Climate-Based Operational Forecasting

Application to Tarrant Regional Water District's Planning Model

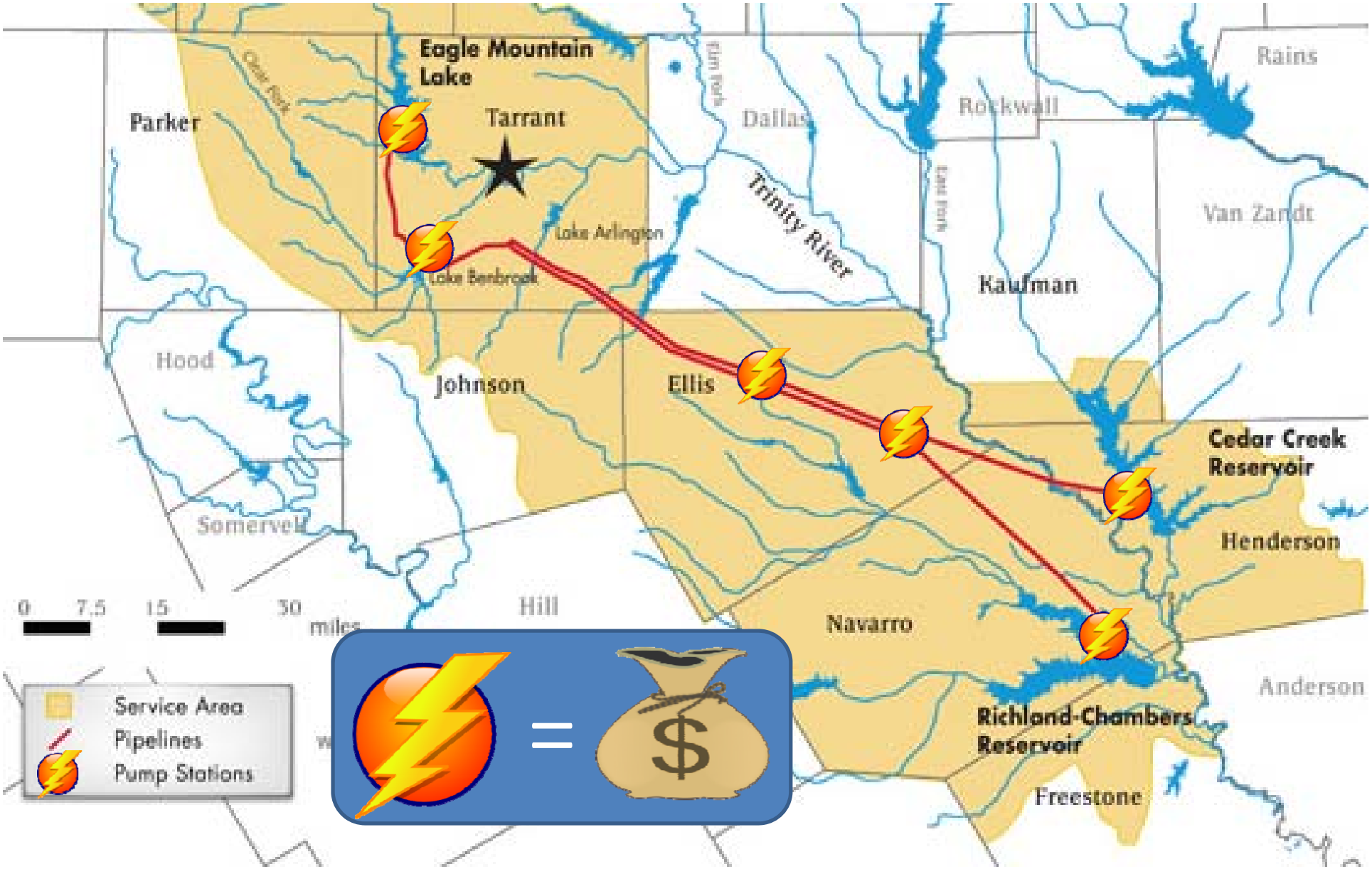
trwd

Hydros Consulting

Presentation Outline

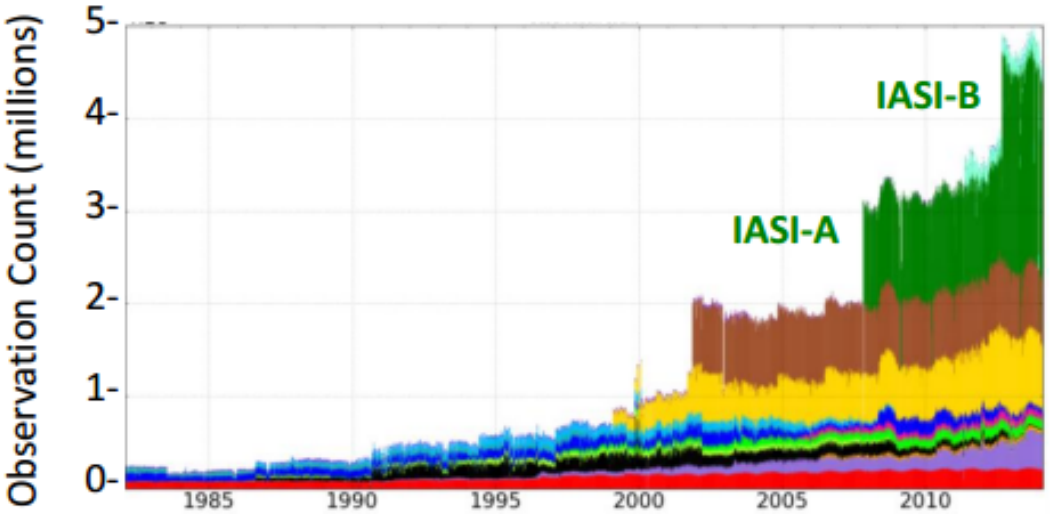
- TRWD Water Supply System
- Climate Data
- Forecasting Method
- RiverWare Implementation
