

Texas FIRO Pilot

- Goals, Initial Findings, and Next Steps**

Yu Zhang, UT Arlington

Pilot Project Team and Contributors

- UT Arlington: Yu Zhang (PI), DJ Seo, Yanjun Gan
- UT-BEG: Bridget Scanlon, John Malito, Sarah Fakhreddine
- Guidance from David Curtis from WEST Consultants, Jonathan Quebbeman from RTI, and Chris Delaney from CW3E

Partners

- Regional
 - US Army Corps of Engineers Fort Worth District
 - Texas Water Development Board
 - NWS West Gulf River Forecast Center
 - Brazos River Authority
- National
 - NWS Climate Prediction Center
 - NOAA Physical Science Laboratory
 - NWS Weather Prediction Center
 - NOAA National Integrated Drought Information System
 - NWS Office of Water Prediction

Acknowledgement of Financial Contributions

- US Bureau of Reclamation
- Texas Water Development Board

Leveraging Concurrent Research Projects

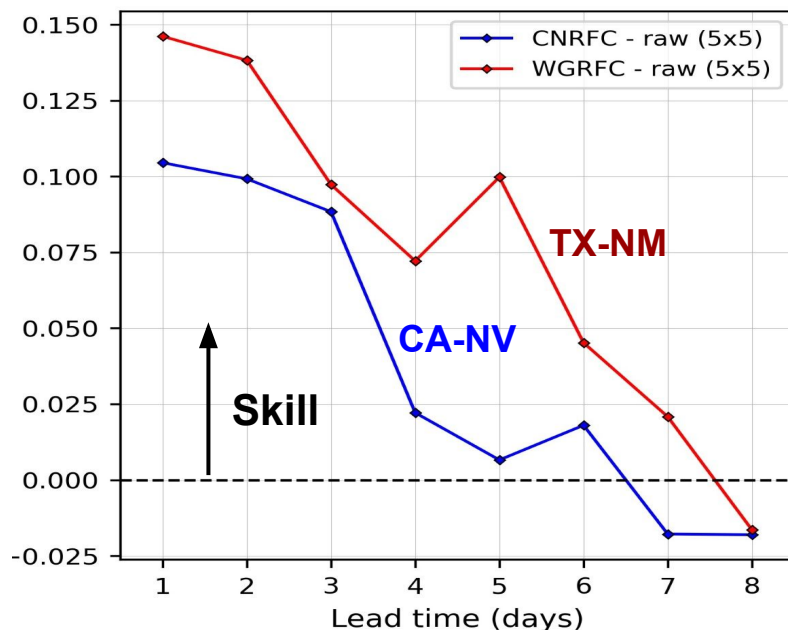
- UTA-CSU subseasonal predictability experiments
 - NASA S2S program and NOAA WPO
- UTA research on improving probabilistic precipitation forecasts
 - NOAA WPO
- UTA research on integrating ensemble seasonal forecasts for drought prediction/planning
 - NOAA CPO
- UTA inflow loss estimation (sponsored by NASA Applied Sci)

Layout of Presentation

- Texas weather, how bad are the rainfall forecasts?
- Vision and Scope of FIRO Pilot
- Preliminary outcomes
- Next steps

Texas Weather: How unpredictable?

