Deltares
Enabling Delta Life

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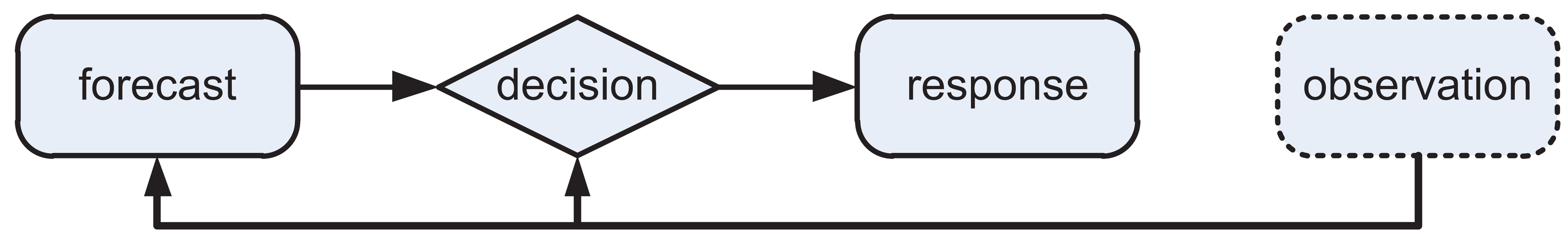
A Staged Development Model for the Effective Use of Probabilistic Forecasts in Flood Forecasting, Warning and Response Systems

Prescriptive studies of forecast value suggest that probabilistic forecasts have higher value than their deterministic equivalents. The reason for this is that the estimate of predictive uncertainty can be taken into account in forecast sensitive decision-making processes. To wit, a probabilistic forecast allows for weighing possible scenarios with the probability of occurrence thereof, thus enabling risk analyses.

Descriptive studies, however, suggest that the maximum potentially value of forecasts is often not obtained. Reasons for that include (i) misunderstanding or misinterpretation of the forecast and (ii) non-use or non-optimal use of forecasts. Thus, the forecasts are not used as effectively as they potentially could have been.

Conceptual forecast - decision - response model



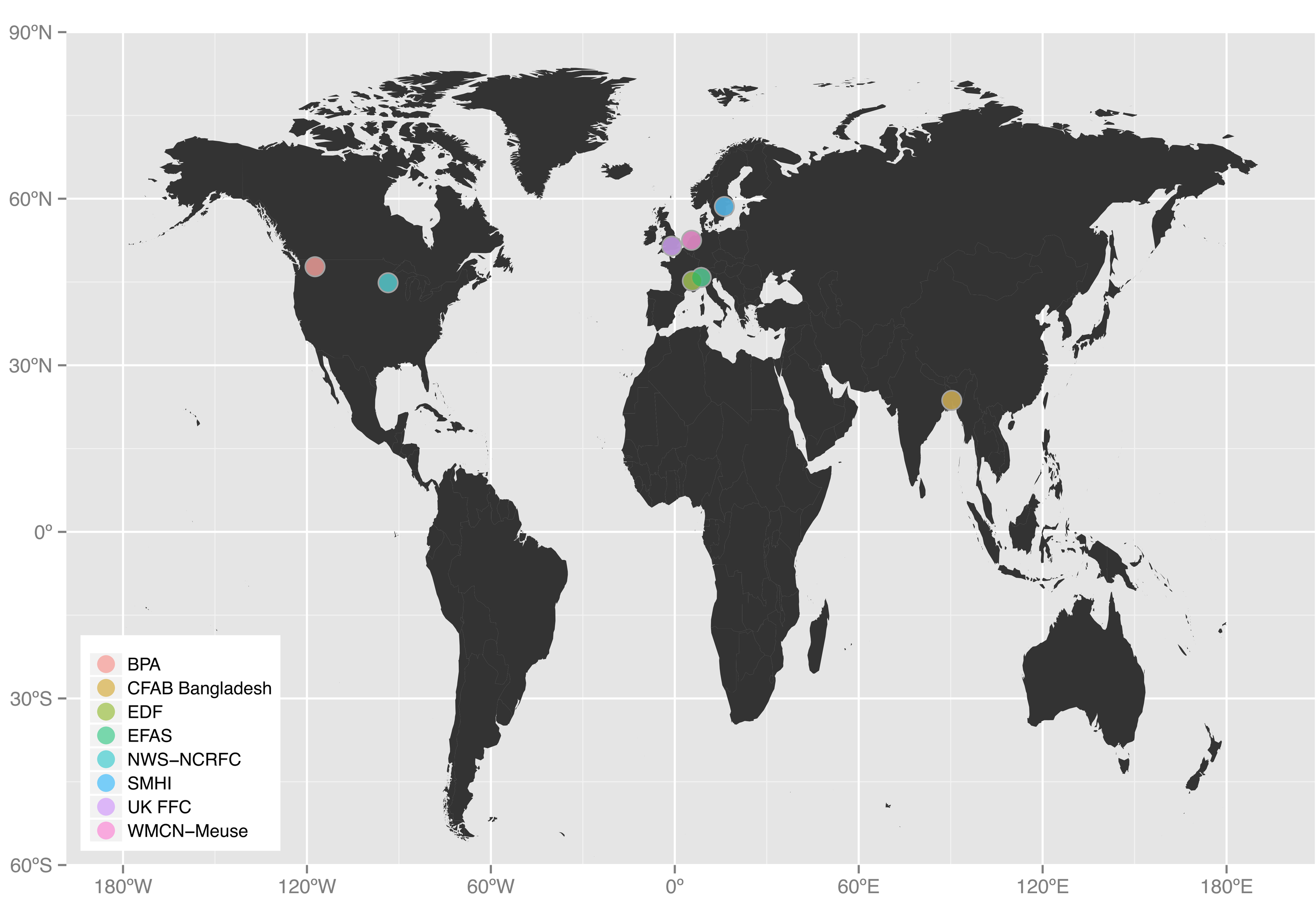
The very nature of probabilistic forecasts introduces challenges that, in current operational practice, hamper fully effective use thereof. These challenges arise in various online (i.e. real-time) and offline (i.e. not real-time) system components or protocols, including forecast visualization, communication, decision-making, training and verification.

It is identified which challenges are relevant and whether best or bad practices pertaining to these challenges exist. These are combined in the Staged Development Model that gives some indication of the development that a forecast – decision – response system may follow. This development path may benefit systems that are about to implement probabilistic forecasts.

Staged development model

Characteristics or criteria	development stages				
	1	2	3	4	5
1 Benefits of probabilistic forecasting clear	No		to limited number of stakeholders only		to all stakeholders; shared
2 Estimates of uncertainty	None		Single source of uncertainty		Holistic approach
3 Verification of probability forecasts	None		Some metrics available but not actively used		Tailored to user needs; actively used
4 Presence of a translational discourse	No		Fledgling		Fully developed and implemented
5 Visualisation of probability forecasts	Hydrographs only		Diversity of graphs		Interactively produced by users
6 Decision making	Based on deterministic forecasts		Intuitively based on probabilities		Well defined probabilistic decision rules
7 Procedures established	None		ad hoc		Fully established
8 Training	None		Single elements of forecast-decision-response system		Integrated trainings including exercises

Case studies



"There is value in improving the quality of the probability forecasts, but the value is an order of magnitude higher in the actual usage of probabilistic flood forecasting"

– Hydrologist, US NWS River Forecast Centre

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