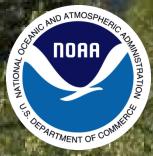
CNRFC Updates

California Cooperative Snow Surveys 59th Annual Meeting of Cooperators November 6-8, 2013

> Alan Haynes Service Coordination Hydrologist



California-Nevada River Forecast Center National Weather Service http://www.cnrfc.noaa.gov

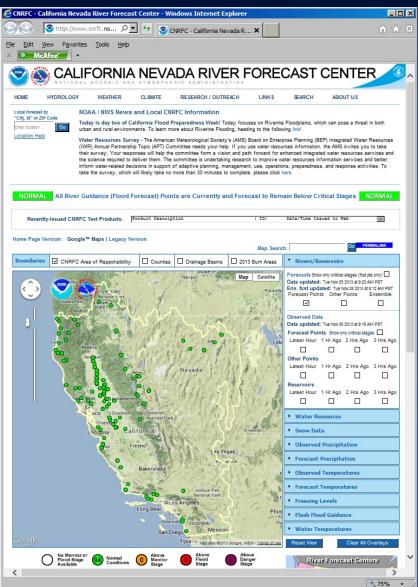


CNRFC Website Design Update

Design updated to match the main NWS web site (www.weather.gov).

New integrated Google[™] maps interface that consolidates all the elements of the various Google[™] pages contained in the old site into one page.

CNRFC Home Page

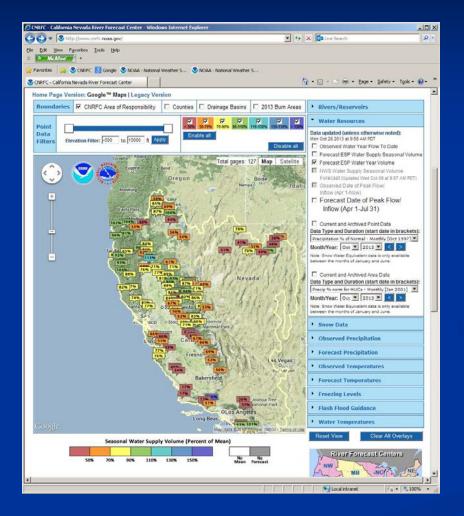


Home Page with river forecast points displayed.

To access pages that were linked on the left-hand menu of the old design, use the pop-up menus across the top of the web site.

http://www.cnrfc.noaa.gov

CNRFC Home Page



Integrated Google[™] Map Interface

Map displayed is forecast ESP Water Year Volume.

Google[™] Maps Interface slider menu on the right: Rivers/Reservoirs Water Resources Snow Data Observed Precipitation Forecast Precipitation Observed Temperatures Forecast Temperatures Freezing Levels Flash Flood Guidance Water Temperatures

