The Regional Integrated Multi-Hazard Early Warning System for Africa and Asia (RIMES)

A Decision Support Framework for Flood Risk Assessment: an Application to the Brahmaputra River in Bangladesh

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Outlines

- Background & Objective
- Risk & Vulnerabilities- Agriculture
- Conceptual Framework for Flood DSS
- Analysis & Results
  - Runoff Prediction & Performance
  - Flood Risk Map
  - Impact Outlook
- Conclusion

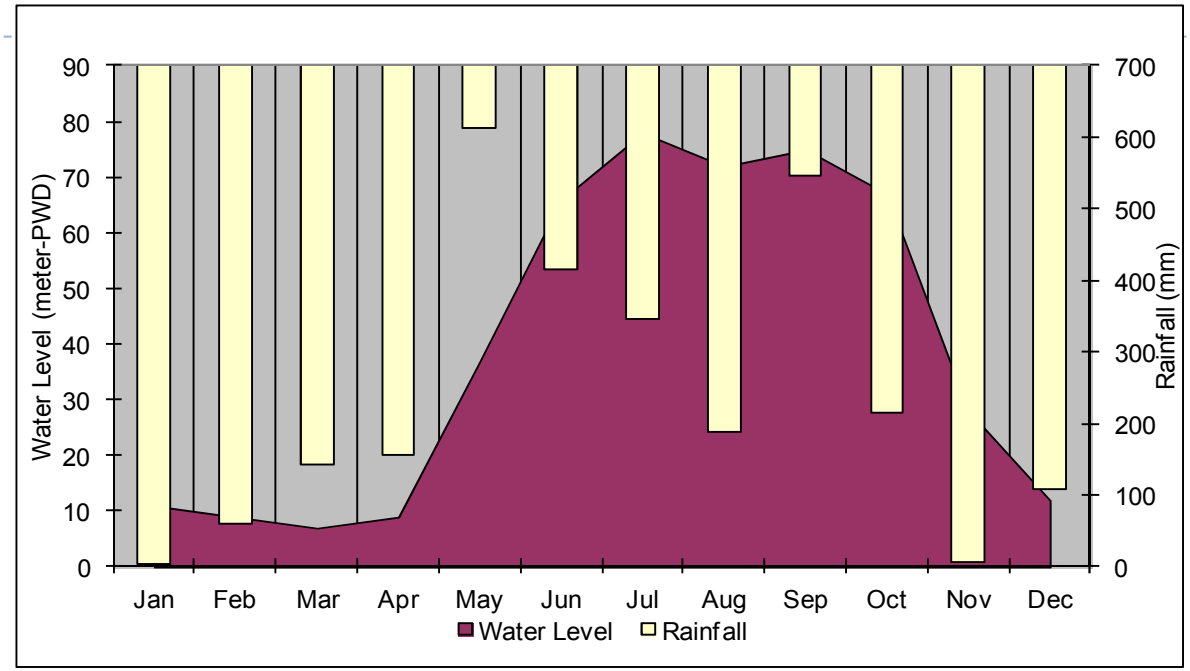
Background & Problem Statement

- Despite advances in forecasting, most cases warning system fails (Parker et al., 2009)
- Generation of long lead flood forecasts is highly challenging and uncertain. Thus there is very limited application of it. (Fakhruddin, et.al 2012)
- A decision making process is essential in a social context where roles and responsibilities are clearly shared for appropriate response (Morss & Wahlb 2007)

The major objective of the program is to design a decision support framework for flood risk management for agriculture sector in Bangladesh.

