NILE BASIN INITIATIVE
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20 YEARS
STRONGER TOGETHER

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

River Basin Management

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- 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

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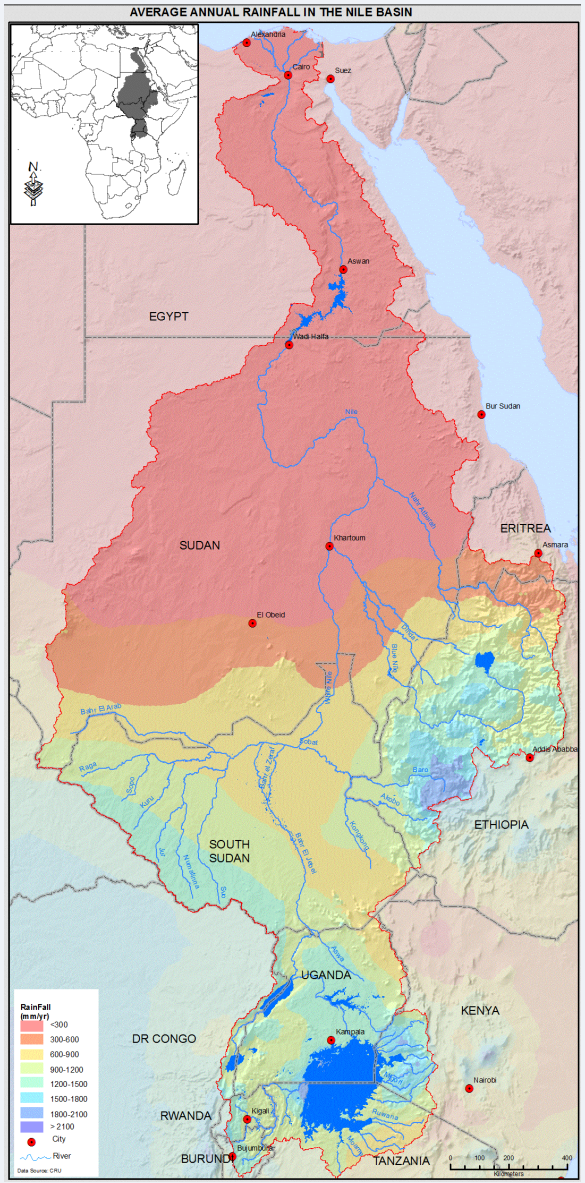
Remote Sensing techniques have been used by NBI to :

- 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 satellite rainfall data products

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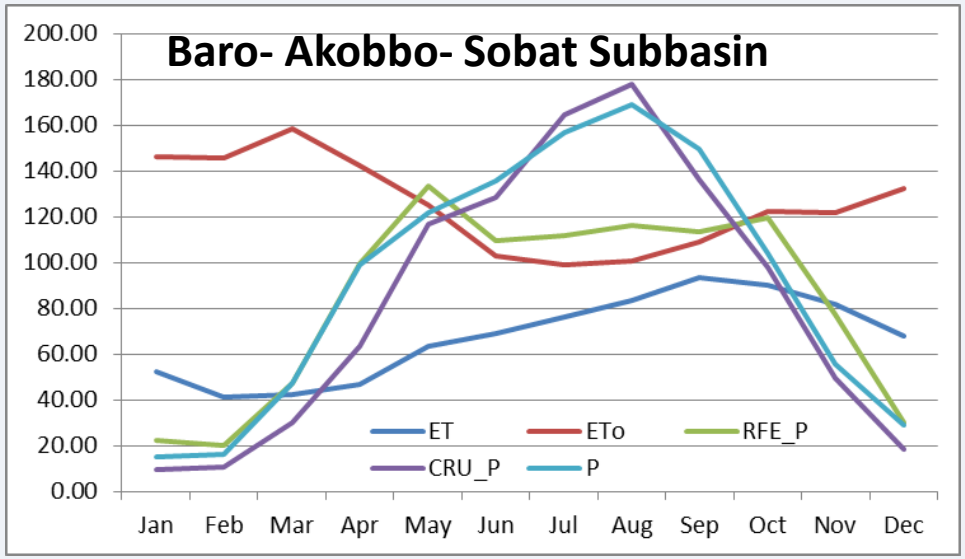