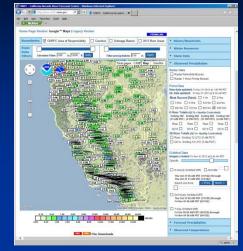


Forecast Points Other Points

CONFC - Google " Haps Interface - Windows Internet Explorer		
🕼 🖓 * 🕲 http://www.confit.nease.gov/porc. P. 🗶 19 😵 Children - Google ** Maps Inter X 🥥 CDEC - Data Application	• ÷ 0	
Die Gdt View Figuraties Dade 1940		
× Contraction +		
CALIFORNIA NEVADA RIVER FORE	😒 🔊 CALIFORNIA NEVADA RIVER FORECAST CENTER 🥒	
	CHOT CENTER	
HOME HYDROLOGY WEATHER CLIMATE RESEARCH / OUTREACH LINKS	SEARCH ABOUT US	
CNRFC Google™ Maps Interface		
Please link: Due to the large amounts of data being displayed on the interface, please be patient as the data is interived and loaded onto the Booole ¹⁰ Maps interface below.		
Data may take as long as 30 seconds to load.	na loaded brits the oblige - Maps Internace below.	
G0 PESHALINK		
Boundaries 🛛 CNRFC Area of Responsibility 🖓 Counties 🗆 Drainage Basins 🗆 2013 Burn Areas	Rivers/Reservoirs	
Map Satolite	Water Resources	
C Show cursor readout	Snow Data	
Association readout	* Observed Precipitation	
	Reder Date	
	Radar Relectivity Mesaic	
	Radar 1-Hour Precip Mosaic	
	Point Data	
	Row data updated: Non Nov 04 2013 at 1.55 PM PST	
Charles and the second s	QC data updated: Max Nov 04 2013 at 0.29 AM PST	
Revado	Most Recent (Raw): 1 Hr 2 Hrs	
	3 His 6 His 12 His 24 His	
	6-Hour Totals (0C'd - Quality-Controlled)	
Care tax	Entine 527 Entine 507 Entine 562 Entine 527	
	(10 AM PST) (4 PM PST) (10 PM PST) (4 AM PST)	
The second of the second secon	Raw Raw Raw Raw	
Contract of the second se	004 004 004 004 004 0	
Lender Contention of	24.Hour Totals (QC'd - Quality-Controlled) Raw - Ending 12 UTC (4.HM PST)	
alar frend and	Grid-Ending 12 UTC (4 AM PST)	
Les Vepart		
Balantija -	Gridded Data	
	Images created: Hon Nov 04 2013 at 0.40 AM PST	
	Opacity:	
Antonio Far	R 6-Hourts Gridged OPE	
Long Beac	Sun Boy #2 04 AM PST (83122) through	
transfer Transfer	Sen Roy 83 10 AM PET (83182) Select obs Time: C Proc Nost >	
San Dirgs Mexican		
Catagor Temps	24Hours English OPE	
	San Nov 63 04 AM PST (83122) through Non Nov 64 04 AM PST (84122)	
Precipitation (inches)	7.0ar Grader OPE	
255 1.00 1.60 2.50 2.50 3.50 3.50 4.00 4.50 5.50 5.50 5.00	Mon Oct 26 65 AM POT (28122) through Mon for Oct 26 45 AM POT (28122) through	
< >		
1,009. • /		

