CR QPF Time Horizons Used in River Forecasts: Part II

An Early Look

Juliann Meyer (MBRFC) and Holly Reckel (NCRFC)
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Overview

The goal of this follow on study is to identify the impacts of variable QPF periods on operational forecasts.

Conclusions will be based upon the discovery of statistically supportable evidence of optimal QPF at both MBRFC and NCRFC.

Objectives

1) Conduct an error analysis similar to the *Optimization of QPF Time Horizons Used in River Forecasts* study, but on a forecast basin scale instead of a 4km grid scale. The error analysis will be conducted on both incremental and cumulative RFC HAS QPF.

2) Determine optimum number of QPF periods, based upon raw RFC HAS QPF forcings applied on a basin scale to RFC runoff zones. The analysis will consider both incremental and cumulative periods of QPF.

3) Determine the optimum number of QPF periods based upon river forecast verification metrics. The analysis will attempt to identify the optimum number of QPF periods that balances river forecast lead-time with river forecast accuracy.

Issues

- Sample Size – not all data posting to database

- Missing data for some days

- sftp of Hermann flow times for the various scenarios fails partially or completely

- scripts that monitor the various processes sometimes fail or no monitoring script is in place

Limitations

The order of station LIDs and SHEF Type/Source Codes in the various IVP plots

Would like to have capability to do rmse-ss against something other then persistence

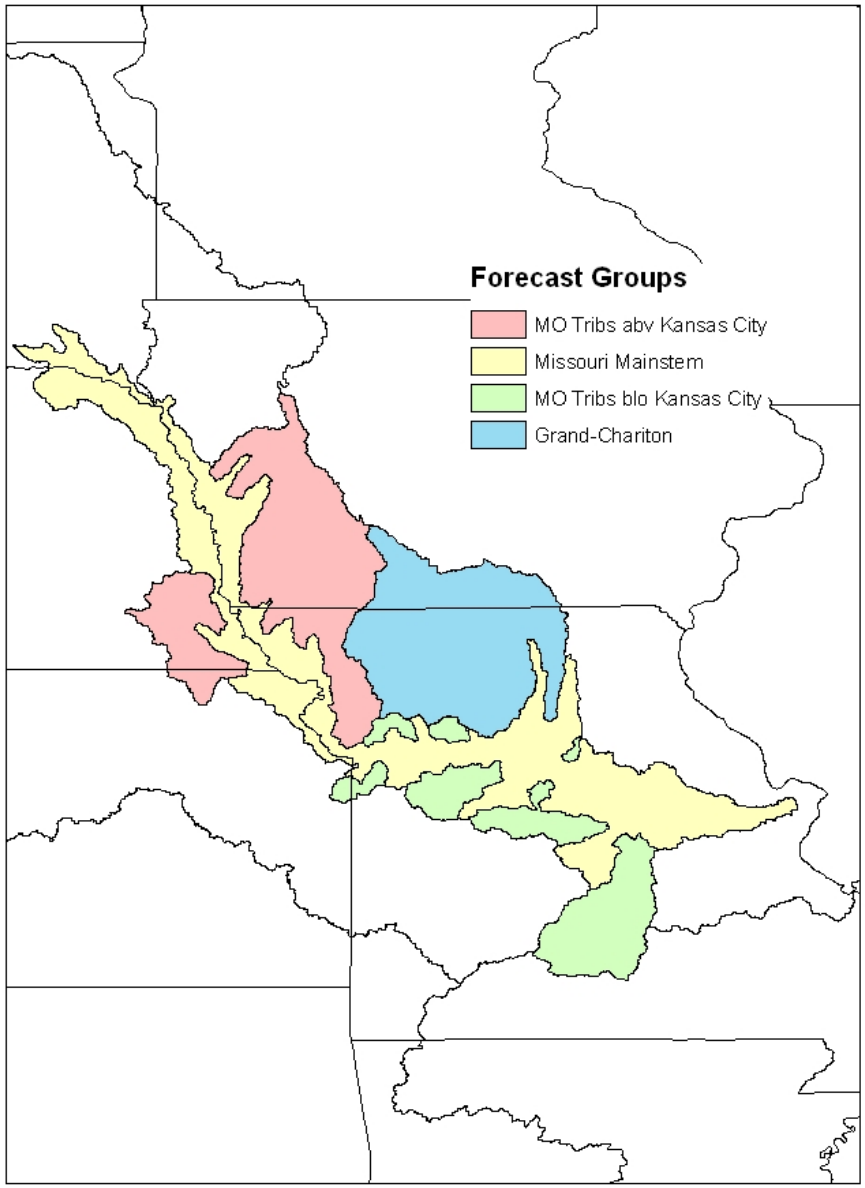
At MBRFC the QPF studies runs are piggybacked on the 17 scenarios we make daily and that job fails if the 95%max and min QPF files are not available

