eastern Nile Basin

- Land Degradation Reversal/Watershed Management
- Flood Management
- Agriculture/Irrigation
- Regional implications of Large Storage Projects
- Improving Agriculture/Irrigation
- Managing water quality/Salinity
- Coordination of Operating Rules
- Holistic Investment Planning, Preparation, Facilitation, and Implementation Support
- Climate Change Adaptation/Carbon Finance Opportunities
- Regional Trade (e.g. in Power, Agricultural, and other commodities)
Population of basin countries increased 4 fold between 1960 and 2010

Shrinking per capita water availability

Source: World Bank; World Development Indicator database
Demand for Water Growing.....

Increasing energy demand

Increasing food demand

More competition for water to meet demands

Source: World Bank; World Development Indicator database
the threat of climate change….

Kenya: variability and growth

Rainfall variability, Ag GDP and GDP

Upstream economies:
- Agriculture is backbone of economy
- Hostage to climatic variability?
Hydromet need and Opportunities
Hyromet Needs – Basin monitoring

River basin monitoring is essential for knowledge based water resources management and development; The current system of Nile Basin monitoring is far from adequate.

→ there is an incomplete understanding and knowledge of bio-physical conditions of many hydrologically significant parts of the Nile Basin

Complex Hydrology
Hyromet Needs – Key Infrastructures

- To meet growing demands of water for food, energy and consumption, the Nile Basin will continue to witness transformational levels of water resources development.
  - Monitoring the change and forecasting the possible impact of the future
  - Sediment monitoring concerning downstream impacts of dam operation and impacts of watershed interventions upstream
Hyromet Needs – Key Infrastructures

- >30 dams, barrages or weirs - proposed/planned currently
- >150 million people leave D/S of dams

→ Monitoring the safety of the dam
Hyromet Needs – Environmental and Social

- Watershed degradation, Soil loss, siltation & sedimentation of infrastructure, declining farm productivity → persistent poverty
- Habitat and Biodiversity loss

→ Monitoring the state of the basin is vital for sustaining the water resource base and managing environmental and social impacts

→ Socio-economic data concerning downstream impacts of water infrastructure for realizing the gains from such development projects
Hyromet Needs – Flood and Drought

- **1998 in Sudan**: caused a direct flood damage of about US$ 24.3 million
- **2003 in Sudan**: More than 250,000 families affected
- **2006 in Ethiopia**: 600 people dead, more than 35,000 people homeless & 115,000 livelihood affected
- **2013 in South Sudan and Ethiopia**: causes losses of many life and damage of properties
- **2014 in Sudan**: 257,000 people in ten states have been affected
Hyromet Needs – Support Decision Making

Support for decision-makers by providing access to reliable and timely available information on the hydrologic, meteorological, and socioeconomic conditions for optimal development and operation of water infrastructures.

Which variables? Where? How frequent? Which technologies?

Databases
Models
Analytical Tools

Questions
Answers

Decision makers
Decisions

Planning and management of water infrastructures
What changes and where?
Efforts Addressing - Hydromet needs

- Gaps in availability of data required for water resources planning and management have already been identified for quite sometime.

- A number of project-specific efforts made by NBI (NELSAP, ENSAP) to strengthen member country hydromet systems.

- In 2008 (SVP Mid-term review), the Nile-TAC instructed Nile-SEC to prepare a Nile river basin monitoring strategy.

- The strategy was developed and subsequently approved by Nile-COM in 2012; the strategy was the first attempt to look into the hydromet questions holistically and provide strategic direction (rather-than piece meal).

- Funding was made available by WB to prepare detailed design and implementation plan; which were completed in May 2015. Now NBI is on the implementation stage.
Opportunity

- Regional Hydro-met and forecasting system
  - Improve accessibility to real time data, knowledge, tools, and partnerships
  - Enhance trans-boundary cooperation
Knowledge Product - Internship

- Improved access and use of global products by identify who can use what - customize appropriate products.
  - Facilitating access to data and knowledge products using modern dissemination
  - Research on Hydromet
  - Filling data gaps
  - Knowledge support to Nile Countries in planning, preparing and managing of investments
A regional Hydromet system provides the data and information required to support cooperative development and management of the water resources.

