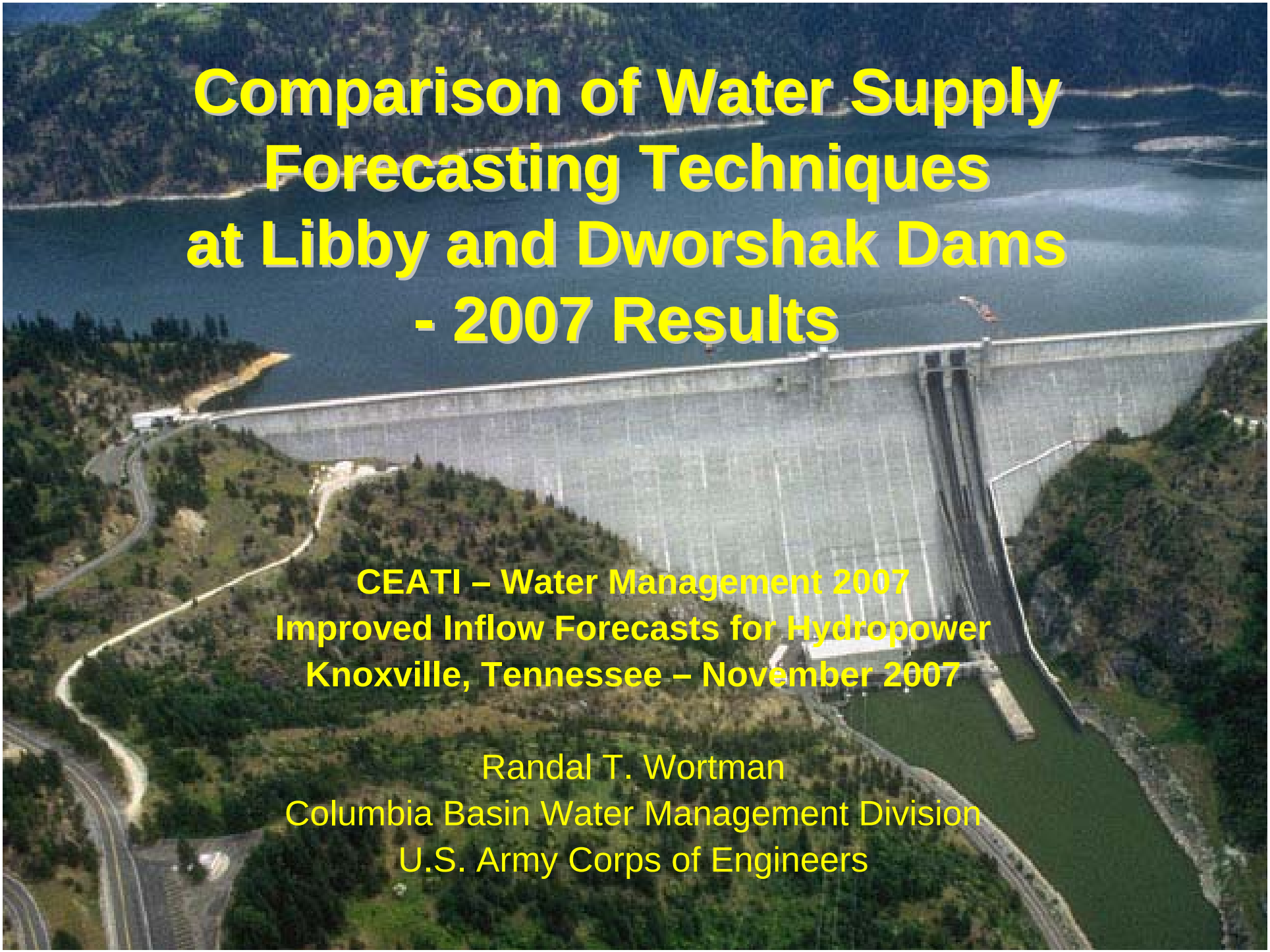
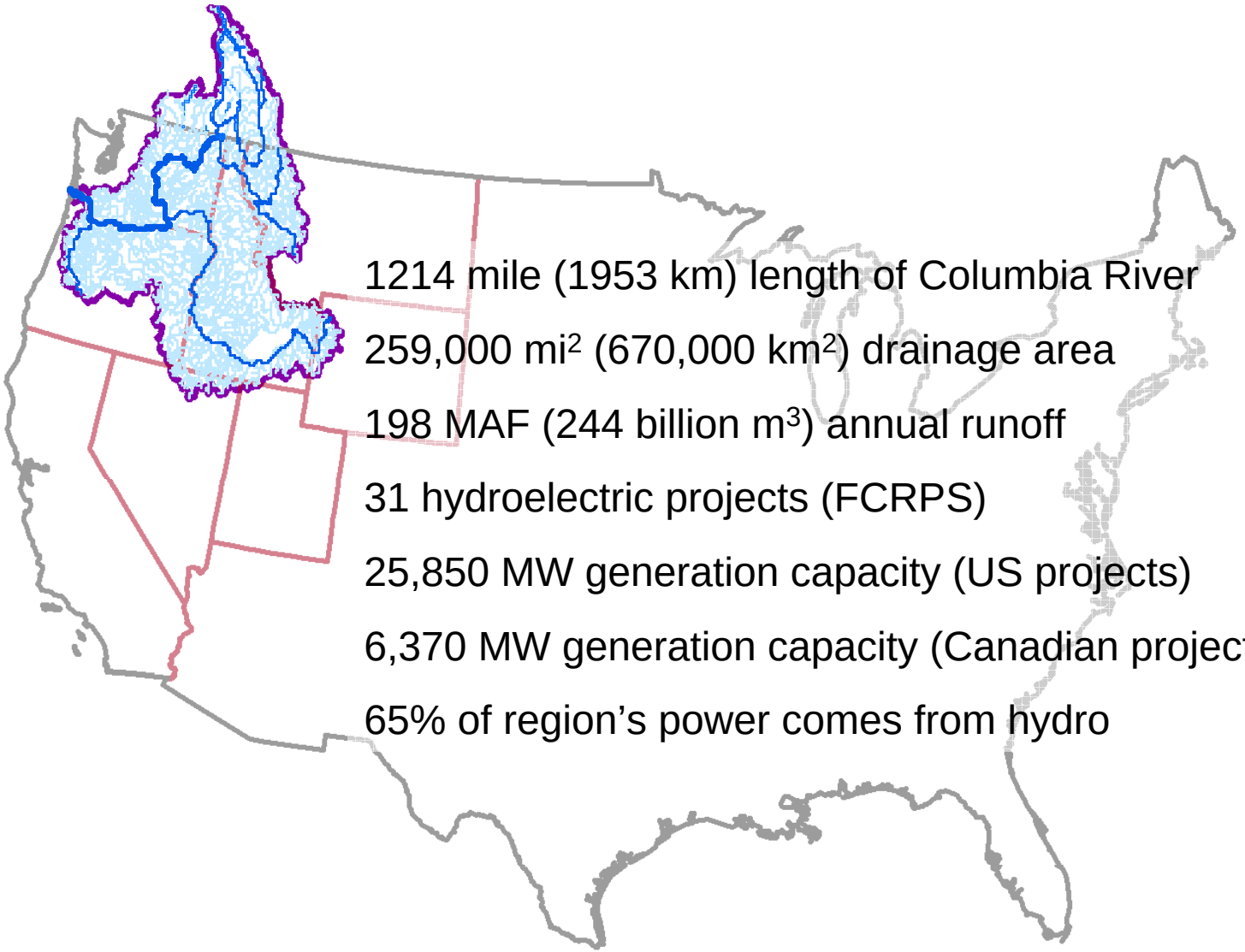


Comparison of Water Supply Forecasting Techniques at Libby and Dworshak Dams - 2007 Results

CEATI – Water Management 2007
Improved Inflow Forecasts for Hydropower
Knoxville, Tennessee – November 2007

Randal T. Wortman
Columbia Basin Water Management Division
U.S. Army Corps of Engineers

