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When the Nile rose again: The science and politics behind Sudan's September floods

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The first half of the 2025 rainy season, from June to mid-August, unfolded at a slow pace. Rainfall levels in the Blue Nile Basin were below average during that time, though precipitation began to increase in the Atbara River Basin starting in early August. This sluggish onset may have distracted observers from the potential drama lying ahead in the second half of the rainy season, despite expert forecasts warning of increasing rainfall from late August through the end of September.

The sudden flooding that struck Sudanese states along the Nile in the second half of September, due to a sharp rise in the water level of the Blue Nile, was expected by environmental and climate experts. As early as May 20, 2025, the IGAD Climate Prediction and Applications Centre (ICPAC) issued a report forecasting a delayed rainy season in western Ethiopia.

The September flood was shaped by the twin forces of climate change and the Grand Ethiopian Renaissance Dam (GERD). These two factors intersected in determining both the timing and intensity of the flooding. As part of a complex global ecological system, Sudan's rainfall patterns are heavily influenced by the Indian Ocean, which drives the seasonal monsoon winds toward the Ethiopian Highlands. The rainfall over the highlands largely depends on sea surface temperatures in the Indian Ocean, which trigger the Indian monsoon depression—a system that increases evaporation of moisture-laden air that moves northwestward. As this air mass reaches the highlands and cools, it condenses and results in rainfall.

This year, however, climate anomalies disrupted that pattern. The warming of the Indian Ocean, which typically begins in June, was delayed. Consequently, the rainy season in northern Ethiopia, particularly over the Tekezé Basin (Atbara River), also started late, well after June and July, leading to an eventual heavy surge in river flow.

Later, the Blue Nile Basin, which is the primary tributary feeding both the GERD reservoir and the Blue Nile itself, saw intense rainfall from August through mid-September, followed by a gradual decline. These fluctuations can be described as natural climatic variability within the regional rain cycle.

However, the GERD introduced a new variable into the dynamics of Nile flow. The natural flow of the river is no longer the sole determinant of water availability downstream in Sudan.

The operation of GERD requires filling a massive reservoir with a total capacity of 74 billion cubic metres. The Blue Nile's annual average flow is about

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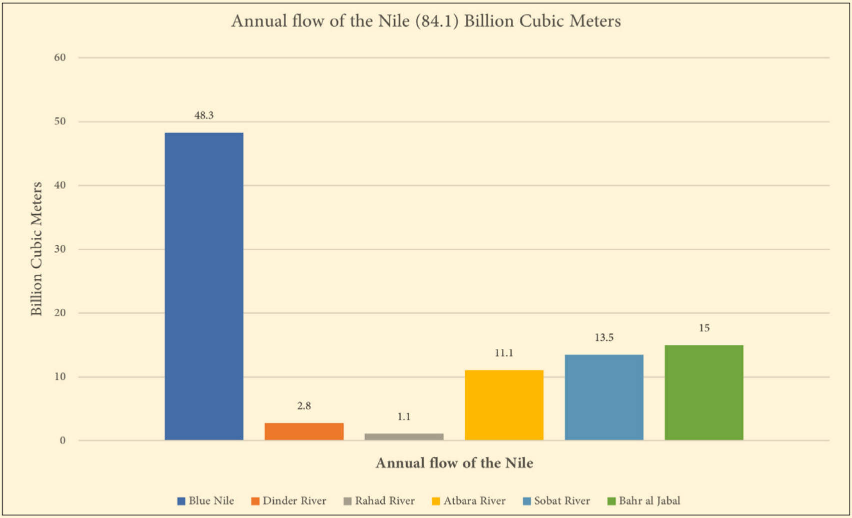
48.3 billion cubic metres, 80 per cent of which, about 41 billion, is concentrated in the rainy season (June to September). This means that Ethiopia can only reliably fill the dam during this limited seasonal window. It is important to note that GERD is not a consumptive project, its water is used to generate electricity, not for irrigation, so the water passing through the turbines eventually continues downstream.

That said, this year's September flood cannot be viewed in isolation from what occurred during the 2024 rainy season, when Ethiopia nearly completed filling the GERD reservoir, benefiting from [above-average] rainfall between 2020 and 2024. This was when the dam's reservoir was filled over five successive stages, all before the dam became fully operational.

Instead of releasing a significant portion of the stored water from previous years in anticipation of new inflows during the 2025 rainy season, Ethiopia [withheld] large volumes. This was likely due to uncertainty about 2025 rainfall, especially after June and July experienced below-average precipitation, prompting fears that Ethiopia might lose part of its annual share if it allowed too much water to flow downstream to Sudan and Egypt, both of which insist on maintaining their



A diagram showing the Nile's annual flow would highlight how the Blue Nile alone, the river on which GERD was built, contributes the lion's share. Seasonal tributaries like Ad-Dinder, Ar-Rahad, and Atbara contribute around 13.9 billion cubic metres, all merging with the Blue Nile inside Sudan. The Ethiopian Highlands also contribute to the White Nile via the As-Sobat River, which joins the Bahr el-Jebel near Malakal in South Sudan, forming the White Nile and providing a combined 26 billion cubic metres annually. Source historical annual quotas (18.5 billion cubic metres for Sudan, and 55.5 billion for Egypt, as per the 1959 Nile Waters Agreement).