Gridded QPE

Observed Data



Precipitation



Snow



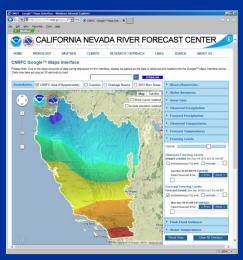
Reservoirs



Water Temperature



Forecast Precipitation, Gridded



Freezing Levels

Forecasts



Forecast Temperature, Gridded

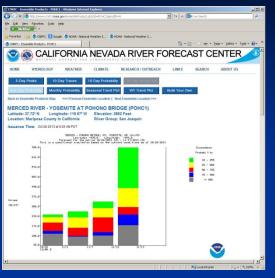


Rivers/Reservoirs

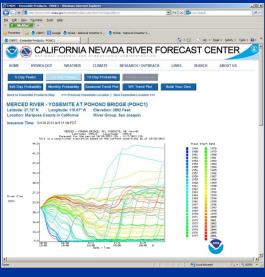


Flash Flood

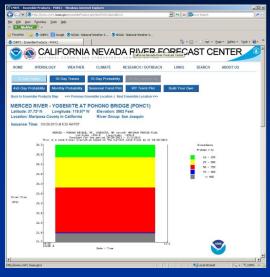
CNRFC Short-Term Forecasts



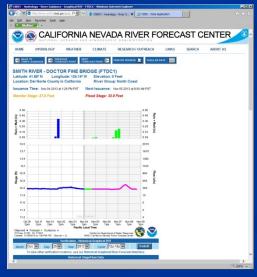
4 X 5 Day Histogram



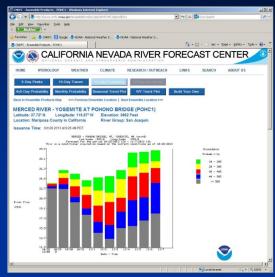
10 Day Traces



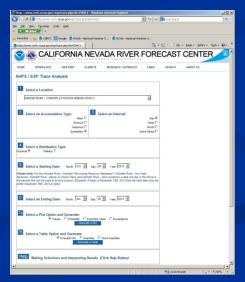
5 Day Peak



5-Day Deterministic

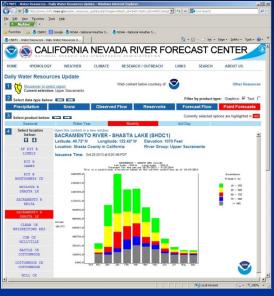


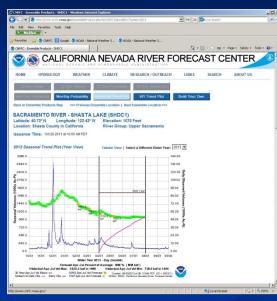
10 Day Histogram



AHPS/ESP Trace Analysis Interface

CNRFC Point Forecasts





Favorites Tools Help McAfee . Favorites 🛛 🙀 🕲 CARFIC 🔣 Google 🕲 NOAA - National Weather S... 💈 NOAA - National Weather S... CHRFC - Ensemble Products - SHDC1 🐴 • 🔂 · 🖂 👼 • Bage • Safety • Tools • 📦 😴 🔊 CALIFORNIA NEVADA RIVER FORECAST CENTER HYDROLOGY WEATHER CLIMATE RESEARCH / OUTREACH LINKS SEARCH ABOUT US 10-Day Traces 10-Day Probability nal Trend Plot WY Trend Piot Build Your Own ability Mo SACRAMENTO RIVER - SHASTA LAKE (SHDC1) Latitude: 40.72° N Longitude: 122.42° W Elevation: 1070 Feet Location: Shasta County in California River Group: Upper River Group: Upper Sacramente suance Time: Oct 28 2013 at 10:37 AM PDT Tabular View | Select a Different Water Year: 2013 2013 Water Year Trend Plot 7200.0 368.00 6600.0 130.00 10.1 300.00 270.00 240.0 210.0 3500.0 180.00 3100.0 150.00 Dec 03 120.00 2400.0 1800.0 90.00 1200.0 60.00 600.0 30.00 0.0 12/01 01/01 02/01 0 03/01 04/01 05/01 later Year 2013 - Day (m Forecast WY Percent of Average: MM % Observed WY to Date Percent of Average: 65 % 9 Volume Average - WY to Date Ots -Arg Daily Ots - ESP WY Volume Fo Created: 09/30/2013 at 12:23 PM PDT (ID + SHDC1) NORA/ MVS/ California Navada River Constant

• + × Gsu

Monthly

April-July

Water Year

mble Products - SHDC1 - Windows Inter

G

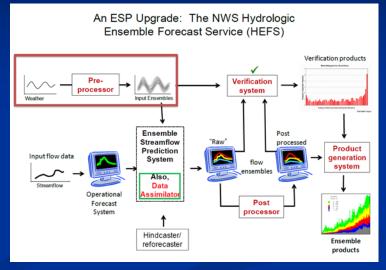
HEFS – Hydrologic Ensemble Forecasting System

Objective

- Quantify and reduce uncertainties in ESP due to
 - Future weather
 - Calibration
 - Initial conditions
- Provide unbiased and skillful forecast ensembles
- Generate reforecast dataset consistent with real-time forecasts

HEFS - CNRFC is one of four prototype RFCs testing Version 1.0.

- Has Post-processing capability to deal with bias and timing errors.
- Hindcasting capability for validation of performance over a historical period.



Ensembles in CSV Format

- Organized by forecast group in zip file format
 - Upper Sacramento, San Joaquin, North Coast, etc
- Available in hourly and daily format
 - Hourly data out to 14 days
 - Daily data out to 365 days

<u>e.g.,</u>

www.cnrfc.noaa.gov/csv/2012110712 San Joaquin hefs csv hourly.zip www.cnrfc.noaa.gov/csv/2012110712_San_Joaquin_hefs_csv_daily.zip

