

# Confidence In Flood Warning Systems And The Value Of Ensemble Forecasts

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# Value of a Forecast

## Characteristics of a forecast

- Quality → Fits the observation? (e.g. CRPS)
- Value → Useful for decision making?

## Which decision? Who makes it?

- Hydrological power → \$\$\$ (but safe)
- **Flood mitigation** → Prevention/defences, evacuation...

# Montmorency River

## Decisions

- Spending (sandbagging, staff...) Matte et al. (2017)
- **Alert**
- Active Evacuation

## If DM was only to base decision on forecasts

- Dressed deterministic
- Meteorological Ensembles (with/without state variable uncertainty estimation)
- We know: CRPS and Overspending

# This Presentation

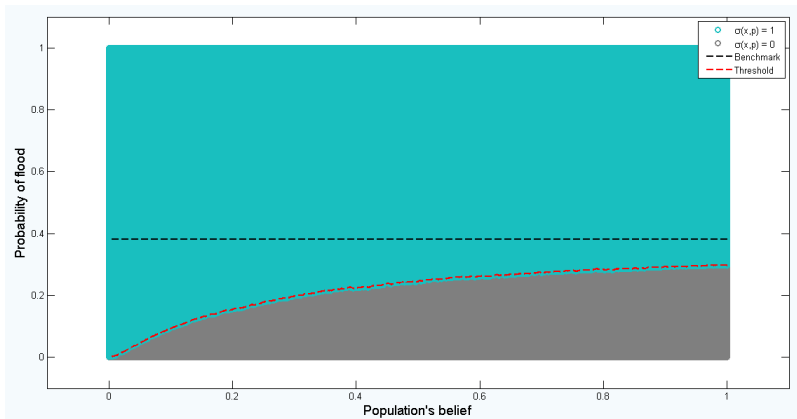
## Alerting the population (binary decision)

- Risk aversion
- Alerts allow time to adjust (e.g. emptying basement)
- **False alerts and missed events reduce credibility of future alerts**

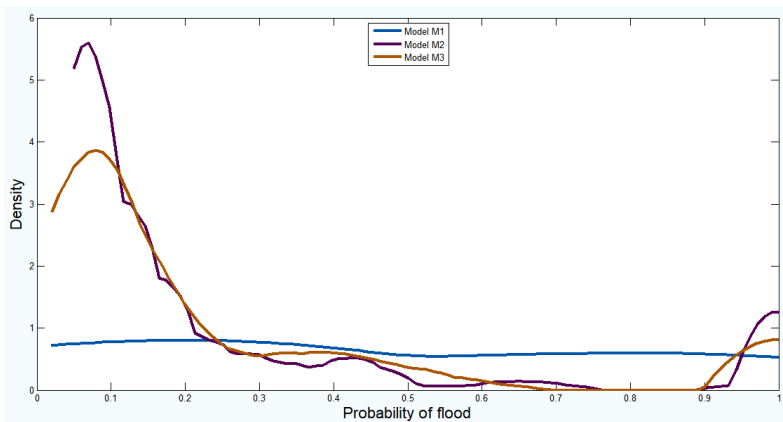
## How we do that? (stochastic dynamic programming)

- Fix: cost, loss, risk aversion, confidence sensibility, initial confidence.
- Data: Forecasts (probability of a flood)

# Optimal decision



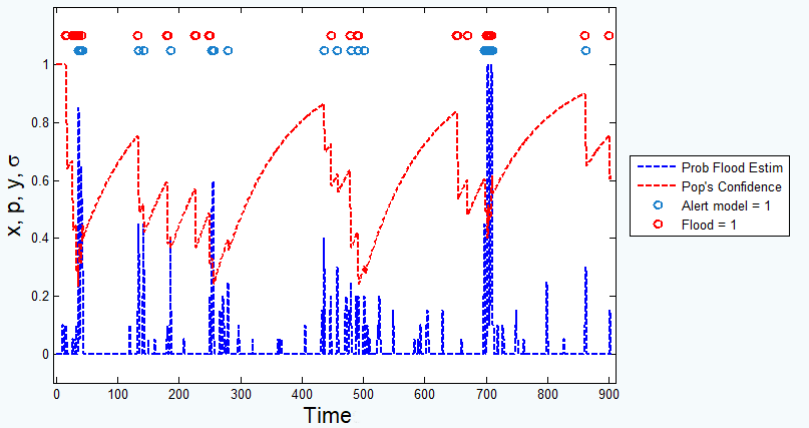
## Forecasts (Density| $Prob > 0$ )



Freq  $Prob > 0$ : 8% // 17% // 16%

# What it looks like

(sorry for the ugly picture)



(Daily: 2011-2014)

## Best Forecast? (Preliminary)

### Optimal decisions:

- False Alerts: Dressed deterministic  $>$  Ensembles
- Missed Events: Dressed deterministic  $>$  Ensembles
- Confidence: Dressed deterministic  $<$  Ensembles

### Value:

- Ensemble forecasts have higher value
- Order of magnitude:  $\approx 0.2 - 0.4\%$  of avoidable damages.



# Next

## Why?

- Ensemble forecasts: larger spread, upward bias
- Something else?

## To do:

- Robustness of the calibration
- Features of a high value forecast?
- Post processing?
- User-friendly code