Climate Change Adaptation Technologies for Water
A practitioner's guide to adaptation technologies for increased
water sector resilience
WATER ADAPTATION TECHNOLOGY BRIEF

Flash flood guidance systems

Challenge: Disaster preparedness   **Adaptation response:** Early warning

Description

Flash flood guidance systems are specialized forecasting and early-warning systems for flash floods. Flash floods occur on short time and spatial scales, which makes them challenging to predict using traditional flood forecasting methods, such as monitoring river water levels. Flash floods' very quick formation also makes them more deadly than any other type of flood. Flash flood guidance systems are designed to provide forecasters with data that allows them to predict a potential flash flood (usually a few hours before it hits), and produce an early warning to increase preparedness.

Implementation

Data input comes from real-time meteorological data from remote sensing satellite radar tracking rainfall in the region and hydrological models based on local climatic and geographic conditions. Flash flood guidance systems focus primarily on heavy rainfall and rainfall on saturated soils. The systems seek to identify the amount of rainfall that exceeds a water body's carrying capacity. Forecasters are able to add any additional information to the guidance system model (e.g. rain gauge data, rainfall predictions) to increase forecast precision.

Training forecasters so that they are familiar with the models and the technology is an important part of flash flood guidance systems. Since the time thresholds and severity of flash floods vary depending on local hydro-climatic and geomorphological conditions, training local staff to run the guidance systems can be an asset due to their knowledge of conditions and historical weather patterns in the region. The forecasters receive information on an interface where they can assess the data, model and predict the possibility of a flash flood occurring. Real-time radar readings of area precipitation are vital, and guidance systems typically also include models to predict soil moisture capacity and threshold runoff (runoff or water level needed to initiate flooding) of local streams and rivers in relation to precipitation forecasts. The system is linked to an early warning system to disseminate a message should there be a threat.

Environmental Benefits
- Mitigates damage to ecosystems (e.g. forests, high biodiversity value areas).

Socioeconomic Benefits
- Increases lead-time and preparedness.
- Promotes response measures to mitigate flash flood impacts, and issue warning messages.

Opportunities and Barriers
Opportunities:

- Training local forecasters gives responsibility and ownership to local communities
- There are already several different flash flood guidance systems used at different regional scales around the world, adjusted to local climatic, geographical and topological characteristics (e.g. Southern Africa, North American, Central American, Black Sea and Middle Eastern, European). The systems can be further scaled down to basin-level for more precision

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- Systems are likely to become more accurate as technological advances improve data acquisition and modelling opportunities.

Barriers:

- Predictions have a degree of uncertainty, and climate change makes severe climatic events such as flash floods increasingly unpredictable
- Relatively expensive implementation/installation costs and requires high technological expertise.

Implementation considerations*

Technological maturity: 3-4
Initial investment: 3-4
Operational costs: 2-3
Implementation timeframe: 2-3

* This adaptation technology brief includes a general assessment of four dimensions relating to implementation of the technology. It represents an indicative assessment scale of 1-5 as follows:
Technological maturity: 1 - in early stages of research and development, to 5 – fully mature and widely used
Initial investment: 1 – very low cost, to 5 – very high cost investment needed to implement technology
Operational costs: 1 – very low/no cost, to 5 – very high costs of operation and maintenance
Implementation timeframe: 1 – very quick to implement and reach desired capacity, to 5 – significant time investments needed to establish and/or reach full capacity
This assessment is to be used as an indication only and is to be seen as relative to the other technologies included in this guide. More specific costs and timelines are to be identified as relevant for the specific technology and geography.

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