Ensembles in CSV Format

,NFDC1 , QINE, QINE 2012-11-11 12:00:00,0.09400764,0.094007 2012-11-11 13:00:00,0.09400764,0.094007 2012-11-11 14:00:00,0.09400764,0.094007 09400764 0 2012-11-11 15:00:00,0.09400764,0.094007 0764.0 2012-11-11 16:00:00,0.09368982,0.09368982,0.094325475,0.09368982,0.09368982,0.0936545,0.0936545,0.0936545,0.0936545,0.09368982,0.0936882,0.0936882,0.0936882,0.0936882,0.0936882,0.0936882,0.0936882,0.0936882,0.093682,0.093682,0.093682,0.0936882,0.0936882, 2012-11-11 17:00:00,0.09337199,0.09337199,0.094678625,0.09337199,0.09337199,0.09354855,0.09330135,0.093407296,0.09330135,0.09337199,0.093407296,0.09337199,0.093407296,0.093407296,0.09330135,0.09330135,0.093407296,0.093407296,0.093407296,0.09330135,0.09330135,0.093407296,0.093407296,0.093407296,0.09330135,0.093407296,0.093407296,0.093407296,0.093407296,0.093407296,0.09330135,0.093407296,0.093 2012-11-11 20:00:00,0.09319541,0.09308946,0.1023066,0.09308946,0.09308946,0.097150646,0.092771634,0.09347793,0.092771634,0.09305415,0.09347793,0.117280014,0.09305415,0.093477296,0.09347793,0.09347793,0.09305415,0.09305415,0.09347793,0.09347793,0.09305415,0.09305415,0.09347793,0.09305415,0.09305415,0.09347793,0.09305415,0.09305415,0.09347793,0.09305415,0.09305415,0.09347793,0.09305415,0.09305415,0.09347793,0.09305415,0.09305415,0.09305415,0.09347793,0.09305415,0.09305415,0.09347793,0.09305415,0.09305415,0.09347793,0.09305415,0.09305415,0.09347793,0.09305415,0.09305415,0.09347793,0.09305415,0.09305415,0.09305415,0.09305415,0.09305415,0.09305415,0.09347793,0.09305415,0.0930545,0.093056,0.093056,0.093056,0.093056,0.093056,0.093056,0.093056,0.093056,0.093056,0.093056,0.093056,0.093056,0.093056,0.093056,0.093056,0.093056,0.093056,0.09 2012-11-11 21:00:00,0.09319541,0.09308946,0.105979316,0.09308946,0.09308946,0.09902233,0.09263037,0.09361918,0.09263037,0.09301884,0.0930184,0.0930184,0.09301884,0.0930184,0.0930184,0.0930184,0.0930184,0.0930184,0.0930184,0.0930184,0.0930184,0.0930184,0.0930184,0.0930184,0.0930184,0.0930184,0.0930184,0.09301 2012-11-11 22:00:00,0.09326604,0.09308946,0.10958141,0.09308946,0.09308946,0.10092932,0.092524424,0.093760446,0.092524424,0.093760446,0.13797441,0.092983514,0.093760446,0.177 2012-11-11 23:00:00,0.093336664,0.093124785,0.11325414,0.093124785,0.093124785,0.10283631,0.09241849,0.09393702,0.09241849,0.09393702,0.1483216,0.092983514,0.09393702,0.122716 2012-11-12 00:00:00,0093407296,0.093124785,0.11689155,0.093124785,0.093124785,0.10474331,0.092312545,0.09411359,0.092312545,0.092983514,0.09411359,0.1586688,0.092983514,0.09397233,0.09411359,0.128 2012-11-12 01:00:00,0.0936545,0.09316009,0.121835604,0.09316009,0.09316009,0.118374765,0.092312545,0.09429017,0.092312545,0.09429017,0.18324782,0.094042964,0.094042964,0.09429017,0.140305 2012-11-12 03:00:00,0.09418422,0.09326604,0.13172372,0.09326604,0.09319541,0.145673,0.09234786,0.09464331,0.09227722,0.092771634,0.09464331,0.23237051,0.092771634,0.09464331,0.164 2012-11-12 04:00:00,0.09443142,0.09330135,0.13666776,0.09330135,0.093230724,0.15933979,0.09234786,0.09478457,0.09224191,0.092665695,0.09478457,0.2569495,0.092665695,0.094254844,0.09478457 2012-11-12 05:00:00,0.094713934,0.09337199,0.14161183,0.09337199,0.093230724,0.17300656,0.09234786,0.09496114,0.09224191,0.092595056,0.09496114,0.28149322,0.092595056,0.094325475,0.094961 2012-11-12 06:00:00,0.09496114,0.093407296,0.14655587,0.093407296,0.09326604,0.18663801,0.09234786,0.095137715,0.0922066,0.092524424,0.095137715,0.30607224,0.092524424,0.094396114,0.0951 2012-11-12 07:00:00.0.094713934.0.093336664.0.16672055.0.093336664.0.09351324.0.2229415.0.09224191.0.09489051.0.09199471.0.09241849.0.09489051.0.31507745.0.09241849.0.094219536.0.09489051.0. 