Columbia River Basin



1214 mile (1953 km) length of Columbia River

259,000 mi^2 (670,000 km^2) drainage area

198 MAF (244 billion m^3) annual runoff

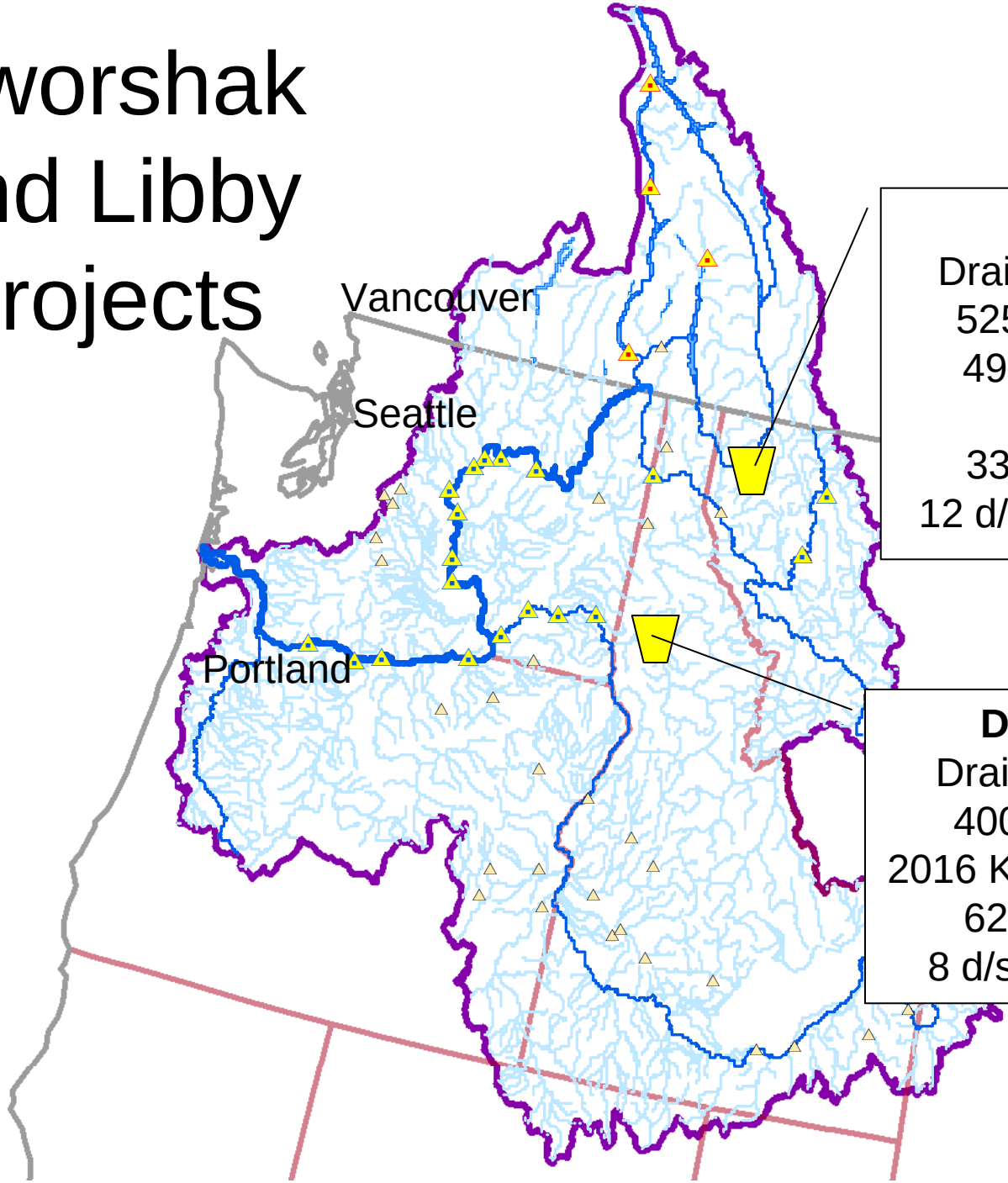
31 hydroelectric projects (FCRPS)

25,850 MW generation capacity (US projects)

6,370 MW generation capacity (Canadian projects)

65% of region's power comes from hydro

Dworshak and Libby projects

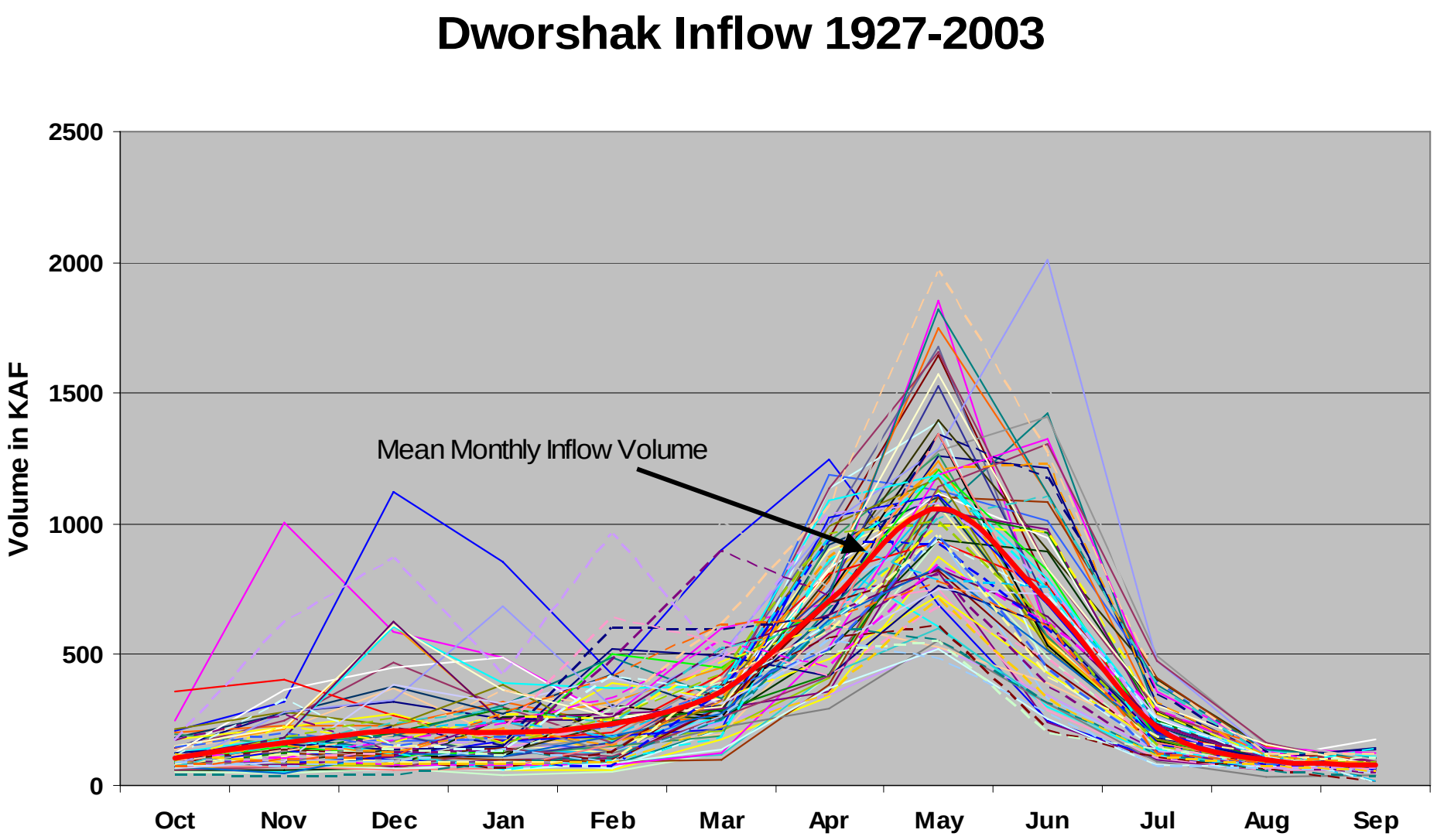


Libby, MT
Drainage=8985 mi^2
525 MW capacity
4980 KAF active storage
337 ft max head
12 d/s power projects

