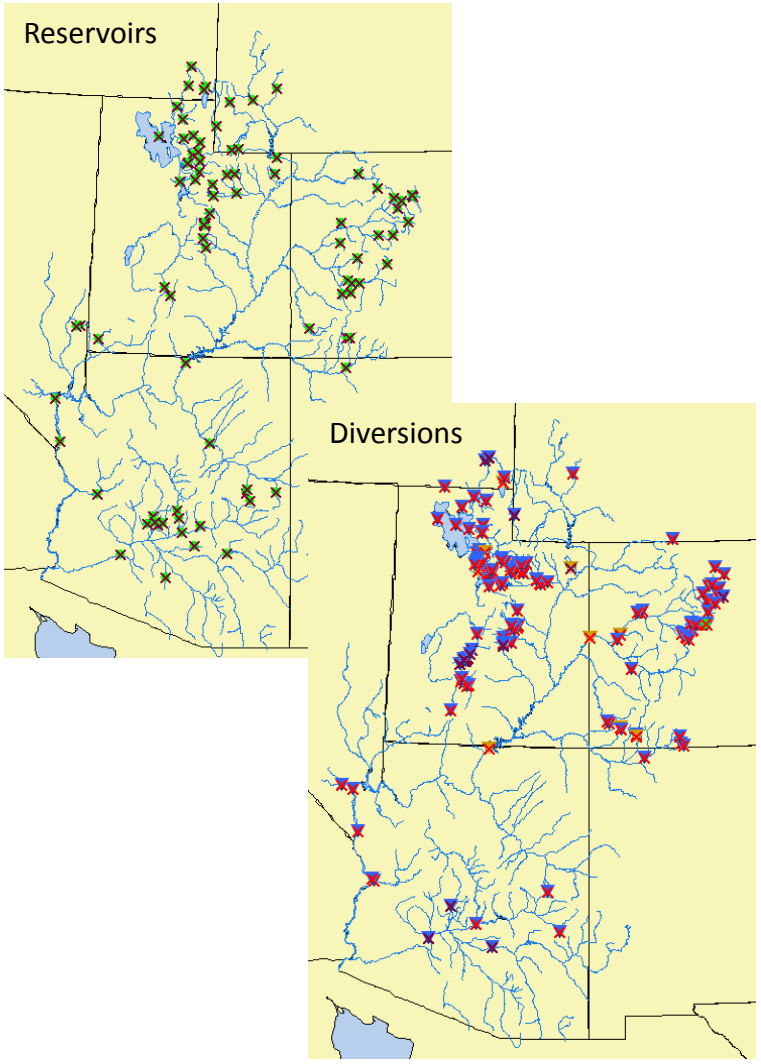
Reservoir and Diversion Data

CBRFC Stakeholder Forum

July 31, 2012

Model Data

- There are ~90 reservoirs and over 150 diversions included in our hydrologic model.
  - We calibrate the model to ‘natural’ flow.
  - Historical reservoir and diversion data is used to calculate the natural flow.
  - Real time reservoir and diversion data is needed to simulate and forecast the observed river flows.
  - We model reservoir inflow, outflow and pool elevation.
- There are unknown reservoirs and diversions we cannot account for explicitly.
  - Consumptive Use operations; determined through calibration process.