Brier Skill Scores > 75 mm/day

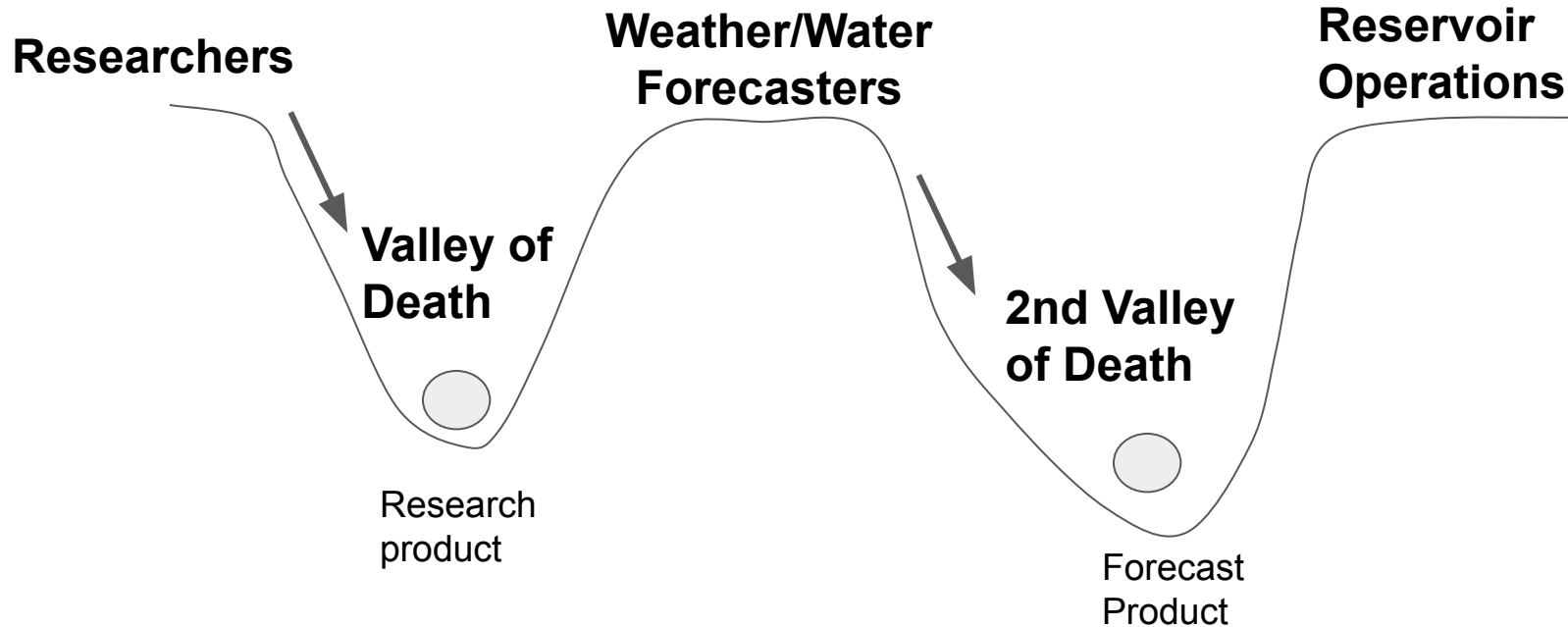


**Probabilistic precip forecasts
2017-2019 more skillful than
climatology till day 7 for both
regions for heavy precip**

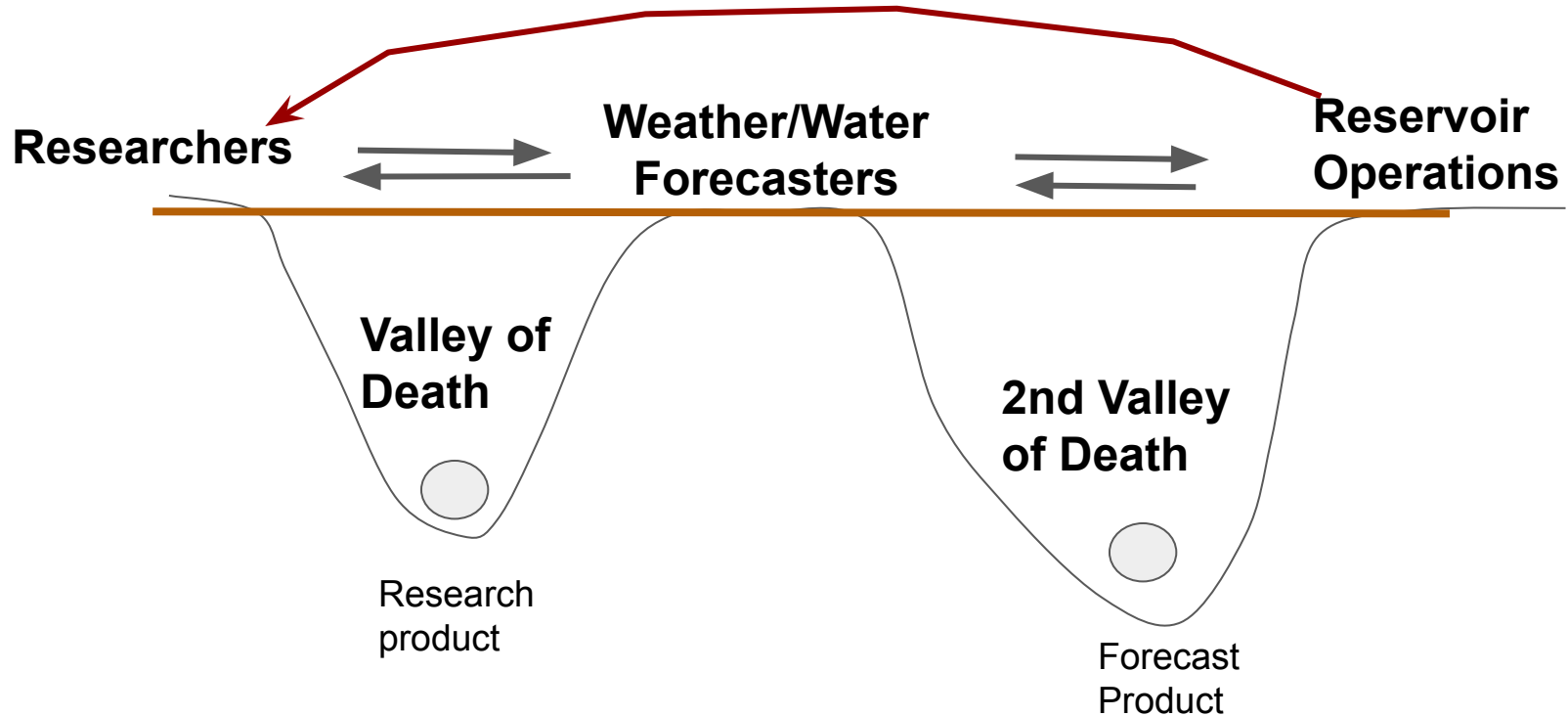
**Skills slightly higher for
Texas-New Mexico**