2012-11-12 08:00:00,0.09446674,0.093230724,0.18688522,0.093230724,0.09372513,0.25924498,0.09217128,0.094607994,0.09181813,0.09227722,0.094607994,0.32411805,0.09227722,0.094042964,0.094607994 2012-11-12 09:00:00,0.094219536,0.093124785,0.20704989,0.093124785,0.09393702,0.29551315,0.092030026,0.094325475,0.09157093,0.092135966,0.094325475,0.33312324,0.092135966,0.09383108,0.0 2012-11-12 10:00:00,0.09397233,0.09301884,0.22717926,0.09301884,0.094148904,0.3318166,0.09192408,0.09407828,0.09135904,0.092030026,0.09407828,0.3421285,0.092030026,0.0930545,0.09407828,0.2 2012-11-12 11:00:00,0.09372513,0.092948206,0.24730861,0.092948206,0.094396114,0.3681201,0.091853455,0.093795754,0.09118247,0.09188876,0.093795754,0.35116908,0.09188876,0.09347793,0.093795754 2012-11-12 12:00:00,0.09347793,0.09284226,0.26747328,0.09284226,0.094607994,0.40442356,0.09174751,0.09354855,0.09097058,0.09178282,0.09354855,0.3601743,0.09178282,0.09330135,0.09354855,0.31098095,0 2012-11-12 13:00:00,0.093336664,0.092595056,0.30282328,0.09347793,0.09725659,0.4210921,0.09164157,0.093407296,0.09164157,0.09316157,0.09337199,0.3592208,0.09164157,0.09316009,0.093407296,0.32514215,0.093407296,0.32514215,0.093407296,0.32514215,0.093407296,0.32514215,0.093373,0.09164157,0.09337199,0.3592208,0.09164157,0.093407296,0.32514215,0.093407296,0.32514215,0.093407296,0.32514215,0.093373,0.09164157,0.09337199,0.3592208,0.09164157,0.093407296,0.32514215,0.093407296,0.32514215,0.093373,0.09164157,0.09164157,0.09 2012-11-12 14:00:00,0.09319541,0.09234786,0.33820856,0.09407828,0.09990519,0.43772534,0.09153562,0.09326604,0.091676876,0.091500305,0.09319541,0.35833794,0.091500305,0.092983514,0.09326604,0. 2012-11-12 15:00:00,0.09305415,0.09210066,0.37355855,0.094713934,0.1025538,0.45439383,0.09142967,0.09308946,0.092030026,0.09135904,0.09305415,0.35741976,0.09135904,0.09284226,0.09308946,0.3 2012-11-12 16:00:00,0.09291289,0.09181813,0.40890855,0.0953496,0.105167076,0.47106233,0.09128842,0.092948206,0.09238317,0.091217786,0.09287758,0.35650158,0.091217786,0.092701,0.092948206,0.36755505 2012-11-12 17:00:00,0.092771634,0.09157093,0.44429386,0.095949955,0.10781568,0.48769557,0.09118247,0.09280695,0.09273632,0.09107653,0.092701,0.3556187,0.09107653,0.092524424,0.09280695,0.3816809,0. 2012-11-12 18:00:00.0.09263037.0.09132373.0.47964382.0.09658562.0.11046428.0.5043641.0.09107653.0.092665695.0.09308946.0.090935275.0.092524424.0.3547005.0.090935275.0.09238317.0.092665695.0.3958421 2012-11-12 19:00:00,0.09263037,0.09114716,0.49592388,0.10453142,0.11459609,0.4957826,0.091041215,0.092665695,0.09474926,0.09082933,0.09228317,0.36575404,0.09082933,0.09224191,0.092665695,0.39386448 2012-11-12 20:00:00,0.092595056,0.0910059,0.51216865,0.11247721,0.118727915,0.48723647,0.090935275,0.09263037,0.09633841,0.09072338,0.09227722,0.3767722,0.09072338,0.09210066,0.09263037,0.39185154, 2012-11-12 21:00:00,0.09255975,0.09079401,0.5284487,0.1203877,0.122824416,0.478655,0.0908995,0.092595056,0.09799821,0.090582125,0.09210066,0.3878257,0.090582125,0.09192408,0.092595056,0.389 2012-11-12 23:00:00,0.092524424,0.09047618,0.5609735,0.1362793,0.13108805,0.4615274,0.09079401,0.09255975,0.10128247,0.09033492,0.091853455,0.40989736,0.09033492,0.09164157,0.09255975,0.3858834,0.1 2012-11-13 00:00:00.0.092524424.0.09029961.0.57718295.0.1442251.0.13521986.0.45294595.0.09072338.0.092524424.0.10290694.0.09022898.0.09171219.0.42095086.0.09022898.0.091500305.0.092524424.0.3 