Peak Flow Forecasts

Methods and Evaluation

CBRFC Open House
August 17, 2010

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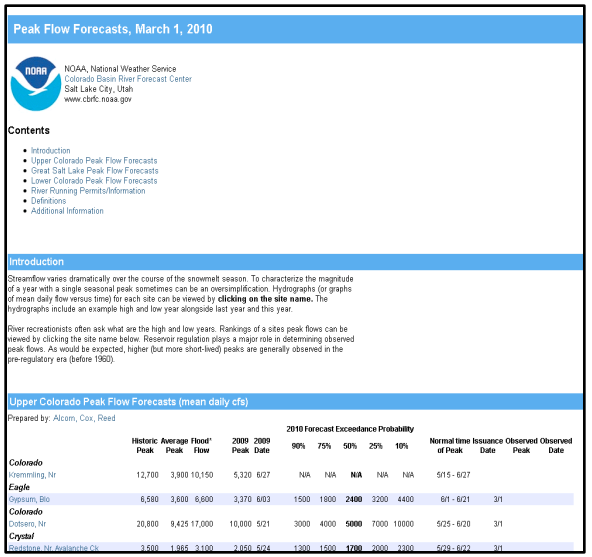
Outline

- What is a peak flow forecast?
- How do we make a peak flow forecast?
- Forecast Evaluation
- Summary
- Questions/Discussion

What is a Peak Flow Forecast?

- Snowmelt Mean Daily Maximum Flow (April-July)
- Probabilistic Forecasts

  Exceedence Probabilities -10%,25%,50%, 75%, 90%
- Issued (at least) monthly from March-June
- 60 points (could change)
- Updated as needed


Peak Flow Forecasts, March 1, 2010

NOAA, National Weather Service
Colorado Basin River Forecast Center
Salt Lake City, Utah
www.cbrfc.noaa.gov

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- Upper Colorado Peak Flow Forecasts
- Great Salt Lake Peak Flow Forecasts
- Lower Colorado Peak Flow Forecasts
- River Running Permits/Information
- Definitions
- Additional Information

Introduction

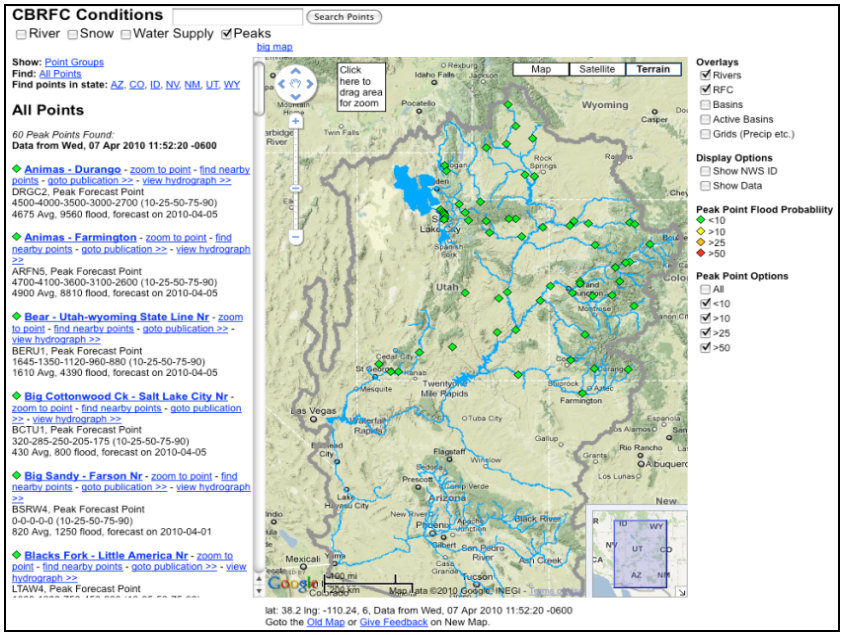
Streamflow varies dramatically over the course of the snowmelt season. To characterize the magnitude of a year with a single seasonal peak sometimes can be an oversimplification. Hydrographs (or graphs of mean daily flow versus time) for each site can be viewed by **clicking on the site name.** The hydrographs include an example high and low year alongside last year and this year.