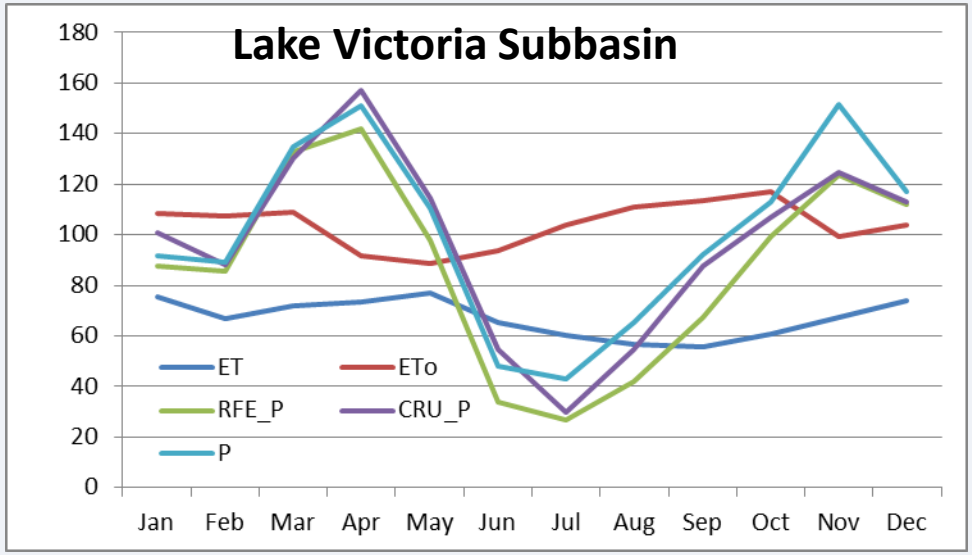

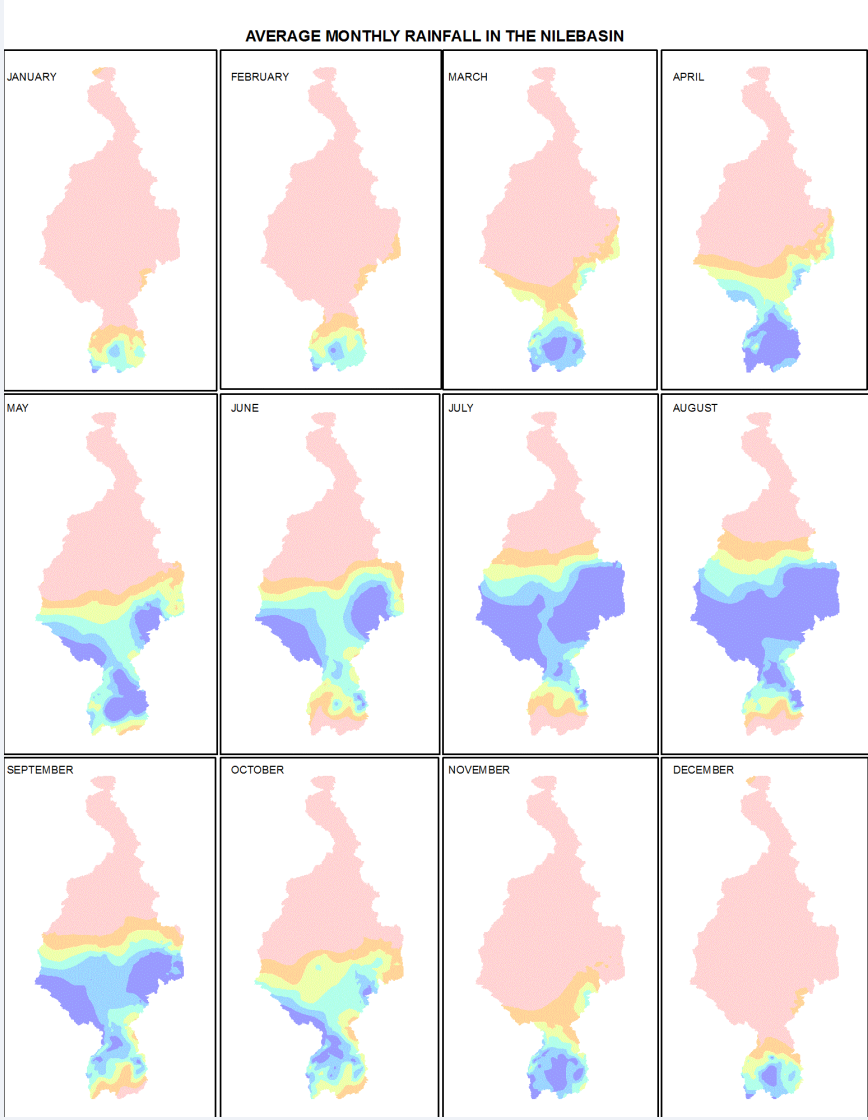

Sample work on Actual Evapotranspiration

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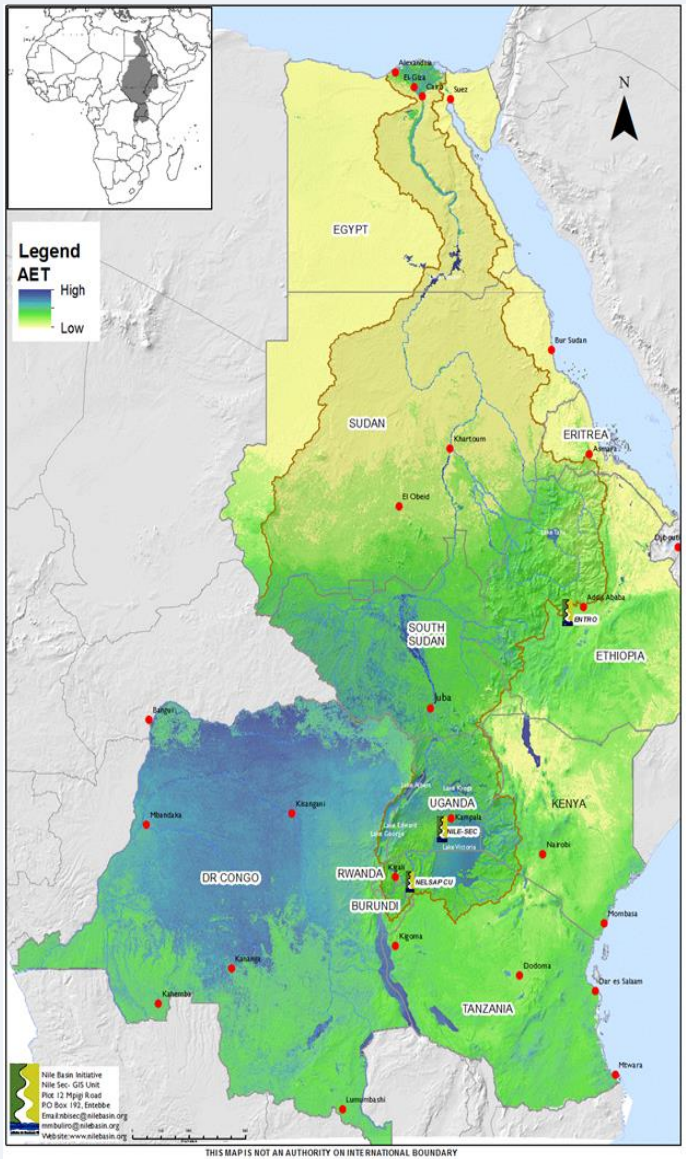
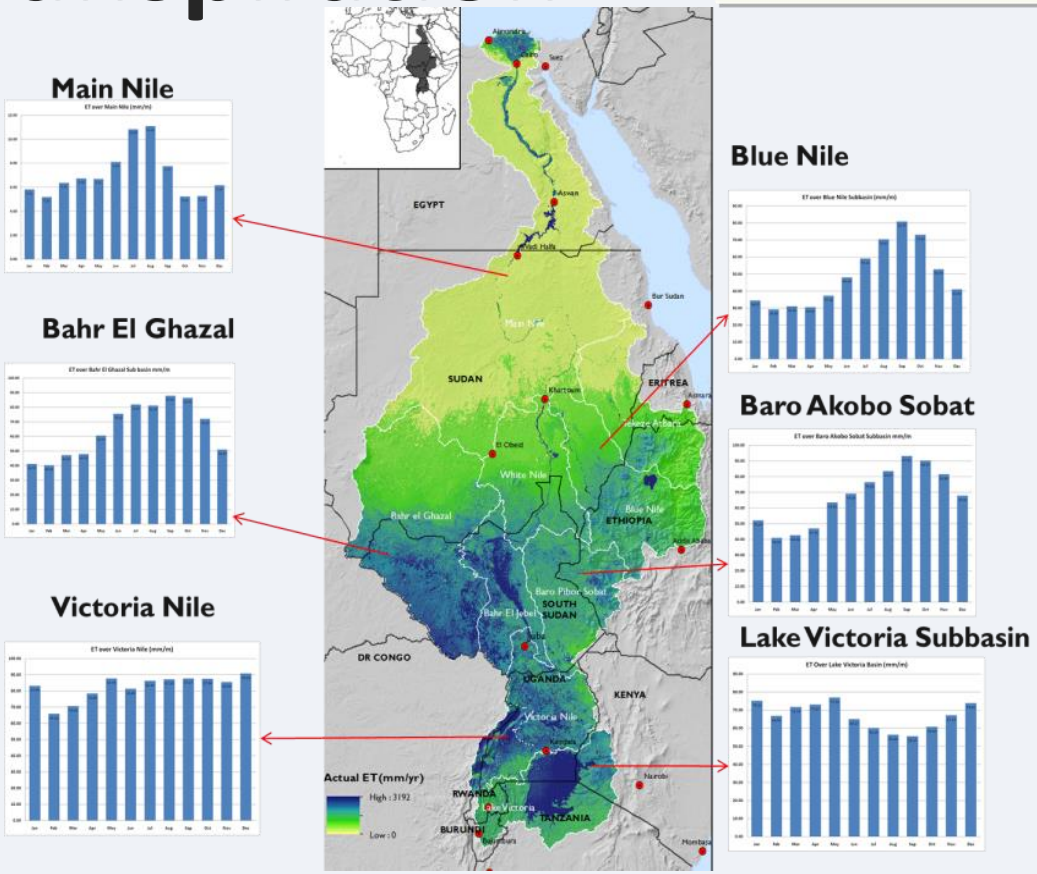
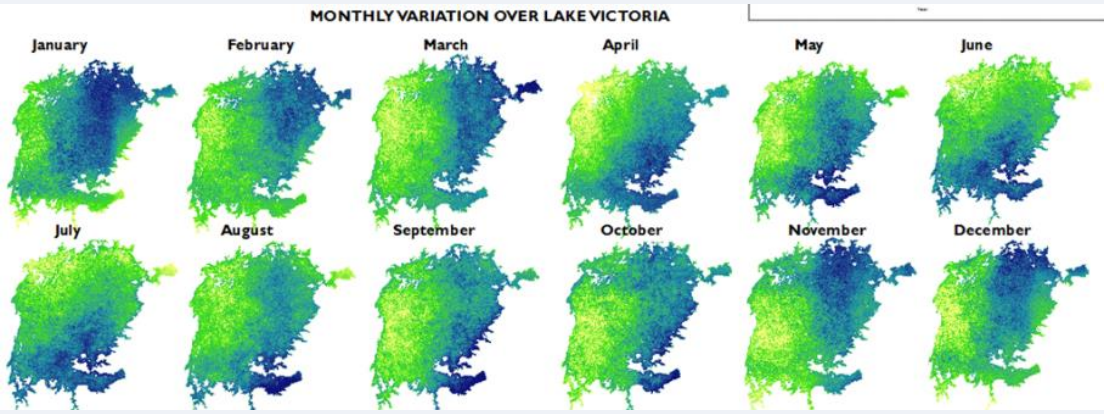
- ET is an **important component** of the water budget
- Is the only **"consumer"** of water
- Previously, **Water balance models** were used to estimate ET as the remainder after determining all other balance components
- Now, **Satellite based techniques** have emerged
- NBI has assessed the performance 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

