

STRENGTHENING FLOOD FORECASTING AND EARLY WARNING IN THE VOLTA RIVER BASIN

Protecting lives and livelihoods in one of West Africa's major river basins

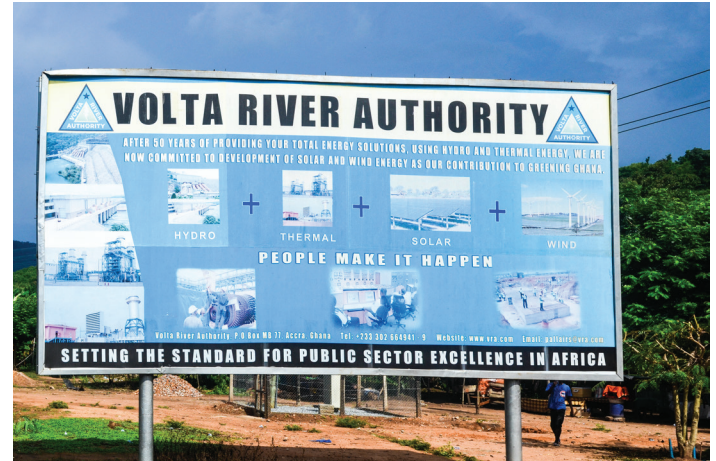
AT A GLANCE

Country: Ghana and Togo

Risks: Floods

GFDRR Areas of Engagement: Strengthening hydromet services and early warning systems, promoting open access to risk information

A technical team worked with local partners to strengthen flood forecasting in the Oti River through the development of a forecasting model and early warning system, as well as knowledge exchange with Japanese experts.



Akosombo dam near Accra. jbdodane/Alamy Stock Photo.

Stretching across six sub-Saharan African countries, the Volta River basin is one of the major river basins in West Africa. While the entire river basin has been frequently affected by flooding over the years—as most recently in October 2020—, this is especially true for the Oti River basin. The Oti River springs from Benin's Atakora Mountains, flows through Burkina Faso and Togo before joining the Volta River in Ghana.

Under the Japan-World Bank Program for Mainstreaming Disaster Risk Management (DRM) in Developing Countries and in collaboration with the governments of Togo, Ghana and the Volta Basin Authority (VBA) among other local partners, GFDRR provided support toward strengthening flood forecasting in the Volta River basin, with a focus on the Oti River.

BUILDING CAPACITY FOR FLOOD FORECASTING AND EARLY WARNING

A key pillar of these efforts was a hands-on, on-the job training program to demonstrate the feasibility of model-based flood forecasting in the Oti River basin, in view of the limited data available. 18 flood experts from Ghana, Togo, and the Volta Basin Authority were trained on state-of-the-art flood forecasting techniques.

A technical team guided the development a flood forecasting model for the Oti River basin, comprising of both a hydrological component, in which flood volumes are estimated from rainfall levels, and a hydraulic component, in which flood volumes are converted into water levels and flood extents.

That model, which was supplemented by extensive field surveys in local communities, informed the flood hazard and flood risk mapping conducted in close collaboration with the relevant authorities in Ghana and Togo, with an eye toward informing their flood resilience strategy, including both structural and non-structural measures. A major finding from these efforts is that the flood risk in the Oti River basin is mainly relevant for the larger towns and settlements in the basin such as Mandouri and Mango in Togo.

Subsequently, the team provided extensive training to flood experts from Ghana, Togo, and the Volta Basin Authority on state-of-the-art flood forecasting techniques, including model-based flood forecasting in a data-constrained environment such as the Oti River basin.

Drawing on the forecasting model, the team provided guidance on how to operationalize a flood early warning



Togo—Flooded Lomé street. Photo: Catherine Leblanc

system, including the development of a dashboard with the forecasted water levels, and warning levels throughout the river basin. Alert levels have also been defined for different sections of the river and validated in the field with local stakeholders.

Experts from Ghana and Togo have since taken the lead in conducting forecasts during the flood season, including during the 2020 flood season. Along with representatives from the Volta Basin Authority, these experts have formed a community of practice which serves a platform for an active exchange of information which informs flood forecasts across the Oti River basin.