- Results
- Example Scenario

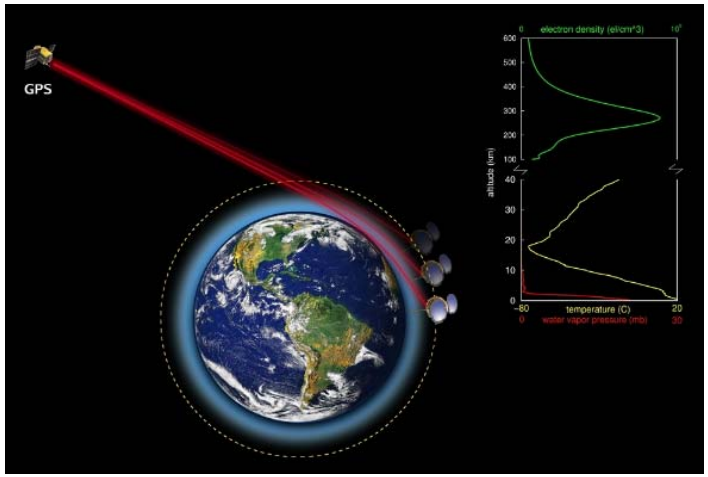
Tarrant Regional Water District



Climate Reanalysis Data

- MERRA-2 Data from NASA
  - Monthly Data (~70,000,000 Data Points)
  - Temperature, Relative Humidity, Pressure, Wind Speed
  - “Assimilated” Observations from Ground, Air & Space