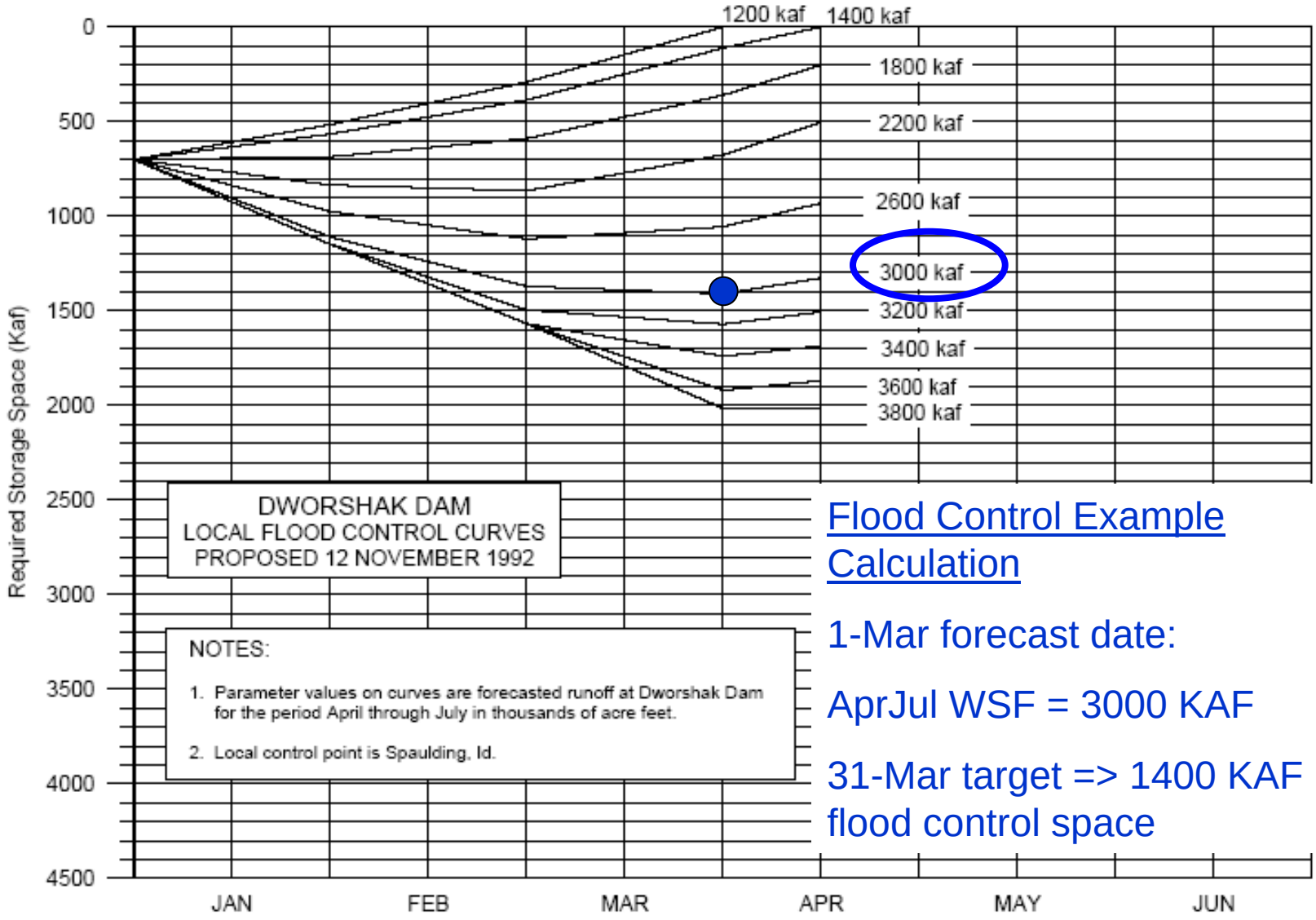
Dworshak, ID
Drainage=2440 mi^2
400 MW capacity
2016 KAF active storage
627 ft max head
8 d/s power projects

Dworshak, Idaho

Seasonal Flow Characteristics



Water Supply Forecasts -> Monthly Flood Control Draft Targets



[Flood Control Example Calculation]

1-Mar forecast date:

AprJul WSF = 3000 KAF

31-Mar target => 1400 KAF flood control space

Dworshak Water Supply Forecasts

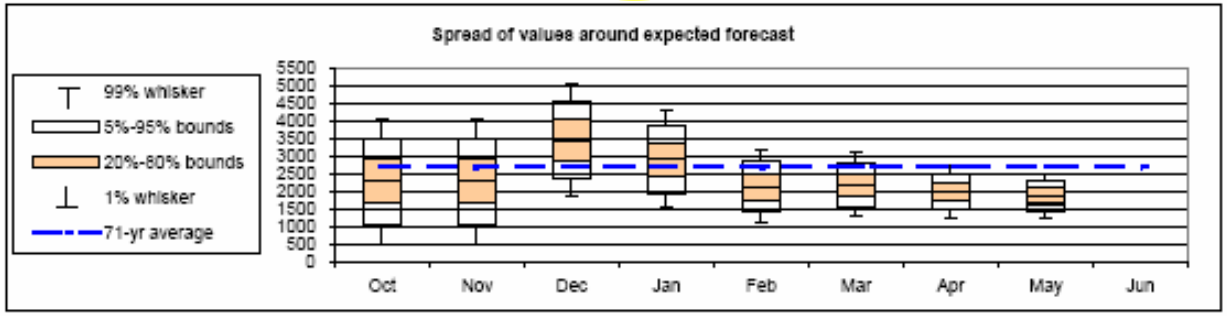
Corps of Engineers Monthly Forecasts Dec 2006 – May 2007

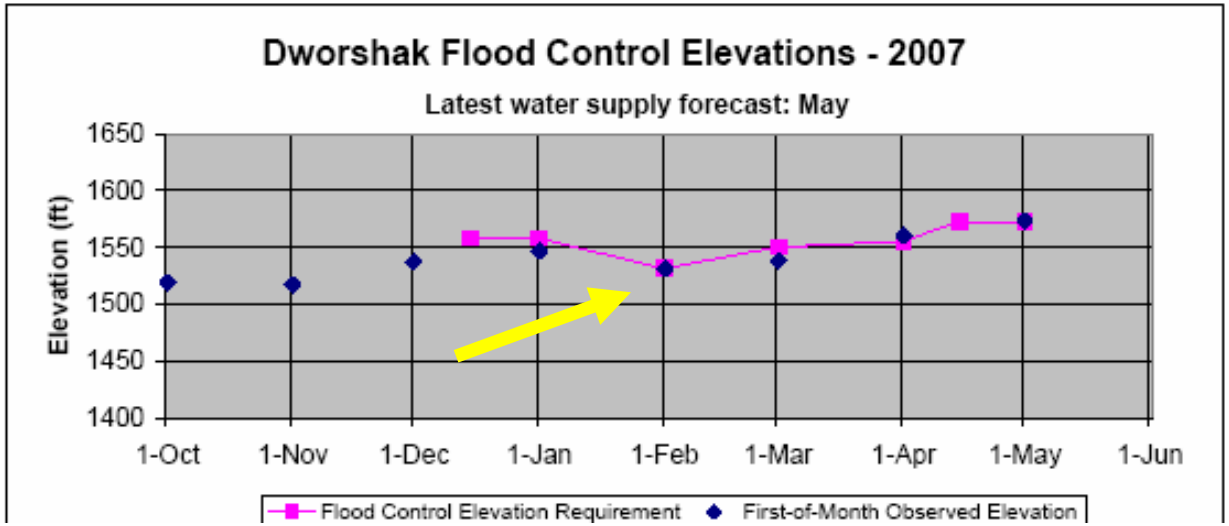
Dworshak : May Runoff Forecast & Flood Control Calculation **WY 2007**

Runoff Forecast and Flood Control				1929-1999 Average	Percent of Average
Most Probable Runoff Volume	Apr-Jul	1868	KAF	2683	70%
	May-Jul	[illegible]	KAF	1980	66%

Seasonal Flood Control (assumes no shift of flood control space to Grand Coulee)