**Using forecasts to guide
decision is not a fantasy**

Role of FIRO Pilot



Role of FIRO Pilot



Role of FIRO Pilot

- **Lynchpin** of Texas FIRO activities
 - Establish FIRO paradigms and use cases
 - Build partnerships among forecasters, operators, and researchers
- **Testbed** to facilitate Research to Operation transition
 - Identify **mature** tools and methods for operational adoption
 - Determine gaps and implementation/research priorities

Pilot Site: Little River System near Austin



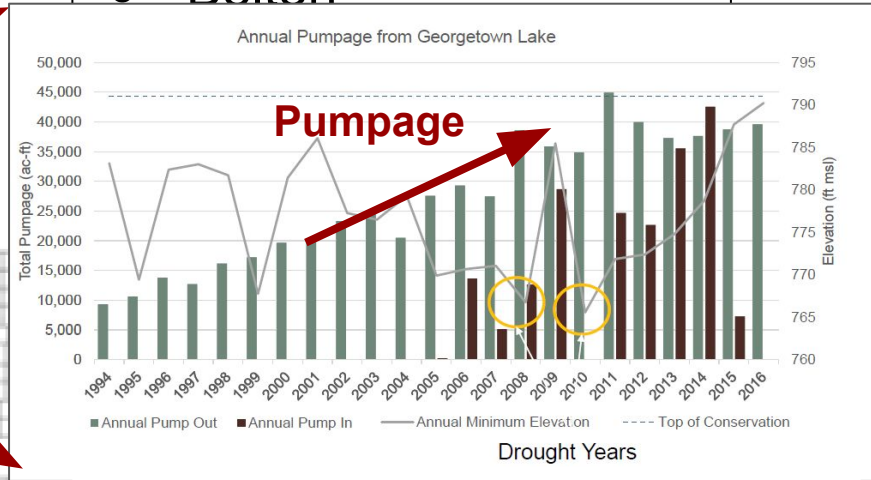
- Georgetown
- Belton
- Stillhouse Hollow
- Granger