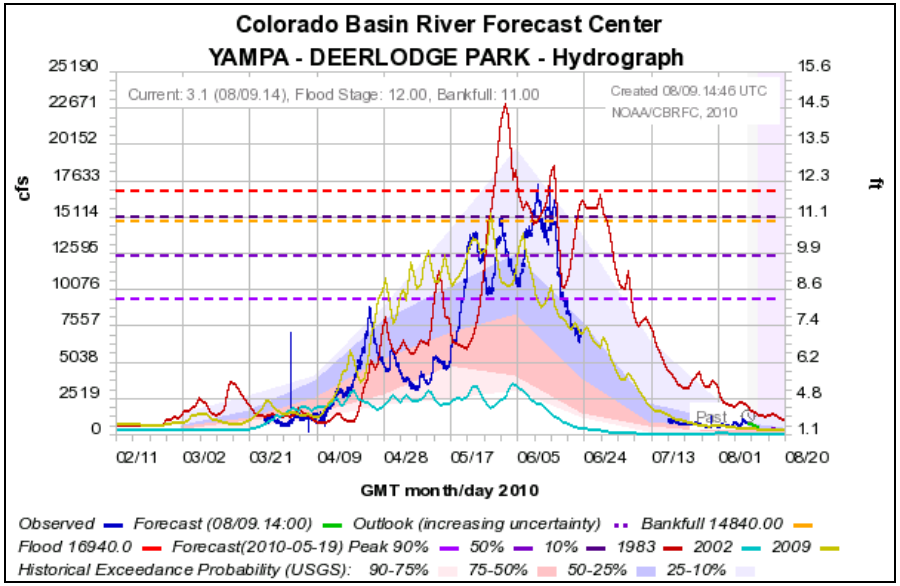
River recreationists often ask what are the high and low years. Rankings of a sites peak flows can be viewed by clicking the site name below. Reservoir regulation plays a major role in determining observed peak flows. As would be expected, higher (but more short-lived) peaks are generally observed in the pre-regulatory era (before 1960).

Upper Colorado Peak Flow Forecasts (mean daily cfs)

Prepared by: Alcorn, Cox, Reed

	Historic Peak	Average Peak	Flood* Flow	2009 Peak	2009 Date	2010 Forecast Exceedance Probability 90%	75%	50%	25%	10%	Normal time of Peak	Issuance Date	Observed Peak	Observed Date
Colorado														
Kremmling, Nr	12,700	3,900	10,150	5,320	6/27	N/A	N/A	N/A	N/A	N/A	5/15 - 6/27			
Eagle														
Gypsum, Blo	6,580	3,600	6,600	3,370	6/03	1500	1800	**2400**	3200	4400	6/1 - 6/21	3/1		
Colorado														
Dotsero, Nr	20,800	9,425	17,000	10,000	5/21	3000	4000	**5000**	7000	10000	5/25 - 6/20	3/1		
Crystal														
Redstone, Nr Avalanche Ck	3,500	1,965	3,100	2,050	5/24	1300	1500	**1700**	2000	2300	5/29 - 6/22	3/1		