Forecast Date>>	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Apr-Jul Runoff Forecast	2283	2283	3465	2905	2126	2192	1982	1868	
First-of-Month Elev	1519.51	1517.31	1537.71	1546.94	1531.2	1538.2	1560.67	1573.42	
Date >>		15-Dec	31-Dec	31-Jan	28-Feb	31-Mar	15-Apr	30-Apr	
Flood Control Space	--	700	700	1078	814	742	479	479	
Flood Control Elevation	--	1558.2	1558.2	1531.4	1550.4	1555.4	1572.6	1572.6	

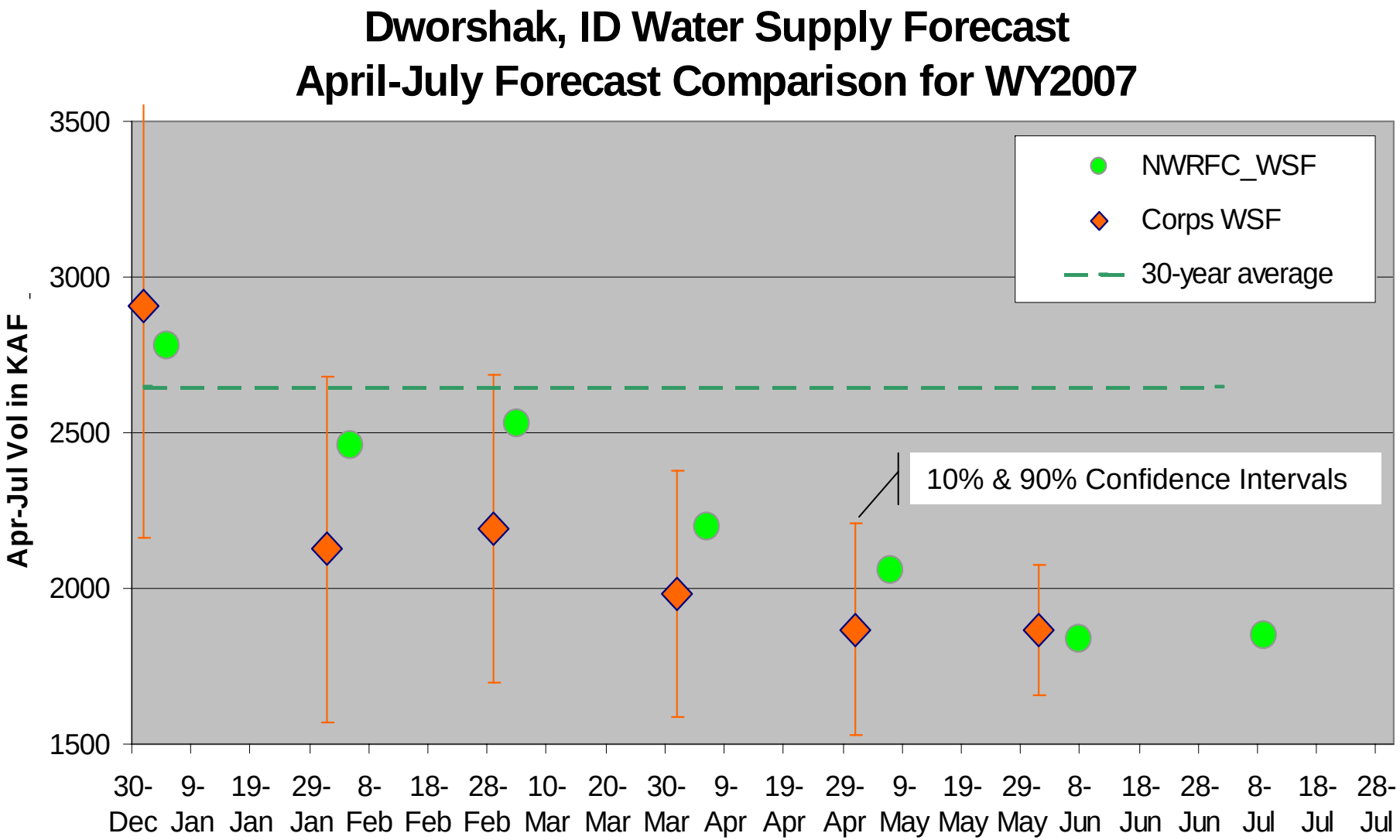


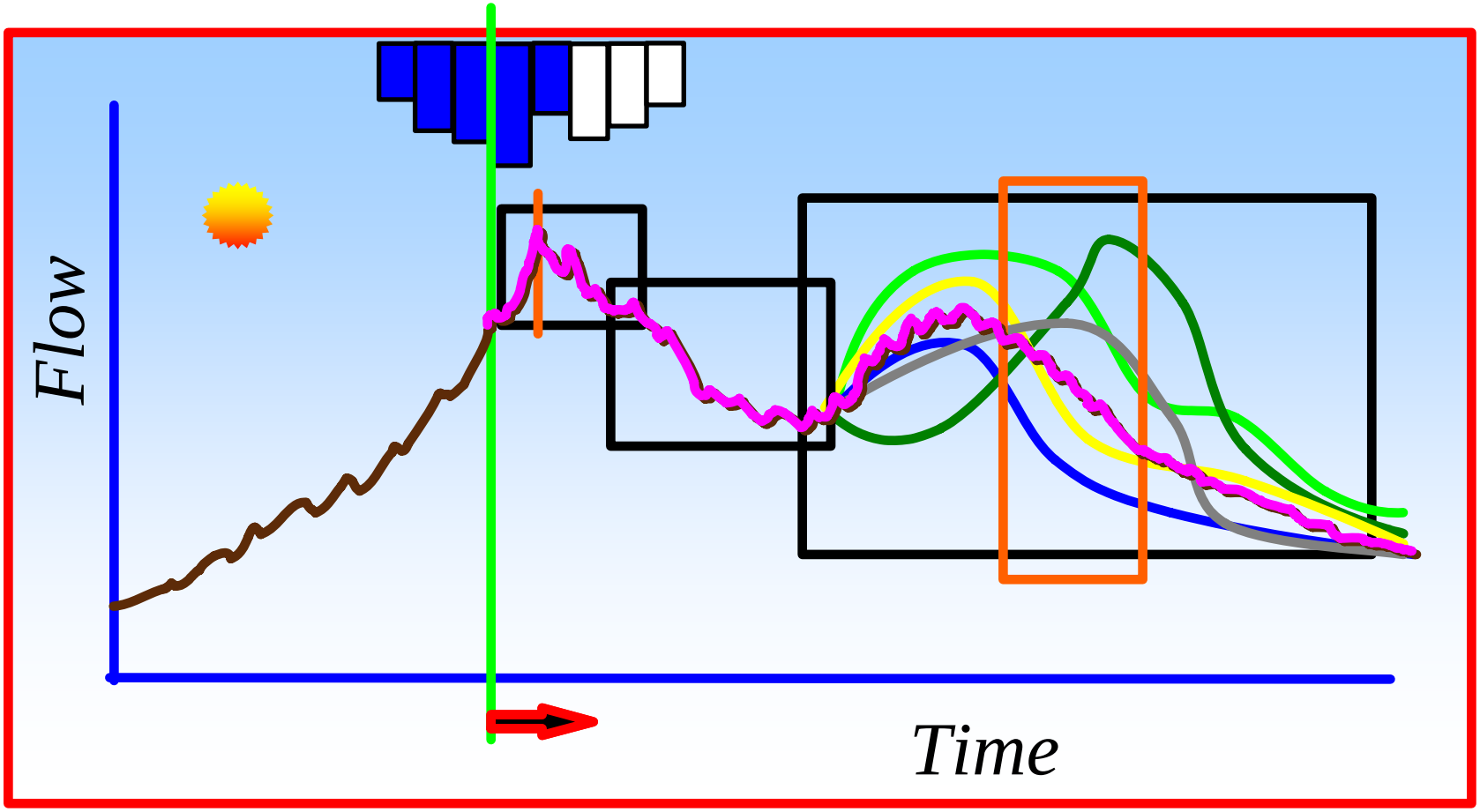


Available Water Supply Forecasts

- Monthly
  - Regression on Precipitation & Snow Index Variables (Northwest River Forecast Center-NWRFC)
  - Principal Component Regression on SOI, Precipitation, Snow (Corps of Engineers)
- Weekly/Bi-weekly Forecasts
  - 45 ESP forecasts using current conditions (soil moisture, snow), current 10-day temp & precipitation forecast, and 45 years of subsequent historic temp & precipitation (NWRFC)
  - Average of 45 values in current ESP forecast (Corps)
- Daily Forecasts
  - PC Regression using SNOTEL (Natural Resources Conservation Service, National Water & Climate Center – NRCS NWCC)

