Hydropower and Water Management Practices and Challenges

NSF - PIRE Kickoff Conference

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Ethiopia Weather & Climate Disasters

Ethiopia - Disaster Statistics

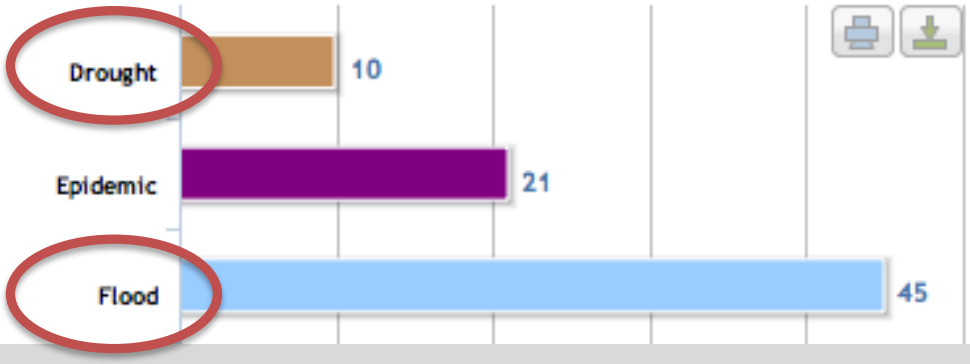
Data related to human and economic losses from disasters that have occurred between 1980 and 2010.

Natural Disasters from 1980 - 2010

Overview

No of events:	86
No of people killed:	313,486
Average killed per year:	10,112
No of people affected:	57,382,354
Average affected per year:	1,851,044
Economic Damage (US$ X 1,000):	31,700
Economic Damage per year (US$ X 1,000):	1,023

Natural Disaster Occurence Reported



Top 10 Natural Disasters Reported

Affected People

Disaster	Date	Affected (no. of people)
Drought	2003	12,600,000
Drought	1983	7,750,000
Drought	1987	7,000,000
Drought	1989	6,500,000
Drought	2008	6,400,000
Drought	2009	6,200,000
Drought	1999	4,900,000
Drought	2005	2,600,000
Drought	1997	986,200
Flood	2006	361,600

Economic Damages

Disaster	Date	Cost (US$ X 1,000)
Drought	1998	15,600
Flood	2005	5,000
Flood	1994	3,500
Flood	2006	3,200
Flood	1999	2,700
Flood	2005	1,200
Flood	1995	500
Epidemic	1980	0
Epidemic	1981	0
Flood	1981	0

Credit: Prevention Web

Weather vs Climate

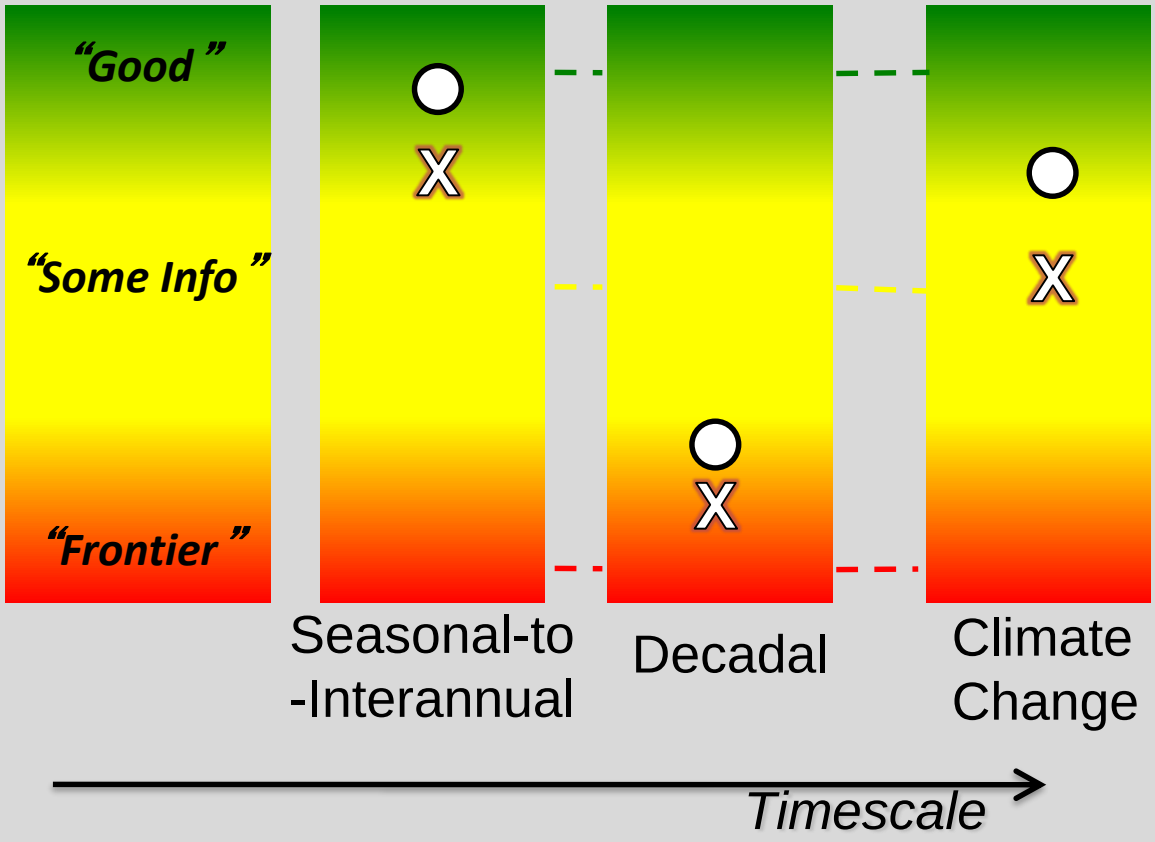
Time scales of interest:

"Weather"	• 1-10 days	Atmosphere-Land conditions
	• 2-3 months	
"Climate Variability"	• 6 months – 1 year	Ocean-atmosphere-land conditions; conditions vary at slower rates – leads to predictability
	• Decades	
"Climate Change"	• Several decades	Climate change: in addition to physical processes, assumptions about human behavior
	• Centuries	

Credit: S. Someshwar

Prediction: Where Are We?