Rapid population growth in the region challenges water supply

Pilot Site: Little River System near Austin

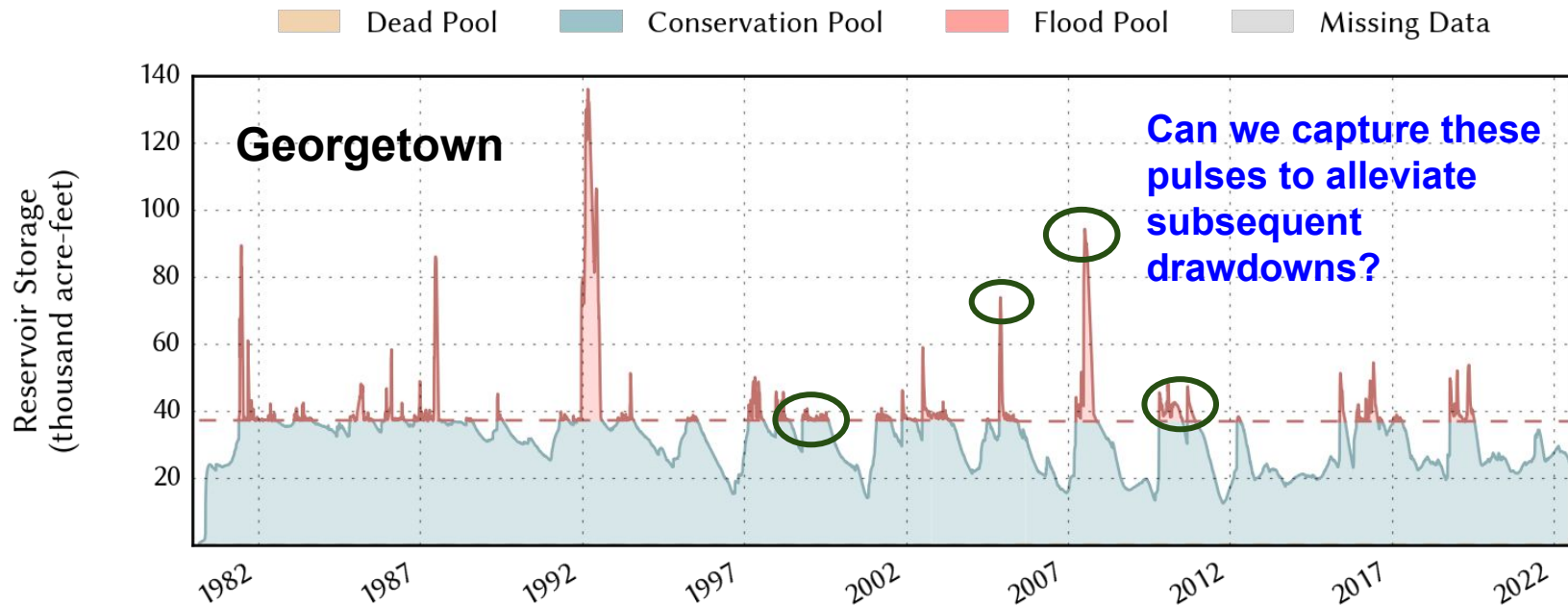


- Georgetown
- Belton



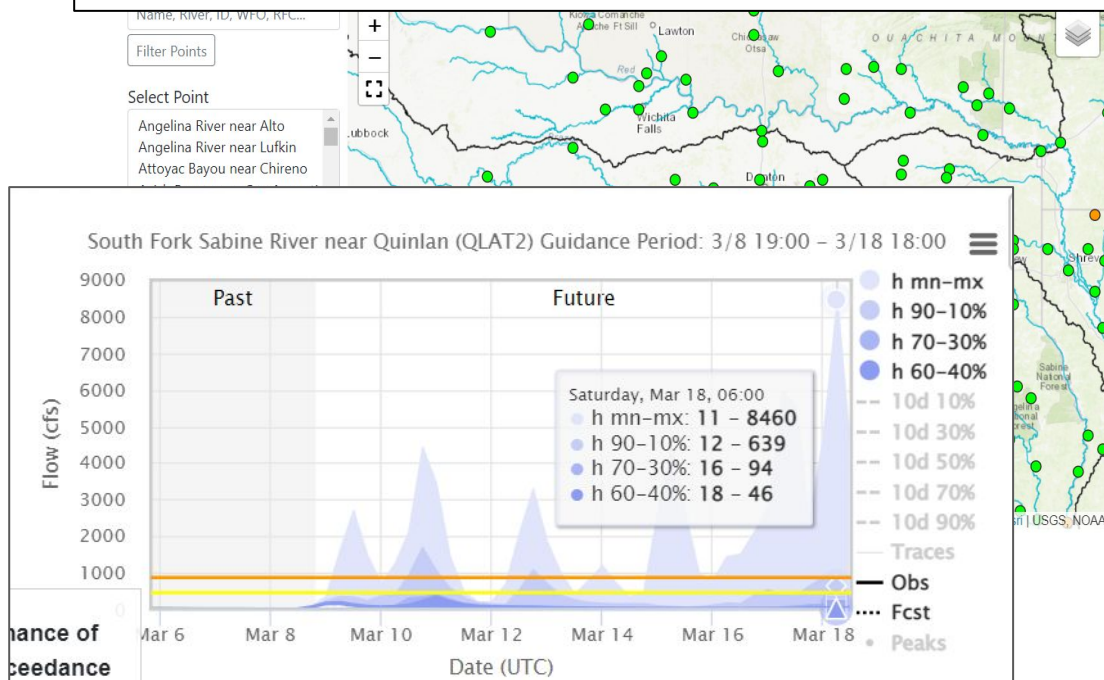
Rapid population growth strains water supply