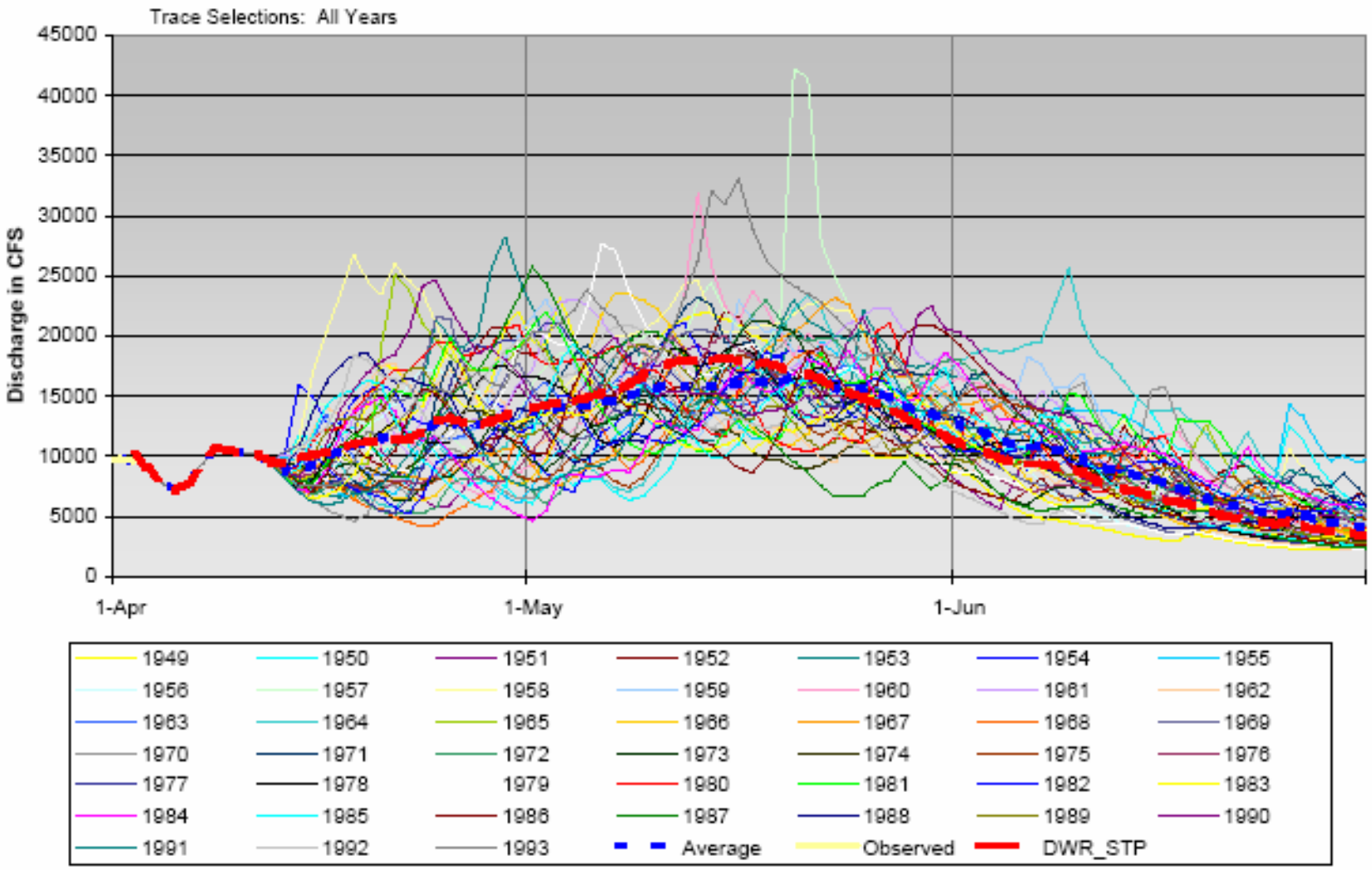
Monthly Regression Forecasts



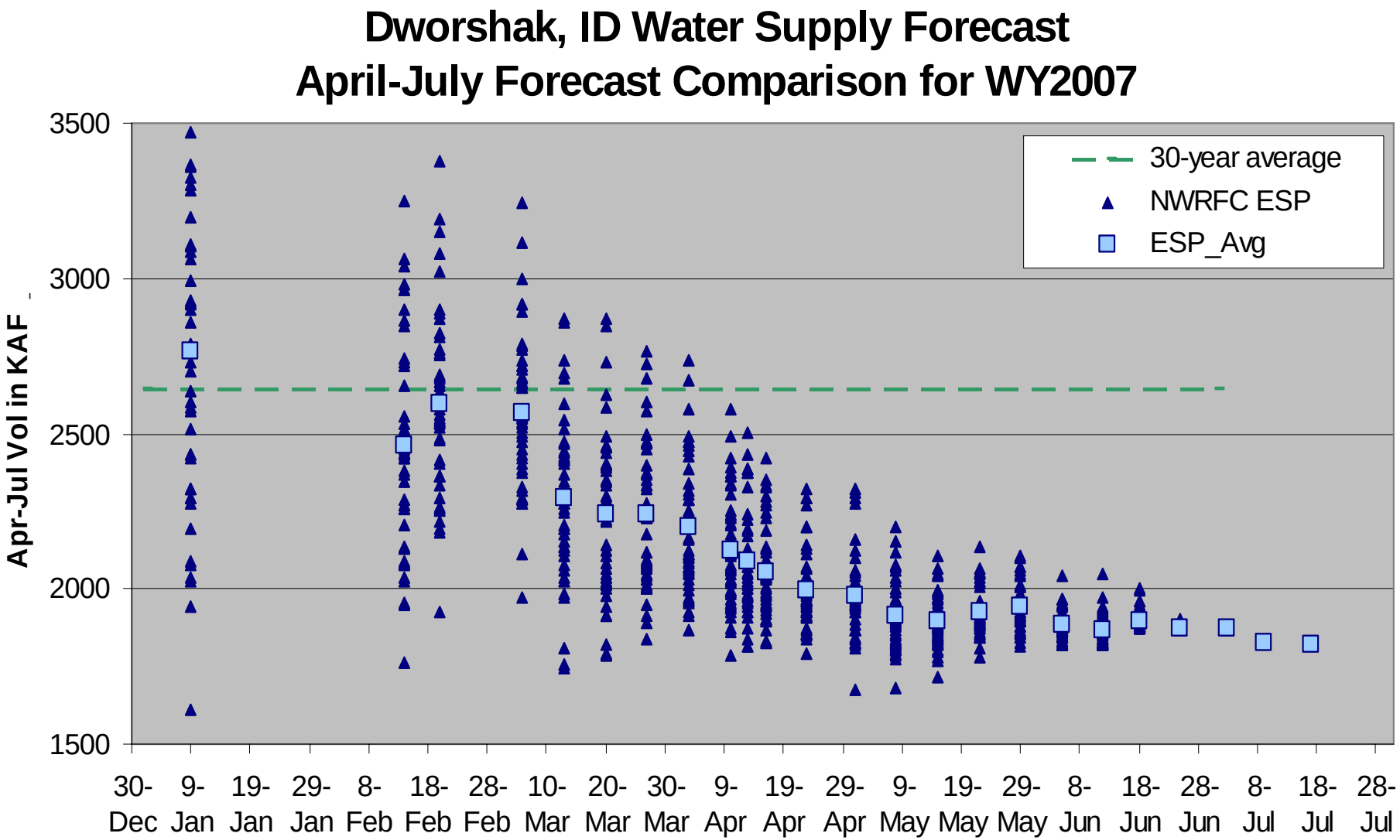

Flow
Time

Weekly ESP Forecast

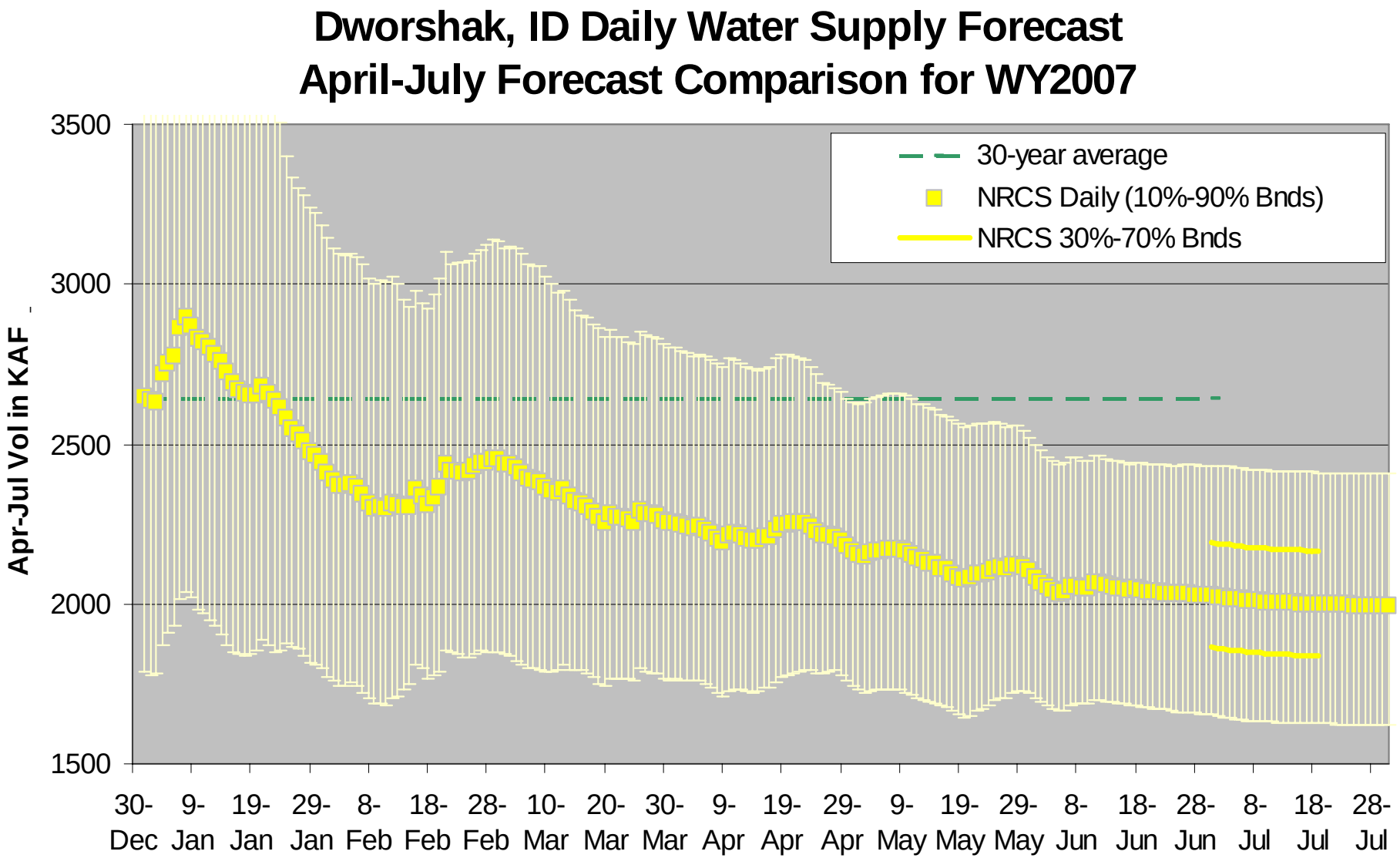
Dworshak ESP traces for 3 Apr 2007



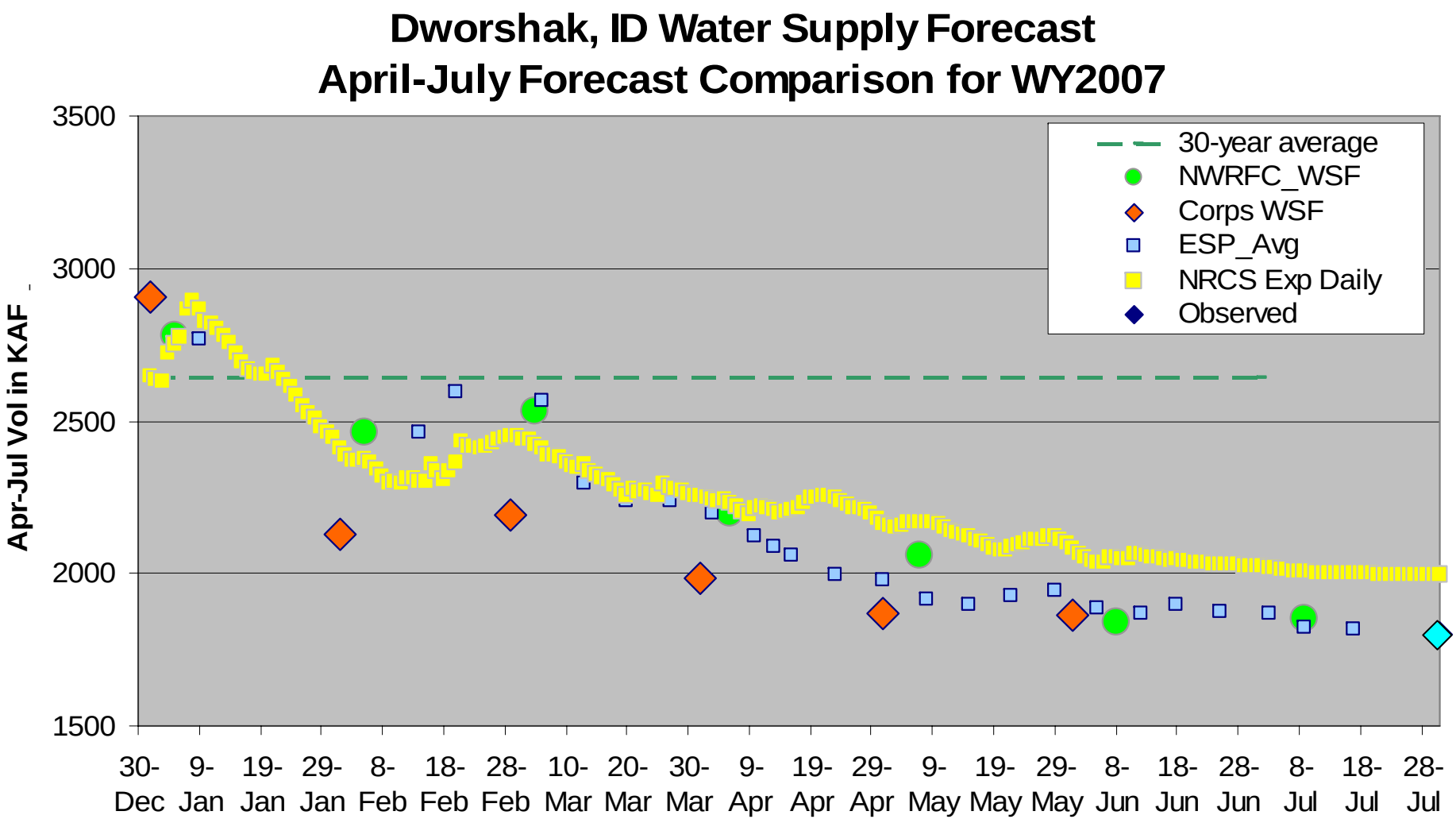
Weekly ESP Forecasts



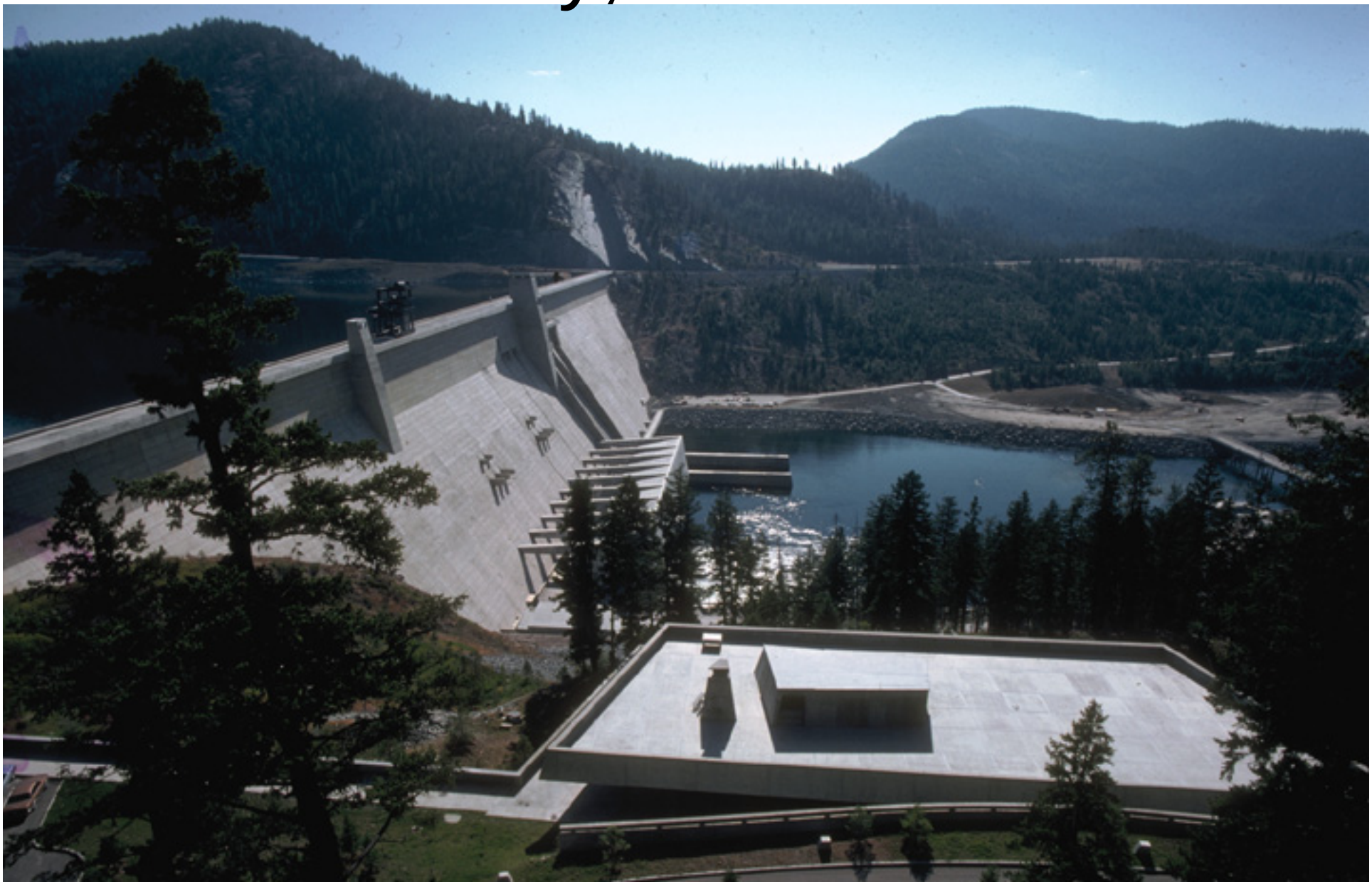
Daily Regression Forecasts



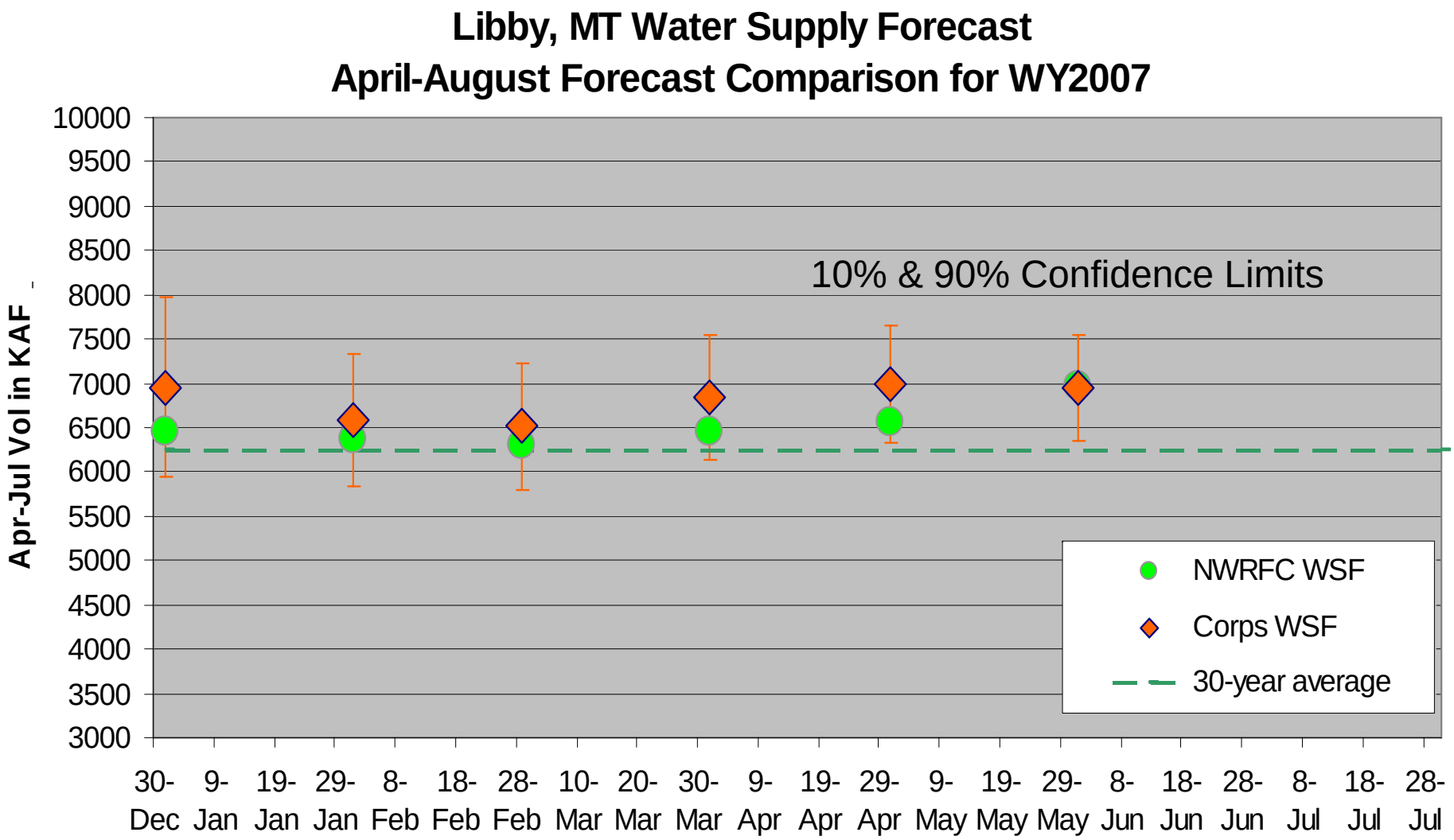
All 2007 Forecasts



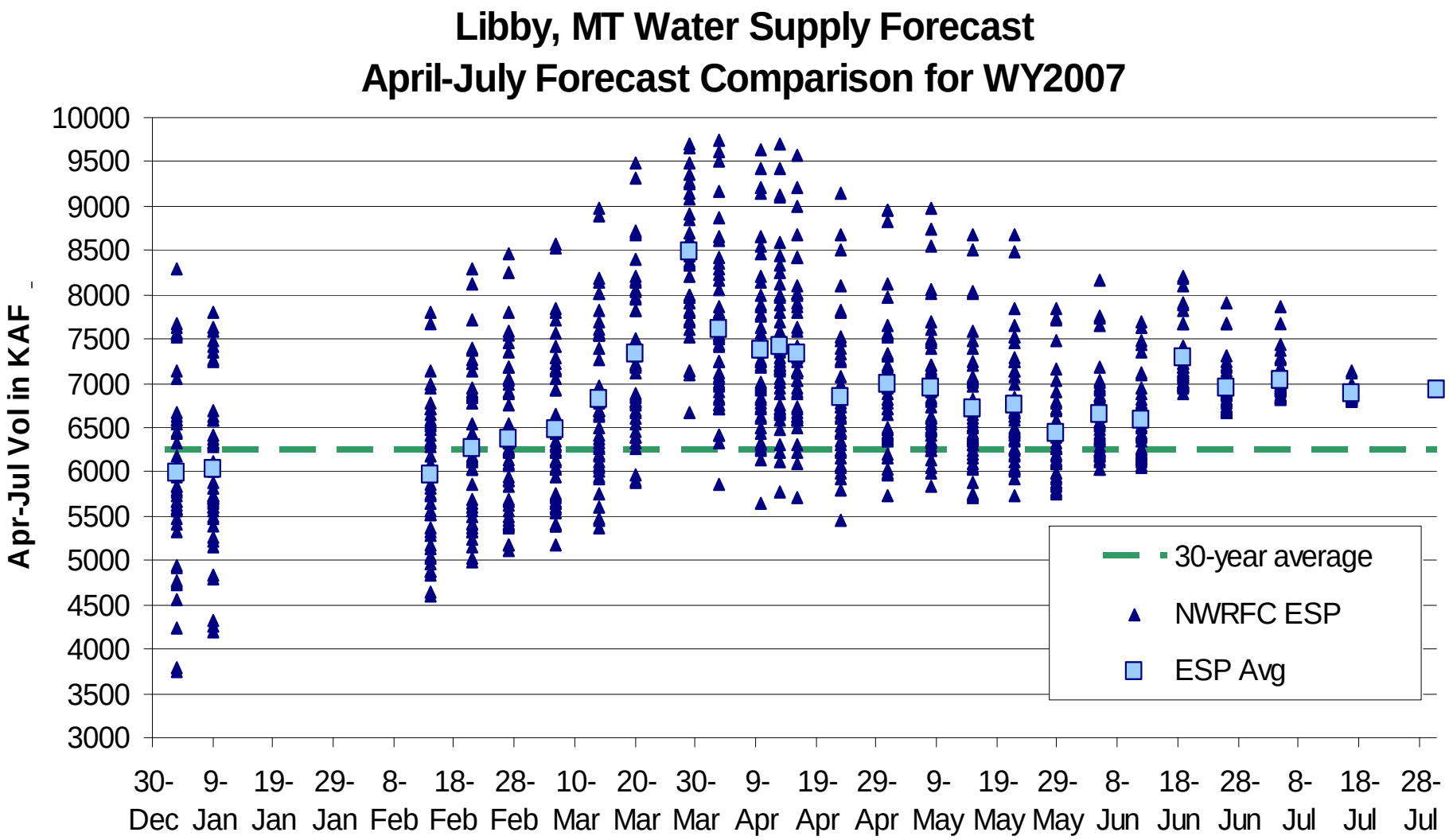