2012-11-13 01:00:00,0.09263037,0.09033492,0.5748169,0.16912195,0.14030518,0.44026798,0.090582125,0.092595056,0.101600304,0.090405546,0.09188876,0.43542984,0.090405546,0.09157093,0.092595056 2012-11-13 02:00:00,0.092701,0.090405546,0.5724154,0.19398347,0.14535518,0.42758998,0.09044087,0.092701,0.10029365,0.09061744,0.0926534,0.4499442,0.09061744,0.09164157,0.092701,0.38937953,0.09044087,0.092701,0.10029365,0.09061744,0.0926534,0.4499442,0.09164157,0.0926534,0.42758998,0.09044087,0.092701,0.10029365,0.09061744,0.0926534,0.4499442,0.09164157,0.092701,0.38937953,0.09044087,0.092701,0.10029365,0.09061744,0.0926534,0.4499442,0.09164157,0.092701,0.38937953,0.09044087,0.0926534,0.09061744,0.09164157,0.0926534,0.42758998,0.09061744,0.0926534,0.09164157,0.0926534,0.4275898,0.0904087,0.0926534,0.0904087,0.09164157,0.092701,0.38937953,0.09044087,0.092701,0.10029365,0.09061744,0.0926534,0.4499442,0.09164157,0.0926534,0.4275898,0.0904087,0.0926534,0.0904087,0.0926534,0.0904087,0.0926534,0.0904087,0.0926534,0.0904087,0.0926534,0.0904087,0.0926534,0.0904087,0.0926534,0.0904087,0.0926534,0.0904087,0.0926534,0.0904087,0.0926534,0.0904087,0.0926534,0.0904087 2012-11-13 03:00:00,0.09280695,0.09047618,0.57001406,0.21888031,0.1504405,0.41491202,0.09033492,0.092771634,0.09898701,0.09082933,0.09224191,0.46438786,0.09082933,0.09171219,0.092771634,0.3 2012-11-13 04:00:00,0.09287758,0.09051149,0.56764793,0.24377716,0.15552579,0.40219876,0.09019366,0.09284226,0.09764506,0.0910059,0.09283317,0.4788669,0.0910059,0.09178282,0.09284226,0.39 2012-11-13 05:00:00,0.092983514,0.090582125,0.5652466,0.26863867,0.16057579,0.38952076,0.0900524,0.092948206,0.09633841,0.09118247,0.09255975,0.4933812,0.09118247,0.091853455,0.092948206,0.091853455,0.092948206,0.091853455,0.092948206,0.091853455,0.092948206,0.091853455,0.092948206,0.091853455,0.092948206,0.091853455,0.092948206,0.091853455,0.092948206,0.091853455,0.092948206,0.091853455,0.092948206,0.091853455,0.092948206,0.091853455,0.092948206,0.091853455,0.092948206,0.091853455,0.092948206,0.091853455,0.092948206,0.091853455,0.092948206,0.091853455,0.091853455,0.092948206,0.091853455,0.091853455,0.092948206,0.091853455,0.091853455,0.092948206,0.091853455,0.091853455,0.091853455,0.092948206,0.091853455,0.091853455,0.092948206,0.091853455,0.091853455,0.092948206,0.091853455,0.092948206,0.091853455,0.092948206,0.091853455,0.092948206,0.091853455,0.091853455,0.092948206,0.091853455,0.091853455,0.092948206,0.091853455,0.091853455,0.091853455,0.092594,0.091853455,0.0918556,0.0918556,0.0918556,0.091856,0.091856,0.091856,0.0918 2012-11-13 06:00:00,0.09305415,0.09061744,0.5628805,0.29353553,0.16566111,0.3768428,0.08991115,0.09301884,0.09503177,0.091394365,0.09273632,0.50786024,0.091394365,0.09129408,0.09301884,0 2012-11-13 07:00:00,0.092948206,0.0910059,0.5514032,0.32521278,0.16714431,0.36593062,0.08984051,0.09287758,0.0953496,0.091394365,0.09263037,0.5111445,0.091394365,0.09192408,0.09291289,0.403 2012-11-13 08:00:00,0.092771634,0.09135904,0.53992593,0.35689002,0.1685569,0.35501838,0.089769885,0.09273632,0.09563212,0.09135904,0.092489116,0.5144641,0.09135904,0.091853455,0.092771634,0. 2012-11-13 09:00:00,0.09263037,0.09174751,0.5284487,0.3885673,0.17004013,0.34407082,0.08969925,0.092595056,0.095949955,0.091394365,0.09238317,0.51774836,0.091394365,0.09139465,0.09139465,0.09139465,0.09139465,0.09139465,0.09139465,0.09139465,0.09139465,0.09139465,0.09139465,0.09139465,0.09139465,0.09139465,0.09139465,0.09139465,0.091465,0.09