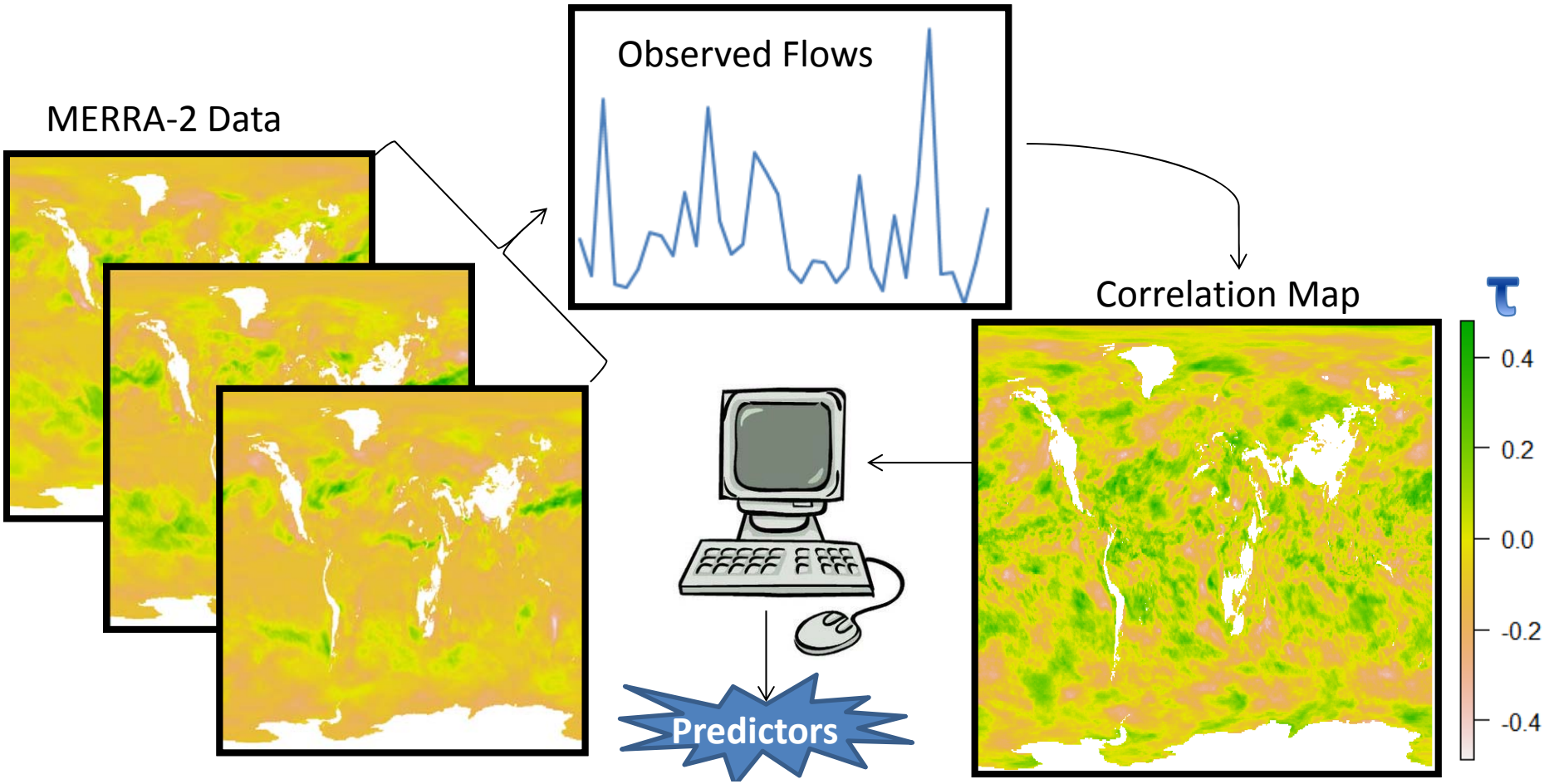


Example: GPS Occultation

Image Sources: NASA Global Modeling and Assimilation Office & UCAR COSMIC

Predictor Selection Example

- June Climate Data -> Predict August Flow
  - Forecast Date ~ July 15th
- Example: 900 mb Covariance of Zonal Wind (E-W) and Relative Humidity