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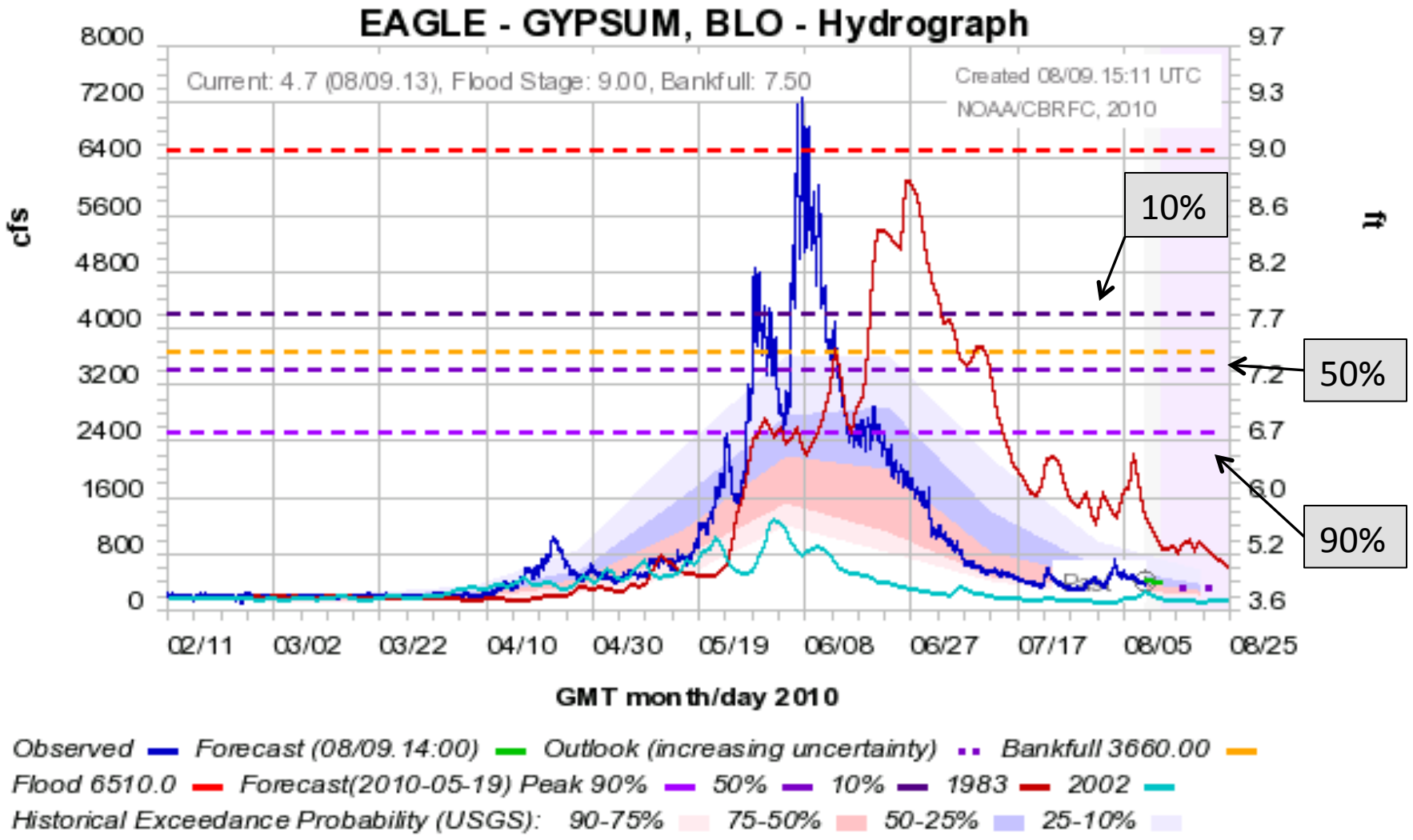
Eagle														
Gypsum, Blo	6,580	3,600	6,600	3,370	6/03	2,500	2,900	**3,400**	3,900	4,200	6/1 - 6/21	5/19	1,030	4/22



How do we make a Peak Flow Forecast?

Main Variables:

1. Current Soil Moisture States
2. Snowpack Conditions
3. Current Base Flow
4. Reservoir Regulation Plans
5. Future Precipitation Events
6. Future Temperature

Methods:

1. **ESP**
   (Max mean daily flow April-July)
2. Regressions
   (Historical Peaks vs Historical Volumes)
3. Hybrid method of ESP + Regressions

Forecast Evaluation

Why peak flow forecast verification?

- **No previous verification information** -Unlike water supply and event forecasts

- **Large uncertainty in forecasts -** Heavily dependent on weather conditions during the melt period

- **Forecast process is difficult -** Verification studies should help drive decisions about changes to peak flow forecast program (e.g. When to start making forecasts? When to update?)

- **Forecasting tools (ESP) –** How are the current tools performing? How the skill/error change over the current and historical forecast period?