UNDERSTANDING ○
and
PREDICTABILITY X



From a WRM perspective, this provides prospects for predicting and managing water system risks (design, operation, allocation…)

Credit: L. Goddard, IRI

Climate Prediction for WRM

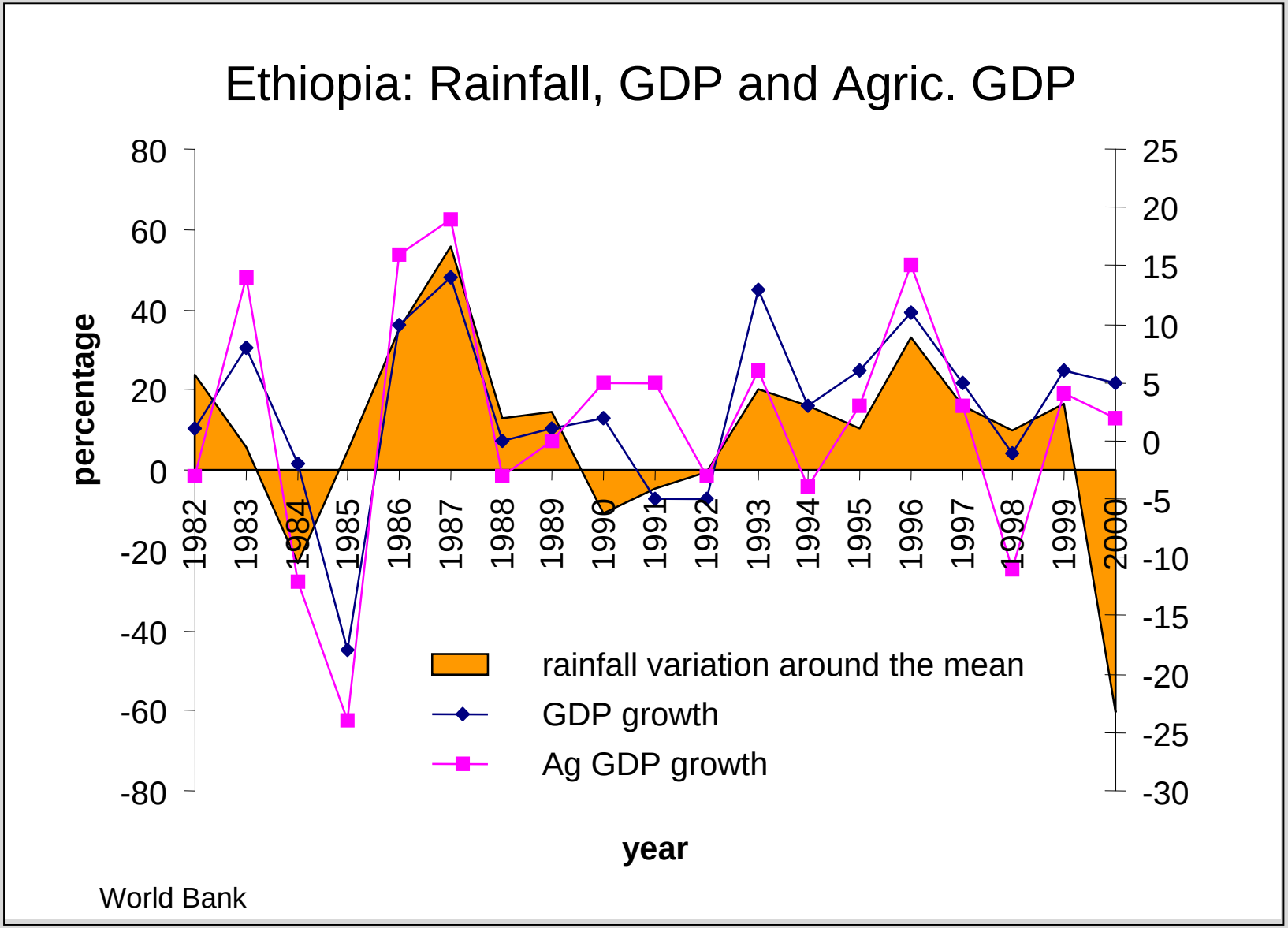
Goal

- Prepare not React
- Reduce risks
- Exploit opportunities

Why is implementation lacking?