→ A basin that is shared by 11 countries can be cooperatively developed and managed its resource only if riparian states have a common understanding on the resource base, its state and the threats it faces.
Ongoing Flood and Drought activities
Reducing the risk of flood devastation for 2.2 million people in the region
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
FFEW & Seasonal Forecast

Eastern Nile Seasonal Forecasting/Flood Forecasting and Early Warning

- To Enhance and expand the FFEW system
- To expand the FFEW system other flood prone areas in EN basin
- To support the EN countries by issuing seasonal forecast and its application in reservoir operation and irrigation water use

Enhanced Flood Forecast System
- Upgrading the existing flood forecast system
- Address Flash flood
- Web base early warning system
- Stakeholder mapping

Seasonal River Flow Forecast
- Seasonal river flow forecast
- Drought Forecast
- Tools developed using river flow forecast for
  - Operation of dams
  - Irrigation water use

Capacity Building
- Capacity building training Flood forum
- Workshops
- Infrastructure

Collaboration with sub-basin Authority/NMA
Establish a Drought Perdition and Early Warning System for Eastern Nile basin (DPEW)

The NBI Seasonal and short-term flow forecasting (Under implementation)

Regional forecast centers (IGAD4CPAC)

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Provide flow forecasts at selected locations

Provide meteorological forecasts

Provide meteorological forecasts

Global International forecast (NOAA CPC, Princeton AFDM, USGS FEWSNET, NASA-FAME, UCSB CHG)

The EN drought monitoring and forecasting system

Global earth observation satellites (Landsat, Sentinel, MODIS, etc)

The EN drought monitoring and forecasting system

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Portals to access and visualize the data (NBI-IKP etc.)

National/Regional and International Users/decision makers can access the dashboard

Figure 2 Framework for estimating crop acreage, health and yield using readily available satellite data.
Rainfall Forecast

Global Forecast input

WRF Simulation
Other

Event
ArcMap
Schedule
GeoDB

Automated WRF

Data

FFEW Database

IKP - Web Interface

Eastern Nile Rainfall Forecast

Forecasts Area
Rainfall Forecast

Date
17 Jul, 2014
Day
First day forecast

Display

Legend
High: 43.6104
Low: 0
Flood Forecasting System

WRF/other Input → MODEL → Flood Admin → Database → Other Visualization

 Meteorological Forecast → Flood Forecast → Early Warning

IKP - Web Interface
Seasonal River Flow Forecasting

Global earth observation satellites
(Landsat, Sentinel, MODIS, etc)

The NB-RFFS

DSS toolkit for operation of dams in Blue Nile sub-basin

River flow and drought forecasts

The EN drought forecasting system

DSS toolkit for irrigation water allocation planning application locations
Drought Forecast

Eastern Nile Drought Dashboard

Satellite Data
Field Surveys
GIS Layers

Crop acreage estimation
Crop health monitoring
Crop yield estimation

Model

DB=database  GIS=geographic information system  UAV=unmanned aerial vehicle

*2 Framework for estimating crop acreage, health and yield using freely available satellite data.
Cloud to Street data and services

- Watershed wide flood frequency and hotspot maps
- Library of historic flood events
- Flood forecast accuracy assessment
- Daily flood alerts and mapping

entro-flood-monitoring.cloudtostreet.info
Eastern Nile Flood Dashboard

• Assess the accuracy of the current ENTRO forecast model
• Help improve provide daily verification of the maps in the bulletin
• Early alerts for flooding to enable faster response and more targeted recovery
• Identify frequently flooded areas and assets like farms, communities and roads at high risk of flooding
Integrated Knowledge Portal

Rainfall Forecast: Short term and Long term

Flood and Flow Forecast: Short term and Long term

River Flow Forecast: Seasonal river flow forecast

Drought Monitoring and Forecast: Satellite base drought monitoring

Capacity Building: Training; Training material and user guide
Thank You