Potential of FIRO



Pivot to HEFS

NWS Hydrologic Ensemble Forecast Service (HEFS)



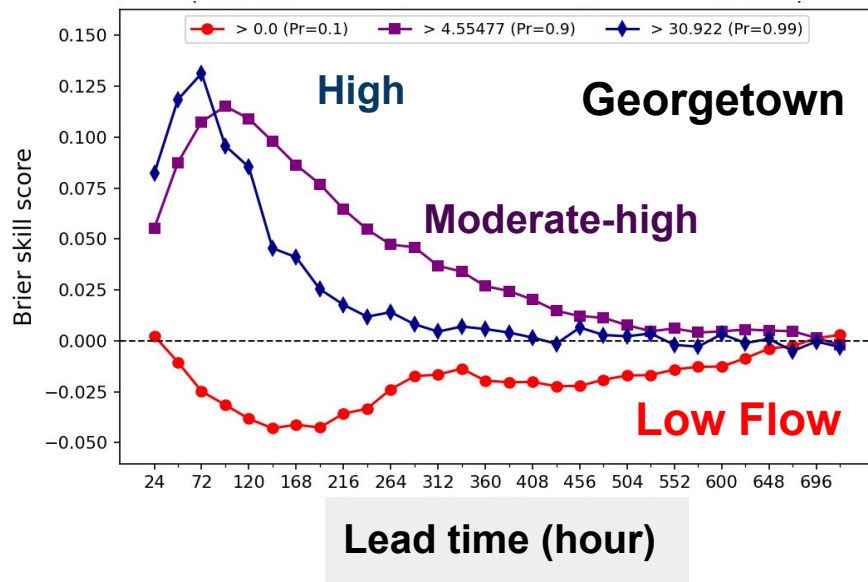
- Operational from mid 2010
- DJ Seo at UTA was primary architect
- Probabilistic forecast to convey forecast confidence

Scope of the Initial Phase

- HEFS adaption, hindcast, and skill assessments
- Model adjustments, calibration, and enhancements
- Application of HEFS in hypothetical reservoir operations
- Identification of potential FIRO paradigms

Skills of Inflow Hindcasts relative to climatology

Brier Skill Score

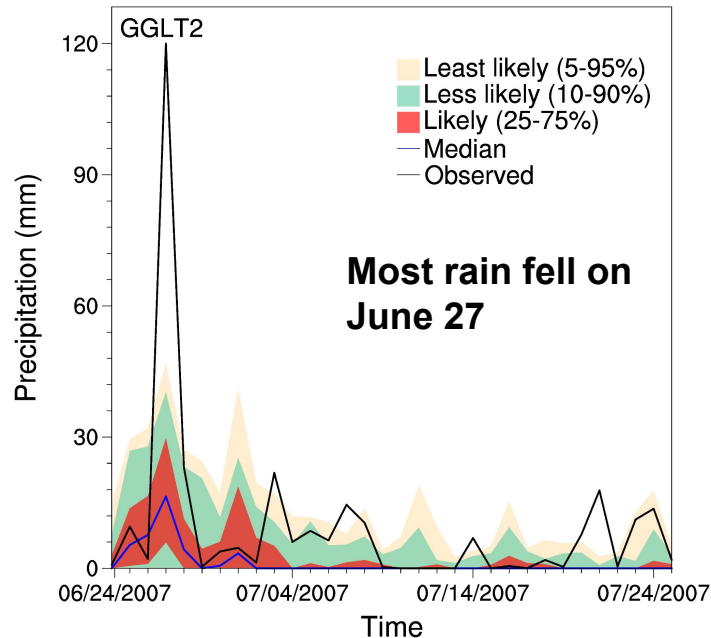
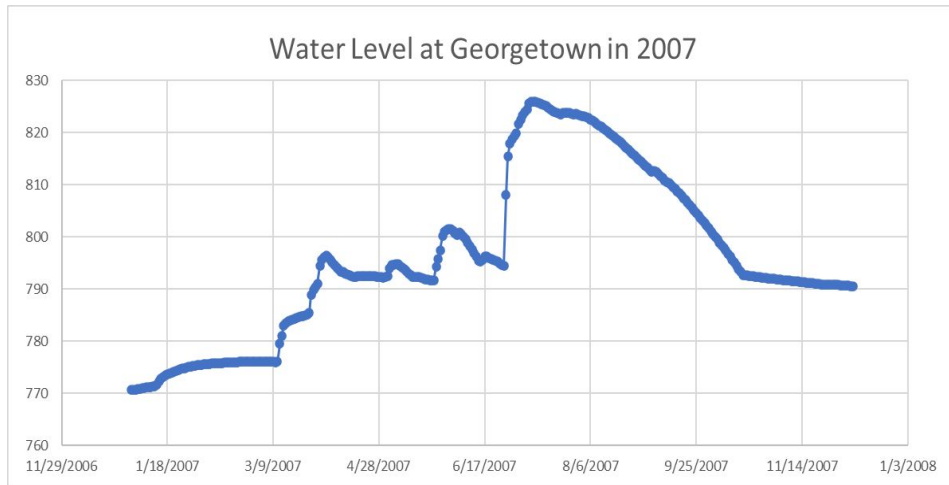