Need Be[illegible]ractice

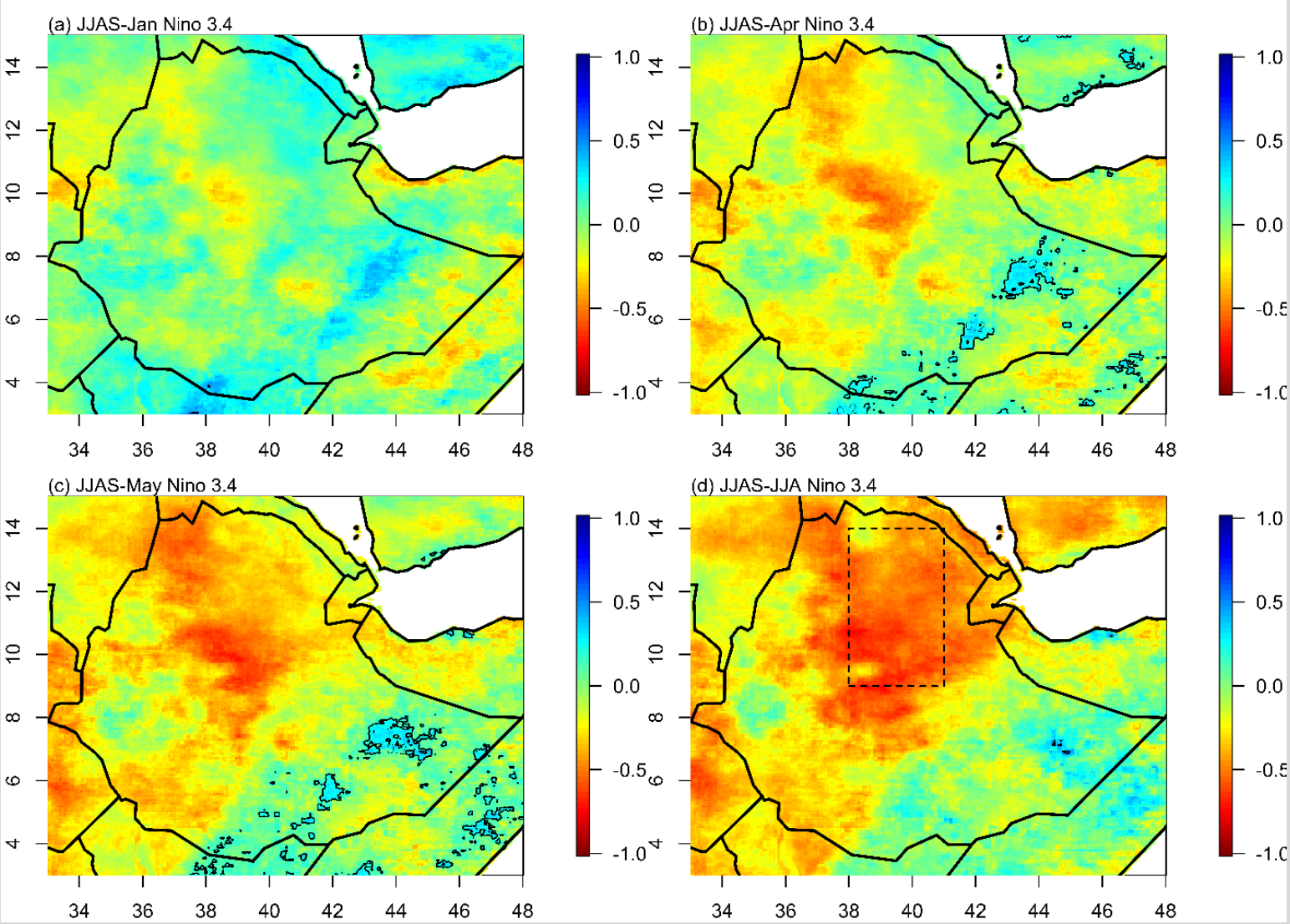
Seasonal Climate Variability



Source: World Bank 2005

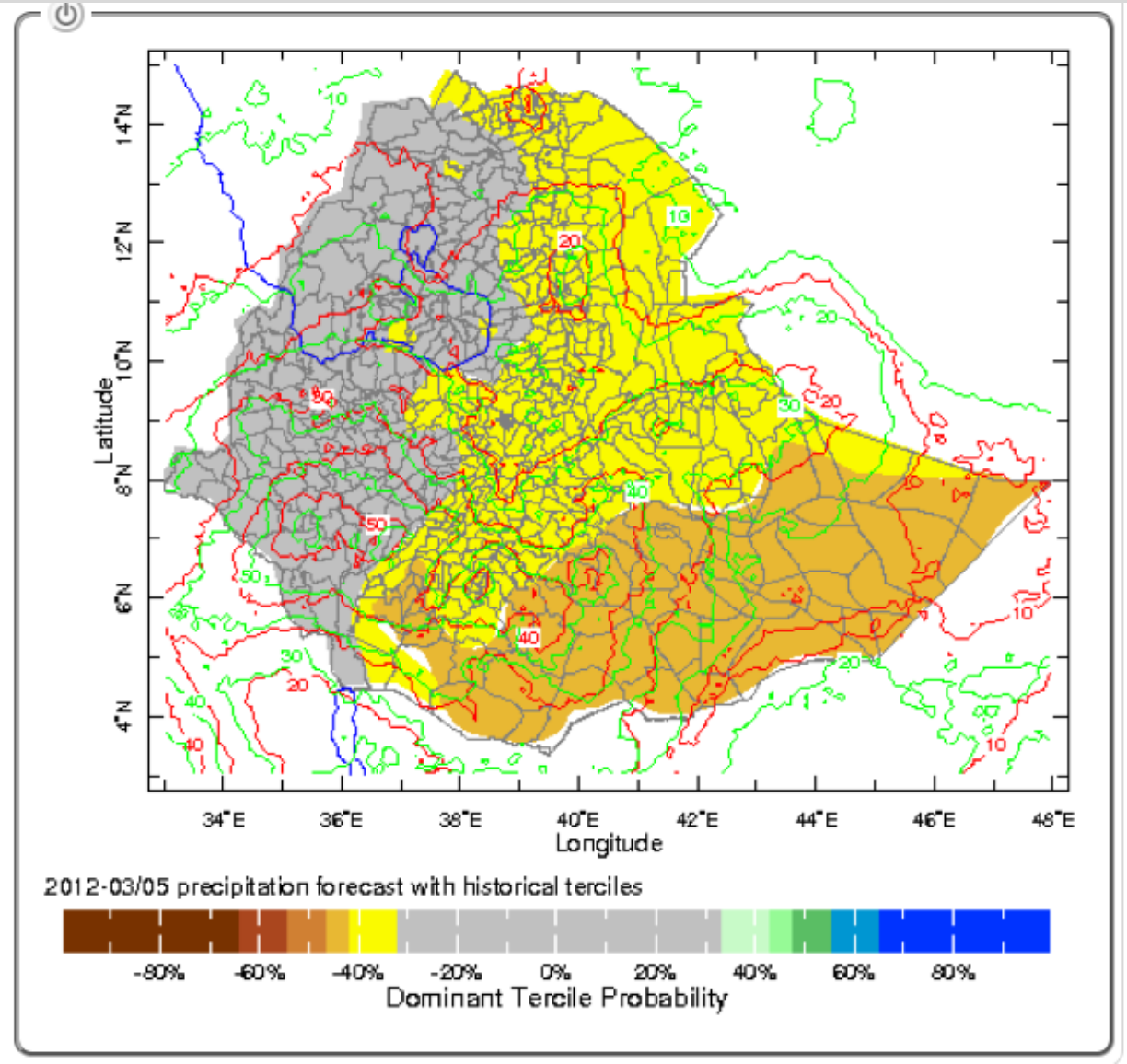
Climate Factors: ENSO

Correlation of Nino3.4 and *Kiremt* Precipitation (CHIRPS); 1981-2015



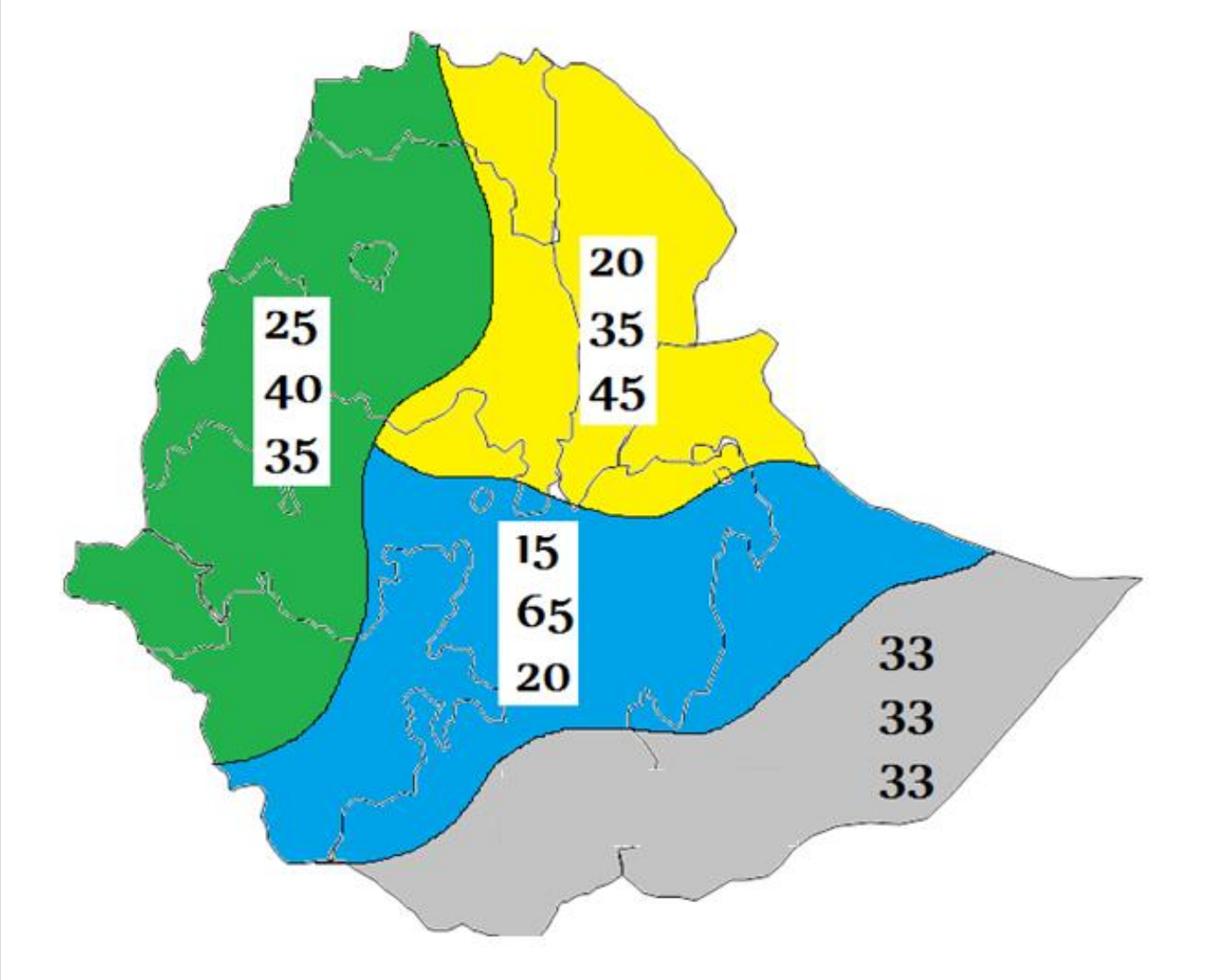