LEARNING FROM JAPANESE EXPERTISE AND EXPERIENCE

Recognizing the value of gleaning insights from Japan's long experience in flood forecasting, on November 6-17, 2017, the team also facilitated a ten-day learning program in Japan for experts working on flood management from Ghana, Togo, and the Volta Basin Authority (VBA). The event was organized by the World Bank Tokyo Disaster Risk Management (DRM) Hub in partnership with Kobe and Kyoto Universities. The training program was structured to focus on the following aspects:

- Engaging the participants in learning and experiencing the first-hand cutting-edge Japanese technologies, research, good practices, and lessons learned on weather and hydrological observation, flood forecasting, and flood risk management through lectures and field-based exercises conducted by Kobe University and Kyoto University.
- Assisting the experts working on flood management in the Ghana, Togo and at VBA in substantiating their knowledge and experience in flood risk management and applied hydrology
- Providing an opportunity to visit and learn from the offices and facilities of the Ministry of Land Infrastructure Transport and Tourism (MLIT) of Japan and Japan Meteorological Agency (JMA). This included daily weather observation centers, multi-purpose dams for flood control, power generation, and water supply, a public education center on water management and use and environmental conservation. Participants' technical knowledge was reinforced through hands on training on river flow monitoring using real-time video-based technology and by testing various models and equipment, including Rainfall Simulator and Inundation Simulator.

LESSONS LEARNED

Throughout the learning event in Japan, participants engaged in extensive discussions with Japanese experts to compile action plans that address the key challenges and highlight opportunities that would enable their efforts towards improving flood risk forecasting and management. Key lessons from the event are:

Modernization of meteorological and hydrological services requires a long-term, phased approach. Japan's modernized hydromet systems are based upon investments made in last more than half a century. The evolution of the system in Japan was enabled not only by technological improvement and hardware investments but through establishment of governance and coordination mechanisms, extensive capacity building, and commitment towards provision of services underpinned by update of systems and maintenance.

Increasing the quality of real time observation data of river flow and rainfall from priority locations is critical to improving flood forecasting. Improving discharge and rainfall monitoring, including the installation of automatic rain gauges, weather stations and water level recorders across the basins is critical for the validation of information and improving the accuracy of the forecasting model. Satellite derived information allows overcoming some of the critical data gaps and enabling the establishment of an operation flood forecasting system.

Floods do not respect geographical borders. Effective trans-boundary flood forecasting requires identifying and strengthening appropriate institutional arrangements that enable collaboration cross-boundary and cross-agency collaboration. During the project implementation process, flood forecasting experts from both Ghana and Togo developed a highly effective community of practice that allowed local experts to support and learn from their peers.

Critical analysis of the appropriateness and applicability of investments in flood forecasting and management is important. Robust hydro-meteorological data is important for flood forecasting. The "fit-for-purpose" solutions that are applicable within the financial and geopolitical settings of the organizations and national frameworks need to be implemented in the West African context. This could be aided by strengthening the connections and dialogue among meteorology and hydrology professionals in the region. The results of this GFDRR support project provided a solid baseline and reference for many ongoing initiatives in Togo and Ghana on capacity development for flood management.



**Demonstrated feasibility
of up to
48-hour
lead time for
flood warning in parts of the
Oti River basin**

The Akosombo Dam, also known as the Volta Dam. Luke Dray/Alamy Stock Photo.

"I was able to see and learn from the visit to JMA Osaka Regional Office and Amagase Dam managed by the Yodo River Management Office how various soft and hard investments are integrated to manage and control, or prevent, floods in Japan. I was very impressed by the integration that is made possible by institutional collaboration between MLIT's national and river offices, as well as between JMA and MLIT. Furthermore, I was impressed how research institutions and universities are collaborating, and how the research that the universities do have a direct impact on trying to solve the problems people are facing"

—Mr. Martin Addi, Meteorologist,
Ghana Meteorological Agency