Vulnerability and Risk Assessment

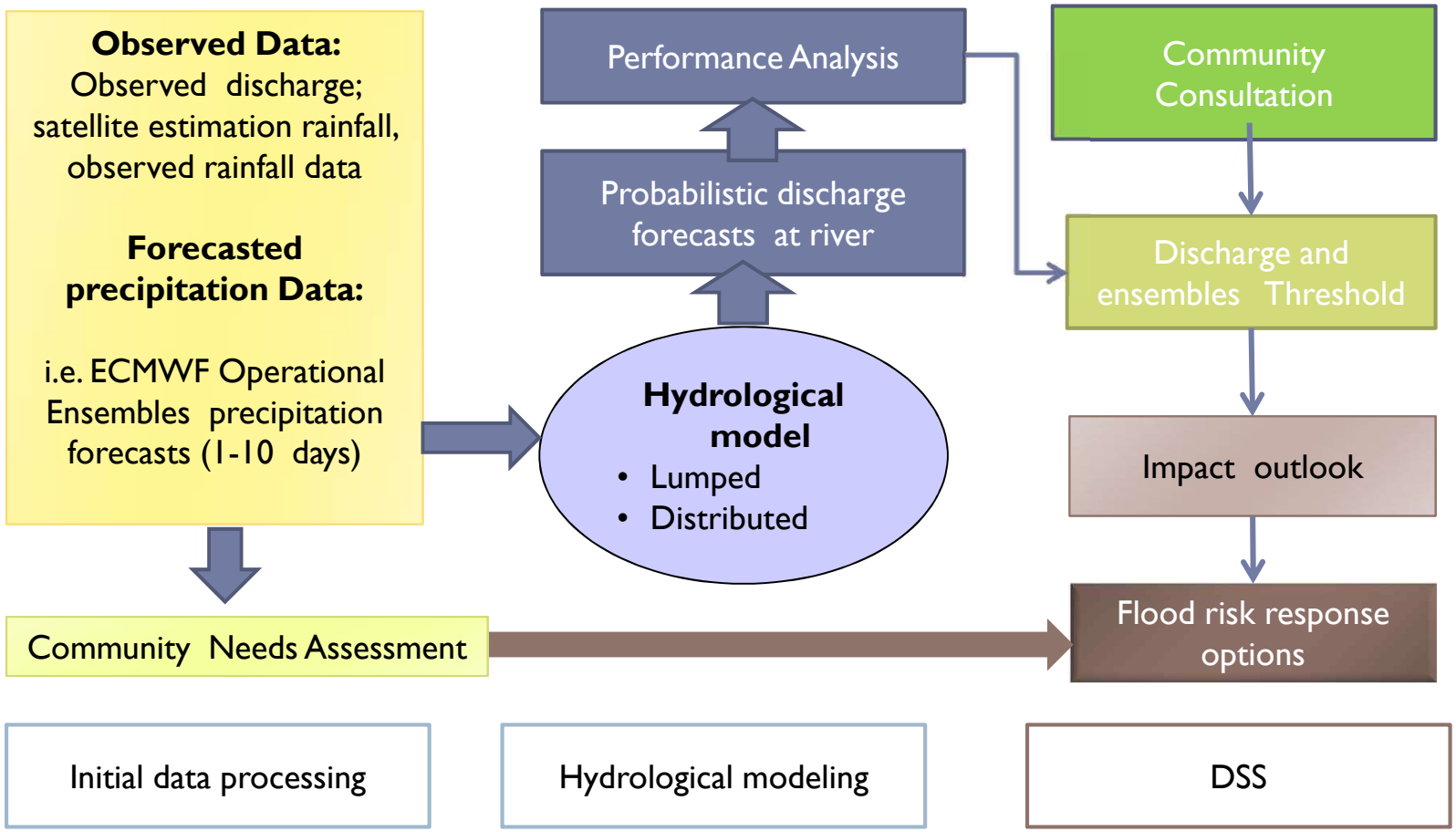
Hydrology



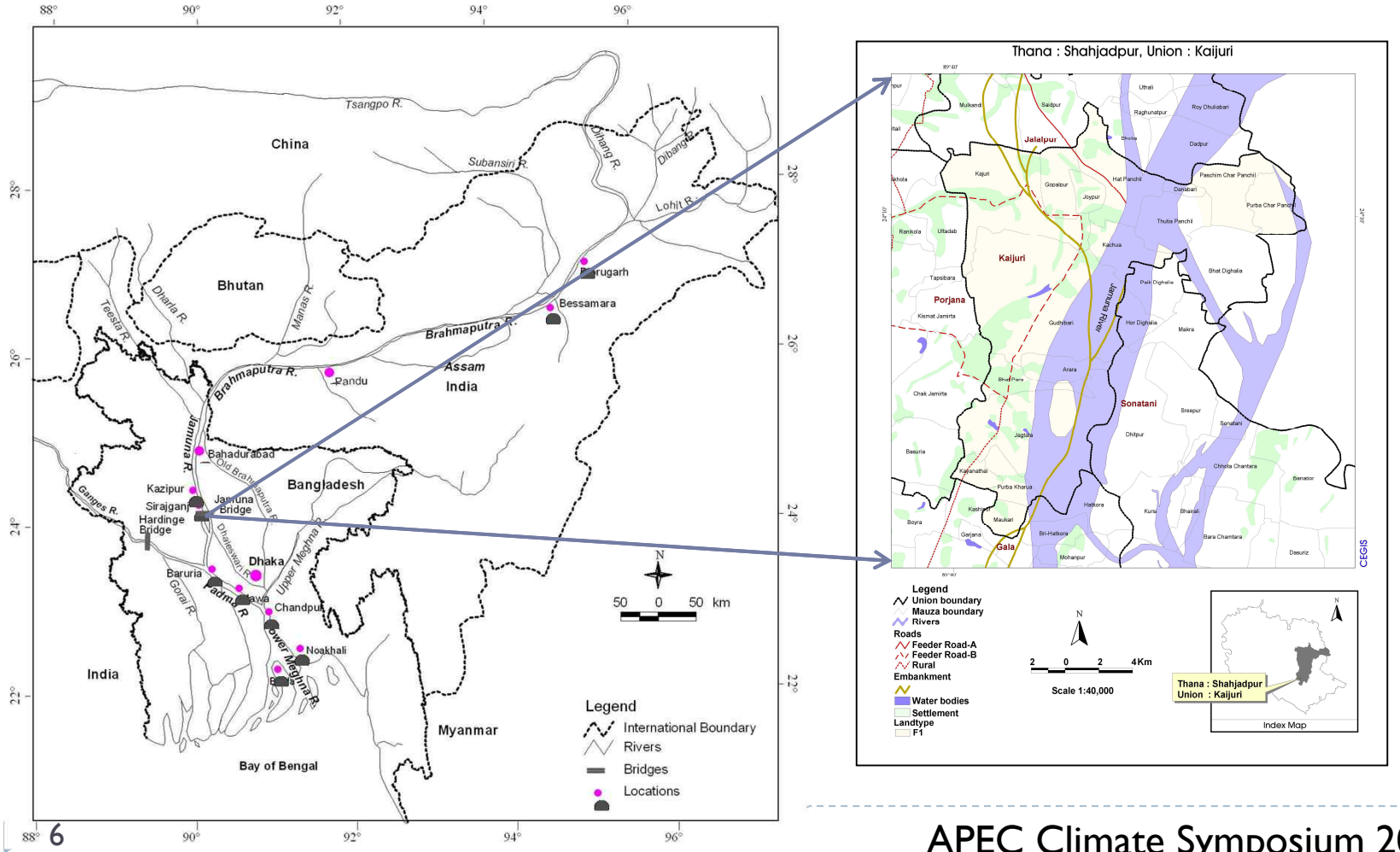
Crop

Crop -Season	Jan-March		April-June				Jul-Sep				Oct-Dec	
	Robi (dry)		Kharif -I				Kharif II				Robi (dry)	
Crop												
Aus				S				H				
T. Aman							S				H	
Boro												