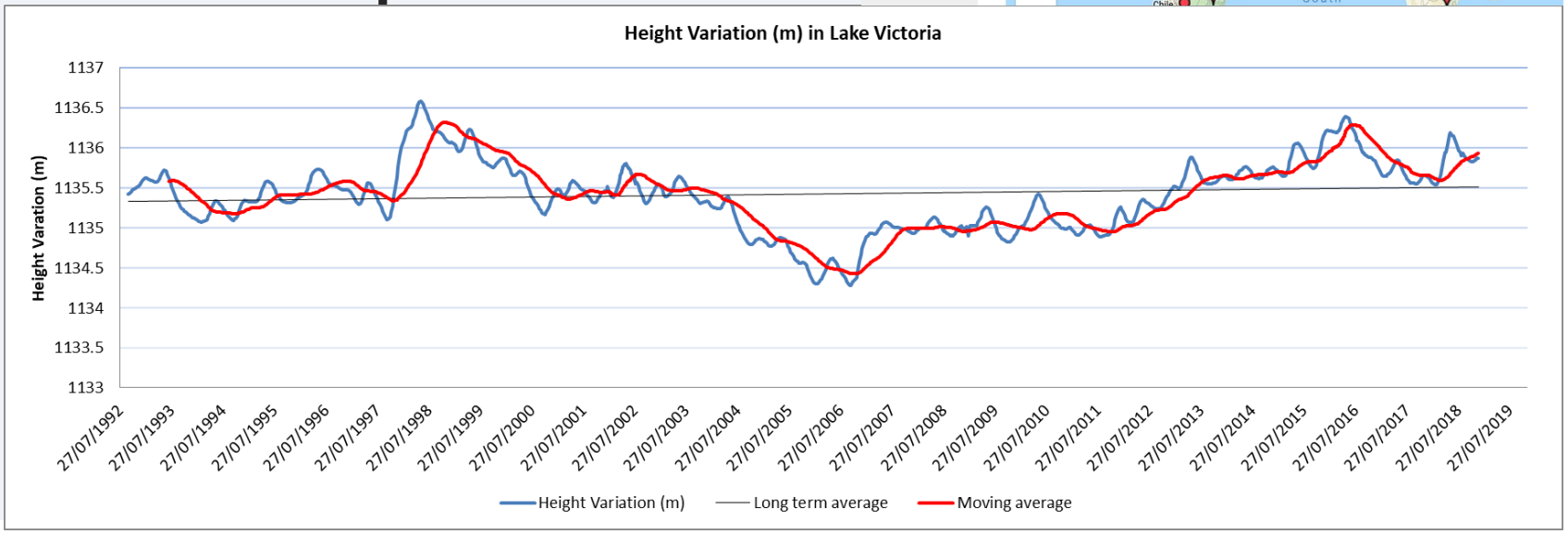




These and more analysis can be performed.