Climate Forecast Products

Advanced information that can systematically be used in decision-making



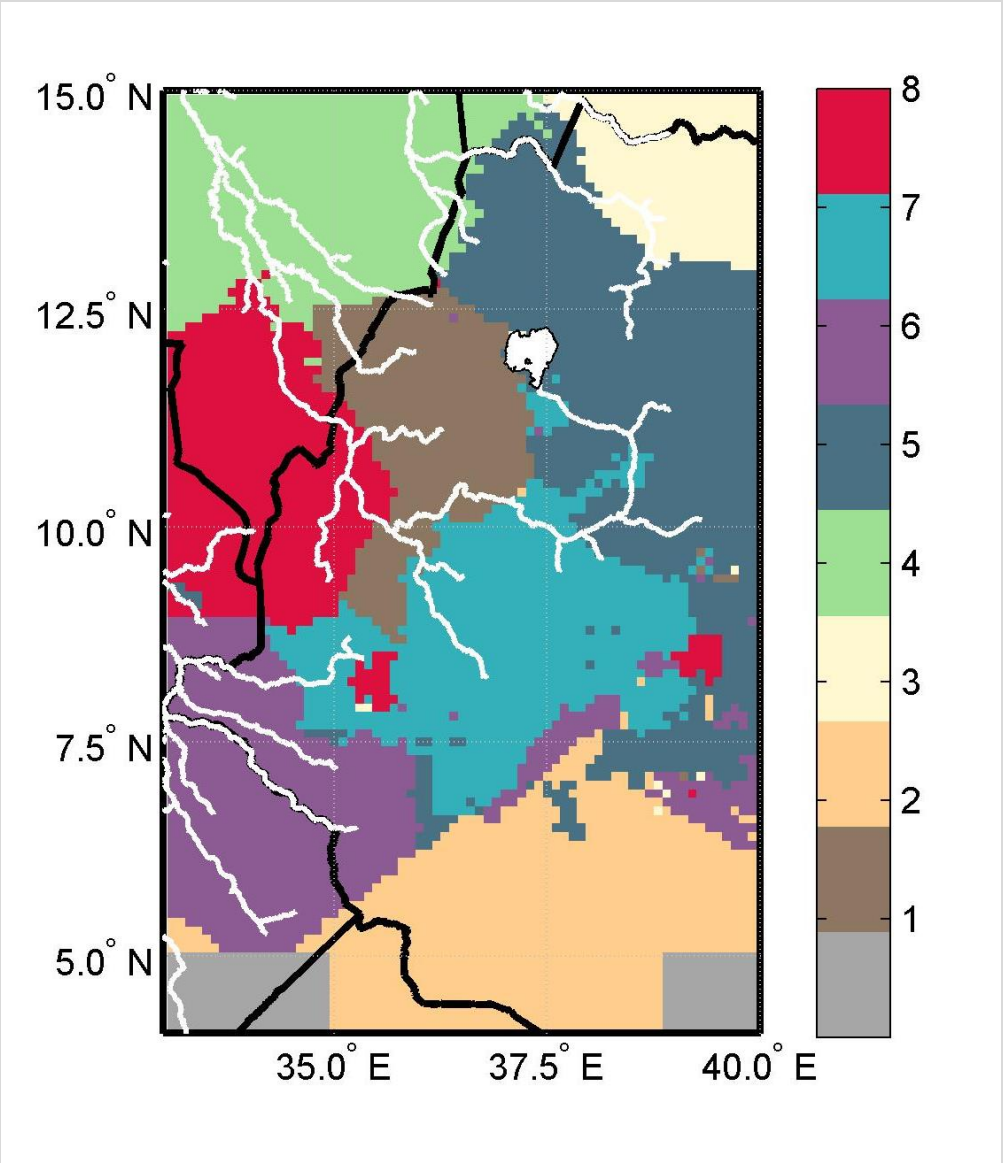
Climate Forecast Products

NMA – 2015 *Kiremt* Prediction; categorical. Shift toward drought

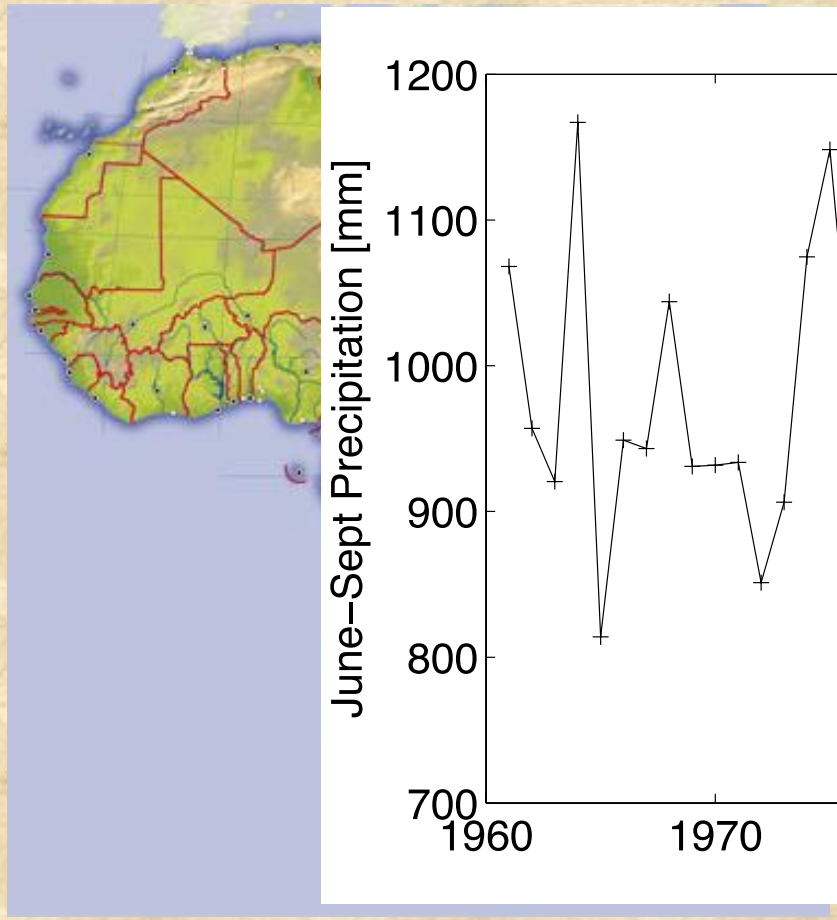