For NCRFC the numbers for the lower end of the Mississippi fcstgrp are dependent on getting the Hermann flows for MBRFC for all the scenarios successfully every day

MBRFC

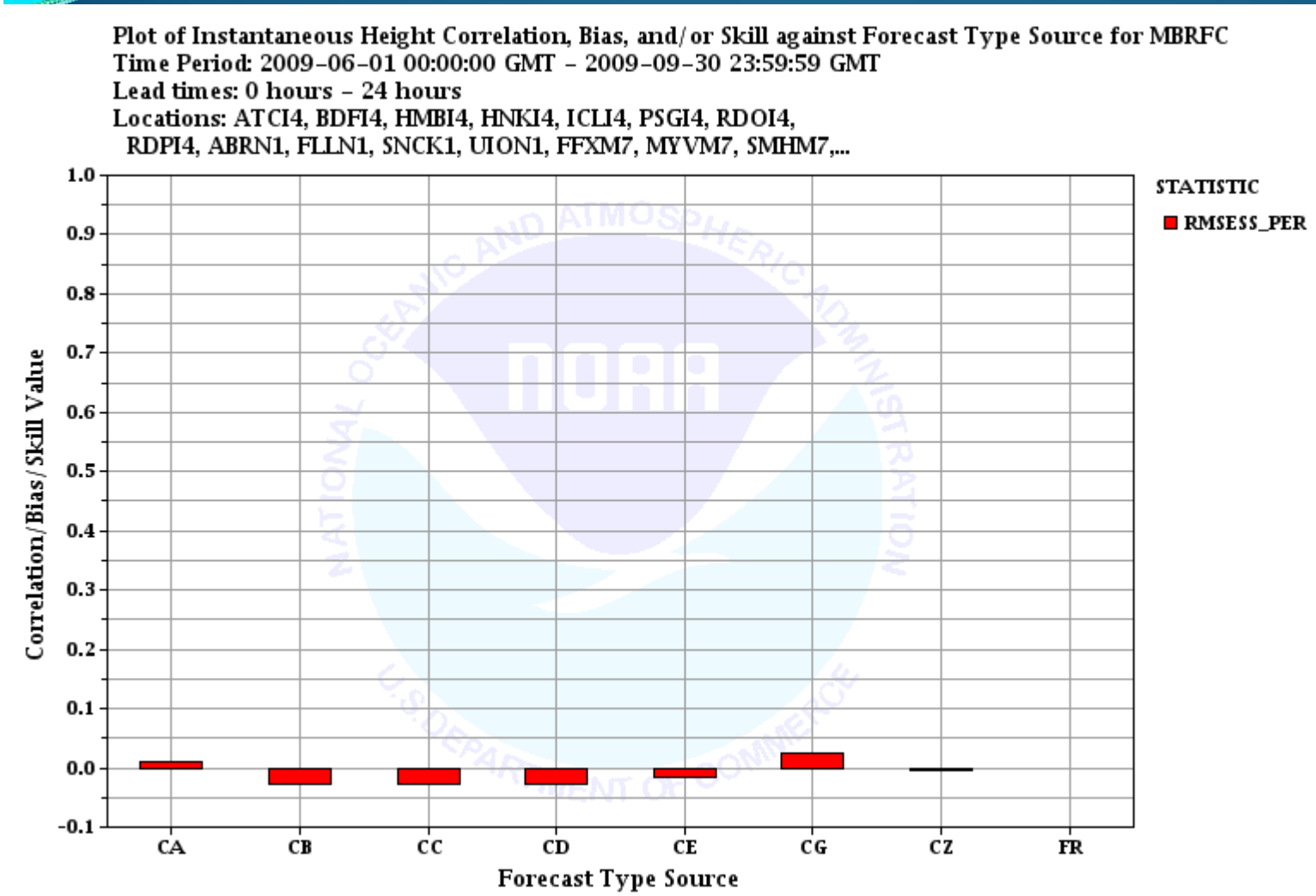
For this presentation looked at 4 forecast groups, Missouri Tribs abv KC, Missouri Tribs blo KC, Grand-Chariton and the Missouri Mainstem.