Sample Work done: Lake Water Levels

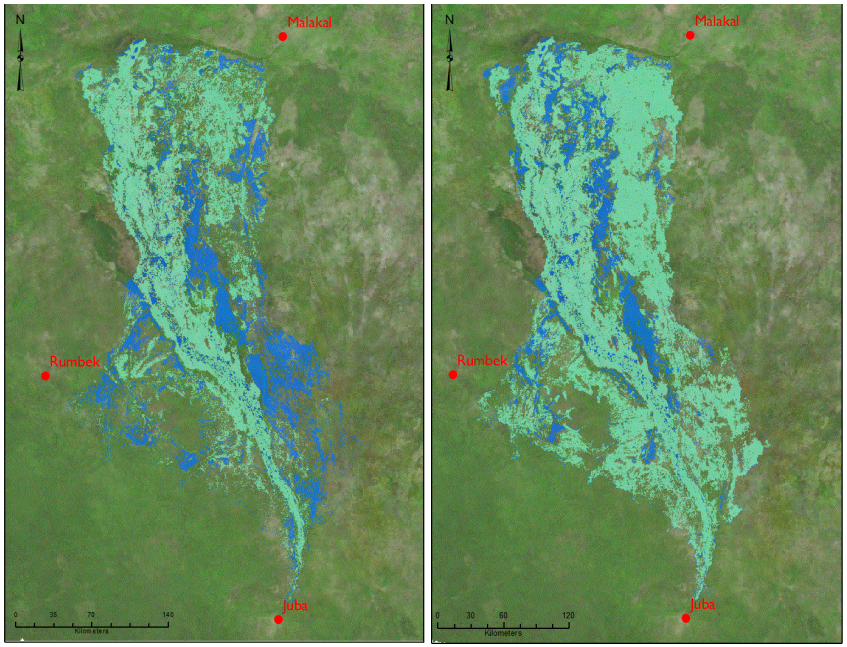
- Monitoring of **water levels** in **large lakes** using satellite Altimetry- **Jason** satellite
- These lakes include Lake Victoria, Lake Nasser, Lake Tana, Lake Kyoga
- Lake height variations (m) are referenced at a particular datum

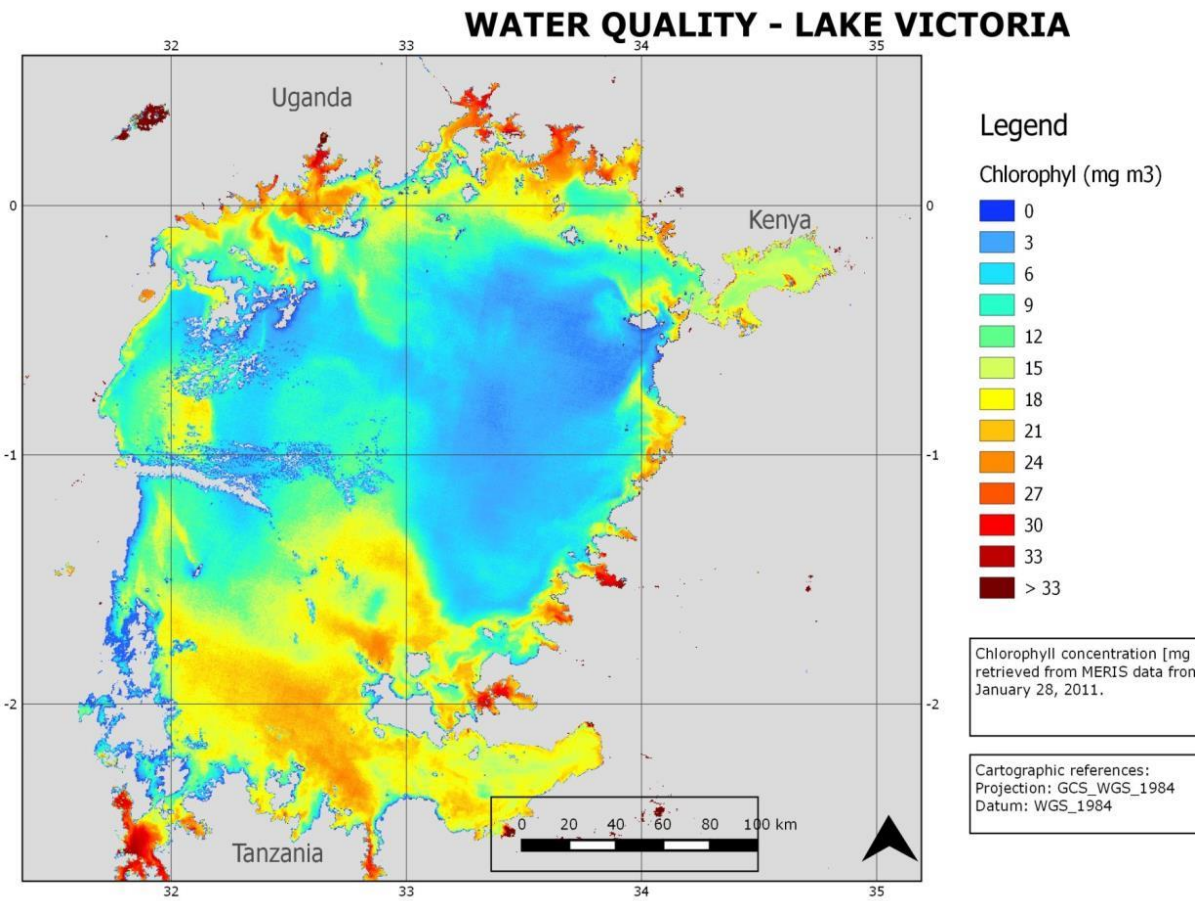


Wetland Management

- 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





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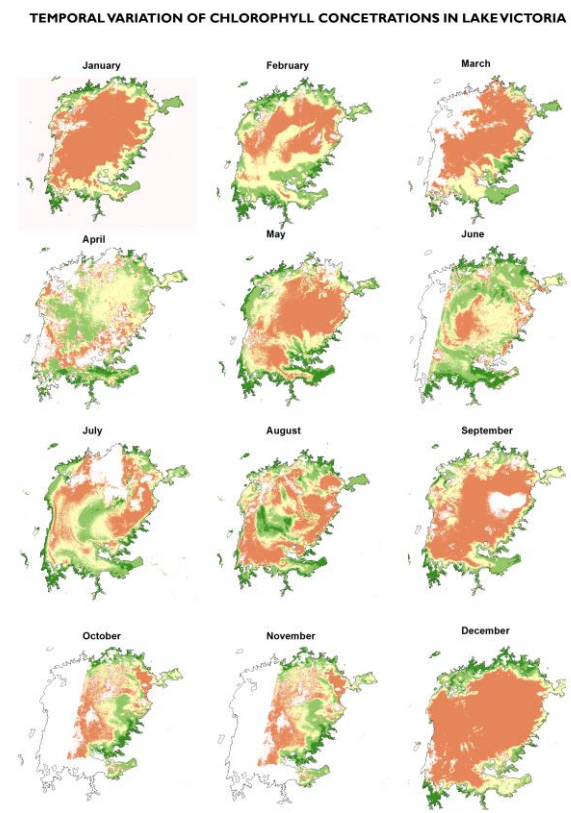

White regions show no data

Water quality indicators observed from satellite data (MERIS) include:

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

From this analysis, point source contamination can

Flood Preparedness sample

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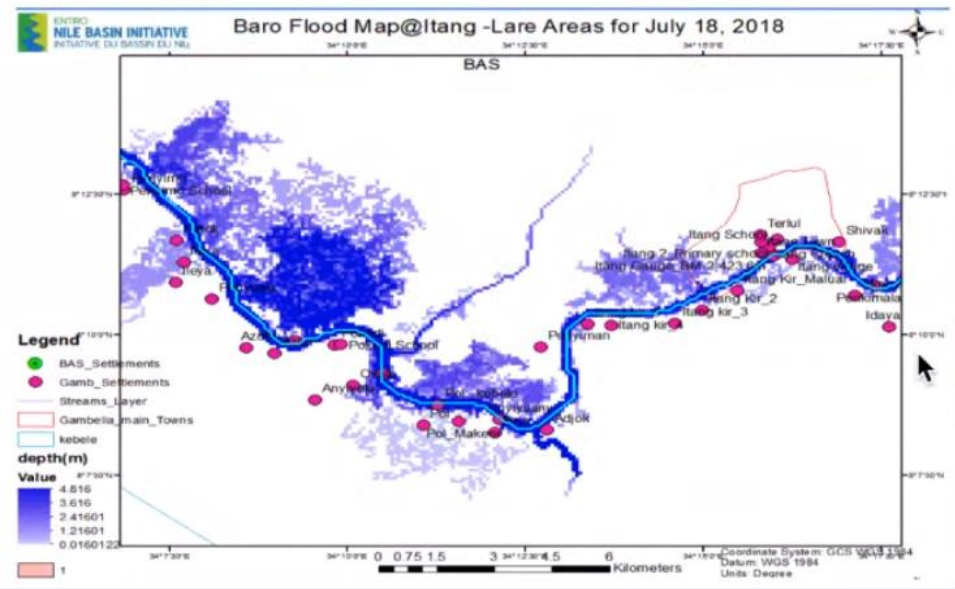
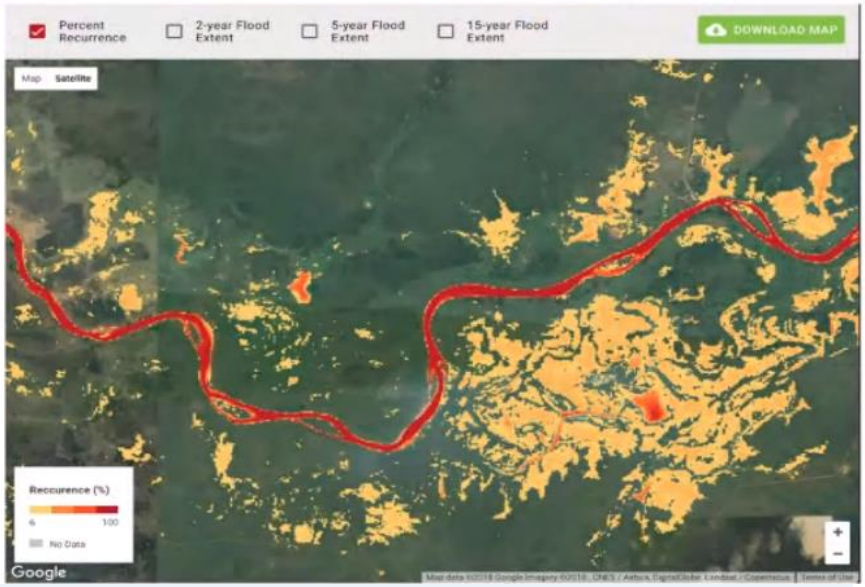
- Flood prone areas in the Eastern Nile
- Flood frequency
- Historical flood mapping





Flood hydrologic modelling compared to Satellite based flood detection

Flood Preparedness

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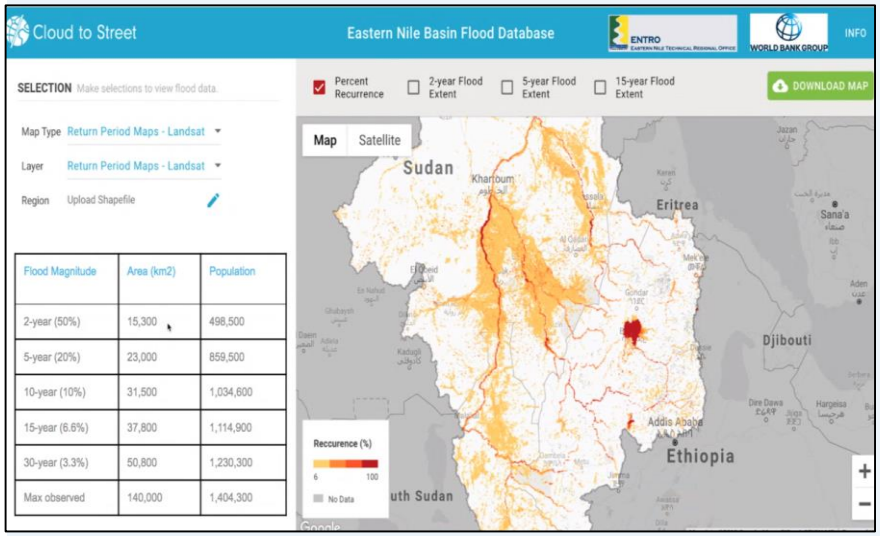