As a result, GERD's reservoir was already full before the end of the current rainy season. That meant any additional rainfall in the Blue Nile Basin would be released directly downstream to Sudan via the dam's spillways.

And so it was that, in mid-September, just days after Ethiopia's GERD inauguration festival on 9 September 2025, residents of Blue Nile State in southeastern Sudan began observing a rapid rise in river levels. The river soon overflowed into Ad-Damazin, Ar-Roseires, and other villages, prompting waves of emergency calls and social media images documenting the floods. Yet it was only a full week later, on September 22 that Sudan's Ministry of Irrigation and Water Resources issued its first official advisory on the rising water levels.

Water levels continued to rise until September 29, when the ministry announced a gradual decline in inflows at Ar-Roseires Dam. Rainfall had pushed water levels past flood thresholds across most of the Blue Nile's hydrological gauges.

But the surprise came further north, in southern Khartoum and Omdurman, both of which lie along the White Nile, not the Blue Nile where GERD discharges its water. So why did these areas flood?

The explanation lies in two interlinked factors, both rooted in Ethiopian rainfall. First, the intense precipitation over the highlands raised the water level of the As-Sobat River, one of the White Nile's key tributaries. Originating in Ethiopia, the As-Sobat joins the Bahr el-Jebel south of Malakal, forming the White Nile, which then flows north into Sudan.

Second, and more critically, the convergence of the swollen White Nile and the surging Blue Nile at the Khartoum confluence (Al-Mogran) created a hydrodynamic clash. The powerful current of the Blue Nile, meeting the White Nile, generates a phenomenon known as the "water wall", where the Blue Nile effectively blocks the White Nile's flow, trapping it between Al-Mogran in the north and Jabal Awlia to the south.

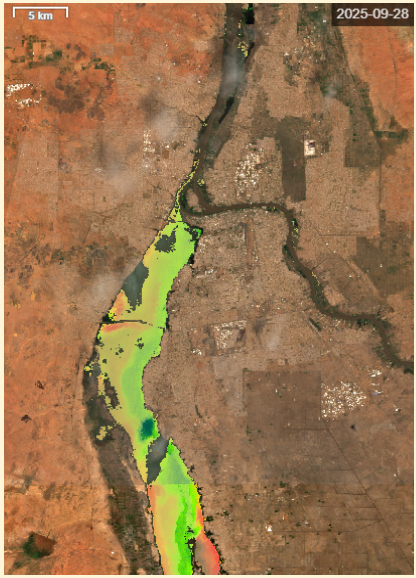
Due to the flat and shallow topography of the White Nile's riverbed, the blocked river begins to behave like a stagnant lake, overflowing onto nearby neighbourhoods. This explains the flooding that struck areas in southern Khartoum and Omdurman, despite their location along the White Nile.

The topography of the river channels plays a critical role in how water flow interacts with the landscape, and in turn, determines the likelihood and severity of flooding. Satellite imagery confirms a notable expansion of the White Nile, whereas the Blue Nile remains narrow, despite carrying four times more water. This is because the Blue Nile flows through deep, steep-sided valleys, acting like gorges that

Two satellite images of the confluence of the Blue and White Nile in Khartoum reveal a dramatic contrast. The first image, taken on July 25, and the second, captured on September 28, show a significant expansion in the White Nile's surface area, which led to flooding in southern Khartoum and Omdurman. By contrast, the surface area of the Blue Nile showed only limited changes. Source

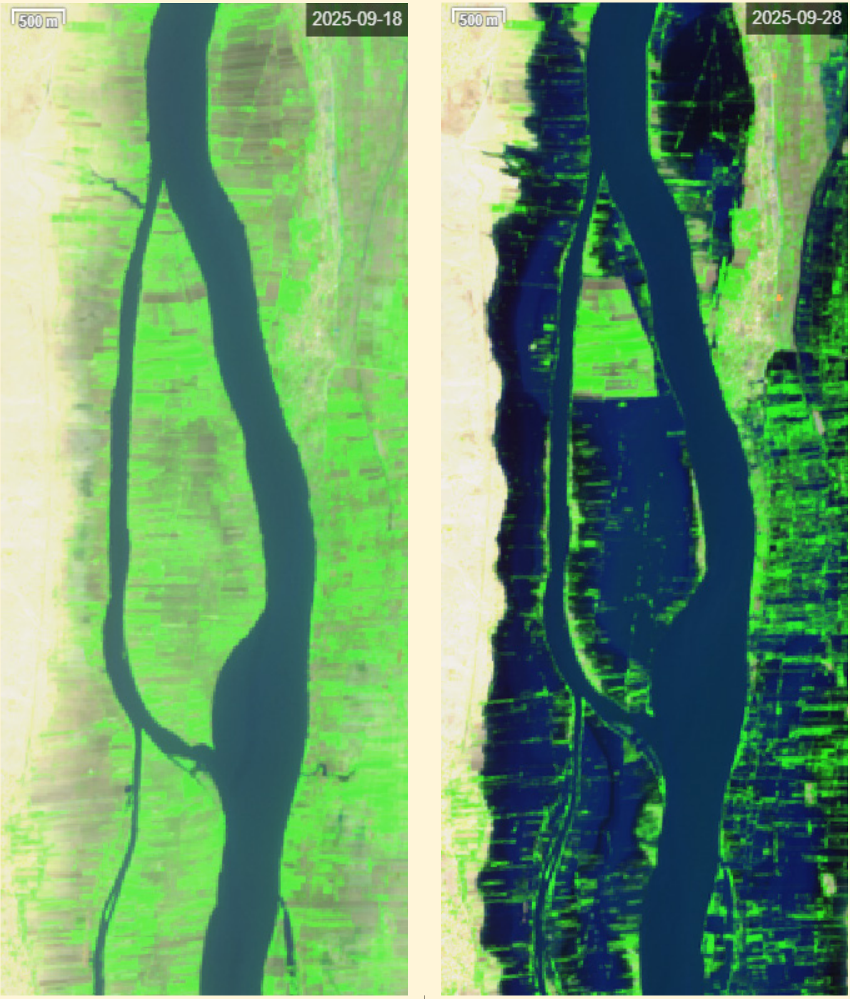
accelerate its flow and prevent significant overflow onto surrounding land, unlike the flatter and shallower White Nile.