- 181 runoff zones
- 33 FAST response time forecast points
- 9 MEDIUM response time forecast points
- 19 SLOW response time forecast points

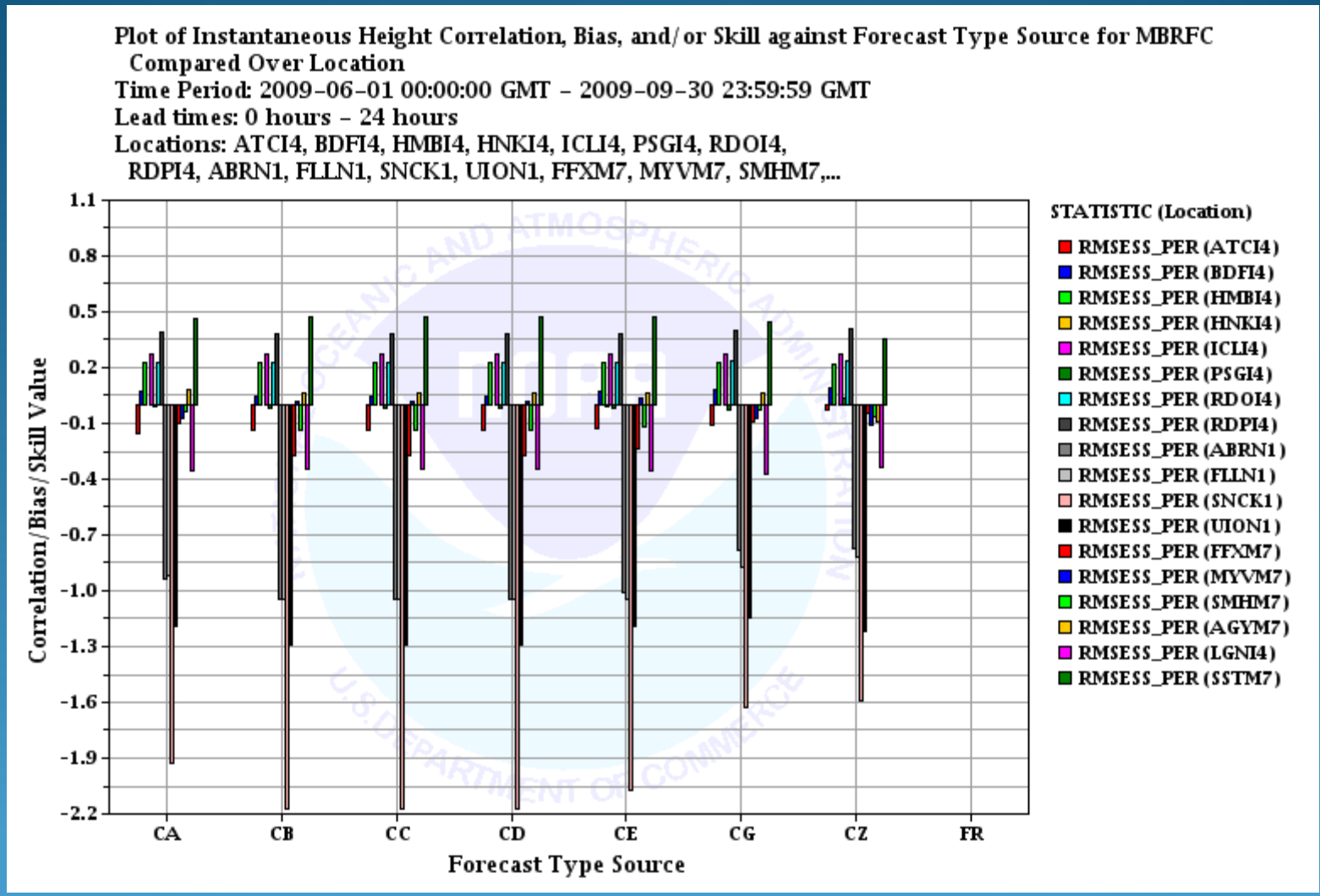

Forecast Groups
MO Tribs abv Kansas City
Missouri Mainstem
MO Tribs blo Kansas City
Grand-Chariton