Data Collection

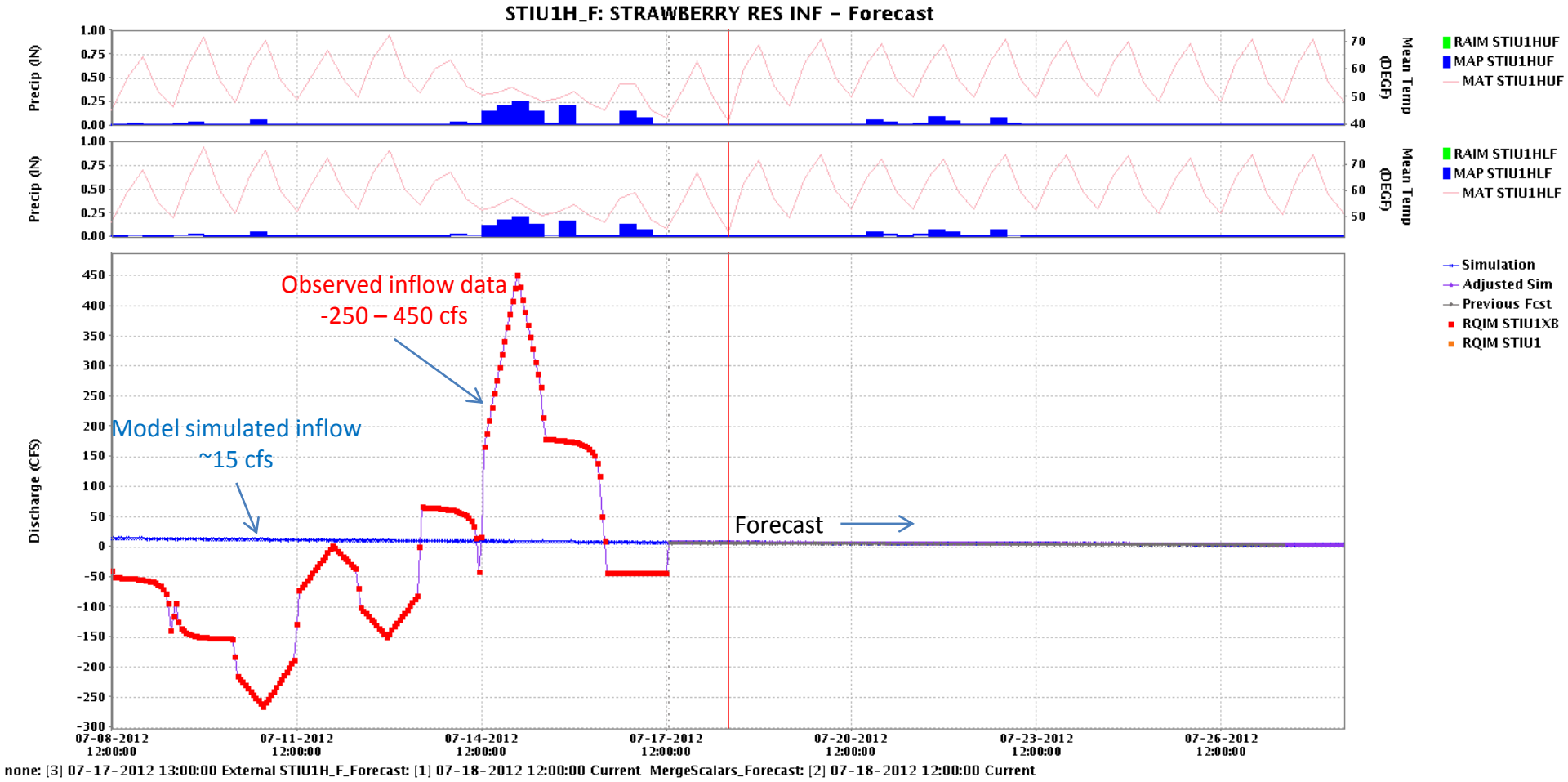
- Sources
  - FTP
  - Email
  - Websites / Web Services
  - Satellite (GOES DCP)
- Providers
  - USBR – Salt Lake City, Provo, Loveland
  - Pacificorp
  - Denver Water
  - Central Utah WCD
  - Many other water groups

- Methods
  - We write programs to parse whatever format is available to us – it varies by source/provider and it just needs to be consistent.
  - Many of these programs run automatically, especially the ones that pull data from websites.
  - When there is a change in format or website location it takes a lot of work for us to find it and fix it.

