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2008 Water Supply Forecast Review

Randal T. Wortman - Portland District

Kenneth Soderlind - Northwestern Division

Columbia River Forecasting Group

Portland, Oregon

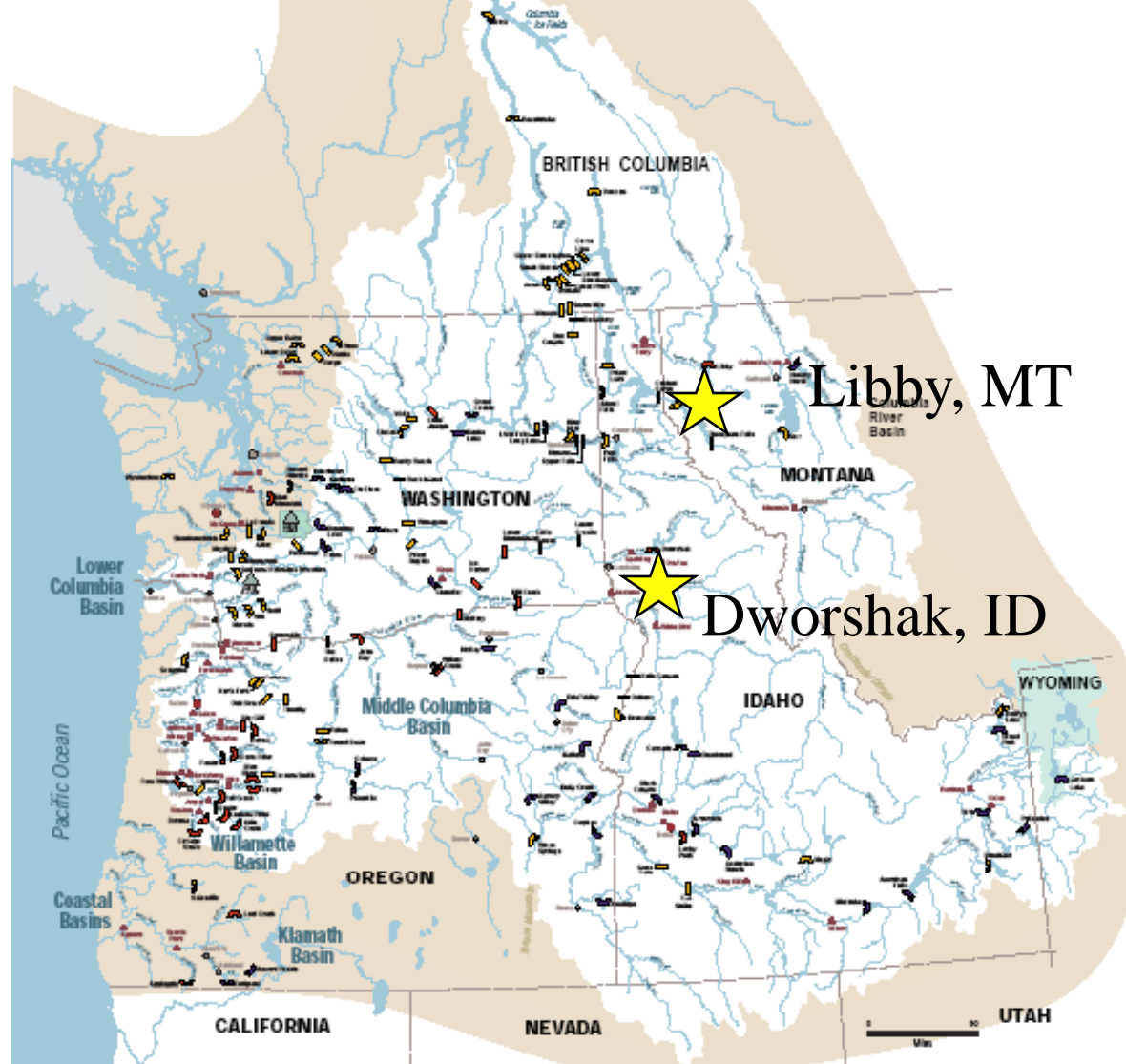
March 12, 2009



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Water Supply Forecast Points