CNRFC Model Calibrations

- We only get the forecasting infrastructure from HQ and NWS.
- We supply the basin soil and snow components, and data sets to the model and see how it works historically.
- Each completed basin goes through a tuning process where model parameters are adjusted.
- 6-year rotation to review all watersheds.
- ~300 watersheds, we tune about 50 per summer plus about 10 new ones.
- CNRFC and CADWR forecasters involved.
- **2013**
 - North Coast
 - Central Coast
 - Others



Collaborations

Forecast Coordinated Operations

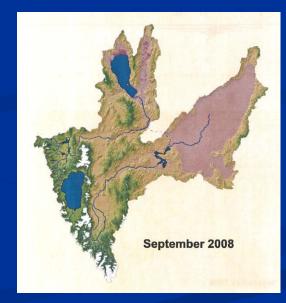
- Streamlined forecast delivery
- Common model for reservoir operations
- Improved coordination and decision making
- Feather Yuba
- San Joaquin
- Everywhere ... eventually
- CNRFC involved with joint CADWR / YCWA / USACE exercise Oct 10, 2013



Collaborations

Truckee / Carson / Walker Basins

- **TR** Water Masters Office
- TROA: Truckee River Operating Agreement
- USBR
- Integrate CNRFC short-term and long-term ensemble forecasts into their decision model
- Integrate CNRFC ensemble forecasts into USBR RiverWare decision model



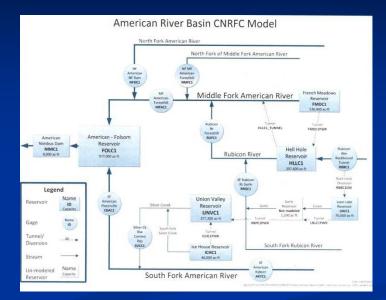
Collaborations

American River SMUD / PCWA

Model Topology Additional Basins

USACE / Community Folsom Operations





Modify our model topology a little better so that its more consistent with their information needs.

Participate in process of how to integrate information into the decision model for the operation of Folsom.

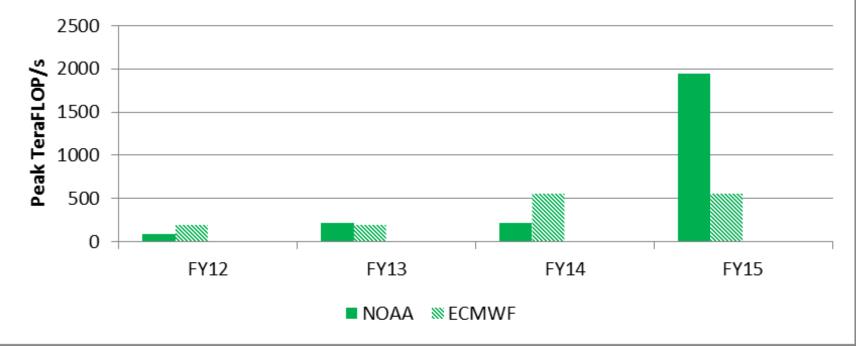
"On the Horizon"

