How Do Emergency Managers Deal With The Uncertainty In River Forecasts?

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Problem Statement

"Prediction agencies have often simply 'assumed' that their forecasts are conveyed to those at risk, that local needs are met and that appropriate adaptive behavior ensues." (Parker & Handmer, 1998)

As of today, the National Weather Service (NWS) publishes river forecasts for the next few days without any information about the associated uncertainty. Recent innovations – systematic verification, ensemble forecasting, formatting of the forecast – suggests that the NWS mainly strives for technical improvements.

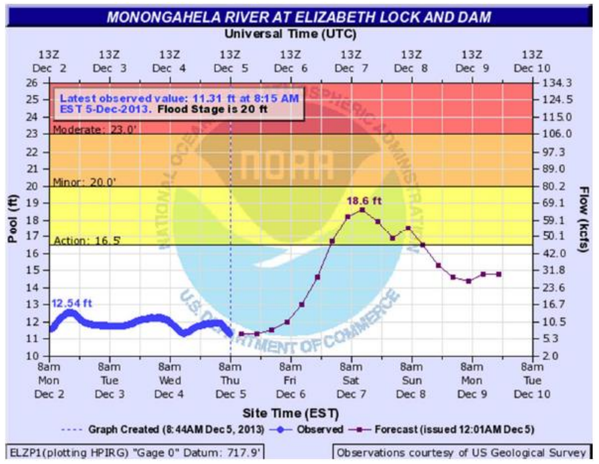

Figure 1: Deterministic river forecast for Elizabeth, PA by NWS. The blue line indicates observed and the purple line the forecasted water levels.

This line of research investigates how forecasts are used by emergency managers (EMs) and studies non-technical factors that diminish the value of the forecast.

Method

In 2012, in-person interviews with emergency managers in Pennsylvania (7), Oklahoma (7) and Arkansas (3) were recorded and transcribed. On average an interview lasted 50 min.

The average work experience of the interviewed EMs was ~12 years (conservative estimate). Seven of them had a fire/police/EMS background. While three held a degree in emergency management, the others came from many different backgrounds: librarian, coal miner, oil worker, veterinarian, military, industrial safety, and banker. Four of the EMs were volunteers, seven were paid full-time. Fourteen EMs were male.

What do Emergency Managers do?

All states require emergency managers for certain types of jurisdictions. The requirements to become an emergency manager differ from state to state. In some states, there are no initial requirements, while others require >20 FEMA courses. **Courses focusing on weather are usually not required and sometimes not even available.** The actual tasks and resources of emergency managers differ from town to town. In times of crisis, emergency managers mainly coordinate and organize logistics:

"You know, if the police comes to the scene they bring guns, firemen bring fire trucks, the emergency manager brings a phonebook."
"You need to get over there in a boat […] I don't have a boat, but I will find a boat."

Dealing with Forecast Uncertainty

Like the public (Morss et al., 2010), EMs are very well aware of the uncertainty in forecasts. To cope with it, they gather all information they can get from media, NWS, residents, acquaintances, etc. Consequently, river forecasts are only one source of information among many. **Decisions are usually based on sources with less uncertainty, such as radar and monitoring crews.**

"The river forecasts are unpredictable."
"…but until the water actually comes and you know which way it's going to go and what floods, you cannot take specific measures."

Value added by emergency managers to forecast

Emergency managers add value to river forecasts that the NWS cannot provide in three ways:

1. Given their often extensive experience, EMs are able to translate river forecast to local circumstances
2. EMs often have fine-meshed personal networks that they utilize to alert people to a crisis and disseminate information about it.
3. Especially in closely knit communities, EMs have the authority to make people act.

Consequences of Deterministic Forecasts

While EMs are aware of the uncertainty in the forecasts, they are reluctant to communicate it to the public. They are worried about the consequences, if their assessment of the situation turns out to be wrong. Instead, they prefer to disseminate the NWS forecast.

Thanks to the discretionary function exception in the Federal Tort Claim Act, no department of emergency management has successfully been sued for damages yet. However, there is a **gray zone**: EMs should not stray from the professional standard of "reasonable care" (Klein & Pielke, 2002).

"Whatever they tell me, I take what they say and act accordingly. I don't take a chance of saying maybe it's wrong. I can't do that."

"If I start putting out my own forecasts, if I start telling people what I think… and then I'm wrong. And I… is the city responsible or liable?"

Conclusion

- EMs need to be trained in using weather data. The training needs to be "boots-on-the-ground."
- Communication of uncertainty is absolutely necessary. It should complement the EMs' mental models that they use to assess the situation.
- NWS needs to consider the purpose of the forecast to improve it. The decisions are currently based on observed data.
- Forecast need to be formatted so that they can be disseminated easily.
- Professional standards need to be spelled out to address accountability concerns.

References

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