Forecast Model Development

- Principal Components Regression
- Monthly Equations (1-Nov to 1-Jun)
- Dependent Variable:
 - Libby: AprAug Dworshak: AprJul
- Model Recalibration:
 - Libby: 2004 Dworshak: 2005
- Selection criteria: Cross-validation Standard Error (Jackknife SE)
- Variables selected from monthly pool of “best fit” models to best maintain month-to-month consistency

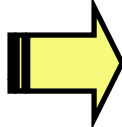


Regression Models-Two Approaches

Observed Data

X_{1_1}	X_{2_1}	X_{3_1}
X_{1_2}	X_{2_2}	X_{3_2}
X_{1_3}	X_{2_3}	X_{3_3}
X_{1_4}	X_{2_4}	X_{3_4}
X_{1_5}	X_{2_5}	X_{3_5}
X_{1_6}	X_{2_6}	X_{3_6}
...
X_{1_N}	X_{2_N}	X_{3_N}

Traditional Regression Model

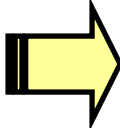

$$Y = \beta_0 + \beta_1 * X1 + \beta_2 * X2 + \beta_3 * X3$$



Principal Components

$PC1_1$	$PC2_1$	$PC3_1$
$PC1_2$	$PC2_2$	$PC3_2$
$PC1_3$	$PC2_3$	$PC3_3$
$PC1_4$	$PC2_4$	$PC3_4$
$PC1_5$	$PC2_5$	$PC3_5$
$PC1_6$	$PC2_6$	$PC3_6$
...
$PC1_N$	$PC2_N$	$PC3_N$

Principal Component
Regression Model


$$Y = \beta_0 + \beta_1 * PC1 + \beta_2 * PC2 + \beta_3 * PC3$$



Libby Forecast Variables

			<i>Forecast Date</i>							
<i>Station</i>			<i>1-Nov</i>	<i>1-Dec</i>	<i>1-Jan</i>	<i>1-Feb</i>	<i>1-Mar</i>	<i>1-Apr</i>	<i>1-May</i>	<i>1-Jun</i>
SOI: Sum of June-September	--	Climate	Jun—Sep	Jun—Sep						
Fortine 1N	MT	Precip	Oct	Oct-Nov	Oct--Dec	Oct--Dec	Oct--Dec	Oct--Dec		
Kaslo	BC	Precip	Oct	Oct-Nov	Oct--Dec	Oct--Dec	Oct--Dec	Oct--Dec	Oct--Dec	Oct--Dec
Glacier Rogers Pass	BC	Precip	Oct	Oct-Nov	Oct--Dec	Oct--Dec	Oct--Dec	Oct--Dec	Oct--Dec	Oct--Dec
West Glacier	MT	Precip	Oct	Oct-Nov	Oct--Dec	Oct--Dec	Oct--Dec	Oct--Dec	Oct--Dec	Oct--Dec
Libby 1NE Ranger Station	MT	Precip	Oct	Oct-Nov	Oct--Dec	Dec--Jan	Dec--Feb	Dec--Mar		
Fernie	BC	Precip	Oct	Oct-Nov	Oct--Dec	Dec--Jan	Dec--Feb	Dec--Mar	Dec-Apr	May
Banff	AB	Precip			Dec	Dec--Jan	Dec--Feb	Dec--Mar	Dec-Apr	May
Cranbrook A	BC	Precip			Dec	Dec--Jan	Dec--Feb	Dec--Mar	Dec-Apr	May



Libby WSF – Climate Variables

- Southern Oscillation Index (SOI)
 - Tested monthly SOI
 - Tested sum-of-months (n=1,2,3,4,6,8)
 - Best relationship to AprAug runoff is when using June, Jun+Jul, Jun+Jul+Aug, or Jun+Jul+Aug+Sep
 - Used Sum of Jun-Sep SOI as a candidate predictor variable.