Low flow: skills lower than or comparable to climatology.

High flow: more skillful than climatology to 16 days

Impactful Events with Low Predictability

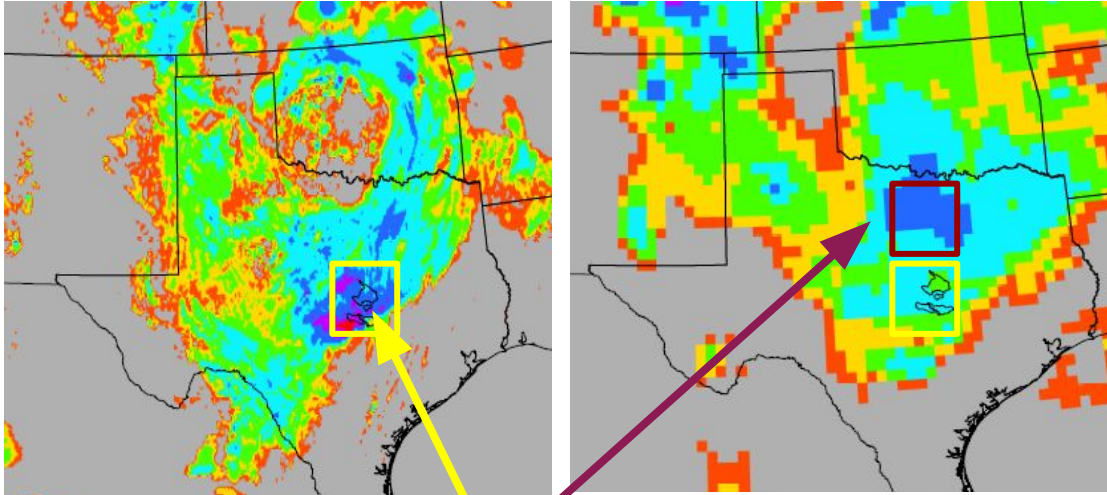
June-July 2007 Flood



Impactful Events with Low Predictability

Observed (MPE)