Libby, Montana



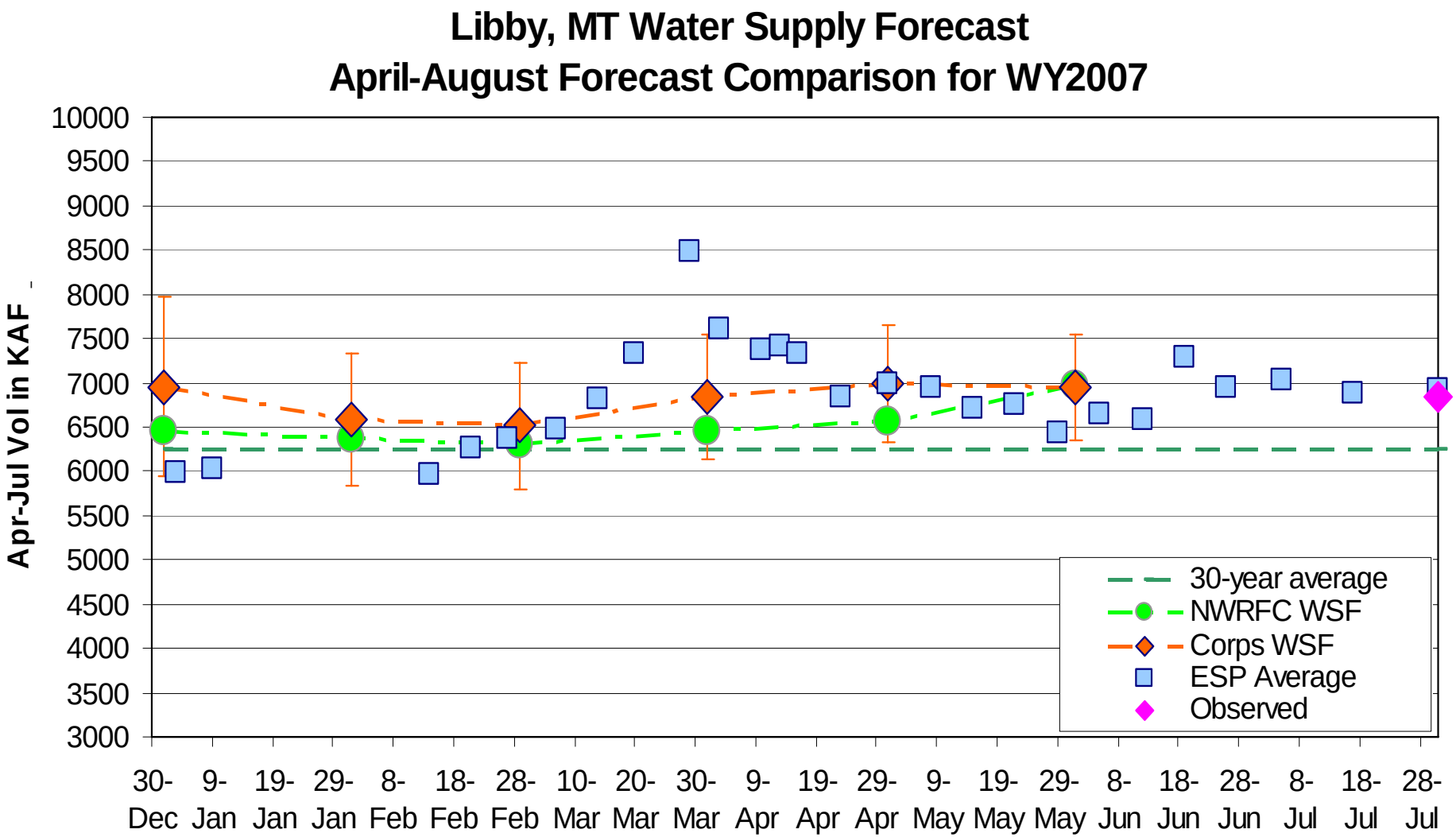
Monthly Regression Forecasts



Weekly ESP Forecasts



All 2007 Forecasts



Conclusions

(based on very limited samples!)

- Through 1-April, monthly regression models meet or exceed other techniques
- Through 1-May, Principal Components regression out-performs standard regression on index variables (NWS technique)
- ESP forecasts are useful for providing insight into forecast variability and sensitivity.
- ESP forecasts are not yet robust enough to provide the operational forecast. ESP forecasts appear good after 1-May.
- NRCS daily forecasts using SNOTEL data appear promising, but currently display an unacceptable bias.

Data Sources

- Monthly Regression Forecasts
  - Northwest River Forecast Center
    - http://www.nwrfc.noaa.gov/wsfcst/station/wsfplot/wsfplot.cgi?DWRI1
    - http://www.nwrfc.noaa.gov/espws/station/wsfplot/wsfplot.cgi?LYDM8
  - Corps of Engineers
    - http://www.nwd-wc.usace.army.mil/report/dwrf.htm
    - http://www.nwd-wc.usace.army.mil/report/libf.htm
- Weekly/Bi-weekly ESP Forecasts
  - NWRFC (statistical summaries only)
    - http://www.nwrfc.noaa.gov/wsfcst/station/wsfplot/wsfplot.cgi?DWRI1
  - Corps (average computed from 45 ESP traces)
- NRCS daily experimental water supply forecasts based on SNOTEL data
    - http://www.wcc.nrcs.usda.gov/wsf/daily_forecasts.html