Libby WSF – Climate Variables

- Pacific Decadal Oscillation Index (PDOI)
 - Tested monthly and sum-of-months PDOI (n=1,2,3,4,6,8,12,18)
 - Best relationship to AprAug runoff is when using Nov or Nov+Dec PDOI
 - *Abandoned monthly PDOI after N. Mantua reported that he could not promise publication until 30 to 45 days out.*
 - Tested Categorical PDOI (Pos., Neg., Neutral)
 - *Insufficient record: Unable to determine PDOI category until several years into regime.*



Dworshak Forecast Stations

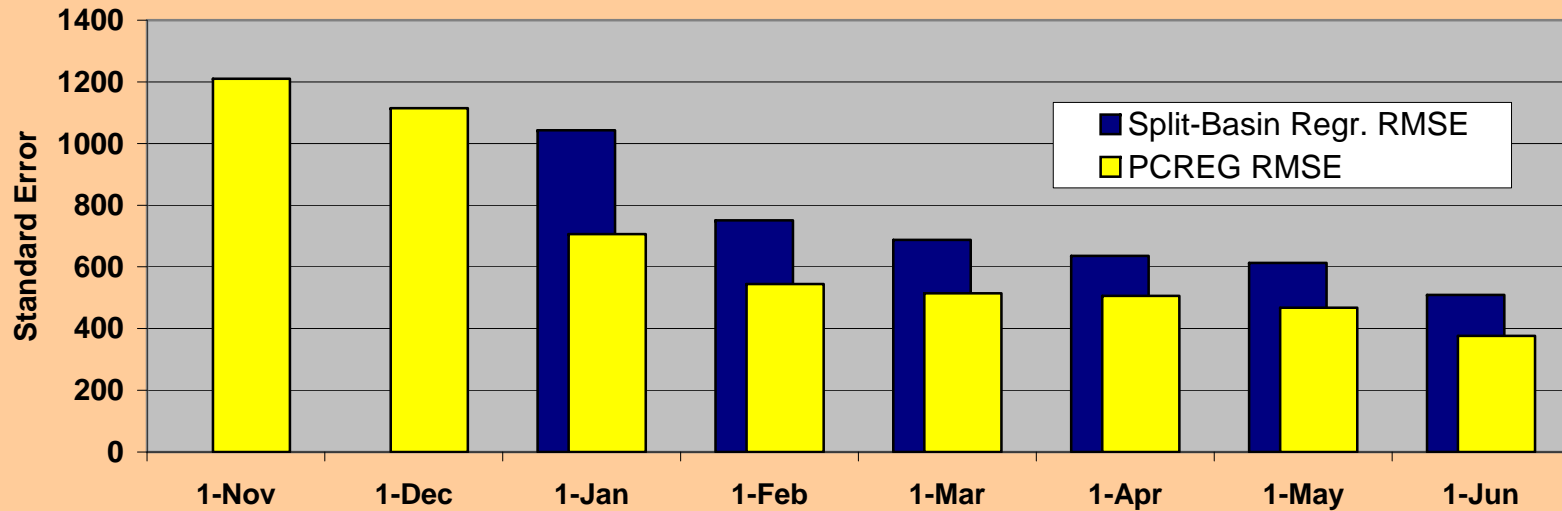
Station			Forecast Date							
			1-Nov	1-Dec	1-Jan	1-Feb	1-Mar	1-Apr	1-May	1-Jun
SOI	--	Climate	Sep	Sep	Sep	Sep	Sep	Sep	Sep	
Headquarters	ID	Precip		Nov	Nov,Dec					
Pierce	ID	SWE			1-Jan	1-Feb	1-Mar			
Hoodoo	ID	SWE			1-Jan	1-Feb	1-Mar	1-Apr	1-May	1-Jun
Elk Butte	ID	SWE			1-Jan	1-Feb	1-Mar	1-Apr	1-May	1-Jun
Hemlock	ID	SWE			1-Jan	1-Feb	1-Mar	1-Apr	1-May	1-Jun
Shanghai Summit	ID	SWE						1-Apr	1-May	1-May
Lost Lake	ID	SWE							1-May	1-Jun
Dworshak Reservoir	ID	Flow				Jan	Jan,Feb	Jan,Feb,Mar		