- **Prototype -** Validate tools and proof of concept before widespread verification of peak flow sites

Verification Methods

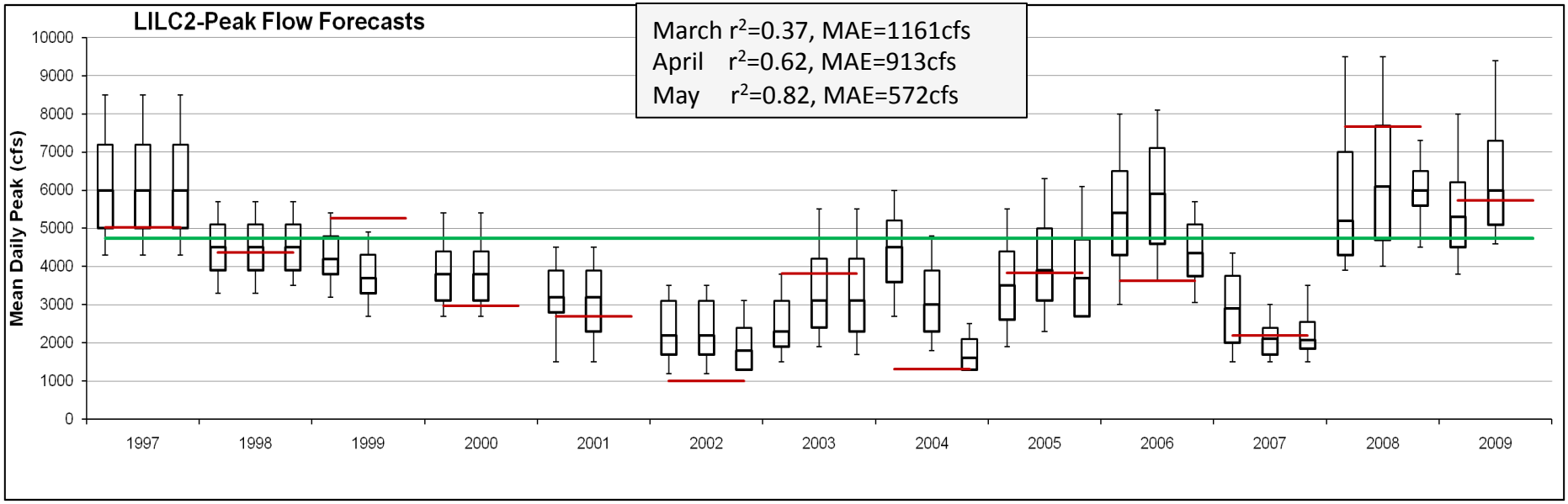
1. Selected 8 sites- 4 unregulated, 4 regulated
2. Collected peak flow forecasts from March-May for 1997-2009
3. Constructed ESP reforecasts of peak flow 1997-2005
4. Calculated error of forecasts and reforecasts
5. Calculated skill of forecasts and reforecasts
6. Compared error/skill of forecasts and reforecasts
7. Verified exceedance probabilities and forecast spread

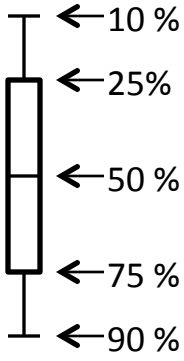
Limitations

-Small sample size
-No future QPF or temperature forecasts included in reforecasts (coming soon)
-Reforecasts currently only available to 2005
-Observed peaks may be rain enhanced
-No archived documentation on forecast methodology

Little Snake nr Lily (LILC2)

FORECASTS (1997-2009)





