International Research Institute for Climate and Society
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THE UNIVERSITY OF CHICAGO
Center for Data Intensive Science

IMPROVING FLASH FLOOD FORECASTING AND RESPONSE

Flood type matters

Floods are one of the most deadly natural disasters, killing millions and displacing many more. But not all floods are the same.

- **Riverine floods** tend to be longer and larger scale disasters, disproportionately affecting property and sometimes life.
- **Flash floods** (by definition) are much faster events, disproportionately affecting life. For example:
  - **Rainfall run-off floods** occur as an immediate direct impact of heavy rainfall. They often occur in urban areas where the water has nowhere to escape, or in areas of high elevation change, or after a drought where the soil is less able to take in water. These have the fastest lead-time, occurring almost immediately.
  - These can also mix with mud and soil to become deadly **mudslides or landslides**.
  - **"Fast" river floods** occur when the water finds an existing small waterway and expands it to many times its size. These are particularly dangerous as they can occur downstream and several hours after a heavy rainfall event.
  - **"Dam burst/release" floods** occur when dams or levees reach danger points and water is released downstream. Although there is often a lot of lead-time before a dam bursting, that information often doesn't make it to communities downstream.

Each of these different types of flood is going to have a different lead-time, scale and impact. Plus, more than one type of flood can happen at the same time.

In January 2015, heavy rainfall over the Lake Malawi basin led to high water levels and subsequent flooding downstream on the Shire River. As levels approached bankfull, persistent convective rainfall occurred over southern Malawi, setting all-time daily rainfall records, causing urban flash floods in Blantyre (Vanya, 2015). On a national sale, the concurrence of riverine flooding and flash flooding led to a complex scenario for disaster managers.

What does this mean for research and response?

Despite the context specific difference in flood impact, floods are often thought of as one thing.

- Flood Emergency Response often focuses on boats or sandbags.
- Research often focuses on mapping and modeling rivers and waterways. "Global Flood Models" are really global river models.
- The records are poor because flood databases often don't disaggregate between flood types.

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What about this project?

We are working on a three-year project (2018-2020) funded by NASA GEO, with a four-step approach:

- There is actually a lot of flood information hidden in disaster impact databases. We are collating and standardizing this information to illuminate existing flood datasets and to create **a global flash flood dataset & maps of flash flood risk, vulnerability and exposure**.

- We are starting to work with partners to **create a series of action based, in-depth case studies**. These will explore Standard Operating Procedures/Early Action Protocols, or the actions/lead-times available to different organizations and floods. These are likely to include:
    - The Rohingya refugee camps in Bangladesh
    - Emergency flash flood response in Somalia.
    - A new case study in Latin America.

- We have access to several new flash flood forecasting tools, including the Ensemble Framework for Flash Flood Forecasting (EF5). **We want to validate and test these against observed flash floods database and the case studies to see if they can forecast flash flood impact.**

- We can then pull everything together to **create user-defined validations of flash flood forecasts, with hazard parameters, evaluation metrics and lead time directly informed by the disaster managers.** We can then build on these to create updated operating protocols.

Want to find out more?

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