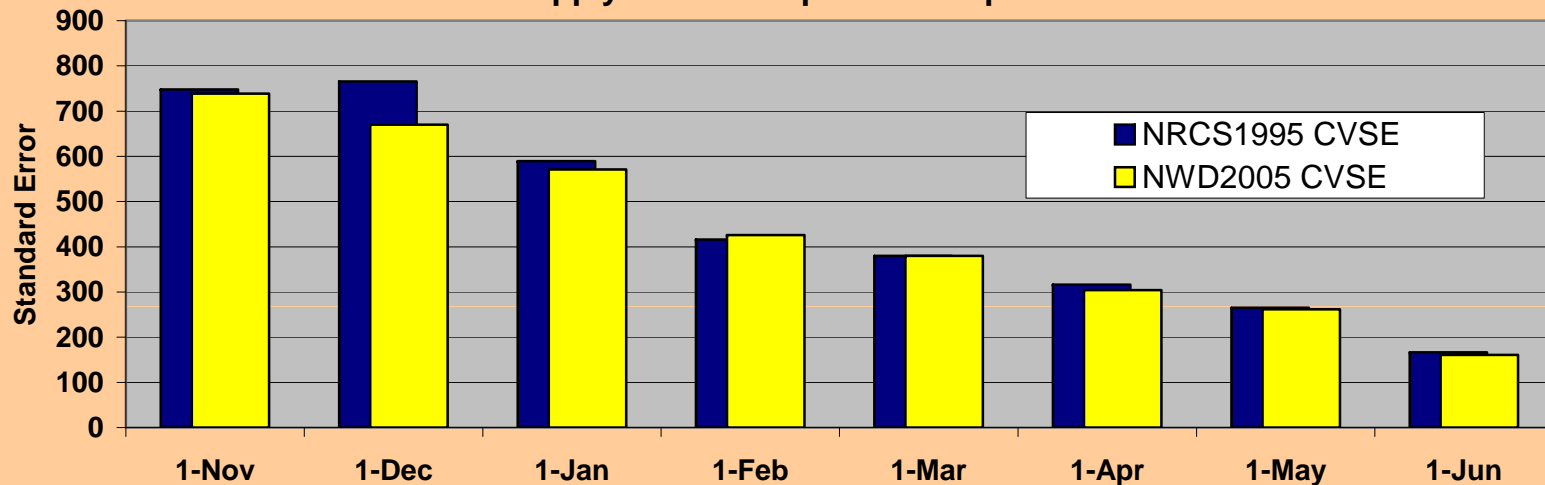
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Libby Water Supply Forecast Update: Comparison of forecast errors



