FORECASTING ZERO

And other creepy tales from Water Year 2015

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DWR Snow Surveys

Overview

- WY 2015 Numbers
- WY 2015 Notables
- Forecasting Challenges
- Forecasting Tools Used

WY 2015 Runoff

BASIN	A-J RUNOFF (TAF)	AVERAGE	% AVERAGE
Trinity	111	651	17
Sacramento	1,051	2,485	42
Feather	378	1,758	22
Yuba	155	996	16
American	185	1,231	15
Mokelumne	75	468	16
Stanislaus	135	699	19
Tuolumne	308	1,221	25
Merced	104	636	16
San Joaquin	193	1,258	15
Kings	208	1,236	17
Kaweah	42	290	14
Tule	1	64	2
Kern	58	465	12

Records Galore!

BASIN	A-J RUNOFF (TAF)	PREVIOUS RECORD	% RECORD
Feather	378	392	96
Yuba	155	200	78
American	185	229	81
Mokelumne	75	102	74
Merced	104	123	85
San Joaquin	193	262	74
Kings	208	274	76
Kaweah	42	62	68
Tule	1.4	2	70
Kern	58	84	69
Truckee	46	52	88
WF Carson	10	12	83

WY 2015 Indices

- N Sierra 8-Stations: 37.2” (74% of Average)
- San Joaquin 5-Stations: 19.0” (47% of Average)
- Tulare Lake 6-Stations: 13.5” (46% of Average)
- Statewide snowpack on April 1: 5% of Average
- Statewide snowpack on May 1: 2% of Average

HOW'D WE DO? (MEH)

BASIN	1-Apr	21-Apr	1-May	26-May	OBSERVED
Sacramento	1190	1070	970	990	1051
Feather	460	370	340	310	378
Yuba	220	165	165	140	155
American	210	155	175	175	185
Mokelumne	95	75	75	69	75
Stanislaus	160	130	95	110	135
Tuolumne	260	225	240	255	308
Merced	90	74	85	90	104
San Joaquin	170	125	130	160	193
Kings	175	130	135	160	208
Kaweah	50	42	38	31	42
Tule	4	3	2	1.6	1.4
Kern	65	45	45	50	58

Forecasting Challenges

- Record low snowpack
- Equations were NOT working
- How to forecast record low runoff
  - Forecasts less than record
  - Monthly actual flows new records
  - How low can April-July runoff go?
- Lower funnel showing less than zero
- Late season rains

Late Season Rains

San Joaquin 5-Station Precipitation (inches)
Water Year 2015
Wednesday, September 30, 2015

October Total:	**0.1 "**	**Percent of Monthly October Average:**	**5%**
October Monthly Average:	2.1 "		
November Total:	**3.1 "**	**Percent of Monthly November Average:**	**66%**
November Monthly Average:	4.7 "		
December Total:	**5.9 "**	**Percent of Monthly December Average:**	**95%**
December Monthly Average:	6.2 "		
January Total:	**0.2 "**	**Percent of Monthly January Average:**	**3%**
January Monthly Average:	7.5 "		
February Total:	**4.0 "**	**Percent of Monthly February Average:**	**58%**
February Monthly Average:	6.9 "		
March Total:	**0.4 "**	**Percent of Monthly March Average:**	**7%**
March Monthly Average:	6.1 "		
April Total:	**2.3 "**	**Percent of Monthly April Average:**	**64%**
April Monthly Average:	3.6 "		
May Total:	**1.4 "**	**Percent of Monthly May Average:**	**78%**
May Monthly Average:	1.8 "		
June Total:	**0.3 "**	**Percent of Monthly June Average:**	**50%**
June Monthly Average:	0.6 "		
July Total:	**1.1 "**	**Percent of Monthly July Average:**	**367%**
July Monthly Average:	0.3 "		

Forecasting Methods

- Calculated the average month-to-month recedence for the 10 driest years for most basins
- Even though equations were not working, the <u>change</u> in the equations from week to week were considered
- Early in the forecast period, dry year equations were used
- Estimated A-J volumes by persisting the exceedance level observed for April into May, June, and July