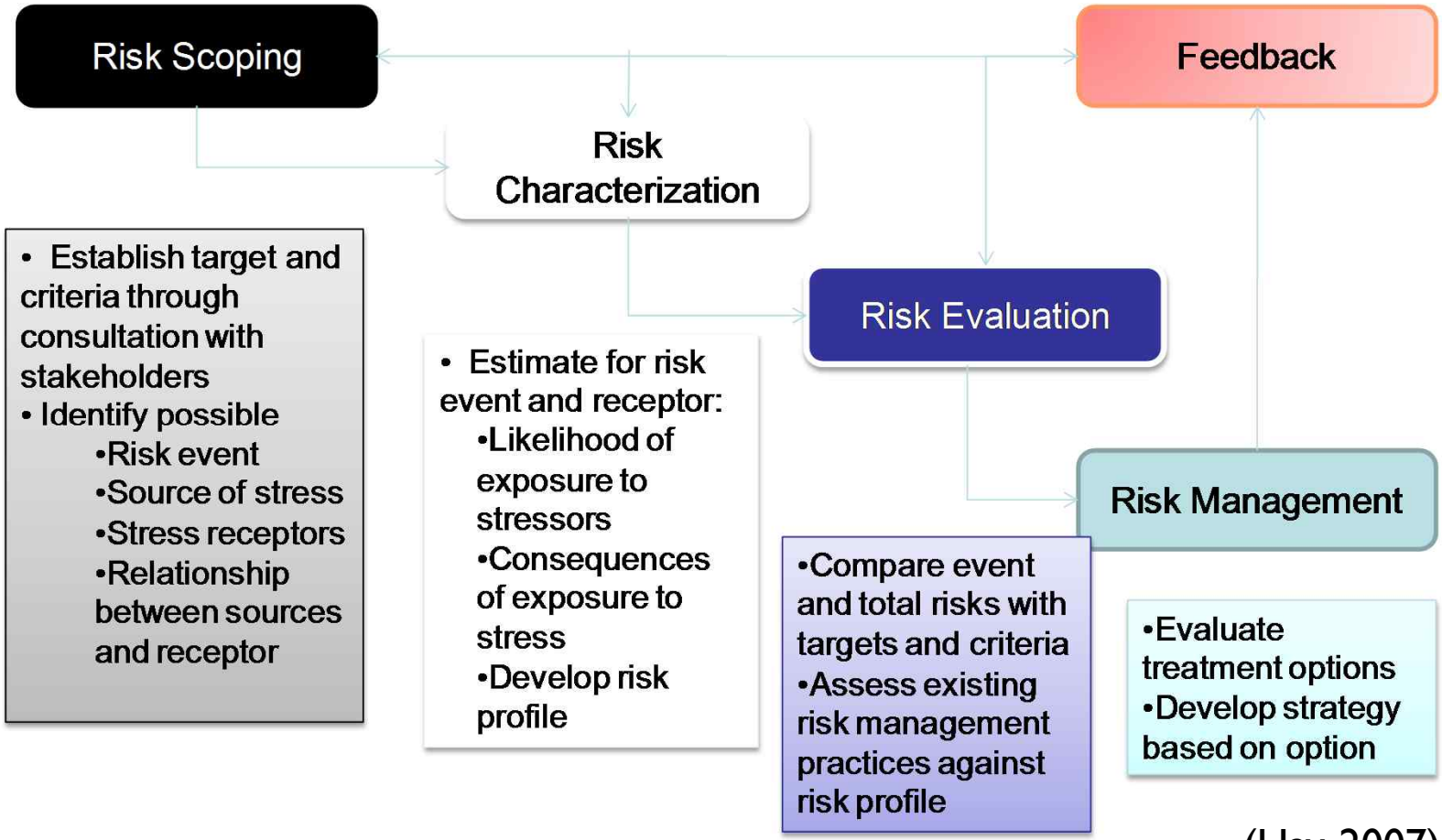
Overall Conceptual Framework



Brahmaputra River Basin- Bangladesh



Vulnerability and Risk Assessment



(Hay, 2007)

Vulnerability & Risk: Needs Assessment of EWS

Target groups	Decisions	Forecast lead time requirement
Farmers	Early harvesting of B.Aman, delayed planting of T.Aman	10 days
	Crop systems selection, area of T. Aman and subsequent crops	Seasonal
	Selling cattle, goats and poultry (extreme)	Seasonal
Household	Storage of dry food, safe drinking water, food grains, fire wood	10 days
	Collecting vegetables, banana	1 week
	With draw money from micro-financing institutions	1 week
Fisherman	Protecting fishing nets	1 week
	Harvesting fresh water fish from small ponds	10 days
DMCs	Planning evacuation routs and boats	20 – 25 days
	Arrangements for women and children	20 – 25 days
	Distribution of water purification tablets	1 week
Char households	Storage of dry food, drinking water, deciding on temporary accommodation	1 week