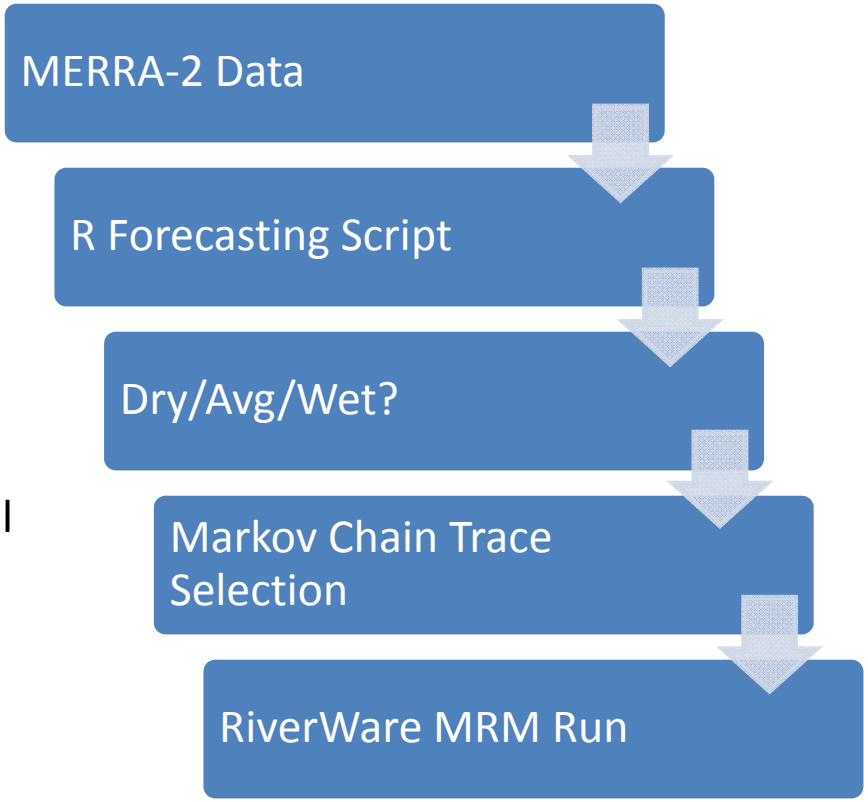
Example Predictor

Attribute	Predictor -> “Polar Vortex”
Location	Above Eastern Coast of Greenland
Level	Troposphere
Variable	Covariance of Zonal Wind (W->E+) & Humidity
Hypothesis	Weakened Polar Vortex Causes Jet Stream to “Buckle” -> Wet Summer