Dworshak Water Supply Forecast Update: Comparison of forecast errors

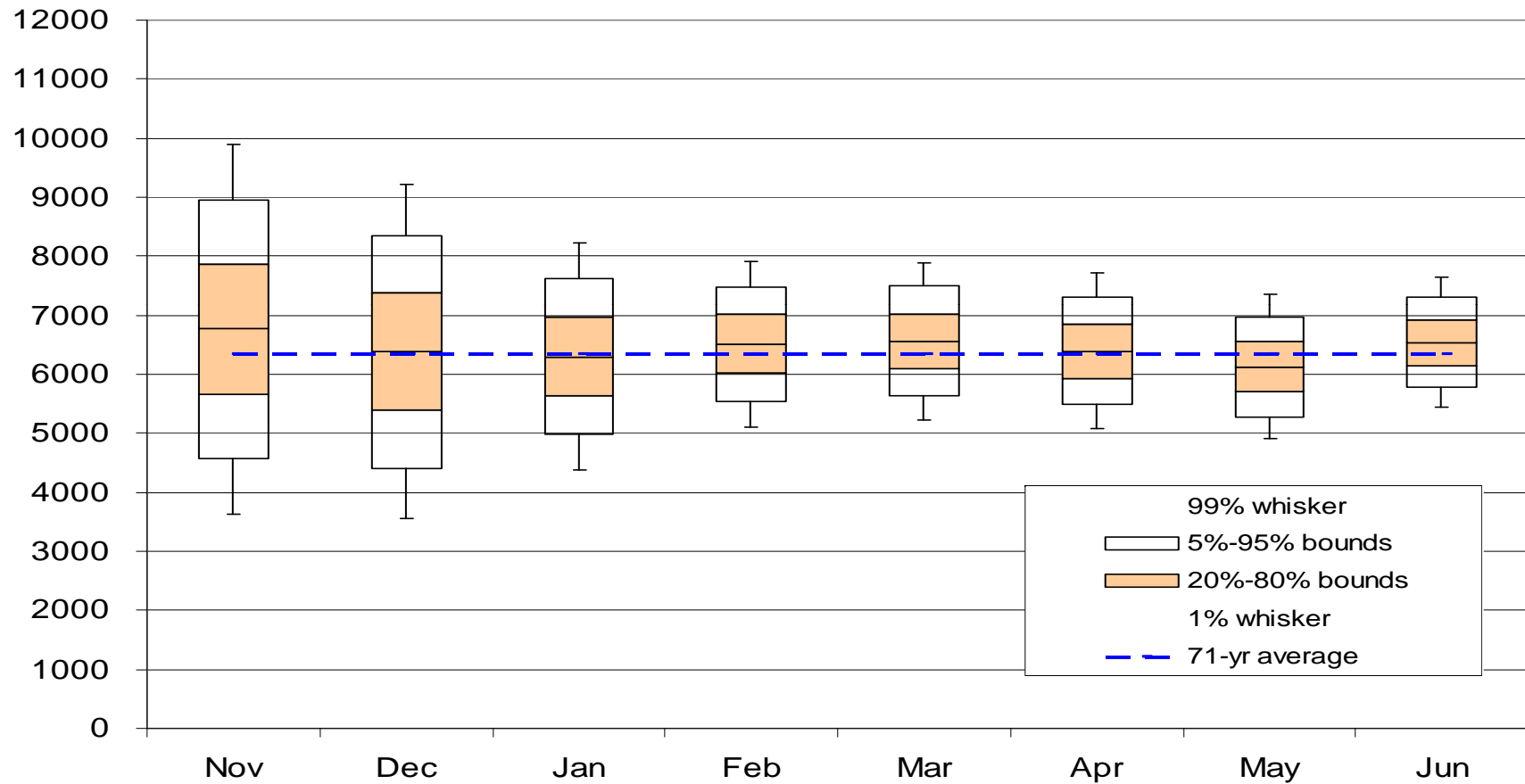




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Libby Apr-Aug Water Supply Forecasts - 2008



<i>Seasonal Flood Control</i>		VARQ Flood Control Implemented						
Forecast Date >>	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Apr-Aug Runoff Forecast	6764	6385	6298	6513	6558	6396	6128	6536