Vulnerability & Risk: : Agricultural Response on EWS

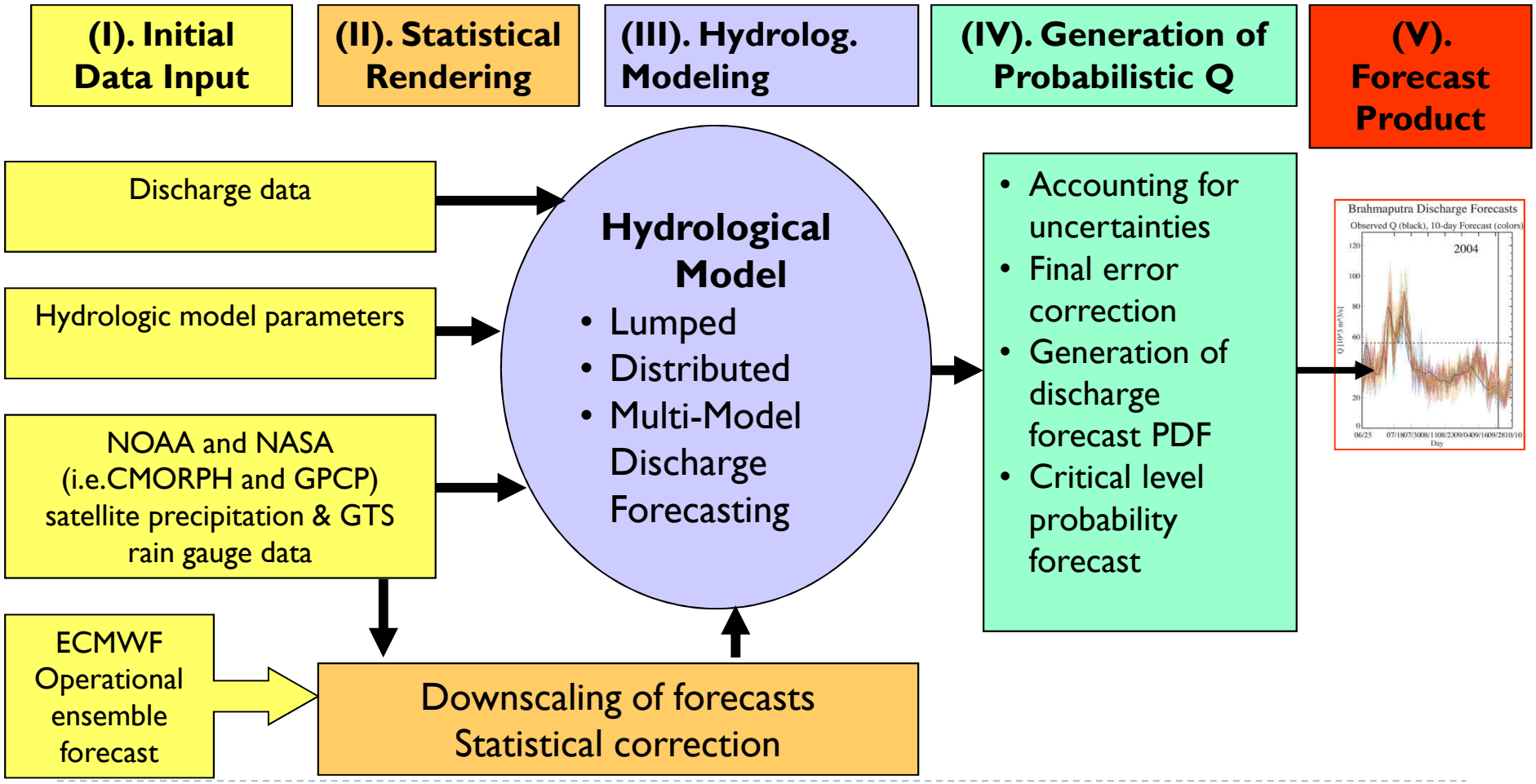
Activities of the Community with Flood Early Warning			
2 days lead time	**10 days lead time**	**20 days lead time**	**2-3 months lead time**
- harvesting of matured crops as much as possible - not effective in most of the cases - not effective if crops are in growing stages	- start to harvest ripening crops if situation demands - stocking of seeds for emergency period - delaying of seed bed preparation - abstaining from planting crops - UDMC could aware the people through miking, postering and drumming regarding forthcoming flood	- steady starting of crop harvesting - UDMC could do meeting with the head of Para (segment of village) regarding preparation to rescue the assets and life from flood - arrangement of seed bed on high land	- early yielding varieties of crops could be cultivated as an alternate options

Vulnerability & Risk: Discharge and Ensembles Threshold

- Three categories- Low probability, medium probability and high probability. The Danger level for the Brhamaputra river is 19.5 m and the recorded highest danger level is 20.5 m.
- Low Flood – 17-18.5 m
- Medium Flood- 18.6-19.5 m
- High Flood- >=19.6 m

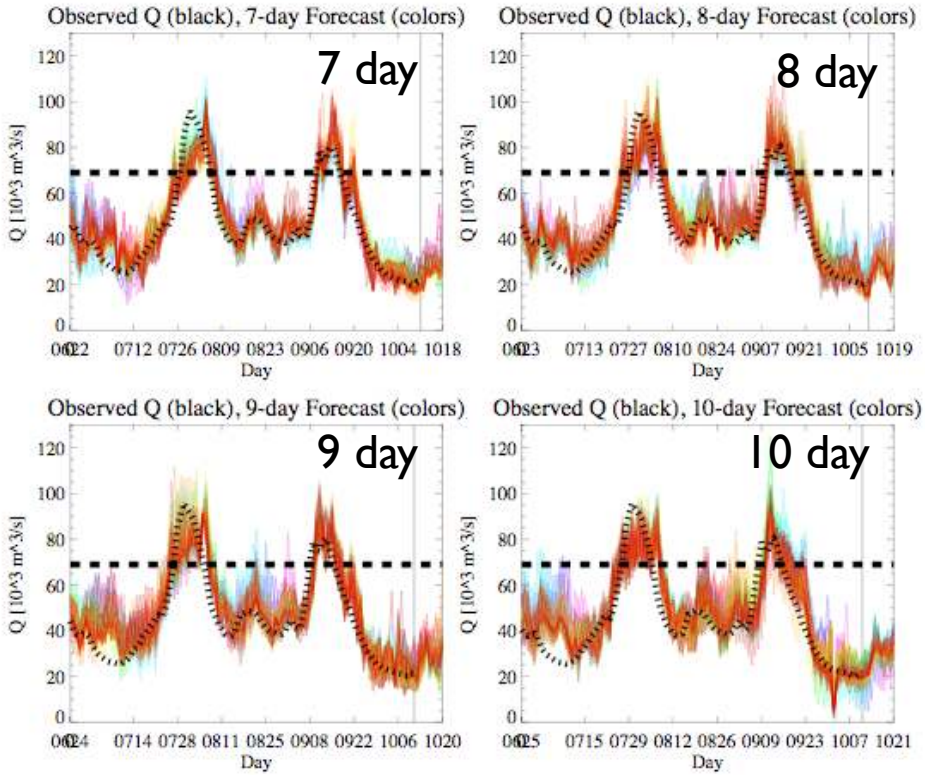
Hydrological Modelling

1-10 days probabilistic flood forecast model (Dr. Tom Hopson's PhD research, University of Colorado, 2005).

