

## Terms of Reference

### Introduction to Python software for water resources and climate data analysis training

#### Output: 1.5.2-Basin monitoring function

#### 1 Background

The Nile Basin Initiative (NBI) is a regional intergovernmental partnership of ten Nile Basin countries, namely, Burundi, DR Congo, Egypt, Ethiopia, Kenya, Rwanda, South Sudan, The Sudan, Tanzania, and Uganda, that seeks to promote cooperative management and development of the shared Nile Basin water resources for win-win benefits, promote regional peace and security. The NBI was established in 1999. The NBI operates from the Nile-SEC located in Entebbe, the Eastern Nile Technical Regional Office (ENTRO) located in Addis Ababa, Ethiopia, and the Nile Equatorial Lakes Subsidiary Action Program Coordination Unit (NELSAP-CU) located in Kigali, Rwanda.

The Nile Basin Initiative, with support from the World Bank through the CIWA Trust Fund, seeks to expand its data and analytics services (NB-DAS) for climate-resilient water resources management in the Nile Basin through innovative information services for climate – resilient investment planning.

With improvements in data collection technology, the availability of data relevant for decisions in many spheres of life, including for water and related natural resources management, is growing astronomically. Most such data is available in the public domain. Further, rapid, precise, and diverse Earth Observation (EO) information is becoming available and freely accessible in the public domain. EO is used to monitor diverse river basin processes, which are critically important for the effective operational management of water and related natural resources. Earth Observation information is increasingly used for environmental monitoring (wetlands, land degradation, water quality), river basin hydrology (soil moisture, water levels, temperature, groundwater movement) and other natural processes. NBI intends to leverage on the data available today in the public domain that is several folds larger and more comprehensive in term of geographic and thematic coverage than those collected through in-situ efforts by countries. Ground observed data from the countries shall complement that from global sources.

#### 2 Context

The sheer speed in growth of the volume of data, the computing infrastructure needed for data storage, analysis, and meaningful interpretation, and the skills needed to make use of such data have been limiting the use of these data in real life. However, progress made in cloud-based solutions for data storage, analysis, and interpretation, such as using cloud-based analytics (e.g. Software as Service), has helped the business world to make expanded the exploitation of both the modern data collection (such as using mobile phones or the web), storage (cloud-based solutions) and cloud analytics for making operational and, often, real-time decisions. To benefit from the cloud-based data storage and data analytics, NBI has planned to train its experts and member country experts data analytics using python software tools.

#### 3 Objective

The objective of the training is to strengthen the analytical capacity of Nile SEC staff and member state water resource experts on the usage of Python software tools for water resources and climate data analysis. NBI is to implement cloud-based data analytics services for NBI member states for the operational management of water and related natural resources. Therefore, this training will enable experts to utilize the cloud-based analytics service to be implemented by NBI.

Specific objectives include -

1. To capacitate NBI staff and NBI member country water resource experts with software tools
2. To introduce climate and water resource data analysis using python script
3. To familiarize trainees with python software tools for geospatial data analysis

#### **4 Scope of the training**

The consultant will provide training to NBI technical staffs and NBI member country experts on introduction to Python for water resources for 5 days. The trainer shall develop training manual/modules, PowerPoint slides and facilitate the training. The trainer will work closely with the Earth Observation expert of NBI and water resources modular.

##### **Specific tasks:**

1. Develop relevant training materials/module and slides
2. Facilitate the training both physically and on zoom for 5 days
3. Theoretical and hands-on introduction to Python scripting language. This part should include python data type, syntax, python libraries/package related to statistical and spatial data analysis among other things.
4. The trainer shall focus on water resources and climate related data analysis in the Nile Basin focussing on the following but not limited to
  - Importing, cleaning, transformation, processing, etc. of data stored in different formats (such as HDF, NetCDF, text, csv, Json, Tiff, shp, excel) in preparation for analysis.
  - statistical analysis including count, mean, std, min, max, percentile calculations, t-test, etc..) of climate and water resource data such as rainfall, temperature evapotranspiration, NDVI, water level from tabular and remote sensing derived grided data (CHRIPS rainfall, WAPOR data, grided population data, etc.).
  - Time series data analysis of precipitation, evapotranspiration, water level, surface temperature, etc. from grided datasets (e.g. CHRIPS rainfall, FAO WaPOR data, etc.)
  - Generation of different visuals (maps, different charts, tables)
  - Generation of Zonal statistics
  - Introduce remote sensing data analysis using python such as visualization of satellite data, Calculating different indices such as NDVI, NDWI, etc.)
5. Write a brief report of the training. The report should capture information related to participants (gender, profession, country.) and level of satisfaction among other things.

#### **5 Training approach**

The trainer shall deliver the training physically at a selected site, other trainers can join the training through zoom.

The training shall be conducted in sequential modules. Each module involves lectures using overhead slides and step-by-step hands-on exercise. Training exercises should be prepared using real data covering Nile Basin area. Training materials shall be distributed to the trainees before the start of the training. Trainees should use their own laptops for the training.

## **6 Implementation arrangements**

The consultant shall sign a contract with Nile-SEC under the overall supervision of the Deputy Executive Director. The consultant shall work closely with the Earth Observation/Remote sensing expert.

## **7 Duration of the training**

The training shall take place for 5 days

## **8 Deliverables**

- Five days training facilitation
- Training materials/module and slides
- A brief report on the training

## **9 Qualifications**

### **Education:**

At least Master's degree in Water resources, hydrology, Climate, Hydro informatics, Geographic Information Systems, Computer Science, Software Engineering or related degree.

### **Required Experience & Skills:**

7-12 years of experience in the following areas

- Statistical programming capabilities in Python language required.
- Water and climate related expertise such as hydrology, meteorology etc.
- Expertise in working with Earth Observation datasets and developing geospatial analysis required.