The Nile Basin Experience in Transferring Innovative Solutions to Meet the Challenges of Water and Climate
River Basin Management

• River Basin Management primarily requires **monitoring** water availability and demand in the basin.

• Use of **remote sensing** techniques and satellite data has been identified as a feasible means to monitor the Nile Basin in addition to ground-based measurements.
Application of Remote Sensing in the Nile Basin

Remote Sensing techniques have been used by NBI to:

• Monitor water availability in the Nile Basin through monitoring historical and status of rainfall, Evapo-transpiration, Temperature, Water levels, etc
• Flood preparedness
• Managing wetlands in the Nile Basin
• Monitoring Landcover/Land use change
• Water quality monitoring in large lakes e.g L. Victoria
• Assessment of potential areas suitable for irrigated agriculture
• Assessment of erosion vulnerability
Sample work done: Monitoring Rainfall

- Rainfall is monitored by both **Ground observations** and **satellite data**
- Satellite derived data products used include:
  - **TRMM 3B43v7** monthly product and the **3B42 daily product**. Continued as **GPM-IMERG**
  - **Chirpsv2** (satellite plus station data and reanalysis)
  - **RFE** (satellite-NOAA)
  - etc
- Other gridded rainfall data products based on gauge observations include:
  - **CRU_TS**, from the Climatic research unit
  - **GPCC**
Nile Basin Rainfall - Comparative assessment of satellite rainfall data products

Baro- Akobbo- Sobat Subbasin

Lake Victoria Subbasin

AVERAGE MONTHLY RAINFALL IN THE NILE BASIN
Sample work on Actual Evapotranspiration

- ET is an **important component** of the water budget
- Is the only “consumer” of water
- Previously, **Water balance models** were used to estimate ET as the remainder after determining all other balance components
- Now, **Satellite based techniques** have emerged
- NBI has assessed the performance of different Evapo-transpiration Satellite data products for the Nile Basin Countries
- NBI has generated AET over Nile Basin Countries based on MOD16ET- Improved algorithm
  - Spatial resolution; 1km
  - Temporal resolution is 8 days, monthly and annual
Actual Evapotranspiration

- NBI is continuing with the generation of AET based the FAO WaPOR product from 2009 to present
- Using such satellite data reveals Temporal and spatial variation over the Nile Basin.
- There is variation even at sub-basin level
- ET accounts for 87% of basin rainfall
- With this data, areas of potential ground water recharge are identified
- With this data, water balance estimates are improved especially for areas in the basin with out gauge stations

These and more analysis can be performed.
Sample Work done: Lake Water Levels

- Monitoring of **water levels** in **large lakes** using satellite Altimetry- **Jason** satellite
- These lakes include Lake Victoria, Lake Nasser, Lake Tana, Lake Kyoga
- Lake height variations (m) are referenced at a particular datum

![Graph showing height variation in Lake Victoria](image)
Wetland Management

- Previous work done 2009 NBI NTEAP project
- Currently (2018-2019) Inventory mapping with support from GIZ - 2018

- Small water body mapping in the Sudd region Based on
- Medium Resolution data such as Spot, Landsat
  - Multi Spectral data such as RapidEye, MERIS, MODIS
  - Sentinel-1a
Water quality indicators observed from satellite data (MERIS) include:

- Chlorophyll concentration
- TDS
- Lake Surface Temperature
- And others

From this analysis, point source contamination can be identified.

White regions show no data.
Flood Preparedness sample

- Flood prone areas in the Eastern Nile
- Flood frequency
- Historical flood mapping

Flood hydrologic modelling compared to Satellite based flood detection
Flood Preparedness

The portals are still under development
Other applications

Erosion potential / Vulnerability

- Soil erosion Potential
- Hot Spot Detection

Land-cover mapping
Forest loss trends

Plans
NBI plans to start ground water monitoring using satellite observations.
Tools

- NBI has participated in the development of Remote Sensing tools such as:
  - GWA - Global Wetland Africa project
    - Produce Wetland information Products and Indicators
    - Over 180 algorithms,
    - Organised in easy to use workflows
    - Based on QGIS - open source
    - Easy to use workflows
  - WOIS - TigerNet
    - Was developed through Demonstration cases
    - 42 algorithms
    - Easy to use workflows - automated scripts
    - Data access tools
    - Based on QGIS - open source

- Cloud2Street -
  - online flood mapping tool
  - Identification of flood prone areas
  - Flood extent
Knowledge Products

- NBI prepares and disseminates Knowledge products based on satellite data. These include:
  - Nile Basin Water Resources Atlas
  - State of River Nile Basin Report

http://atlas.nilebasin.org/
Climate change efforts in the Nile Basin by the Nile Basin Initiative
Climate Change

• The 10-year NBI strategy under Goal 5 identifies two primary areas:
  a) Provision of climate change projection data at appropriate spatial and temporal resolution for key target end users;

  I. Understanding climate change impact for the Nile Basin
     • 10 bulletins prepared for each Nile Basin Country showing an assessment of climate change
     • These assessments provide pathways for potential adaptation to climate change
WHAT DOES A GLOBAL AVERAGE TEMPERATURE RISE OF 1.5 AND 2 DEGREE MEAN FOR THE NILE BASIN?
• Performance of 35 GCMS were assessed for each sub-basin
• For both rainfall and temperature
• Statistically downscaled data is available for each sub-basin
• Different GCMs performed differently in the different sub-basins
• This bias corrected data can be used for impact studies for areas of interest with in the basin
Climate Change

• The 10-year NBI strategy under Goal 5 identifies two primary areas:

b) Provision of scenarios of the hydrology of the Nile Basin under various climate change projections.”
The graphs show projected river flow scenarios for different stations based on the CORDEX dataset for RCP4.5 and RCP8.5 for the white Nile and Blue Nile.

Similar assessments were performed for monthly and annual temporal scales.