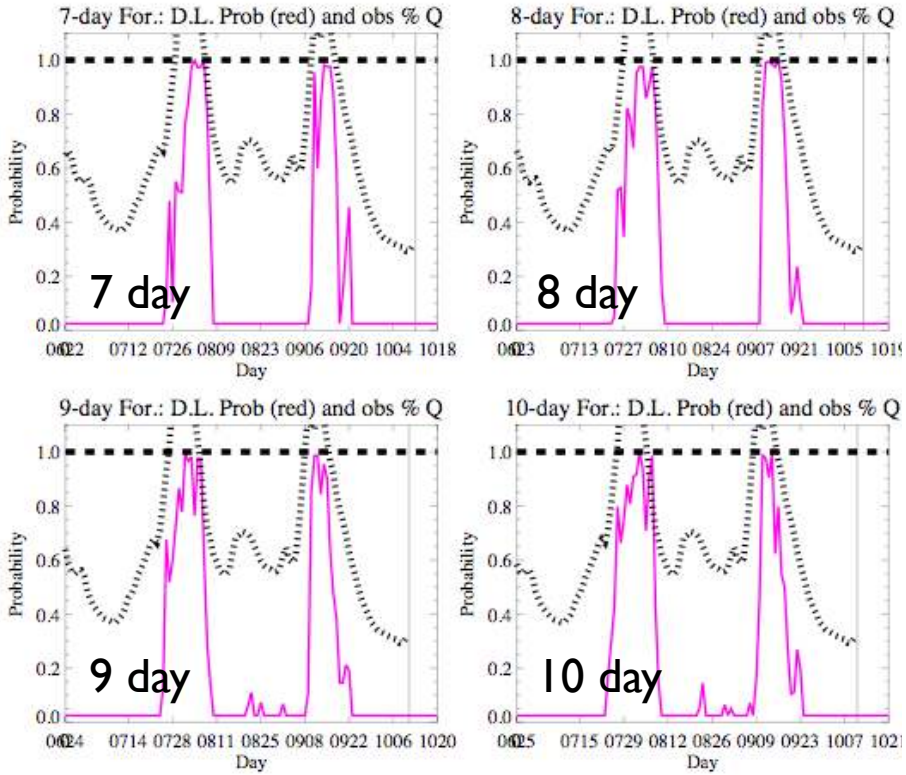


2007 Flood- Brahmaputra Ensemble Forecasts

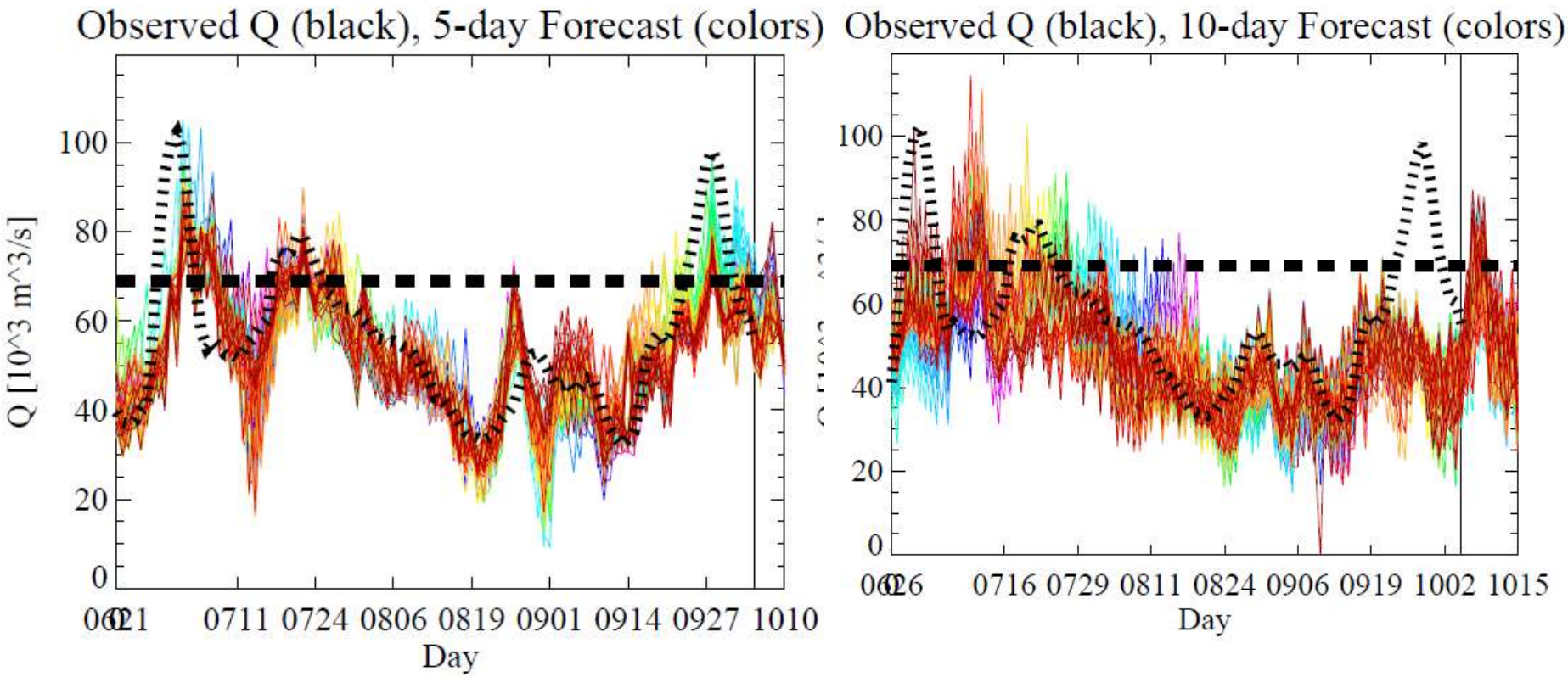
7-10 day Ensemble Forecasts



7-10 day Danger Levels

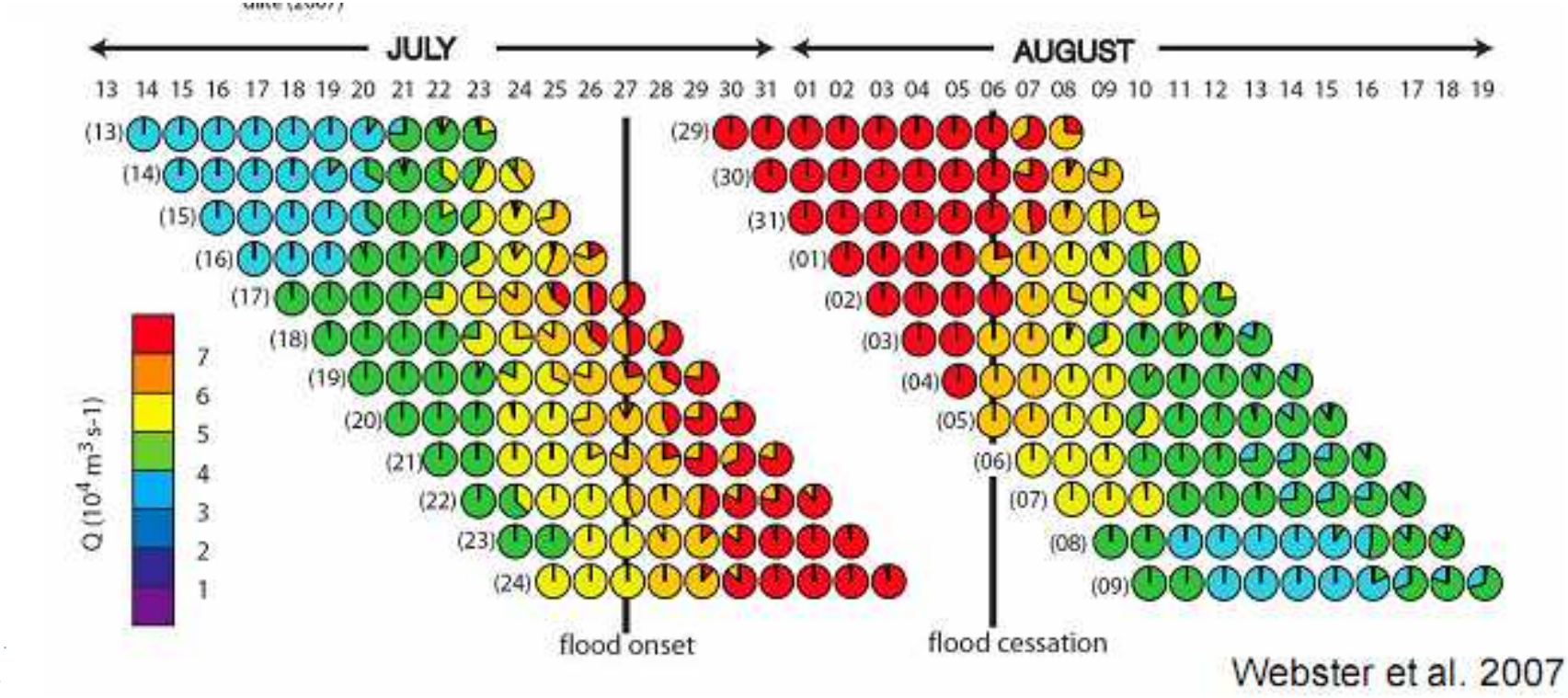