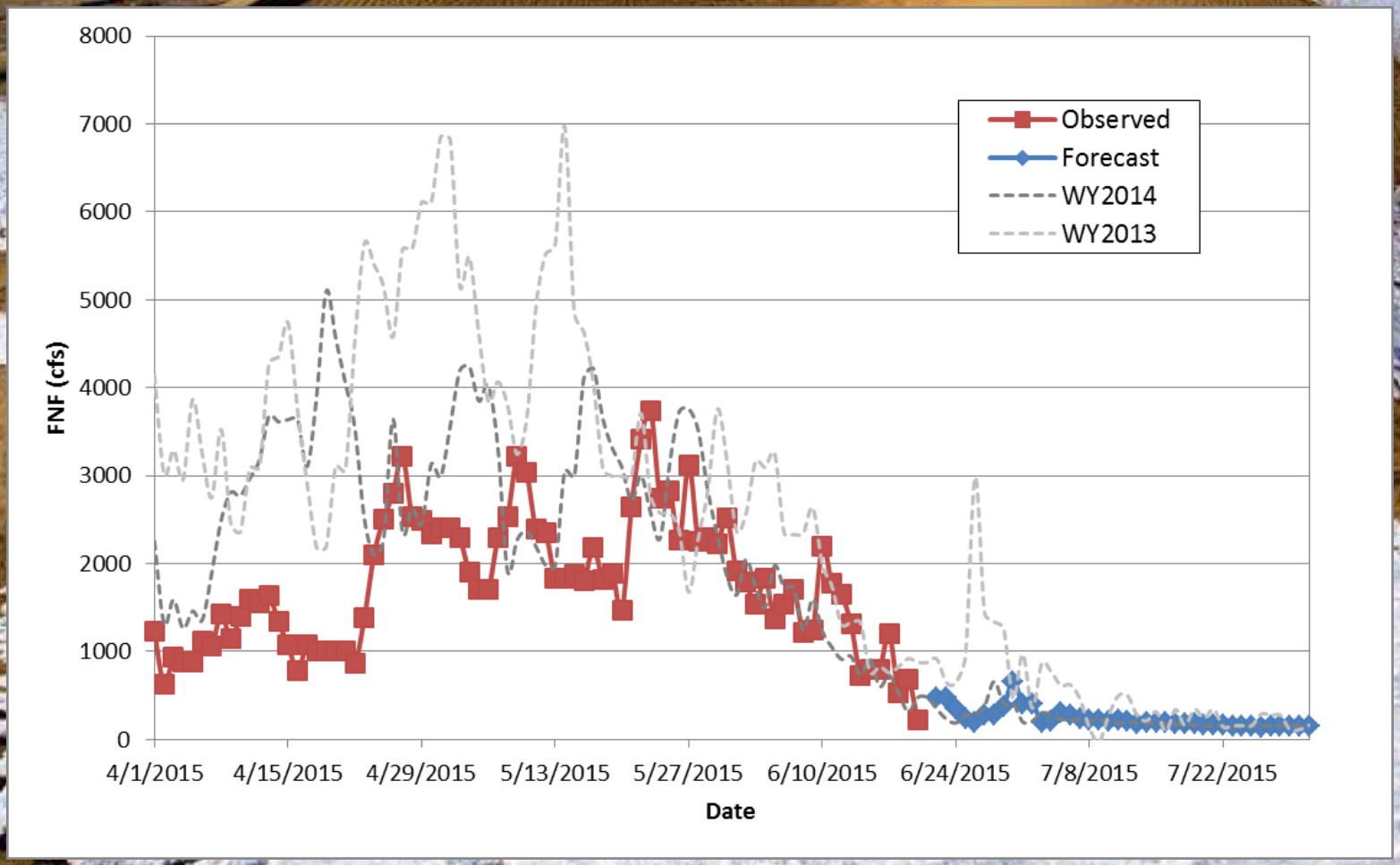
Forecasting Methods

- Estimated A-J volumes by using similar dry years' actual monthly values and interpolating based on April for May, June, & July – used 1924, 1931, and 1977
- Looked at record years (1977 and 1931) to make monthly breakouts, checking to see if we were forecasting new records that made sense or not
- Examined CNRFC forecasts to determine where we differed and tried to figure why