Image Source: Google Earth

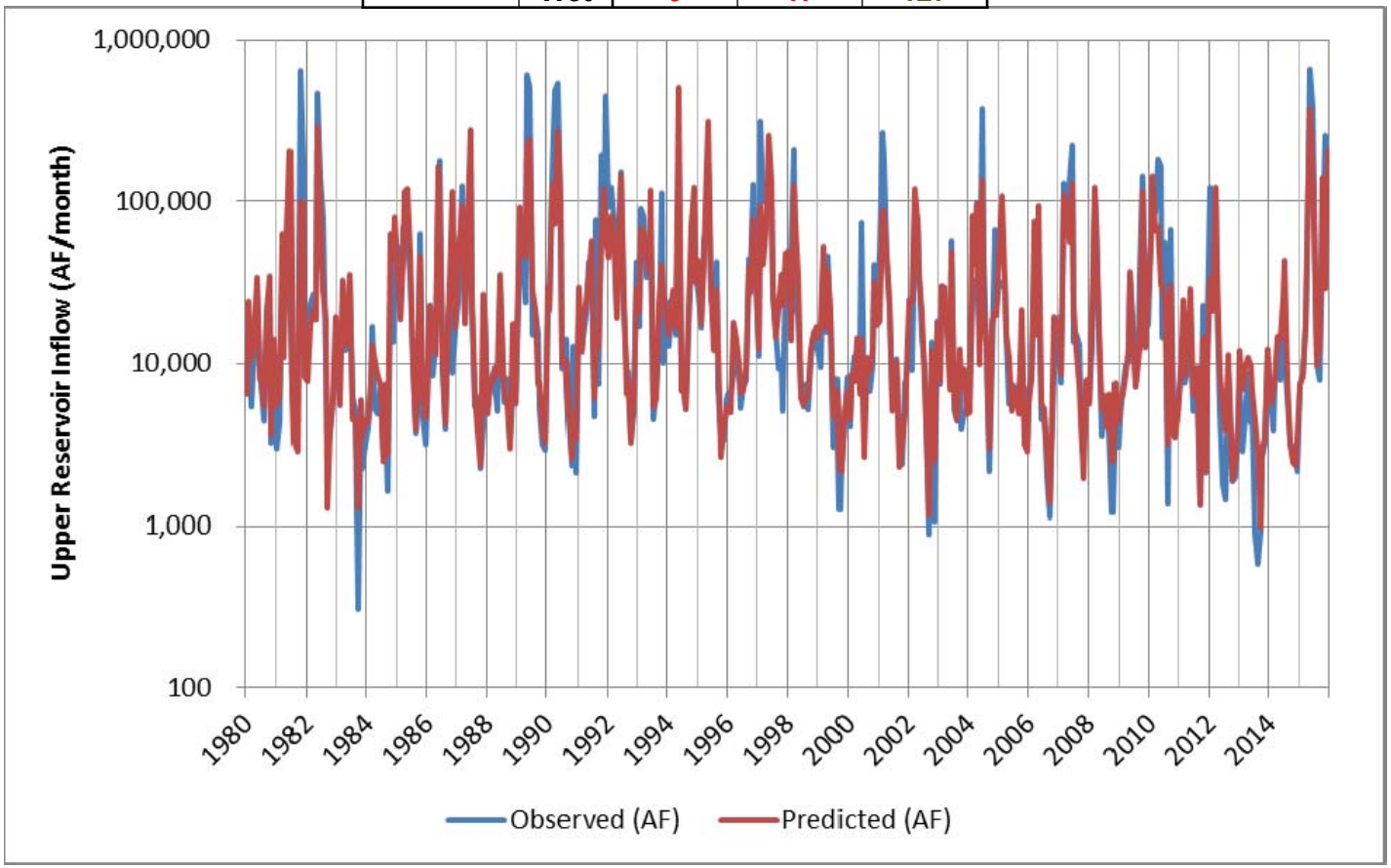
RiverWare Implementation

- R-script Generates Forecast
  - Dry, Avg, or Wet
  - Starting Climate State for Simulation
- Select Set of 100 Markov Chain Traces
  - Observed Data Resampled
  - Historical Transition Probabilities
  - Simulate in RiverWare Planning Model
- Review Results



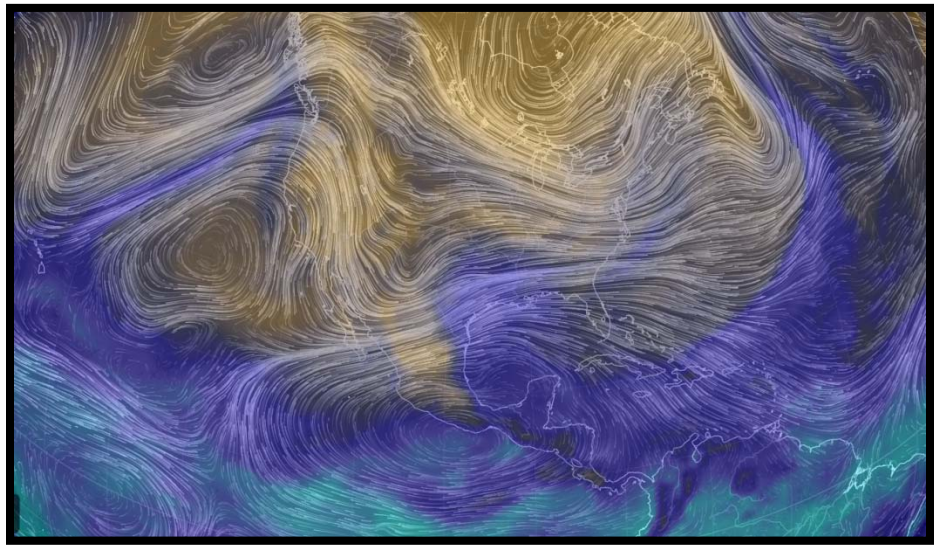
Results

Contingency Table		Predicted		
		Dry	Avg	Wet
Observed	Dry	143	1	0
	Avg	2	114	28
	Wet	0	17	127

