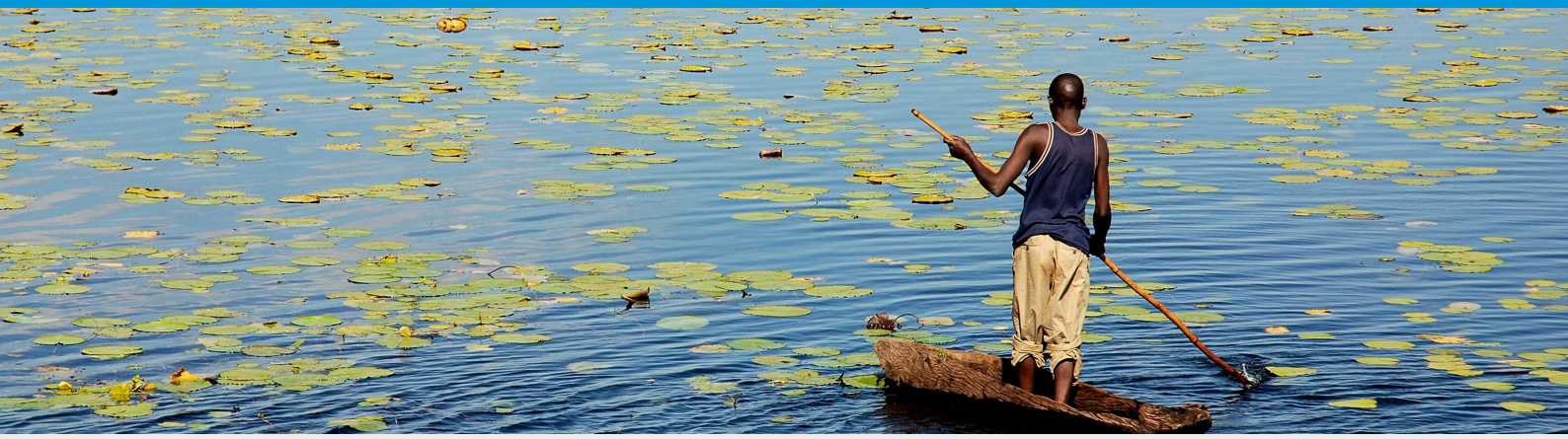


MODELLING FUTURE FLOWS OF THE NILE RIVER

Supporting the development of climate change adaptation methods for floods and water scarcity

The Nile River Basin is a vital resource for millions of people. However, climate change and rapid population growth are expected to affect the amount of water the Nile River brings to the riparian countries. Working with the Met Office Hadley Centre, we've developed new regional climate projections as well as a hydrological and water resources model for the Nile Basin Initiative (NBI) and United Nations Environment Programme (UNEP). The regional study will help the NBI countries increase their knowledge of the potential impacts of climate change on the Nile flows. This will help them evaluate possible methods to adapt to climate change, ensuring the equitable use of the Nile's water across boundaries.

PREPARING FOR CLIMATE CHANGE

The 3 million km^2 large Nile Basin is one of the most important shared basins in Africa. Although it accounts for only 10% of Africa's land mass, nearly 25% of the continent's population lives in the Nile Basin. Agriculture, energy production, socio-economic development and the general livelihood of millions of people all depend on the river's flow. Drastic fluctuations in the Nile Basin's climate can lead to droughts, water scarcity and famine in some parts of the basin and floods in other parts. Sharing the waters of the Nile between the river's riparian countries only adds to the challenge.

Infrastructure projects and increased water use upstream can mean less water for downstream countries. In addition, downstream countries receive less rainfall than upstream countries, making them more dependent on the Nile's flow. A rapidly growing population in the region and the future effects of climate change can make it difficult to strike the right balance between national needs and regional challenges. To do this, it is vital to understand how climate change and increasing water demands will modify the river's flow.

For trans-boundary basins like the Nile, climate adaptation must be addressed not only at the local and national level, but for the basin as a whole. With the Met Office Hadley Centre, we developed new regional climate projections and a hydrological and water resources model for the entire basin.

MODELLING THE NILE BASIN

The hydrological characteristics of the Nile Basin are highly complex. The relative scarcity of data and the dramatic variety of climatic conditions make hydrological modelling challenging. Utilising data provided by the Nile Basin Initiative (NBI), among others, we developed a hydrological model of the entire basin.