Cluster Analysis

Homogeneous Precipitation Regions (*Zhang, Moges, Block*)



Upper Blue Nile Basin - Hydropower



Courtesy of Dorling Kindersley

Base Map Courtesy of PLC Map Collection, UT

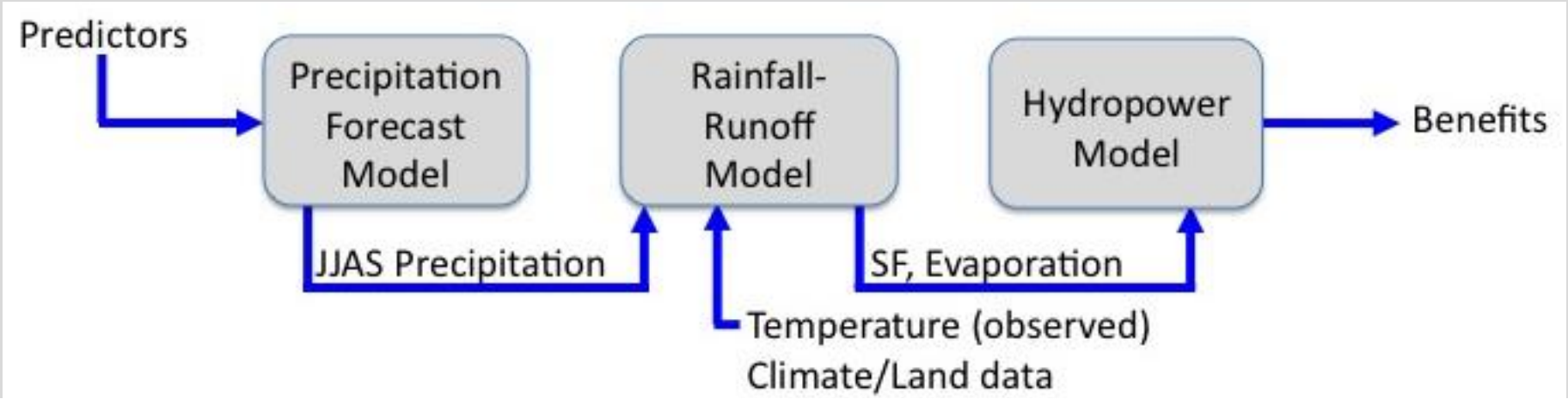
Four large-scale dams proposed (one started)