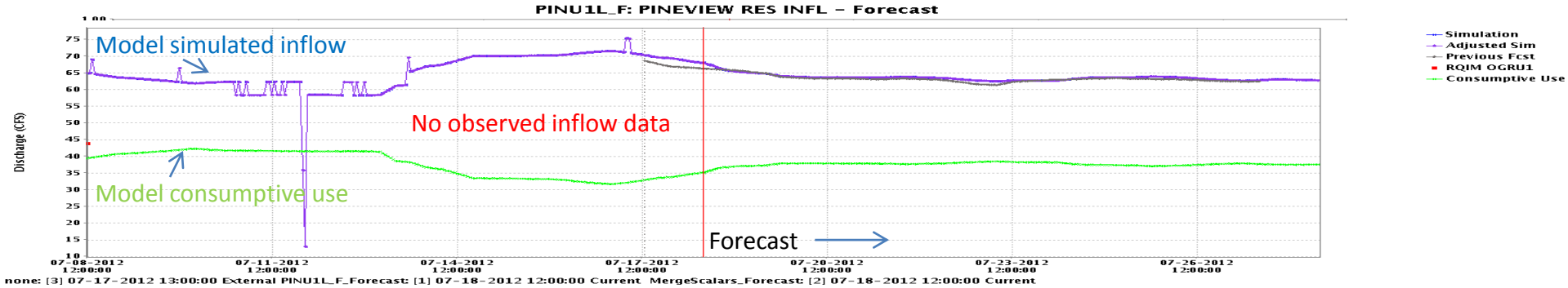
Observed Data Needs

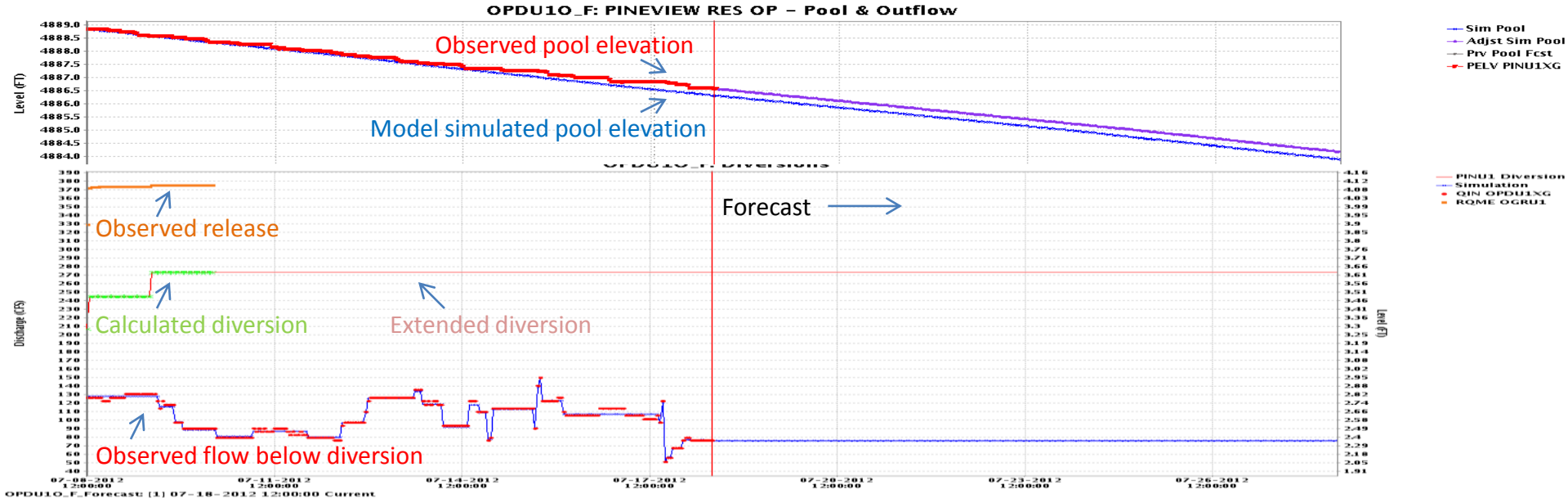
- Availability of good real time observed data is essential to our forecasting efforts.
  - We compare (and adjust as needed) current modeled reservoir states and river flows to observed data in order to produce more accurate forecasts.
  - Missing or bad data makes it difficult to determine current conditions, which leads to lower quality forecasts.
- Accurate meta data also needed.
  - Reservoirs:
    - Elevation-storage curves.
    - Spillway curves.
    - Critical reservoir levels (i.e. spillway, passflow elevations).
    - General operating criteria.
  - Diversions:
    - Maximum capacities.
    - Minimum in-stream flow requirements.