CLIENT

United Nations Environment Programme (UNEP) and Nile Basin Initiative (NBI), with the support of the Swedish International Development Cooperation Agency (SIDA)

CHALLENGE

- Increasing water scarcity, high population growth and loss of ecosystem services
- Lack of knowledge about the impact of growing population and climate change on the flows of the Nile River Basin
- Need to effectively manage water resources of the Nile across borders
- Need to implement climate change adaptation methods

SOLUTION

A comprehensive regional study that examines future changes to flows across the entire Nile River Basin

VALUE

- Enhanced knowledge of the effects of future climate change and population growth on the Nile's water resources
- Implementation of a shared water resources management tool for the region
- Enabling decision-makers to evaluate and implement regional water management and climate adaptation measures

LOCATION

Nile River Basin, Africa

The hydrological model included:

- rainfall-runoff
- lakes
- reservoirs
- dams
- wetlands
- irrigation water demands

We estimated future water demands for the region using:

- irrigation and water demand projections from the Food and Agriculture Organization
- population projections from the United Nations Department of Economic and Social Affairs

The Met Office developed climate projections based on the Special Report on Emission Scenarios (SRES) A1B scenario for the entire Nile Basin. The A1B is a 'business as usual' climate scenario which contains no mitigation and is a widely used reference. The study focussed on two 30-year periods, corresponding to near future (2020-2049) and the far future (2070-2099) planning.

Instead of using a single climate model projection, we selected global models that best represent the current climate over Africa, while capturing the uncertainty in climate projections. We downscaled the global climate projections using the regional climate model (RCM) PRECIS.

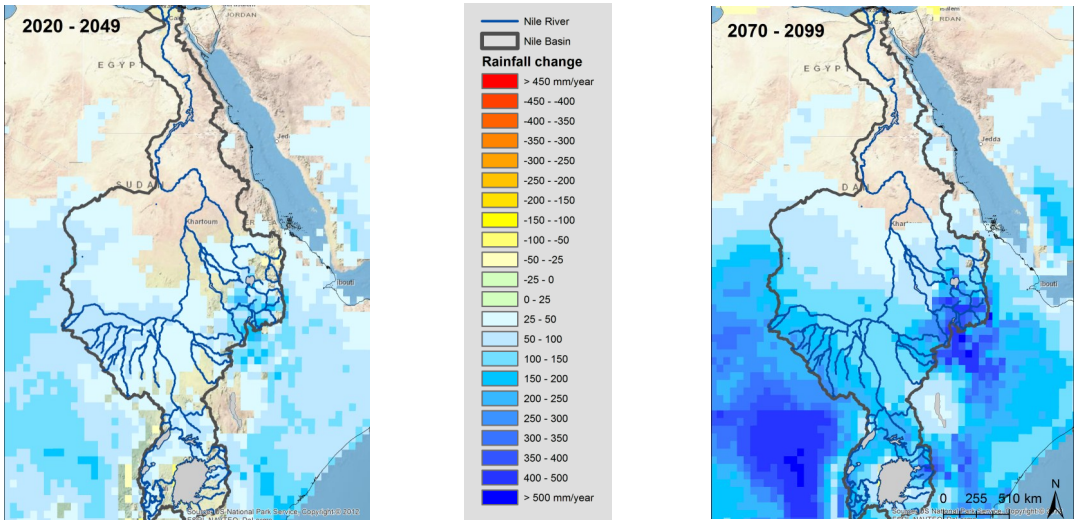
Next, we used the regional climate projections to assess the impacts of climate change on flows across the entire Nile River Basin using our MIKE HYDRO software. We then compared the climate impacts with the effects of increasing water demands over the same periods.

CAPACITY BUILDING AND WORLDWIDE APPLICABILITY

The rainfall projections (see figure) indicate a generally wetter climate but this average masks a large variation between the different RCMs. Indeed, the hydrological model projections indicate that some areas of the Nile River Basin will see increased flows in the near future, while other parts may see an increase in water scarcity. With the comprehensive study and hydrological model, the NBI:

- has gained a better idea of water availability in the region in the future
- has a better knowledge basis to formulate a regional water policy for climate change adaptation
- will be able to develop and implement co-ordinated national and local climate adaptation plans

The hydrological model will also serve as a shared water resources management tool for the countries of the NBI. With the Met Office, we provided training on how to use the model to estimate the effect of climate change on water resources to representatives from the NBI countries. The applicability of the approach used for the Nile Basin can be used for large and small basins worldwide that are vulnerable to the effects of climate change.



Average of five RCM-based projections of rainfall change over the Nile Basin from the baseline Climate Research Unit (CRU) data (1960-1989) to the near future (2020-2049) and far future (2070-2099). The transparent areas represent changes of rainfall of less than +/-25 mm per year.

CLIENT TESTIMONIAL

> *NBI is in the process of operationalizing its recently formulated first climate change strategy and, in this context, this study is a strategic contribution to increase the understanding of how climate change will affect the Nile region and how to increase resilience to its effects.*
> *Dr. Abdulkarim H. Seid — Head, Water Resources Management — Nile Basin Initiative Secretariat*

Contact: info@dhigroup.com
For more information, visit: www.dhigroup.com