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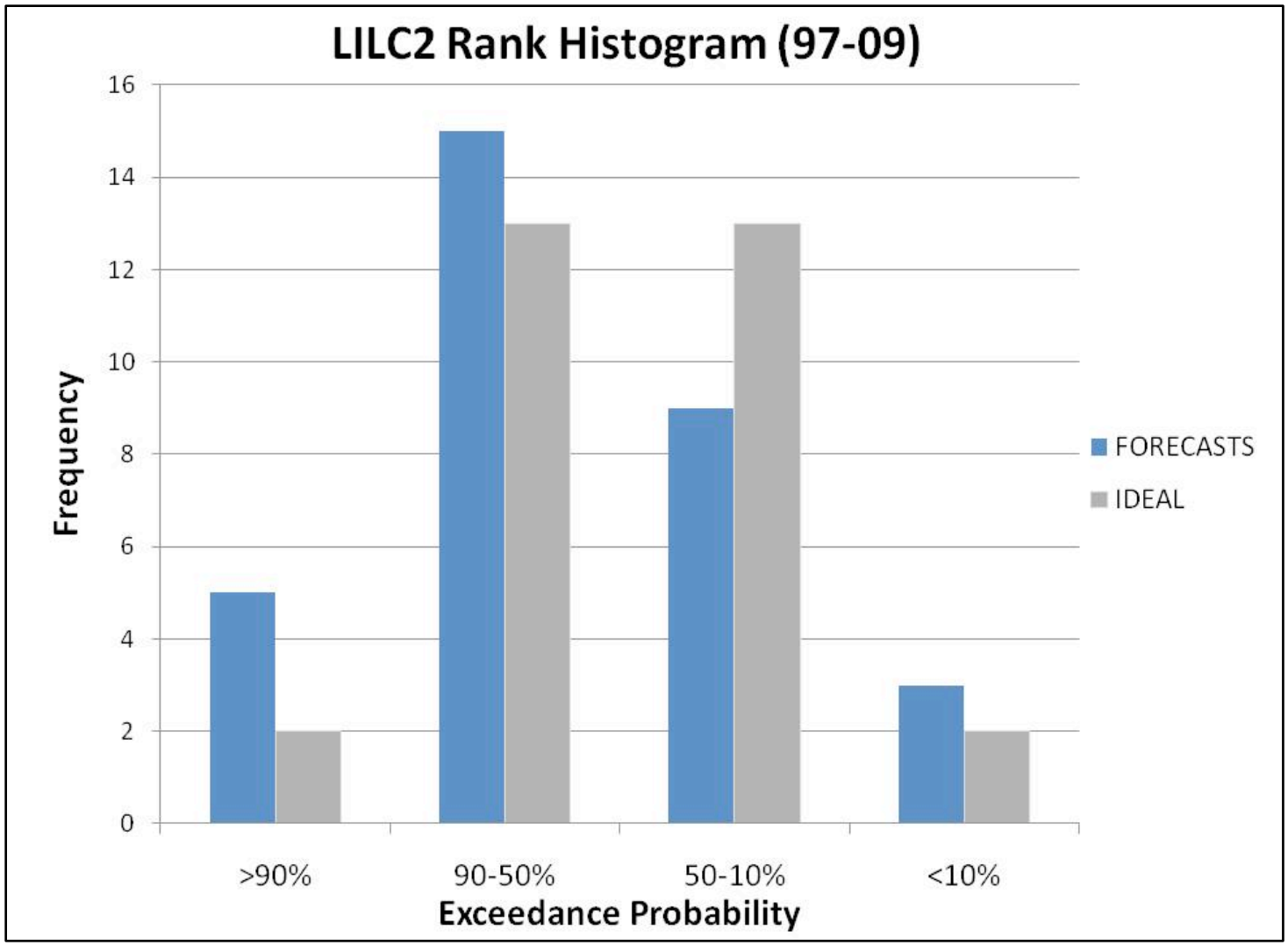