Bad Data


STIU1H_F: STRAWBERRY RES INF - Forecast
Precip (IN)
Mean Temp (DEGF)
RAIM STIU1HUF
MAP STIU1HUF
MAT STIU1HUF
RAIM STIU1HLF
MAP STIU1HLF
MAT STIU1HLF
Discharge (CFS)
Simulation
Adjusted Sim
Previous Fcst
RQIM STIU1XB
RQIM STIU1
Observed inflow data
-250 – 450 cfs
Model simulated inflow
~15 cfs
Forecast
07-08-2012 12:00:00
07-11-2012 12:00:00
07-14-2012 12:00:00
07-17-2012 12:00:00
07-20-2012 12:00:00
07-23-2012 12:00:00
07-26-2012 12:00:00
none: [3] 07-17-2012 13:00:00 External STIU1H_F_Forecast: [1] 07-18-2012 12:00:00 Current MergeScalars_Forecast: [2] 07-18-2012 12:00:00 Current

Missing Data



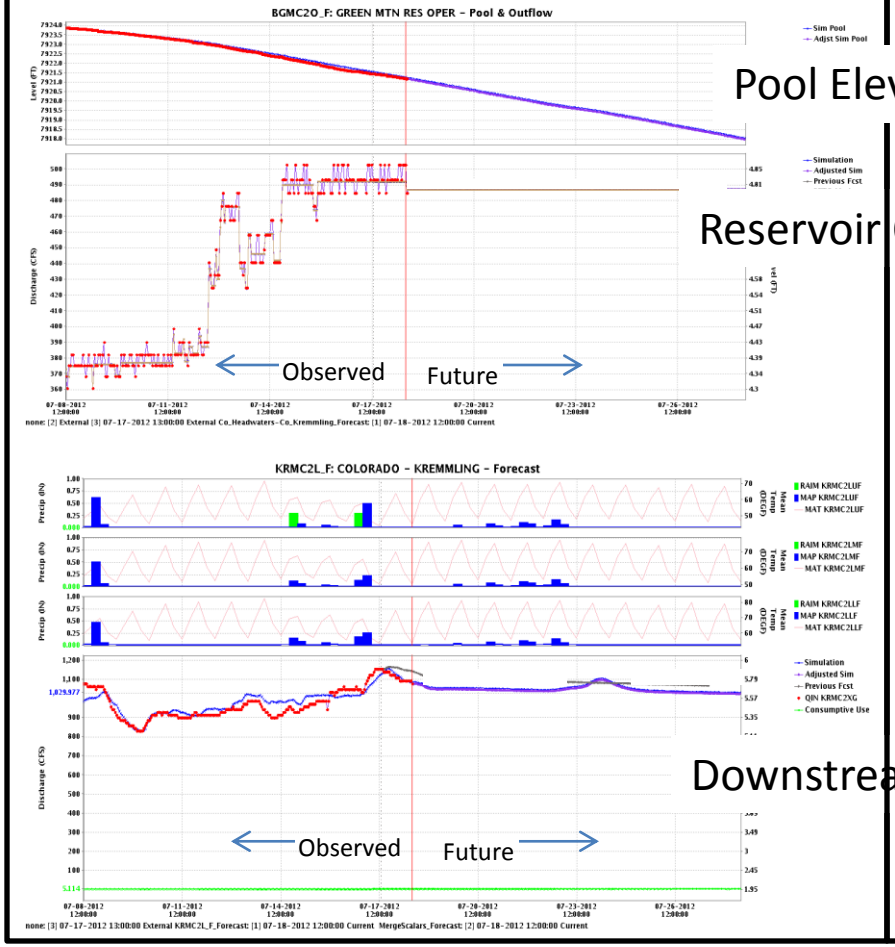


Future Data – Short Term

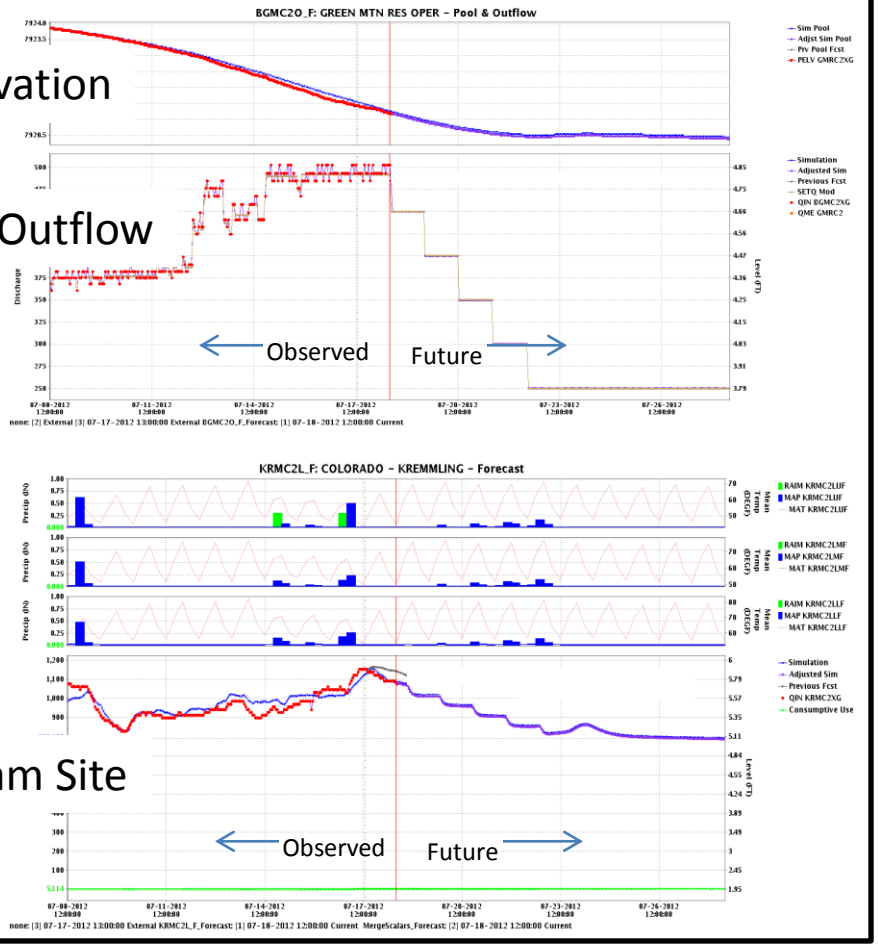
- Short term (~10 day) reservoir release schedules and diversion plans help with daily forecasting.
  - We assume current releases will remain constant if we have no other information (unless spilling).
  - Especially important when reservoir is getting close to spill, but reservoir operations are planned to avoid/reduce spill.
    - Our forecasts will show big rises downstream due to expected spill.
  - Assume either current diversion levels or constant flow left in the river – determined by best guess of forecaster.