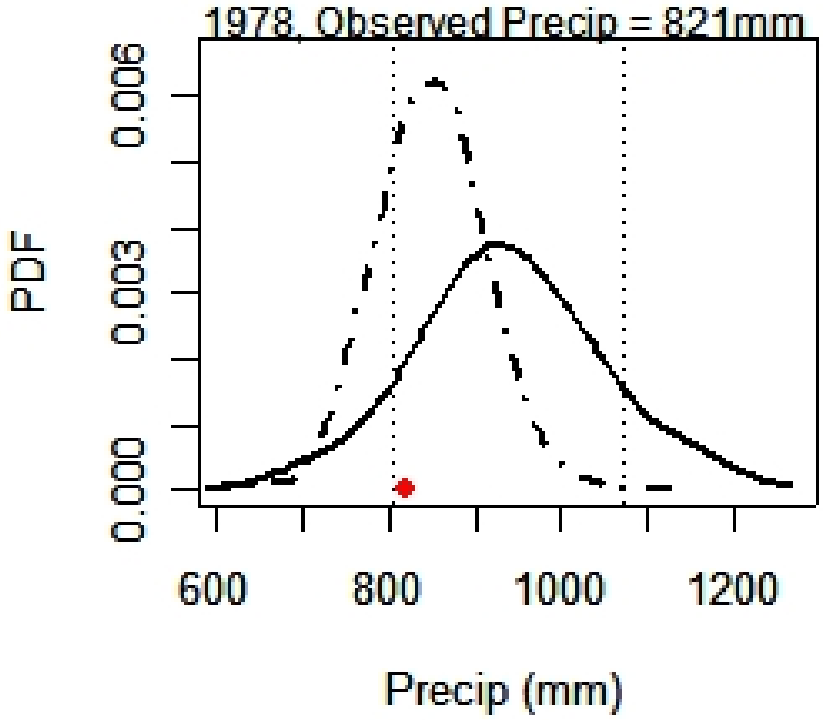
Could a seasonal forecast improve benefits?

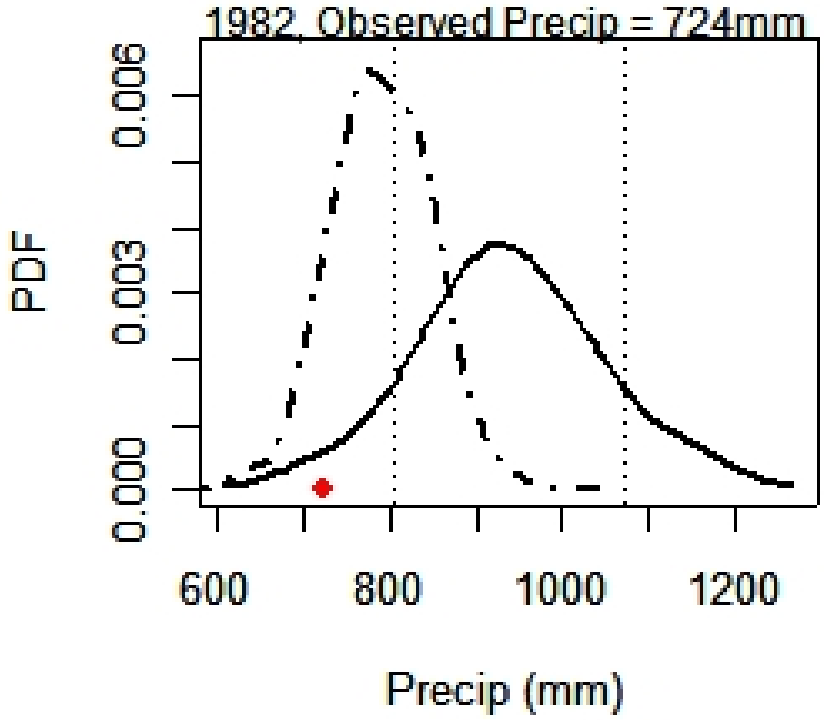
Does the prediction technique have any influence?

Does increased prediction skill translate to greater benefits?

