

**Impacts of GERD on Sudan**  
**Elfatih A B Eltahir**  
**December 2019**

The conflict over the Nile water has received significant attention in the last few years. This attention has been associated with the recent decision by the Ethiopian government to build a large dam on the Blue Nile (the Great Ethiopian Renaissance Dam, or GERD) to produce electricity, mostly for export to neighboring countries. This decision, which was announced suddenly and without prior consultation with neighboring Nile basin countries, is consistent with Ethiopia's long-term plan to utilize its hydropower potential to generate electricity that can be transmitted into neighboring countries in exchange for badly needed hard currency. The dam, currently under construction, is relatively large compared to previous designs for the same location. This caused serious concerns in Egypt, reflecting worries about the security of Egypt's current share in the Nile water in the short- and long-term.

My views on the Nile conflict were presented in [several publications](#), and most recently documented in a new book (A Path Forward for Sharing the Nile Water: Sustainable, Smart, Equitable, and Incremental), available through Amazon.

[https://www.amazon.com/gp/product/1734069619?pf\\_rd\\_p=ab873d20-a0ca-439b-ac45-cd78f07a84d8&pf\\_rd\\_r=33DFEVQDY2DJYWB135S5](https://www.amazon.com/gp/product/1734069619?pf_rd_p=ab873d20-a0ca-439b-ac45-cd78f07a84d8&pf_rd_r=33DFEVQDY2DJYWB135S5)

In summary, the book takes a long-term view and emphasizes the fact that GERD is not the root cause of the conflict on the Nile water, but rather a symptom of a complex persistent problem rooted in three evident trends: (i) explosive population growth that accelerates the demand on water in the Nile basin, (ii) anemic adoption of modern agricultural technology such as fertilizers, better seeds, and advanced irrigation (these technologies would reduce demand on water), and (iii) legitimate and urgent needs for economic development in the Nile Basin. If, tomorrow, the three countries of the Eastern Nile Basin agree on all aspects of GERD, these three trends will continue to inflame the conflict on the Nile water.

Recently there have been surging interest in the issue of the impact of GERD in Sudan. The Sudanese attitudes towards water issues including the reaction to GERD, as well as other national issues, should be shaped by objective and pragmatic considerations and not be built on

emotional and ideological motivations. A large-scale project like GERD is likely to have several and complex impacts in Sudan, some positive and some negative. The objective and pragmatic approach would be to identify and acknowledge these positive and negative impacts and then take a position based on weighting these factors against each other, and then assessing the balance of evidence in the light of the national interest of the country.

Given my views expressed above regarding the root causes of the Nile water conflict, I did not spend significant time studying the detailed operations of GERD, but rather focused my research on the real long-term issues that will definitely shape the future of the Nile water conflict. However, the downstream impacts of GERD on Sudan are not unique, compared to other similar settings around the world, and the main and essential effects can be deduced by reviewing the current situation in the Nile basin and by comparing to other similar settings around the world. These issues need be discussed openly in order to inform the ongoing public debate about GERD. In the following, we discuss these effects in simple terms accessible to non-specialized audience.

The main purpose of GERD is hydropower: to generate electricity; and it will do that by storing water, from the flood season to the dry season, in order to produce relatively steady supply of electricity.

Hence hydrologically, the construction of the dam is:

- likely to reduce the flow in the Blue Nile by relatively minor magnitude due to evaporation from the new lake (although evaporation per unit area at GERD reservoir is significantly smaller than evaporation per unit area from lake Nasir, which is surrounded by desert), but
- would definitely regulate the flow significantly by reducing the flow of water in the Blue Nile during the flooding season (June to November) and increasing the flow during the dry season (December to May).

These hydrological changes will have significant *beneficial* impacts on the potential for generation of electricity in Sudanese dams (Roseires, and Merowe). In order to understand these

impacts, we need to understand how these hydropower systems are operated, before introduction of GERD. During the flooding season, the flow of water into the reservoirs exceeds the capacity of the turbines to generate electricity and exceed the capacity of the reservoir to store water, and as a result significant water is lost from the system as discharge through spillways (structures on the side of the reservoirs designed to get rid of water storage beyond the capacity of the reservoir), wasted without generating electricity out of it. During the relatively dry season, the flow of water into the reservoirs is relatively low and may drop below the flow needed to utilize the generating capacity of the existing turbines (or future expanded generating capacity). As a result, the flow of water into the reservoir may constrain the magnitude of how much electricity is generated.

Clearly, construction of GERD will benefit hydropower systems in Sudan:

- Reducing the flow during the flooding season => reducing the waste of water through the spillways in this season, and
- Increasing the flow during the dry season => increasing the available water to potentially operate turbines at full capacity even during the dry season.