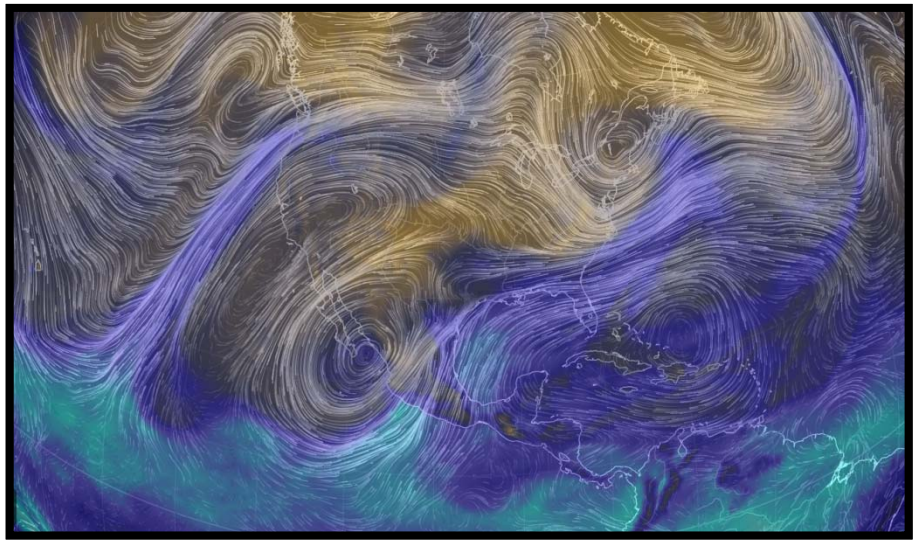


Example Scenario

- Scenario: April 2015 -> Predicting May Flow Using March Data



[March 2014](#) *7,500 AF*

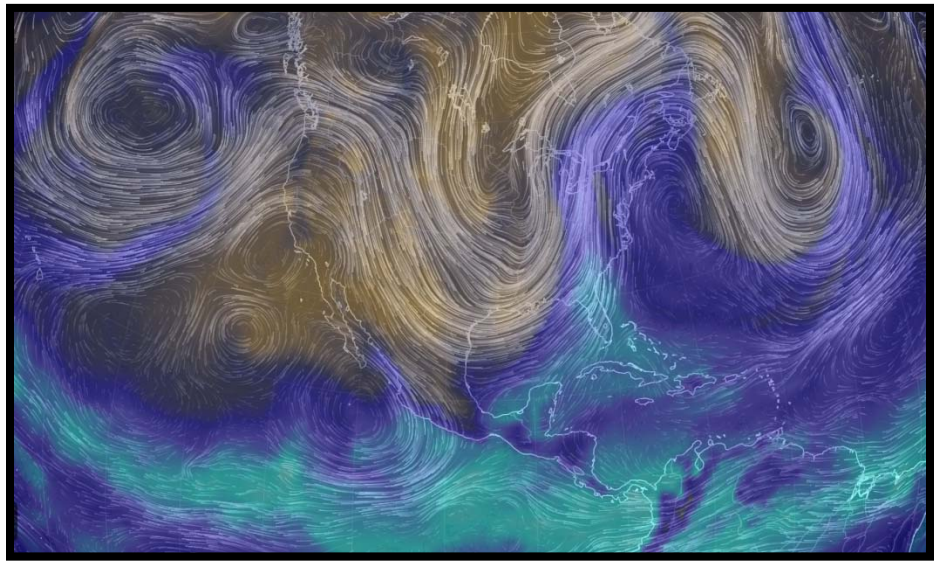


[March 2015](#) *18,000 AF*

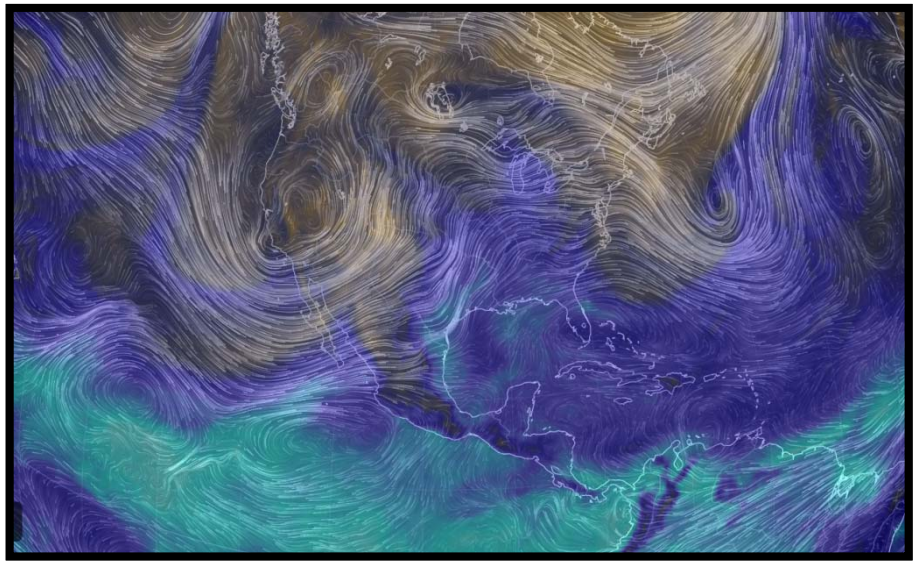
Image Source: Earth.Nullschool.Net (Cameron Beccario)

Example Scenario

- Scenario: April 2015 -> Predicting May Flow Using March Data
  - March 2015 Flow ~ 2x March 2014 Flow
    - March 2015 = Dry
  - May 2014 Was Historically Dry (Lots of Pumping)
    - 2x May 2014 = Dry
  - Purchase Power for Pumping?
    - No, Prepare for Flood Control



May 2014 *7,800 AF*



May 2015 ***650,000 AF***

Image Source: Earth.Nullschool.Net (Cameron Beccario)