In recent days, the Blue Nile has carried an enormous volume of water—estimated at 750 million cubic metres per day. However, its impact has varied across different areas along its banks.



Another satellite image, taken during the peak of the flooding on September 28, highlights the hydrological properties of the Nile's tributaries. The Blue Nile appears dark brown, indicating rapid flow, while the White Nile appears green, a sign of the beginning of phytoplankton growth due to its now-stagnant waters. This stagnation is the result of a hydraulic barrier formed by the forceful current of the Blue Nile, effectively trapping the White Nile. Source

While parts of Blue Nile State, East Nile in Khartoum State, and northern Bahri (Wad Ramli, for instance) were submerged, the Al-Jazirah State experienced little to no flooding, even though water levels reached flood thresholds. This contrast is attributed to differences in geological and topographical features, explaining why some cities were inundated while others were spared.



Two more satellite images taken of Wad Ramli, north of Bahri (Khartoum North), show the dramatic shift over just ten days between September 18 and 28 with visibly increased inundation due to the river's rise. Source

The factors that determine the onset, intensity, and location of flooding go far beyond the GERD. Reducing such a complex phenomenon to a single cause, let alone politicizing it, only undermines scientific understanding.

Data from Sudan's Ministry of Irrigation and Water Resources shows that this year's Nile levels did not exceed those recorded during the record-breaking 2020 flood season, which occurred before GERD's operational filling began. Similarly, 2022 witnessed devastating floods with significant damage. Therefore, this year's flood was not the worst in recent memory.

It is also important to remember that climate anomalies, such as the El Niño phenomenon, can cause non-Nile-related flooding. Just last year, eastern and northern Sudan experienced heavy rains unrelated to Nile activity. Ironically, GERD played a stabilizing role during that time by holding back large volumes of water, resulting in moderate river levels in downstream cities.

This year's September floods, however, are ripe for political exploitation. Egyptian media outlets have already seized on the events to present themselves as Sudan's advocates, hosting selectively chosen anti-GERD Sudanese experts while silencing opposing views. They typically conclude such segments with predictable statements: that Egypt warned of this all along, and that Ethiopia is deliberately causing harm.

Egypt does this despite suffering no actual damage from the flooding, thanks to the High Dam, which can absorb large volumes of water from Sudan. What Egypt truly risks losing, after the GERD, are the historical privileges it enjoyed for decades.

Despite how the September floods may tarnish GERD's image, the project remains an invaluable opportunity for Sudan, if it can be leveraged within a framework of regional cooperation, transparency, and shared management. Ethiopia has already achieved its goal: GERD is a fait accompli. Egypt remains shielded behind its massive High Dam, with its enormous 162 billion cubic meter capacity. Meanwhile, Sudan is the most vulnerable, exposed to unpredictable water releases and floods, unless it revives mechanisms for coordination and information sharing.

The September floods are proof of Sudan's loss in the stalled negotiations. Khartoum has been stripped of even the most basic safeguard: advance knowledge of storage levels and release schedules. Had that information been available in time, the government could have activated an early warning system, and possibly prevented the devastation suffered by residents on both banks of the Nile.

Yet, there is a glimmer of hope. The full activation of GERD's turbines may offer a path toward flood mitigation. The power generation process releases around 133 million cubic metres of water daily, year-round. This consistent outflow will gradually reduce the reservoir's volume ahead of each rainy season, lowering the risk of sudden surges.

The fundamental question now confronting Sudan's decision-makers is whether they can break the deadlock in negotiations. They must also investigate claims that political or military concessions were exchanged for external support in the ongoing war, now entering its third year. Regardless of the answer, one truth remains: Lasting resolution will only come when all parties choose to turn GERD from a flashpoint into a tool for regional integration. That vision is not out of reach, if political stability can be restored.

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