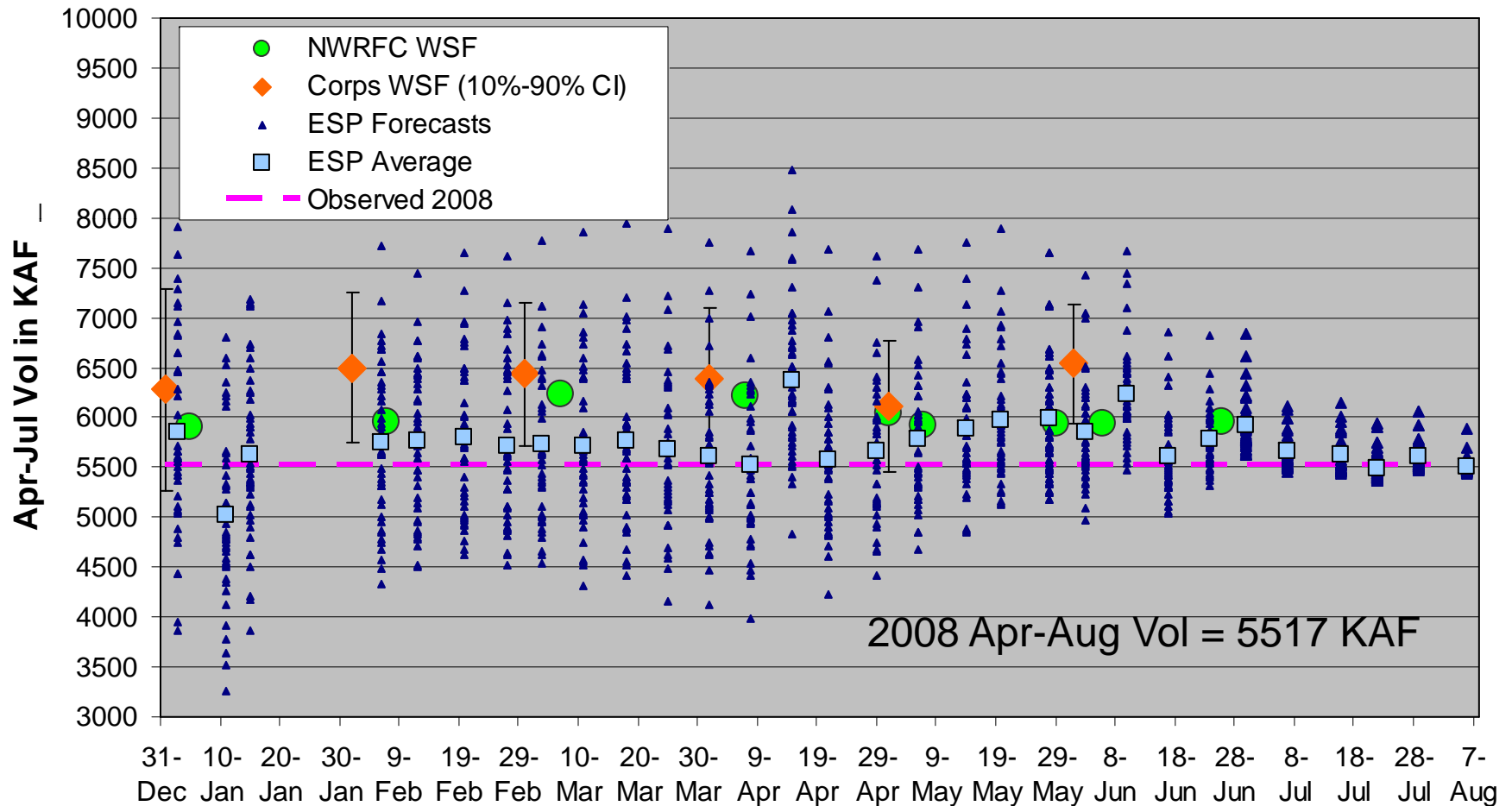


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Libby, MT April-August Inflow Volume Forecast Comparison