** Includes first of month forecasts from March, April, and May**

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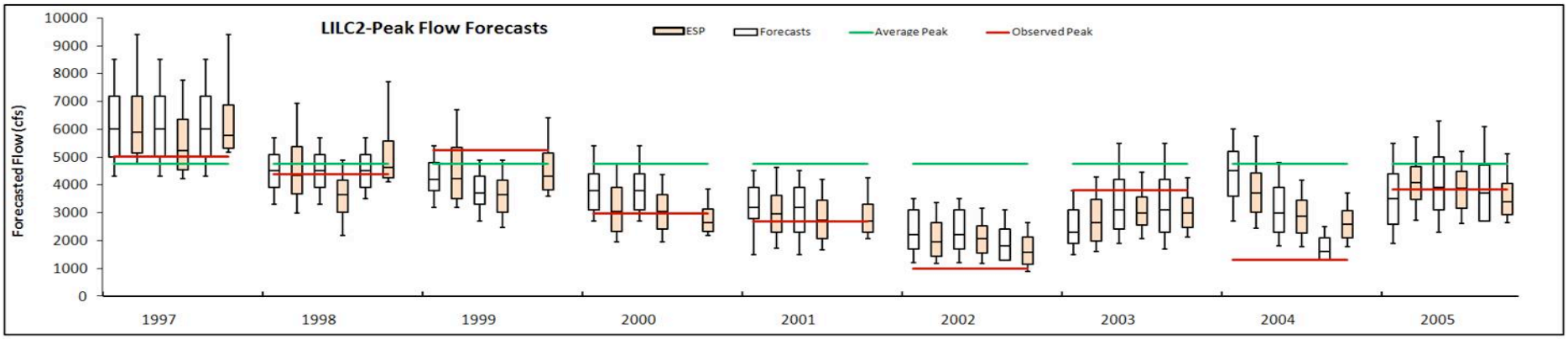
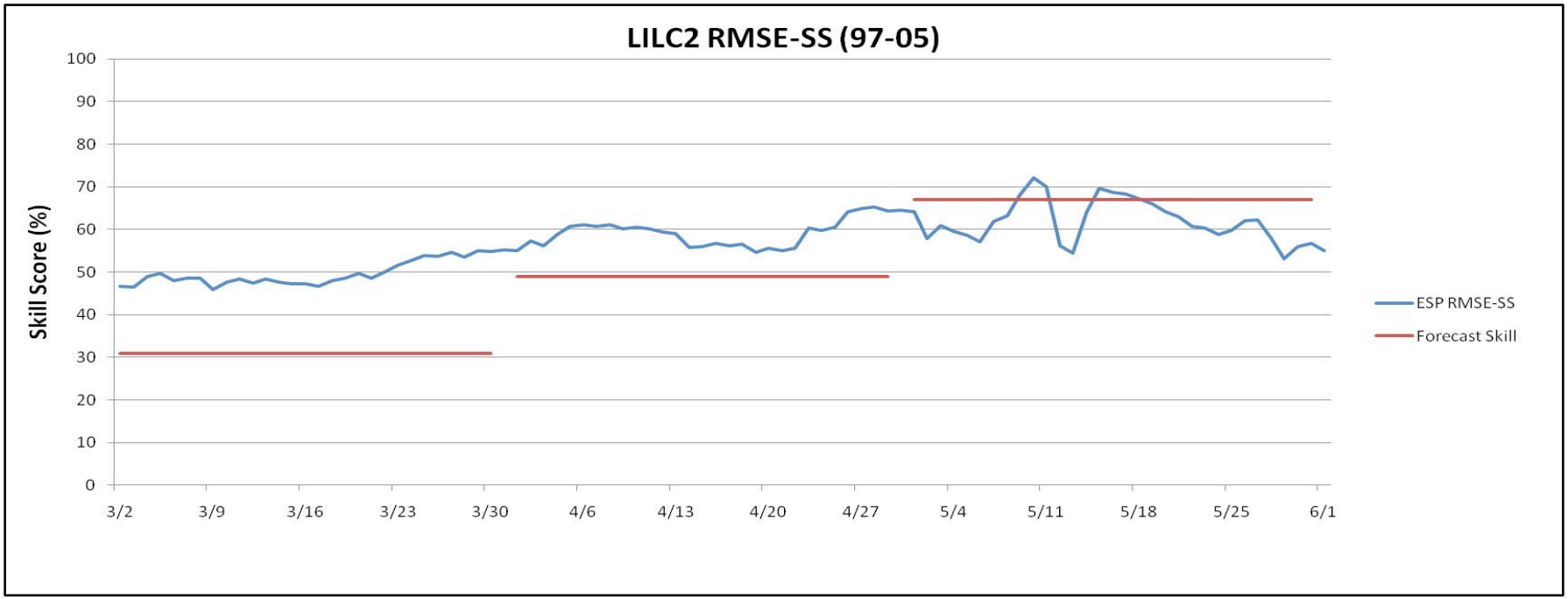
ESP REFORECASTS (1997-2005)