20012 Flood- Brahmaputra Ensemble Forecasts



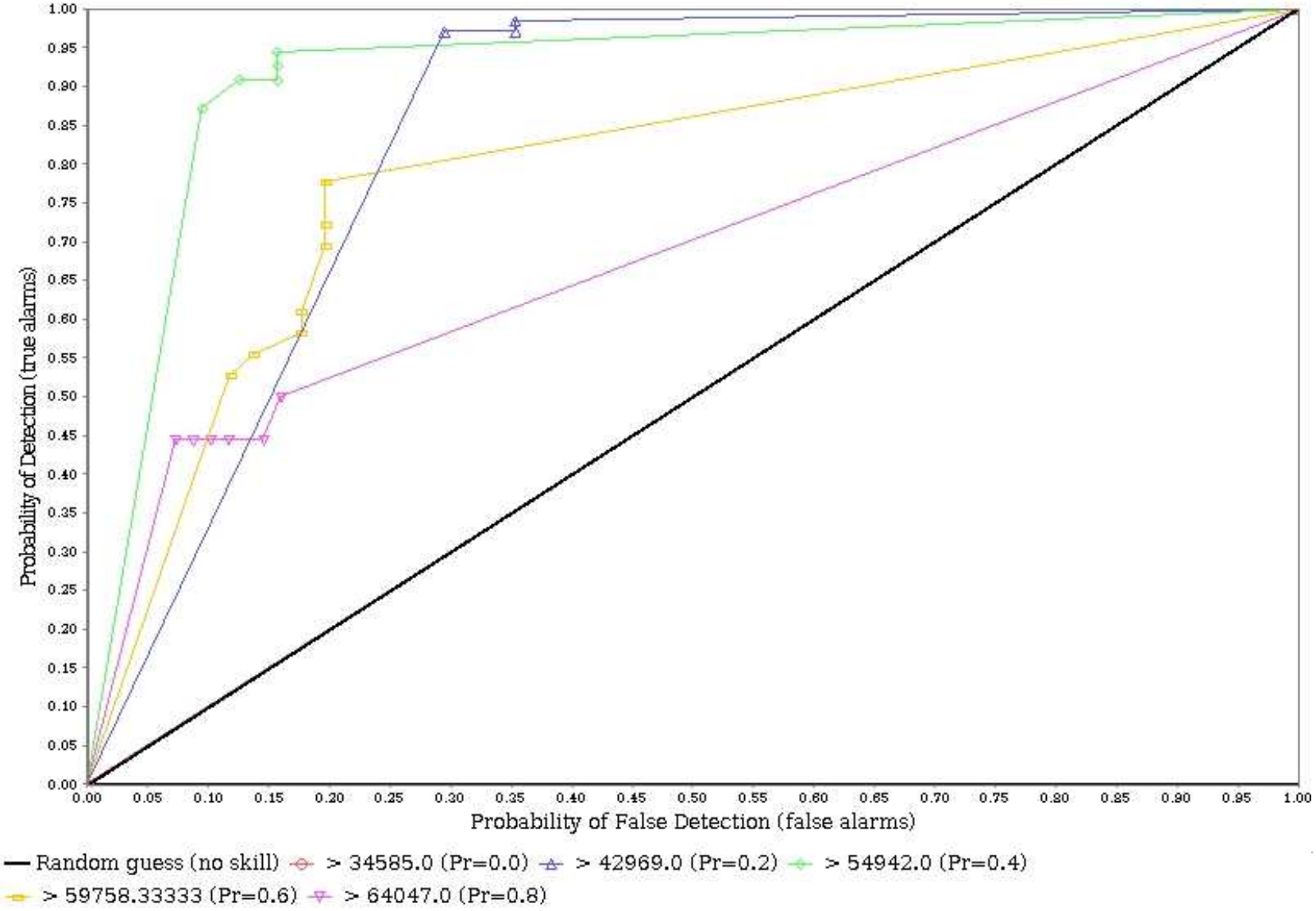
Plumes and probability pies for the first Brahmaputra flood July 28-August 6, 2007

Model able to meet **three** fundamental information needs of communities at risk

