Integrating Joint Hydroclimatic Modeling with Debt Relief Supports Cooperative Nile Hydropower Management

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Abstract: Hydropower dams on transboundary rivers in the Eastern Nile Basin can make a meaningful contribution to the regional energy security and economic growth when risks to downstream water availability are quantified and transparently managed, especially during recurring, prolonged droughts. Over the past decade, the lack of agreed-upon scientific metrics and coordinated management has made the Grand Ethiopian Renaissance Dam (GERD) a focal point of geopolitical tension, overshadowing broader regional development opportunities. Mediation efforts led by international development institutions and renewed U.S. diplomatic engagement underscore the need for an actionable, economically sound framework capable of addressing upstream and downstream operational concerns during prolonged droughts. To meet this objective, we propose a governance framework for GERD operations that integrates joint and inclusive hydroclimatic modeling with debt-relief instruments to incentivize more balanced and politically feasible energy-water trade-offs in the Eastern Nile Basin. Our findings show that debt relief resulting from joint hydroclimatic modeling enhances the national creditworthiness of the Eastern Nile River Basin's riparians, where sovereign debt distress constrains investment in development. Additionally, joint hydroclimatic modeling supported by debt relief and involving upstream and downstream scientists can help rebuild public trust among the riparian societies of the river and reduce the risk that GERD and future hydropower dams become symbols of insecurity or dominance. Finally, this approach can significantly assist in timely resolving the ongoing conflicts associated with the expansion of Nile upstream hydropower dams and can be adapted to other transboundary river systems encountering comparable energy-water nexus challenges.

Keywords: Nile; GERD; Debt Relief; Hydropower dam; Water Management.