Since, still significant flow will likely occur through spillways in the future, though less than in the past, the small reduction in the Blue Nile flow due to GERD is not likely to impact electricity generation negatively in Sudan.

The hydrological changes due to GERD will likely have *beneficial* impacts on irrigation potential in Sudan. Again, in order to understand these impacts, we need to review how irrigation projects are operated in Sudan, before introduction of GERD. Since the construction of the Sennar dam and development of the Gezira Scheme, a century or so ago, water has been extracted from the Blue Nile to irrigate large-scale agriculture. Irrigation is used to grow crops, supplementing the rain during the summer rainy season, and as the main source of water during the dry winter season. While the flow of water during wet season is obviously not limiting for irrigation in Sudan, the relatively low flow during the dry winter can be the limiting factor constraining the second agricultural season. In fact, my first research article published by Sudan Engineering Society thirty years ago was on the topic of [“Forecasting of Winter Flow in the Blue](#)

Nile”, as an important input for management of irrigation in Sudan. The area to be prepared for irrigation in winter is necessarily proportional to the winter flow in the Blue Nile.

Clearly, construction of GERD will *benefit* large-scale irrigation systems in Sudan:

- Increasing the flow during the dry season in the Blue Nile => increasing the available water to potentially irrigate Sudanese land during the dry winter season.

One *negative* impact on irrigation in Sudan relates to the reduced seasonal “flood” irrigation, traditionally practiced at small-scales along the banks of the river. However, at least some of this impact can be addressed by using modern pumping equipment as already practiced widely.

So, given that GERD is likely to have *beneficial* impacts on the important sectors of hydropower and irrigation in Sudan, are there any potential negative impacts for this project on Sudan?

I can think of two potential *negative* impacts of GERD on Sudan. One has to do with the ecological functioning of the Blue Nile and the main Nile in the stretch of river between GERD and the High Aswan Dam (HAD). A large dam like GERD will likely trap a significant fraction of the sediment flux in the Blue Nile, and by doing so shorten the life span of its own reservoir, extending the life of downstream reservoirs in Sudan and Egypt, and reducing sediment deposition and replenishment of nutrients on the banks of the river in Sudan. In addition, reduced seasonality of the river will likely impact the flora and fauna in the Nile valley. The impact of HAD on the ecology of the Nile downstream from Aswan may offer lessons on how GERD may impact the downstream ecology in Sudan, although probable changes in Sudan are likely to be smaller.

One other potential *negative* impact of GERD on Sudan relates to the risk related to the structural stability of the dam itself. Concerns were raised about the potential failure of the dam structure due to earthquake activity resulting in triggering of a sudden flooding wave into Sudan.

Although in general earthquake activity may pose a significant risk to the stability of any of the dams built on the Nile basin or elsewhere, I am not aware of known enhanced geologic risk at the specific site of GERD. Presence or absence of such enhanced risk is a technical issue that can be easily evaluated by Sudan Geological Service.

In my view, a *more serious concern* about the stability of the dam structure stems from how GERD is being built as a large-scale infrastructure project. In a typical large construction project like GERD, several stakeholders would be involved: owner of the project, financier of the project, consultant designing firm, and contractor. The interests of these parties do not always agree, and the resulting system of checks and balances would grantee a functional, economically efficient, and structurally safe product. Given that GERD was faced with strong resistance at regional and international levels, the development of the project did not follow the traditional approach in financing, designing, and construction of the project. (For example, Ethiopia is the owner AND financier of the project.) As a result, all aspects of the objective stated above: “functional, economically efficient, and structurally safe” may suffer.

This is an issue that can be addressed, by Sudanese authorities, participating in regional meetings, insisting on reviewing the details of the structural design, and insuring that sound quality control measures were taken at the construction stage. Independent international reputable firms can be consulted to address this technical task. Until recently, regional meetings about GERD were dominated by Egyptian concerns. That may need to change in order to address some of these Sudanese concerns. The Sudanese public can then be assured about the safety of GERD structure.

Having addressed the main benefits and risks from GERD on Sudan, the balance of these factors points to a *positive* impact of GERD on Sudan. This new dam offers Sudan several opportunities and challenges.

1. Specific plans will need to be developed carefully to prepare the hydropower and irrigation sectors in Sudan for optimal utilization of the opportunities introduced by GERD, expanding both hydropower generation and irrigation in Sudan. Development and sharing of such plans with the public will inform the ongoing debate in Sudan about this new dam project.
2. Similarly, efforts will be needed to ascertain if any significant potential risks of failure exist related to the dam structure itself, and then, if any exists, quantify and address such risks, and

3. Some planning is needed to mitigate the impacts of GERD on the ecology of the river basin between GERD and HAD, and on the traditional “flood” irrigation practiced for millennia on the banks of the Nile in Sudan.