Linked Model System

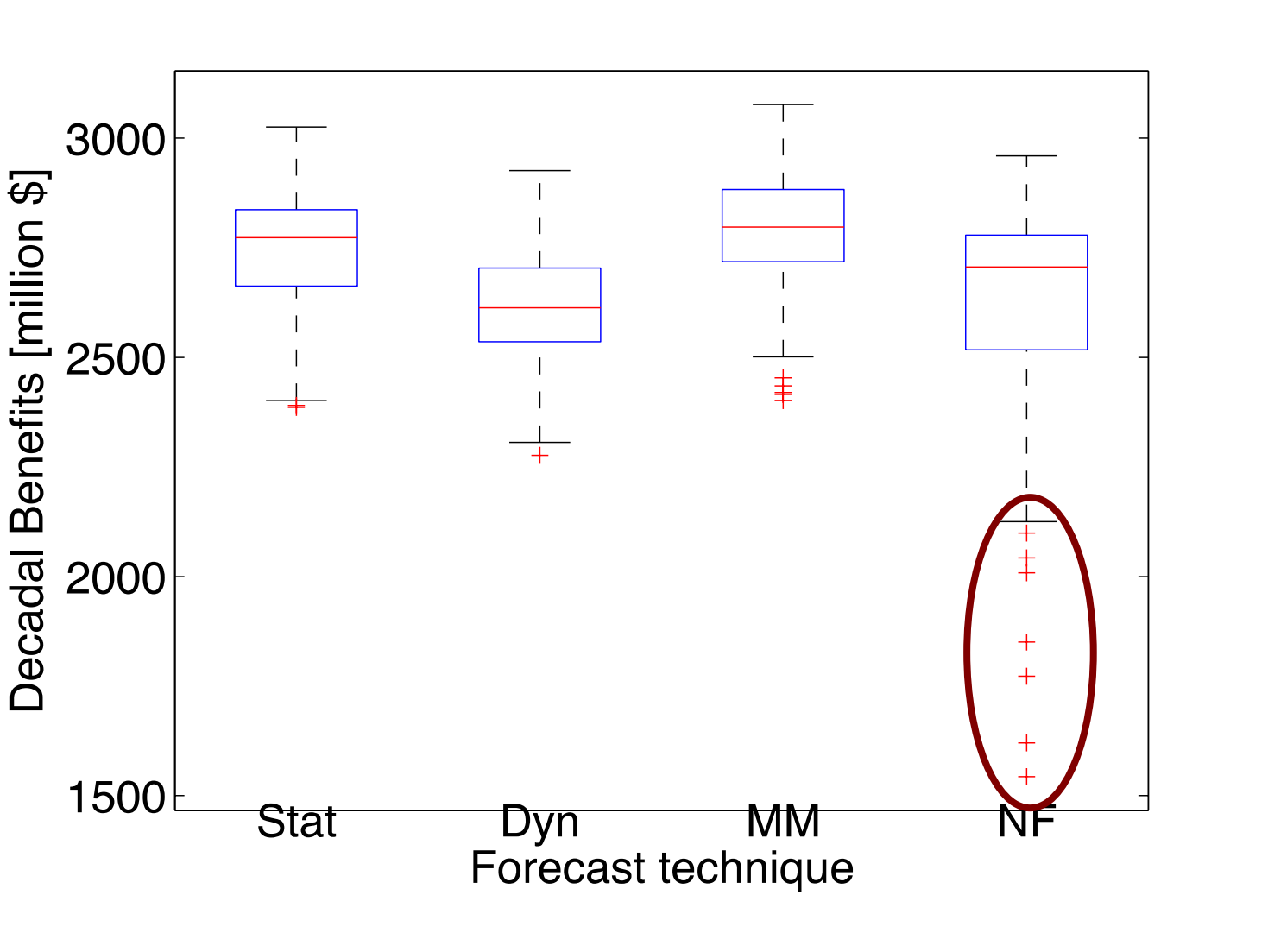






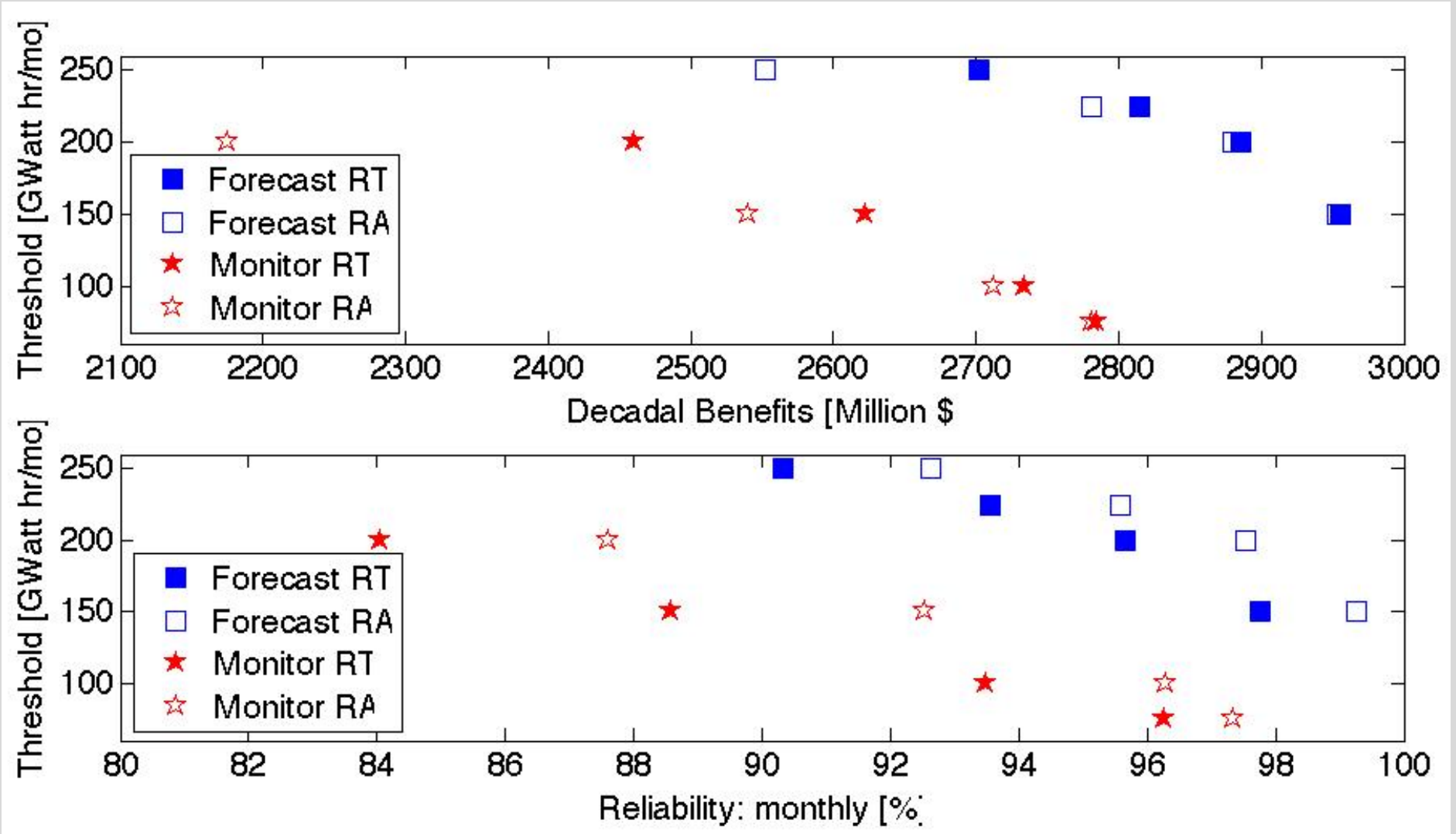
Hydropower Benefits

Median = marginal improvement; reduction in probability of low decades

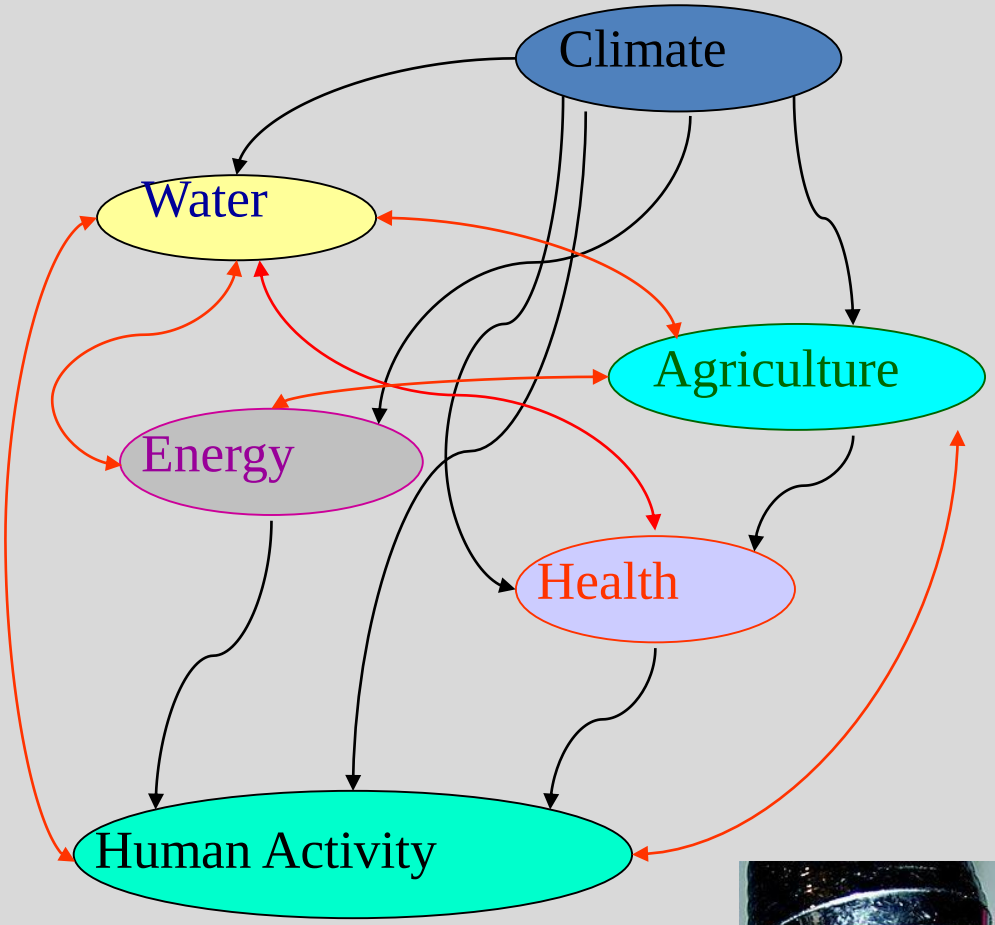


Forecast Value, Reliability, Threshold

Trade-off between reliability and benefits



Water Management



The Challenge

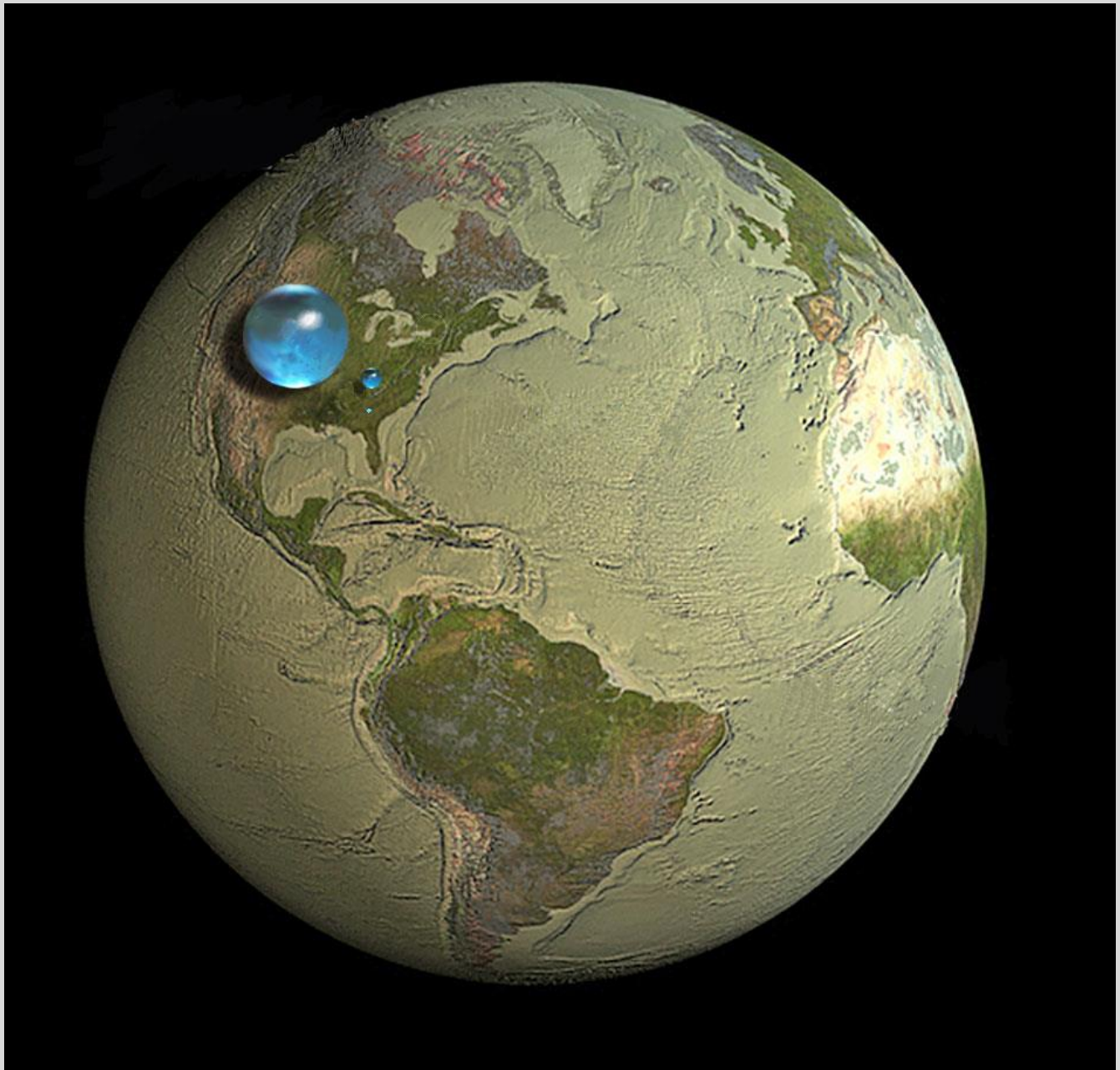
How can we better inform seasonal decision-making for agriculture and water resources / hydropower management?

- Technology development
- Social – Human understanding
- Institutional cooperation
- Year-to-year variability in supply; changing demands
- Extremes

National or Local Issue?

Focus on Today (security) or the Future (sustainability and resilience)?

World's Water



USGS