GEFSv12 Reforecast



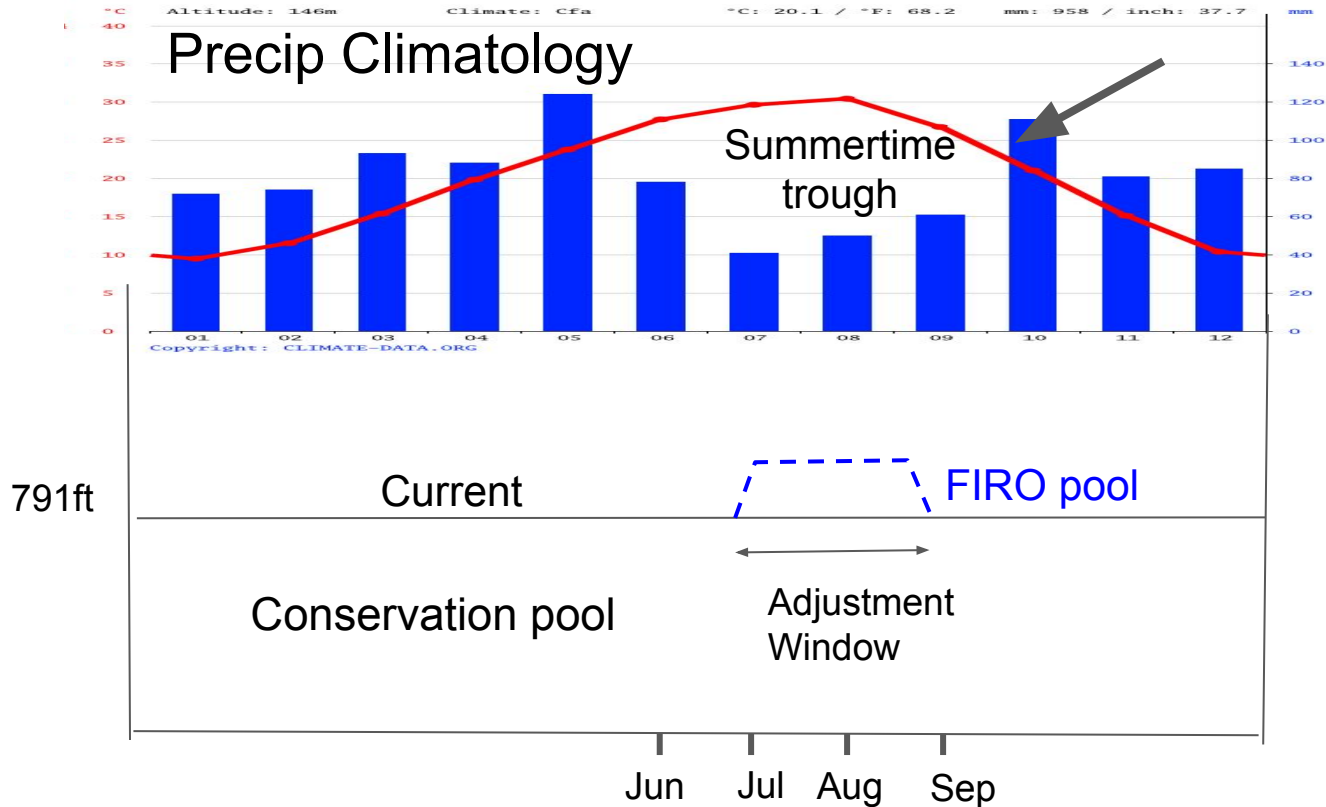
**GEFSv12 reforecast
valid on 6/27 foretells
the event 3 days ahead**

**Forecasted rainfall center
off by hundred miles**

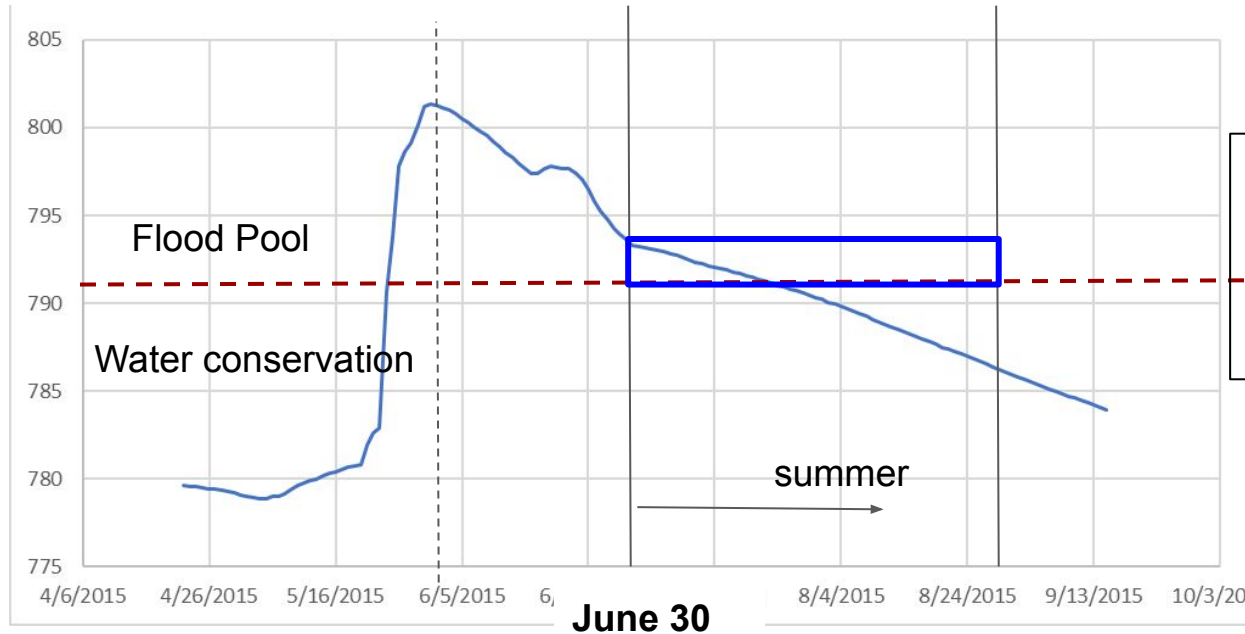
A First Look at FIRO Strategies

- Several options available
 - Climatology-based
 - Climatology-based, forecast informed
 - Forecast-informed

Potential of Seasonal Guide Curve



Case Study: Water Year 2015 at Lake Georgetown



Most of inflow occurred in May; switch to seasonal curve results in a small **storage gain**.