updated 29-Aug-2008

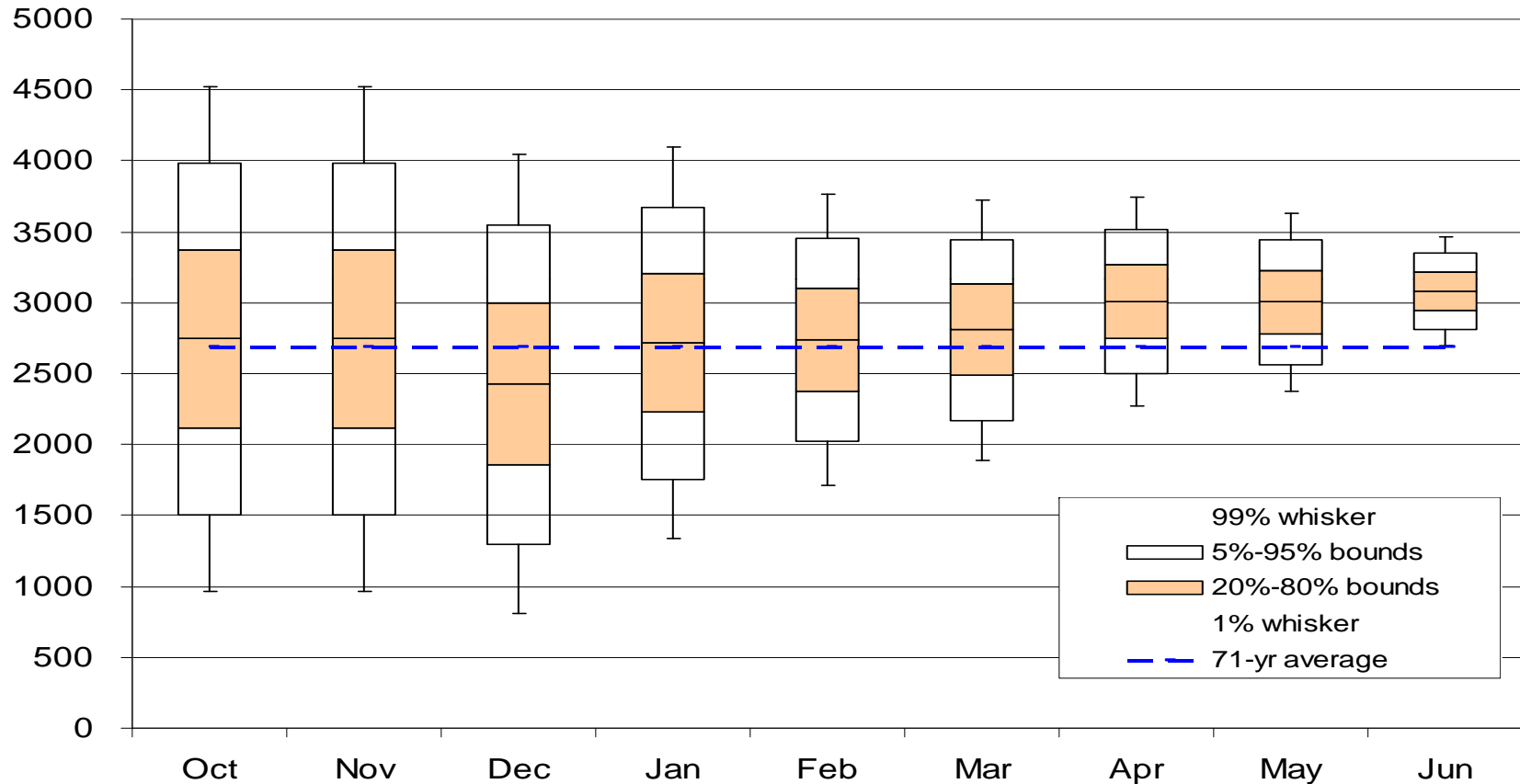




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Dworshak Apr-Jul Water Supply Forecast - 2008



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	2744	2744	2425	2717	2738	2810	3010	3003	3081