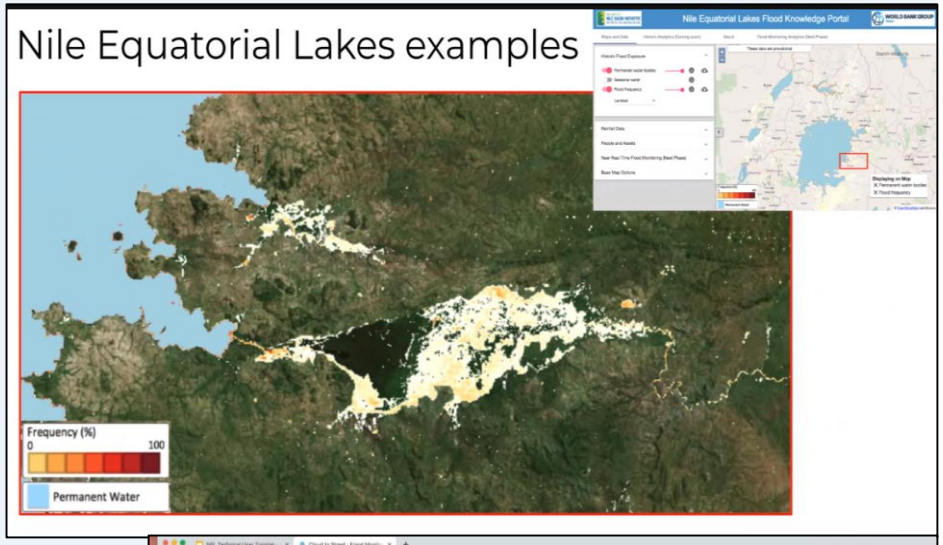

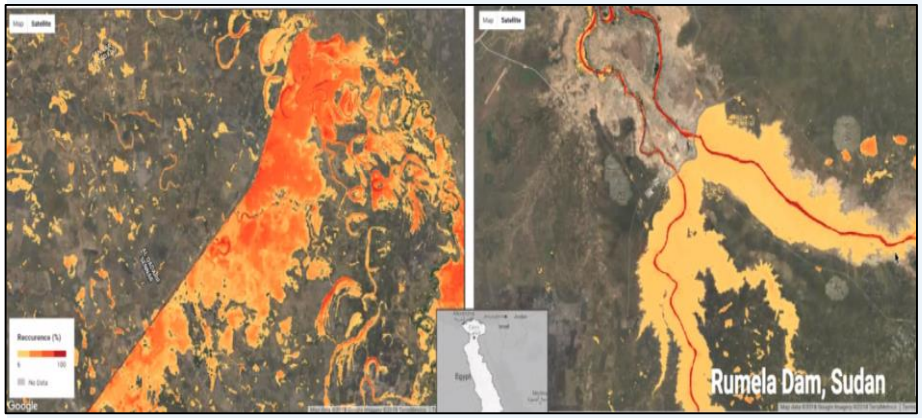

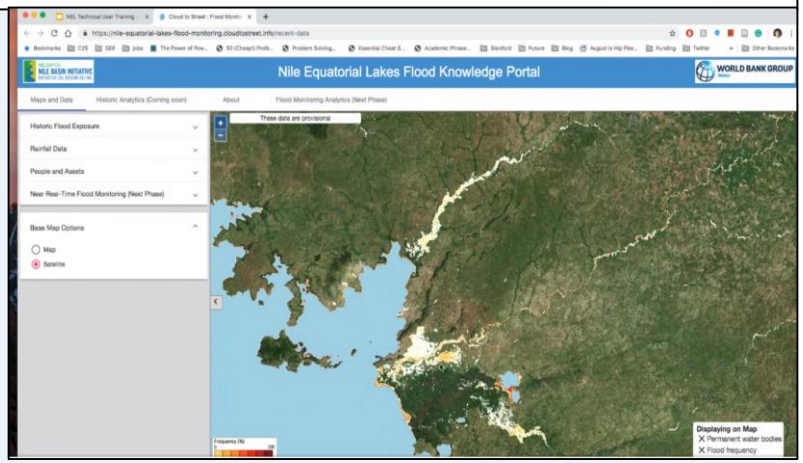

The portals are still under development

Other applications

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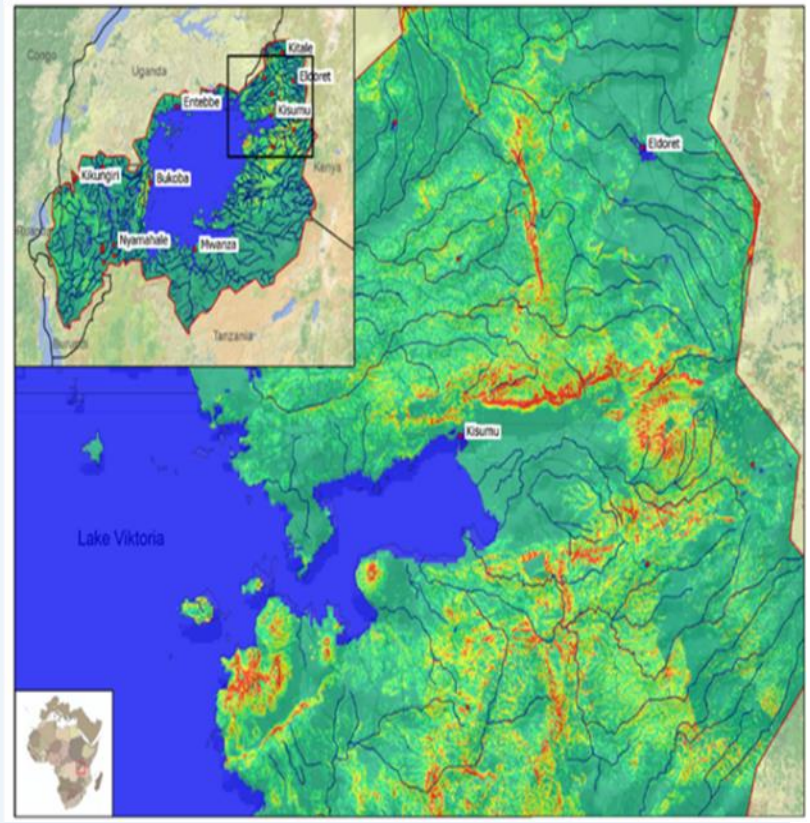
Erosion potential / Vulnerability

- Soil erosion Potential
- Hot Spot Detection

Land-cover mapping

Forest loss trends



Plans

NBI plans to start ground water monitoring using satellite observations

Tools

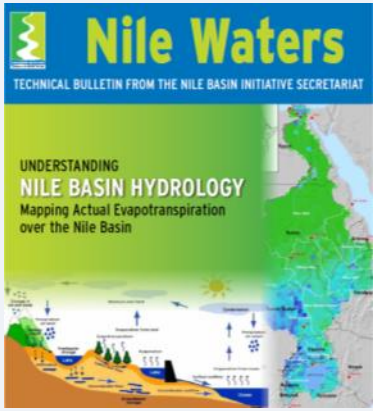
- NBI has participated in the development of Remote Sensing tools such as;
  - GWA - Global Wetland Africa project
    - Produce Wetland information Products and Indicators
    - Over 180 algorithms,
    - Organised in easy to use workflows
    - Based on QGIS- open source
    - Easy to use workflows
  - 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

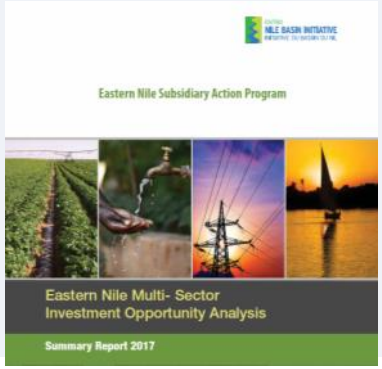
Knowledge Products

- NBI prepares and disseminates Knowledge products based on satellite data. These include:
- **A quarterly Bulletin:** Monitoring the Nile Basin using Satellite data: Disseminated every quarter.
- Nile Basin Water Resources Atlas

http://atlas.nilebasin.org/

- State of River Nile Basin Report





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Climate change efforts in the Nile Basin by the Nile Basin Initiative