Odds of Success

- If we can tolerate max of 10 ft of water in flood pool

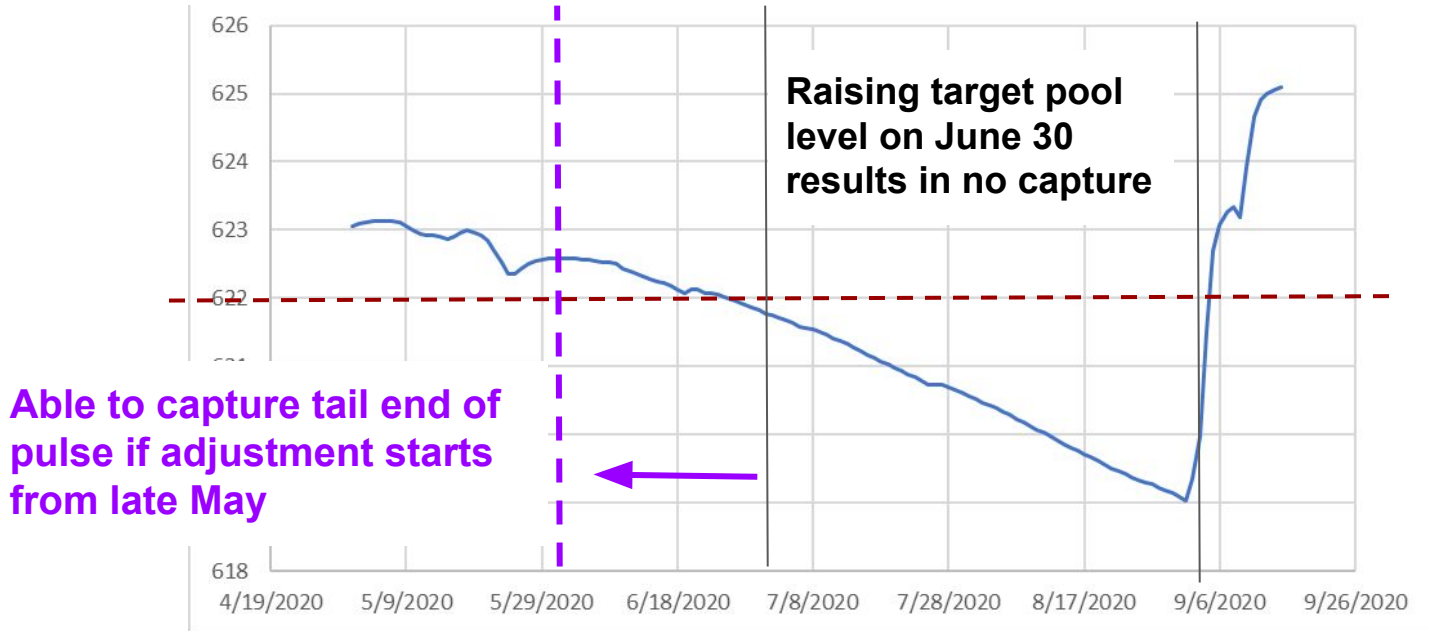
Reservoir	Georgetown	Stillhouse
Total # of years	43	52
Years w/ successful capture	10	26
Years w/ capture but elevated flood risk	1	0

- **About 1/4 to 1/2 of years with additional storage**
- **None to small increase in flooding risk**
- **More effective for Stillhouse Hollow**

How forecasts come into play

- There are still a few years when heavy rain fell in summer
 - 2002 summertime storms
 - Forecast may guide proactive release from FIRO pool
 - Alleviate concerns of flooding or flood pool storage
- Render flexibility in start/end dates for FIRO pool
 - Earlier transition to summer guide curve if late spring/early summer is forecasted to be dry with high confidence

Case Study: Stillhouse Hollow 2020



Next Steps

- Improve HEFS skills for impactful events
 - Leverage HEFS testbed by Physical Science Lab and NWC
 - Coordinate w/ NWS GEFSv13 onboarding/hindcasts
- Further FIRO analysis
 - Estimate storage gain through adopting seasonal guide curve
 - Examine potentials of alternative, forecast-driven strategies
- Expand partnership with other water suppliers to formulate FIRO paradigms