Next Generation Delta Forecasts

- Time for an upgrade
- 5-day duration
- Stage, flow, temperature, salinity
- Everywhere as opposed to a few limited locations
- Major collaborative project
 - Leverage existing/developing modeling
 - Sustained technology infusion

Implement in CNRFC/DWR *daily* operations.

NOAA vs. ECMWF Operational Computing Capacity













Credit: Dave Rizzardo, CADWR





California Nevada River Forecast Center



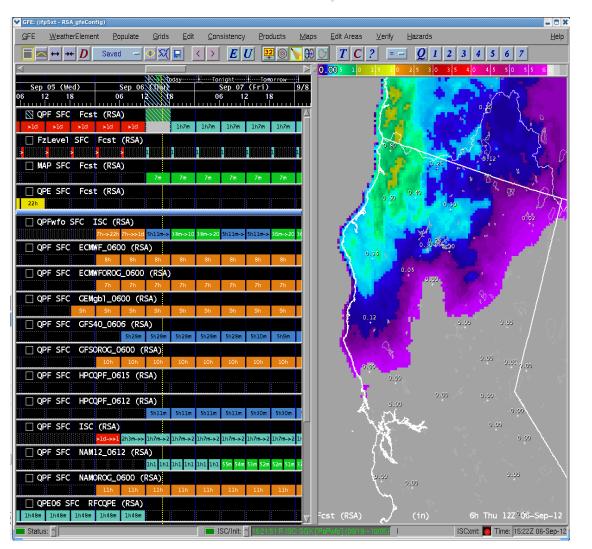
Alan S. Haynes Service Coordination Hydrologist (SCH)

National Oceanic & Atmospheric Administration National Weather Service 3310 El Camino Ave., Suite 227 Sacramento, CA 95821-6373 www.cnrfc.noaa.gov

Tel: (916) 979-3056 x328 Fax: (916) 979-3067 Cell: (916) 202-9473 E-mail: alan.haynes@noaa.gov

How Precipitation Forecasts for CNRFC River Models are Made

Gridded 6-Hour Precipitation Forecast in GFE



Forecast intervals are 6-hours out to 6 days.

Guidance is provided by several numerical weather prediction models that are updated every 6 or 12 hours.

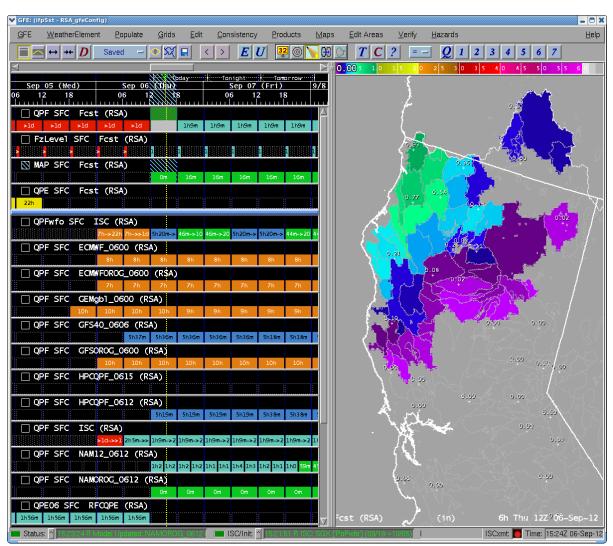
Forecasters interpret and assess the model guidance and apply local knowledge and experience.

Forecasts are made for specific point locations. There are over 25 forecast points just in northern CA.

The Grid Forecast Editor tool (pictured on the right) distributes point precipitation forecasts to a 4-km grid using a technique that takes into account a

How Precipitation Forecasts for CNRFC River Models are Made

Gridded 6-Hour MAP Forecast in GFE



A single-value MAP (Mean Areal Precipitation) is calculated for each basin by averaging the forecast precipitation for all grid points that fall inside the basin boundary.