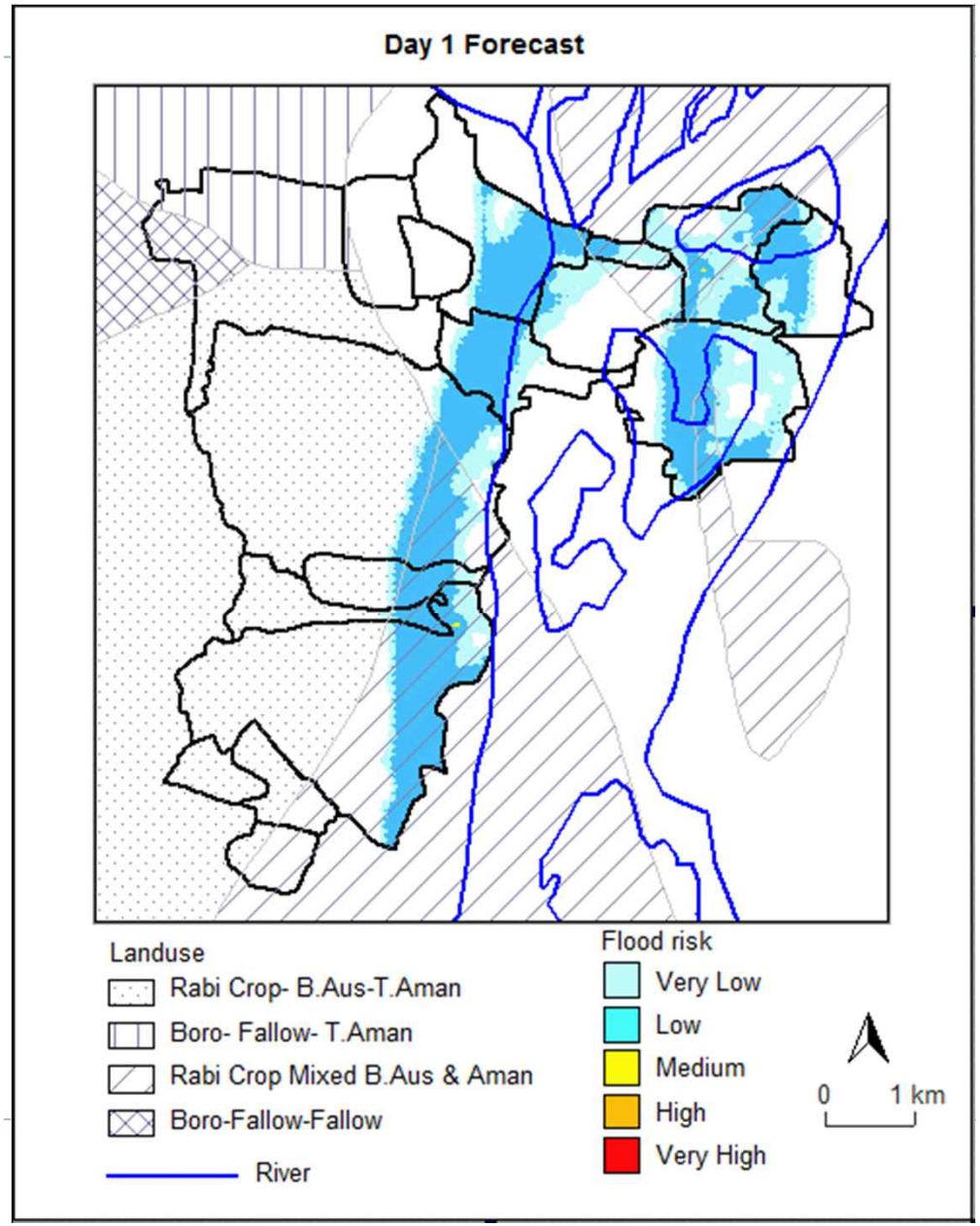


Webster et al. 2007

Relative Operating Characteristic for Different Event (Probability) Thresholds



Flood Risk Map

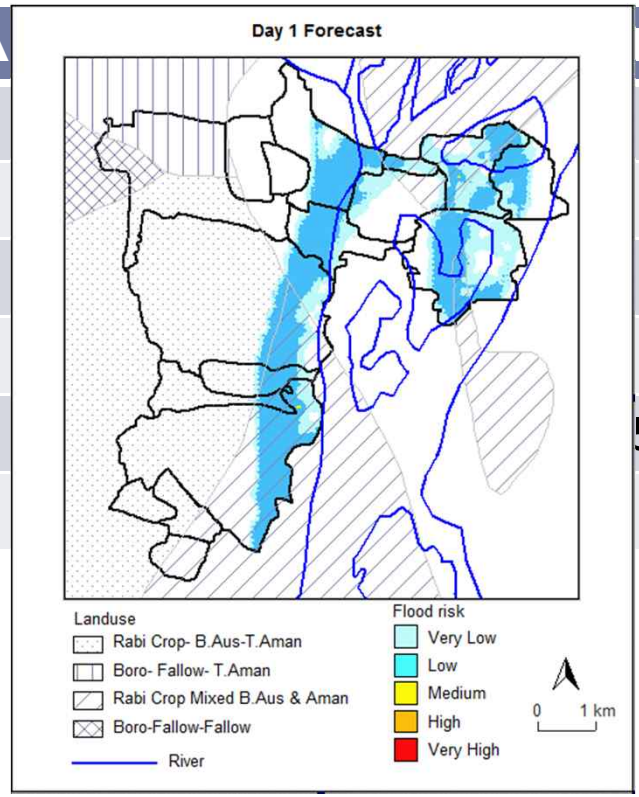


Community Response Options

Disasters	Crop	Stages	Season / month	Impacts	Time of flood forecast	Alternative management plan
Early flood	T. Aman 	Seedling and Vegetative stage	Kharif II Jun - Jul	Damage seedlings Damage early planted T. Aman Delay planting Soil erosion	Early June	Delayed seedling raising, Gapfilling, skipping
	T. Aus 	Harvesting	Kharif I Jun - Jul	Damage to the matured crop	Early June	Advance harvest
	Jute 	Near maturity	June - July	Yield loss Poor quality	May end	Early harvest
	S. Vegetables 	Harvesting	June - July	Damage yield loss Poor quality	Mar - Apr	Pot culture (homestead) Use resistant variety
High flood	T. Aman 	Tillering	Kharif - II July - Aug	Total crop damage	Early June	Late varieties Direct seeding Late planting

Community Response Plan

Low flood	J	F	M	A	D
T.Aman					
T.Aus				2	
Jute					
S.Vegetables					
Cattle	5	5	5	5	5
…					



Community outcomes

1. Delayed seedling raising, gapfilling, skipping early fertilizer application
2. Advance harvest of paddy (70-80 % mature)
3. Early harvest of jute for rotten in water
