Flood warnings for Africa advance with EU expertise

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Satellites and on-the-ground sensors are helping Kenya, Ghana and Zambia tackle inundation risks and farmers cope with drought.

Like most people, Mark Noort reacted with horror to images last month of devastating floods in Libya. Unlike most others, Noort had a professional reason to follow the drama.

An expert in Earth observation technology, he took part in a research project that used EU funding to set up a flood-alert system in another African country: Kenya.

Early warnings

Noort had that successful work in mind as he watched the impact of torrential rains in Libya that caused two dams to burst, inundate the coastal city of Derna, destroy entire neighborhoods and kill thousands of people. Survivors have said they received no adequate alert.

"Putting an early-warning system in place could have warned people and the number of casualties would have been far lower," said Noort, a Dutch native who is an independent consultant on geospatial information applications. "Although it was a flash flood, it still takes some time to get to the urban area."

The EU project—called TWIGA—established such an early-warning system with the Kenya Meteorological Department in Narok, a town located in the southwestern part of the country near the capital Nairobi. The initiative wrapped up in July 2022 after more than four years.

Narok regularly gets inundated in part because it is located in a basin known as the Great Rift Valley, with a flash flood in February 2022 resulting in two deaths and widespread destruction.

The alert system relies on satellite data and official weather forecasts combined with additional—but relatively inexpensive—weather stations and water-flow measurements of rivers.

Residents can subscribe to phone alerts. The system is now being improved in a follow-up project—TEMBO Africa—that started in February 2023 and will include monitoring of smaller rivers.

"If you get five or even just two hours of warning, that is valuable," said Nick van de Giesen, who ran TWIGA, now leads TEMBO and is a professor of water-resource management at Delft University of Technology in the Netherlands. "We are generating information that can be turned into actions."

Flood prediction allows people to move to safety, relocate animals and vehicles and block latrines.

Dam flows

More places in Africa are becoming vulnerable to floods as a result of climate change and urbanization, which has increased the amount of hard surfaces that prevent water absorption by the ground. Inadequate drainage also often plays a role.

"The idea now is to roll out a flood-prediction service throughout Kenya and after that to find partners in other African countries to do the same," said Noort.

Another part of TWIGA tackled water levels behind dams. It deployed technology for monitoring inflows into reservoirs for hydropower plants in Ghana and Zambia.

Water can sometimes reach such heights that dam operators are forced to spill it through sluice gates to drain a reservoir. This can cause flooding downstream. It also wastes potential hydroelectricity.

Better management of reservoirs by measuring rainfall and river flow

upstream was shown in TWIGA to be a game changer. Knowing how much water is coming allows dam operators to act before an emergency release becomes necessary.

"Maybe you could more gradually spill water or—ideally—generate extra electricity by letting the water run through your turbines," said van de Giesen.

Scientists are working with local partners in Ghana and Zambia to create easy-to-use technology. This should prevent deluges in towns and villages downstream of hydropower dams.

"It is better to spill than have the dams washed away, like what happened in Libya," said van de Giesen, who has worked on water projects as an engineer in West Africa.

Seed security

Seed insurance is also being trialed for farmers in Ghana, where a semi-arid climate contributes to crop losses.

Under a planned scheme, growers would pay a little extra when buying seeds in return for compensation in the event there isn't enough rain after they're sown.

The key is to tell planters when to sow and know when there has been insufficient rain for germination.

"If you have small farmers, with less than two hectares, you cannot send insurance agents to all," said van de Giesen.

Satellites and rainfall detectors automatically signal when insufficient amounts have fallen.

While satellites play a role high up, they are unable to scrutinize rainfall down on the ground for farms.

Instead, project scientists have turned to cosmic rays for a helping hand.

Fast payouts

Subatomic particles from space—called neutrons—zip around at speeds up to 20,000 kilometers a second on Earth. When there's plenty of rain, the particles bounce off water molecules, slowing them down.

The researchers built a kit that can detect this neutron slowdown, which signals rainfall. The system combines this information with satellite images to improve predictions about when an individual farm faces drought.

In a drought scenario, a farmer automatically receives seeds in compensation or a payout to buy more if needed.

"A big innovation here is that we're going to be really fast with paying out," said van de Giesen.

A Ghanaian insurance group plans to make the product available to local insurers and banks in 2024.

"This is really about anchoring satellite observations to measurements on the ground," said van de Giesen.

More information:

- TWIGA
- TEMBO Africa
- Earth observation in Europe—EuroGEO