Climate Change

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- 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

Climate Change Bulletins for each Nile Basin Country

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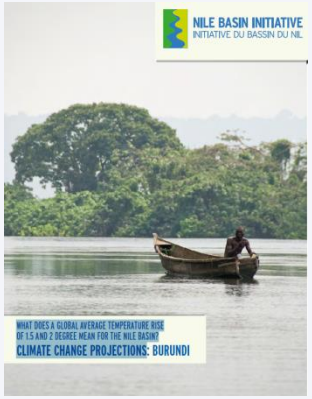
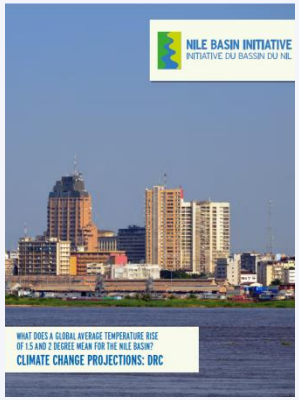
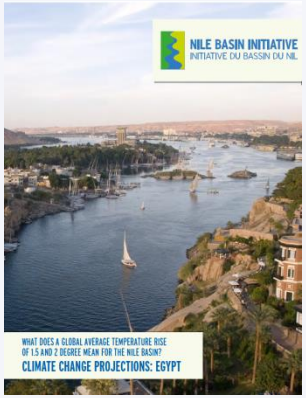
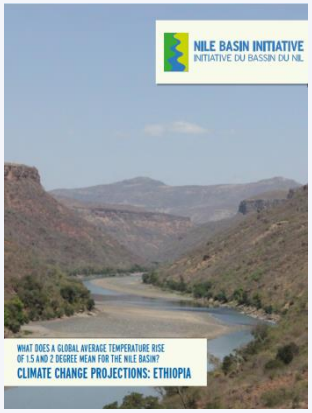
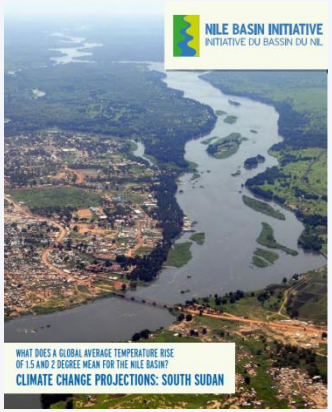
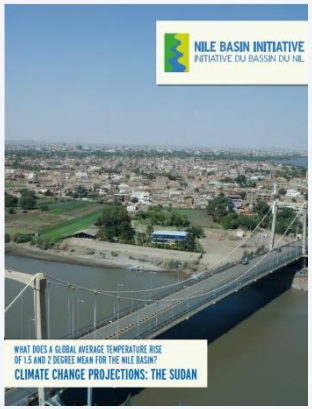


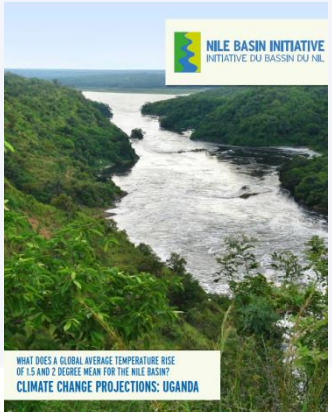




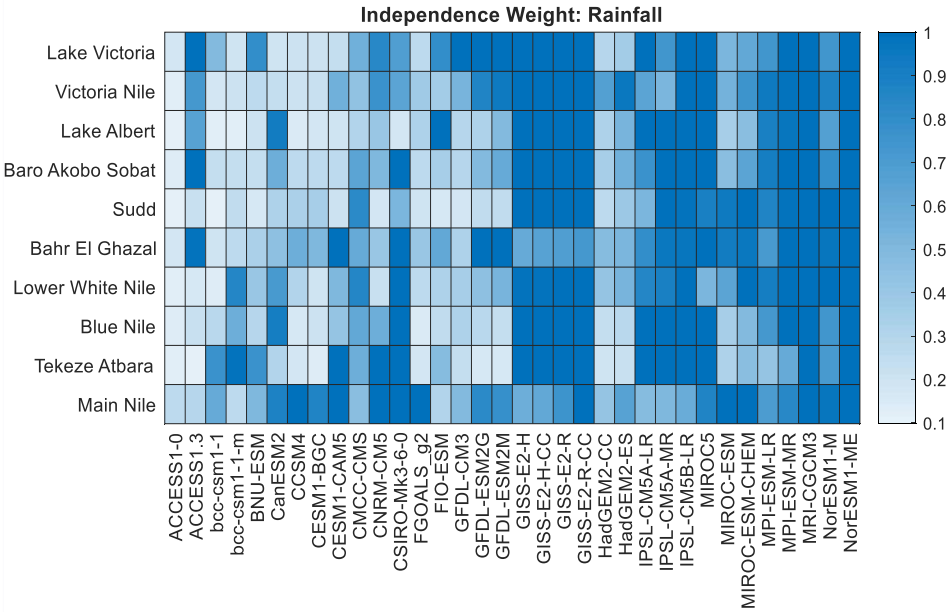


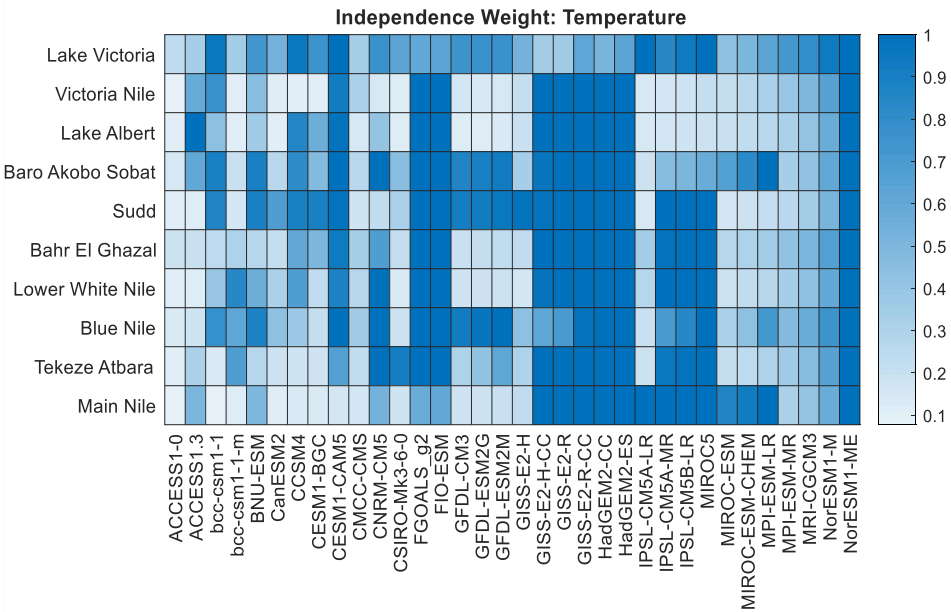






WHAT DOES A GLOBAL AVERAGE TEMPERATURE RISE OF 1.5 AND 2 DEGREE MEAN FOR THE NILE BASIN?