4. Pot culture (homestead), Use resistant variety
5. Food storage, flood shelter, vaccination de-warming

Risk Communication of flood forecasts

Risk Communication for Flood Forecasts

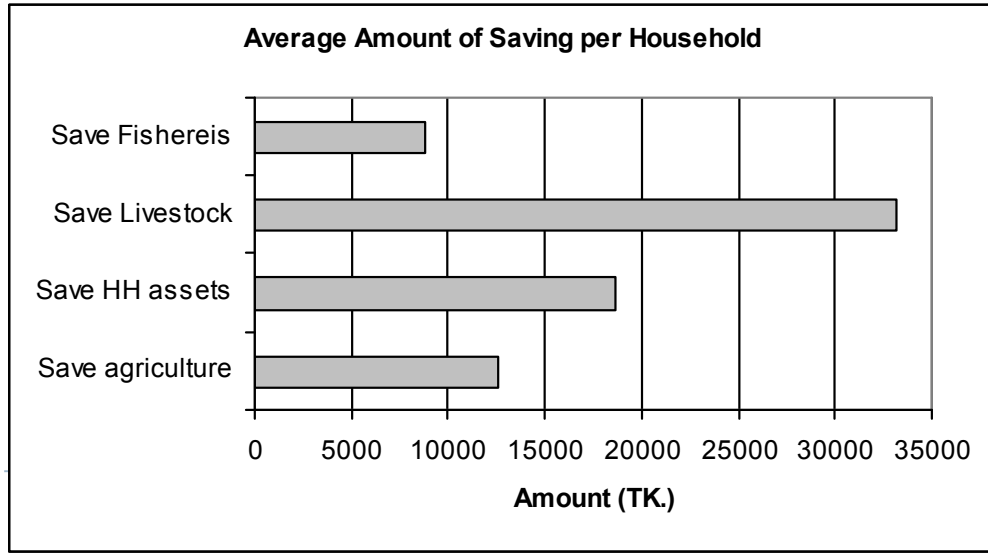
Mobile phone

Flag hoisting

Community responses to flood forecasts

Economic- Benefits

- In 2008 Flood, Economic Benefits on average per household at pilot areas
  - Livestock's = TK. 33,000 ($485) per household
  - HH assets = TK. 18,500 ($270) per household
  - Agriculture = TK 12,500 ($180) per household
  - Fisheries = TK. 8,800 ($120) per households
- Experiment showed that every USD 1 invested, a return of USD 40.85 in benefits over a ten-year period may be realized (WB).



Recommendations & Conclusion

- The DSS is useful and could helps the community interpret and translate scientific information into risk information.
- The understanding of probabilistic long lead flood forecasting is valuable for society and to protect agriculture in flood-prone areas.
- The DSS framework highlights more comprehensive response options, where technical and non-technical tools, about hazard as well as vulnerability aspects, coexist.

Thanks you

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