Forecasting Methods

- Driest snowpack EVER, so we need to forecast records, RIGHT?
- Looking at daily FNF trends and peaks to forecast a runoff recedence that seemed likely since we've never had a year as dry as this
- Used daily FNF trends to-date, used the corresponding values from previous water years (WY2014) to match a flow pattern recedence
- Used the exceedance tables to lag the monthly pattern. The lag for WY 2015 turned out to be about 1.5 months ahead of normal

WY 2014 Flow Pattern Matching



Exceedance Chart
Lag Method

WY	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Apr-Jul	WY
1901	28	74	57	130	309	159	[illegible]	33	297	103	25	7	899	1686
1902	9	17	52	14	51	85	[illegible]	56	194	38	13	5	714	960
1903	7	19	31	85	65	140	286	225	217	41	8	0	769	1124
1904	2	40	18	13	274	385	324	596	275	82	23	15	1277	2047
1905	74	25	29	41	77	151	177	205	146	39	9	5	567	976
1906	5	5	9	155	118	336	320	[illegible]	560	324	59	17	1710	2415
1907	11	10	80	104	201	648	486	[illegible]	50	273	69	21	1692	2834
1908	16	12	23	34	32	75	154	41	85	32	12	6	412	620
1909	7	8	10	360	228	172	294	392	337	92	20	7	1114	1926
1910	9	62	143	143	92	242	329	244	97	28	9	8	697	1406
1911	8	12	22	258	170	341	376	419	501	201	36	14	1497	2357
1912	12	13	13	20	15	32	58	225	169	29	8	7	480	600
1913	5	15	11	22	20	30	140	209	102	25	11	5	475	594
1914	7	10	20	266	164	198	262	430	[illegible]	105	23	8	1073	1769
1915	10	9	17	42	131	90	204	356	320	96	18	9	976	1301
1916	8	8	23	143	136	291	358	349	249	74	20	10	1030	1669
1917	20	16	40	28	144	85	202	353	383	84	15	8	1021	1377
1918	3	7	11	9	32	160	205	214	153	21	6	8	593	828
1919	13	16	17	13	50	65	206	317	59	11	3	0	592	768
1920	4	5	14	12	15	97	150	289	124	[illegible]	5	3	589	743
1921	13	28	50	117	96	157	189	309	239	[illegible]	9	4	790	1262
1922	4	6	25	35	107	103	170	495	378	87	17	4	1129	1430
1923	6	16	79	78	55	77	207	356	161	73	12	10	797	1130
1924	12	9	10	12	27	24	70	85	11	1	0	0	167	261
1925	6	27	32	31	153	120	261	356	172	51	11	5	839	1225
1926	8	10	14	13	74	79	216	139	41	7	3	3	402	607
1927	5	23	61	52	162	134	267	332	245	63	14	7	907	1364
1928	10	41	26	31	48	253	214	240	67	13	5	3	534	950

Stanislaus Forecasting

	Apr 1	%Avg	Apr 14	%Avg	Apr 21	%Avg		
Stanislaus River, below Goodwin Res. (blw New Melones)								699
90% Exceedance	75	11%	85	12%	75	11%		
50% Exceedance	160	23%	155	22%	130	19%		
10% Exceedance	370	53%	300	43%	240	34%		

	May 1	%Avg	May 12	%Avg	May 19	%Avg	May 26	%Avg
Stanislaus River, below Goodwin Res. (blw New Melones)								699
90% Exceedance	70	10%	69	10%	88	13%	100	14%
50% Exceedance	95	14%	95	14%	100	14%	110	16%
10% Exceedance	160	23%	140	20%	135	19%	135	19%

WY 2015 Observed 135

- 5/1, forecasting records for all central Sierra basins except Stanislaus so adjusted down
- Record low snowpack 4/1 and 5/1
- Late season rains brought it back

CAN GODZILLA SAVE US?