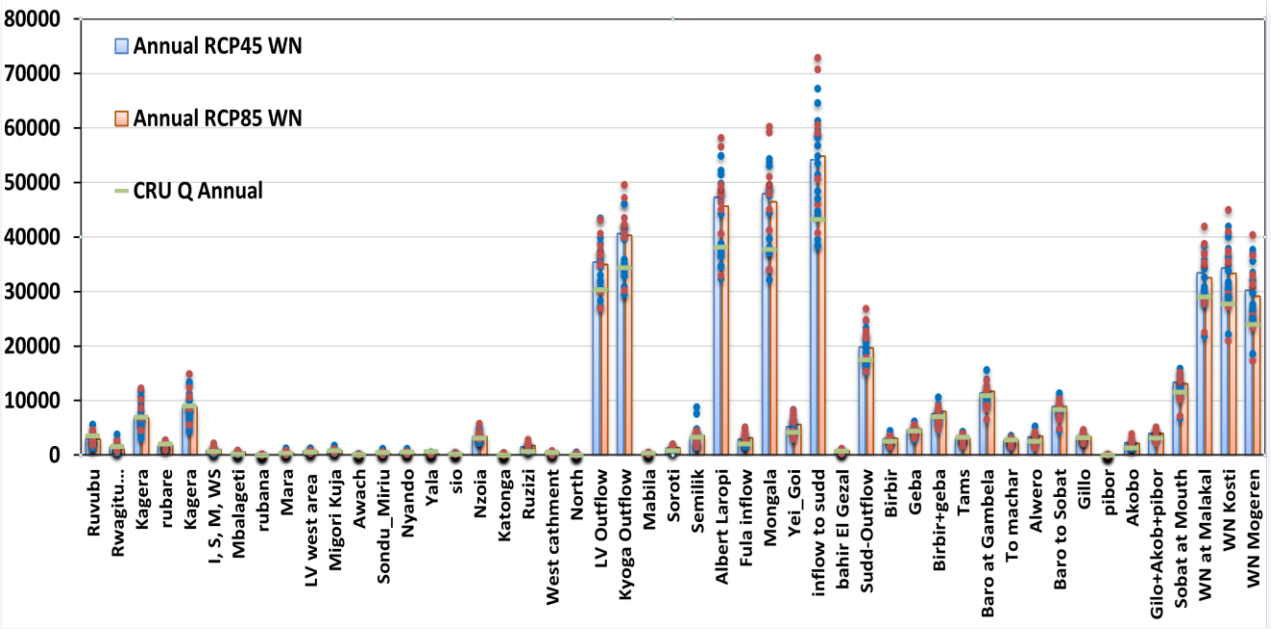


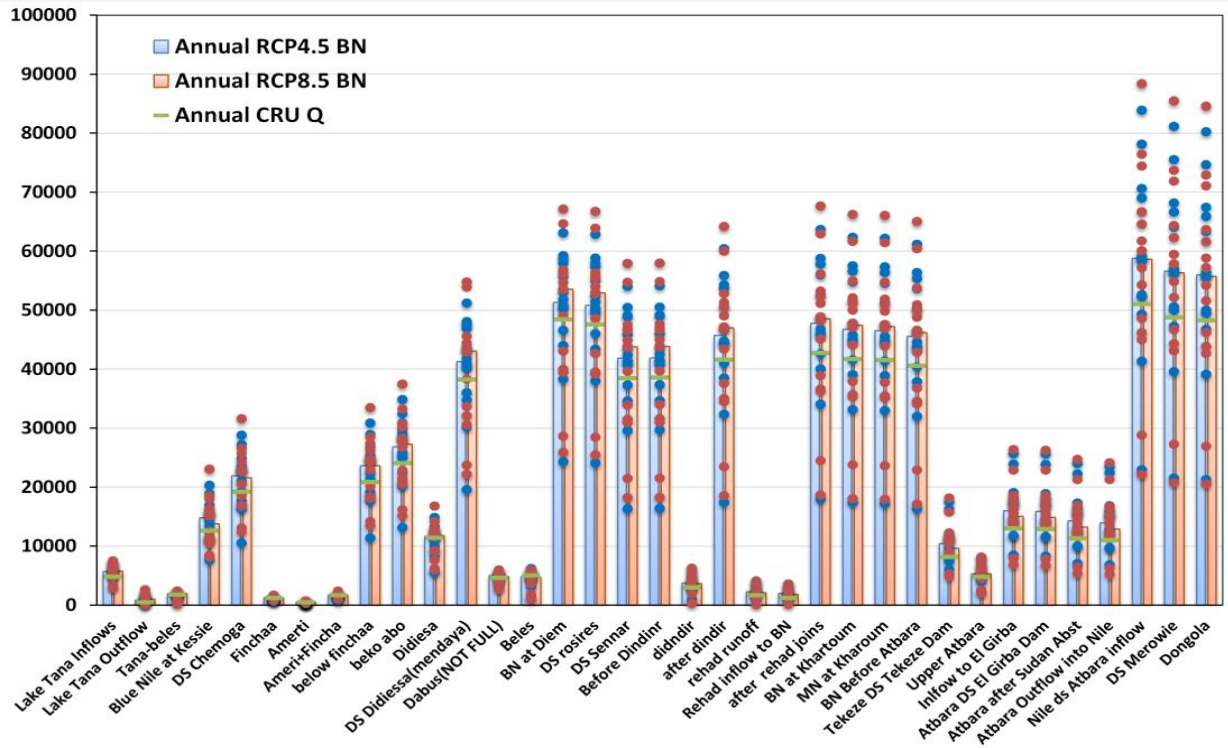
- **Performance of 35 GCMS were assessed for each sub-basin**
- **For both rainfall and temperature**
- **Statistically downscaled data is available for each sub-basin**
- **Different GCMs performed differently in the different sub-basins**
- **This bias corrected data can be used for impact studies 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