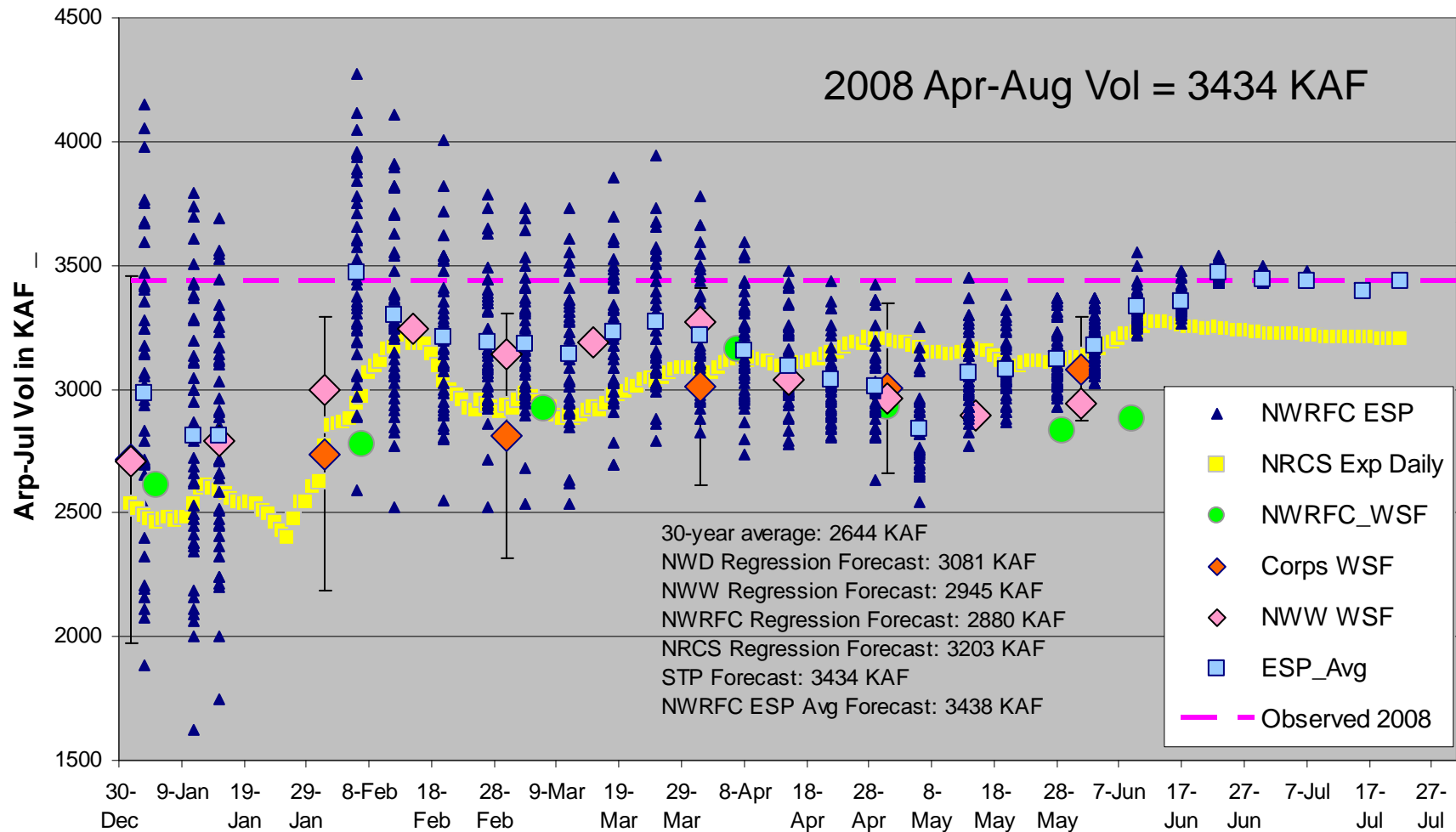


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Dworshak, ID April-July Inflow Volume Forecast Comparison

updated 29-Aug-2008





Corps WSF - Contacts

- Forecasts through 2008
 - by Northwestern Division
 - Ken Soderlind 503 808-3950
- Forecasts from 2009 forward...
 - Libby WSF by Seattle District staff
 - Joel Fenolio 206 764-6683
 - Ken Brettmann 206 764-6567
 - Amy Reese 206 764-3660
 - Dworshak WSF by Walla Walla District staff
 - Providing both Official forecast & NWW Secondary forecast
 - Steve Hall 509 527-7550
 - Jeremy Giovando 509 527-7053



Corps Forecast Products

<http://www.nwd-wc.usace.army.mil/report/colriverflood.htm>




**Columbia Basin
Water Management Division**



Columbia River Flood Control Information

NOTE: You will need the free [Acrobat Reader](#) software to view/print PDF documents.

1. [Libby Volume Inflow Forecast](#)
2. [Dworshak Volume Inflow Forecast](#)
3. [Summary of Columbia River Flood Control Data](#)
4. [Upstream Space Adjustment](#) (for computing Grand Coulee space requirements and the Initial Controlled Flow (ICF))
5. [VARQ Flood Control Operation at Libby Dam and Hungry Horse Dam](#)
6. [Treaty Flood Control Operating Plan \(Red Book\), May 2003](#)  (874k)
This Columbia River Treaty Flood Control Operating Plan has been coordinated with and approved by the Treaty Operating Committee and supersedes all previous versions.
7. [Storage Reservation Diagrams \(SRD\) used to determine flood control storage space requirements](#)