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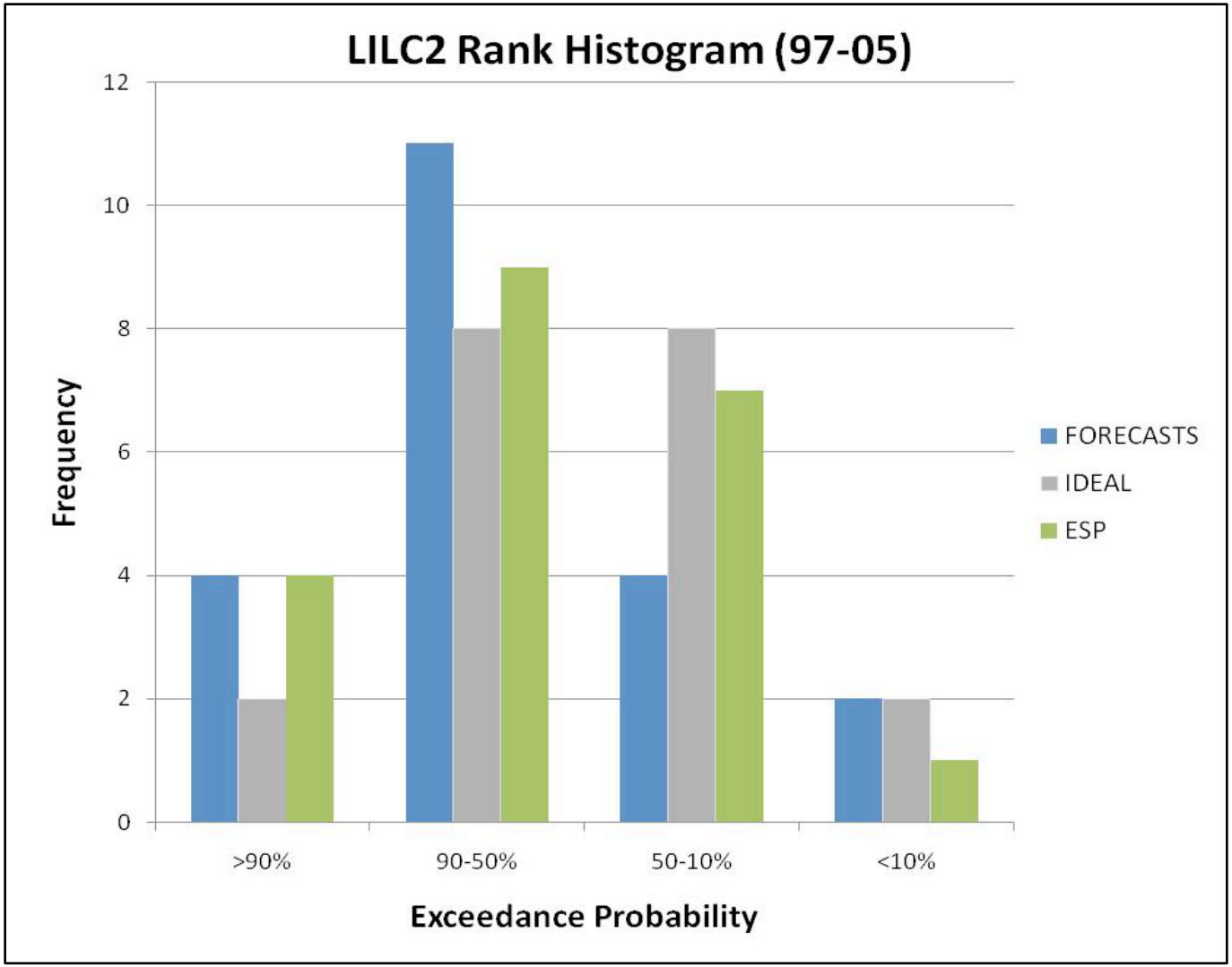

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Summary

Forecasts and ESP Reforecasts (4 unregulated sites)

MAE

- April ESP reforecasts less error at 3 sites; difference in error <20%
- May forecasts less error (3 sites <10%, 1 site ~30%) at all 4 sites
- No clear trend in MAE
- Reforecasts and forecasts error trends match at 3 of 4 sites

Skill

-March ESP reforecasts had greater skill at 3 of 4 sites
-April ESP reforecasts had greater skill at all 4 sites
-No clear trend in skill

Histograms

-Forecasts are statistically reliable (e.g. 10% exceeded ~10% of the time)
-ESP reforecasts are statically reliable at 3 of 4 unreg sites

Future Plans: Forecast verification will drive future forecast program (e.g. forecast frequencies, locations, issuance dates, etc)

What do you want?
Questions/Comments?