Daily Forecasts – Releases

No Release Schedule

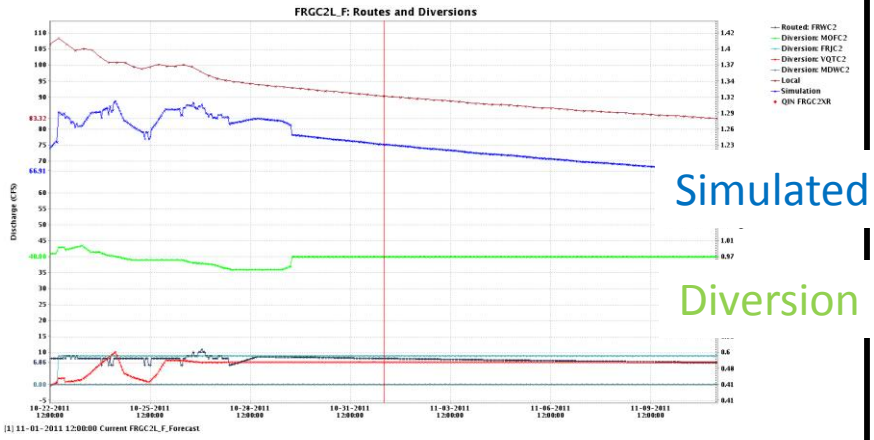


Release Schedule



Daily Forecasts – Diversions

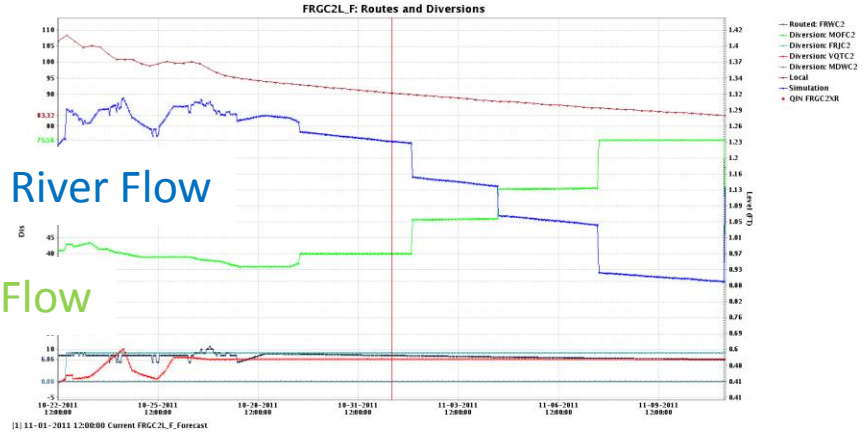
Steady Diversion



Simulated River Flow

Diversion Flow

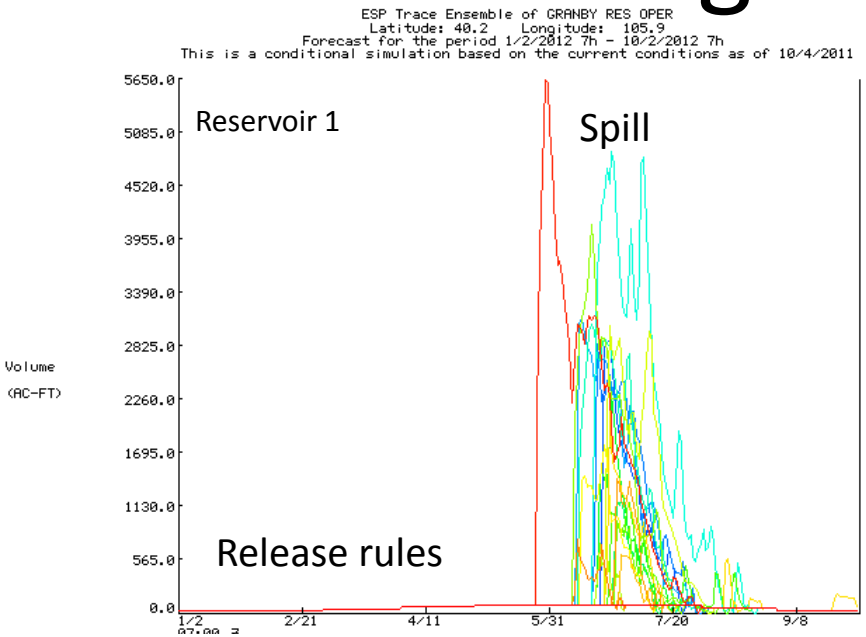
Changing Diversion

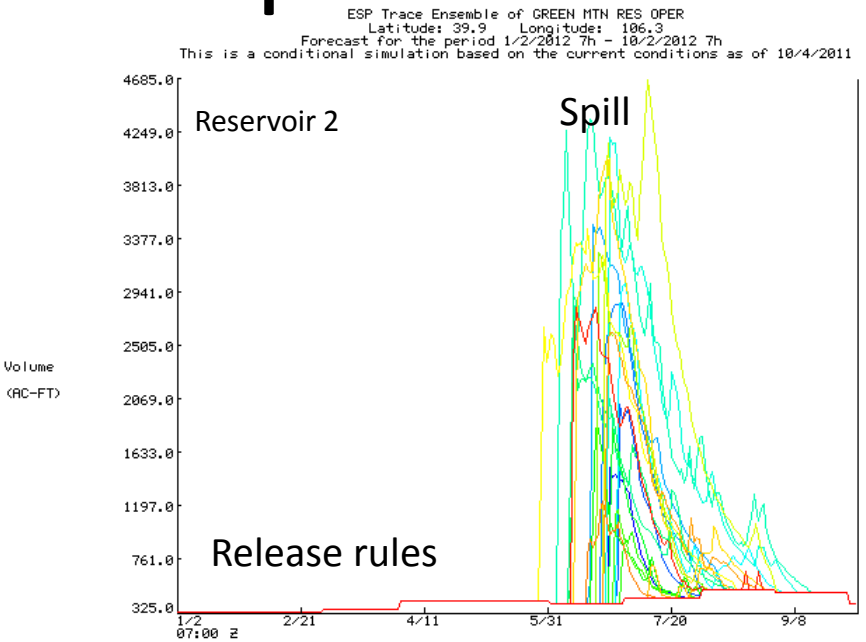


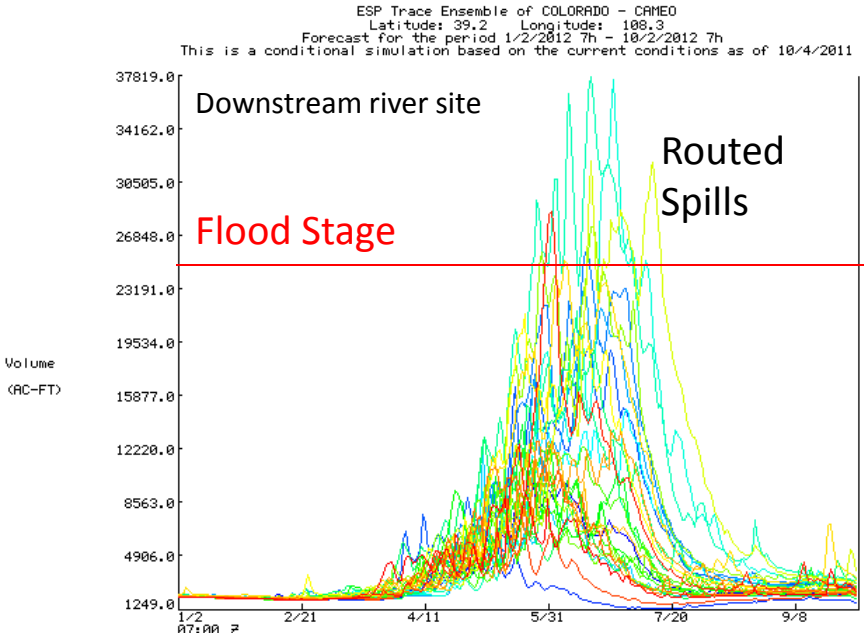
Future Data – Long Term

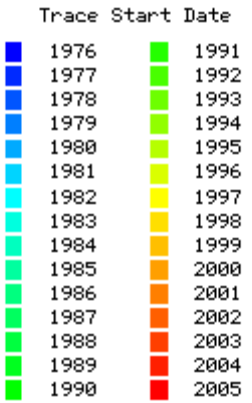
- Long term reservoir plans can help with long lead peak flow forecasts and river flow outlooks.
  - General reservoir operating rules for any year.
    - Regulated ESP uses ‘rules’ written into our model to determine reservoir releases; these are usually based on either the reservoir elevation or the time of year.
  - Early season (~Jan-Mar) outlook leading up to the snowmelt runoff season for the current year.
    - Will allow our model to have better initial reservoir levels for the start of the runoff.
    - When rules kick in beyond planned releases, results will be more reasonable for spill conditions.

Regulated Esp









Summary – What We Need

- Accurate real time observed data for reservoirs and diversions.
  - Make sure our starting conditions are correct.
- Short term (~10 day) reservoir release schedules and diversion plans.
  - Help with daily forecasting.
  - Especially important when reservoir is getting close to spill, but reservoir operations are planned to avoid/reduce spill.
- Long term reservoir plans.
  - Help with long lead peak flow forecasts and river flows (e.g. CROS).
  - Plans for early season (~Jan-Mar) leading into runoff season.
- Updated reservoir information.
  - Latest storage and spillway curves.
  - Critical elevations.
  - Information that would help refine our model rules.