Stage Analysis

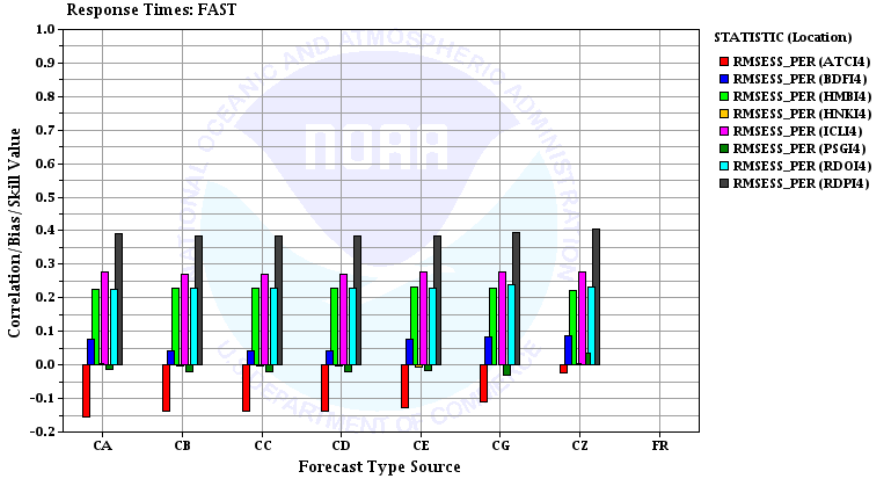
Primary statistic used for this initial look was rmse-ss



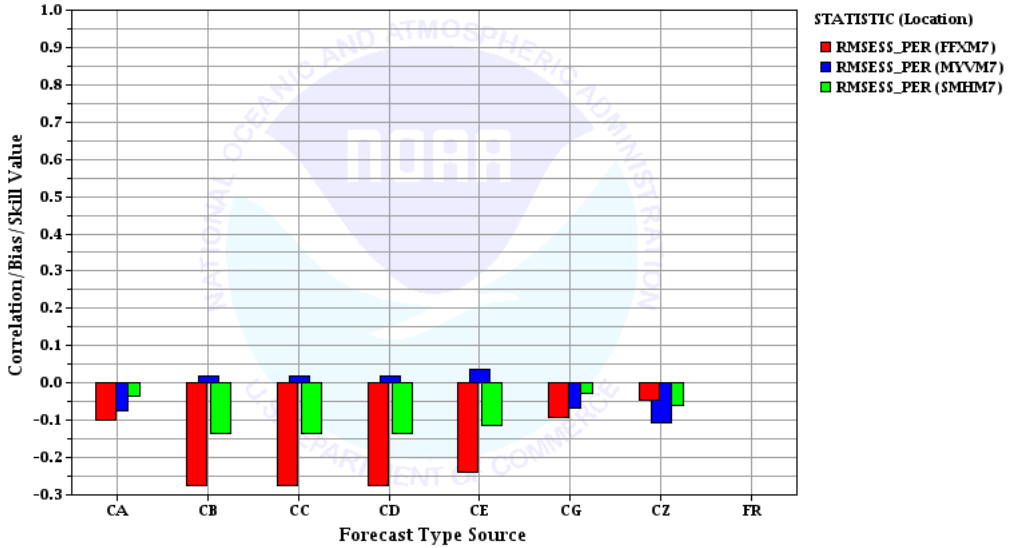
CA - 12
CB – 24
CC – 48
CD – 72
CE – 18
CG - 6
CZ – zero


Plot of Instantaneous Height Correlation, Bias, and/or Skill against Forecast Type Source for MBRFC
Compared Over Location
Time Period: 2009-06-01 00:00:00 GMT - 2009-09-30 23:59:59 GMT
Lead times: 0 hours - 24 hours
Locations: ATCI4, BDFI4, HMBI4, HNKI4, ICLI4, PSGI4, RDOI4,
RDPI4, ABRN1, FLLN1, SNCK1, UION1, FFXM7, MYVM7, SMHM7,...
Correlation/Bias/Skill Value
1.1
0.8
0.5
0.2
-0.1
-0.4
-0.7
-1.0
-1.3
-1.6
-1.9
-2.2
CA
CB
CC
CD
CE
CG
CZ
FR
Forecast Type Source
STATISTIC (Location)
RMSESS_PER (ATCI4)
RMSESS_PER (BDFI4)
RMSESS_PER (HMBI4)
RMSESS_PER (HNKI4)
RMSESS_PER (ICLI4)
RMSESS_PER (PSGI4)
RMSESS_PER (RDOI4)
RMSESS_PER (RDPI4)
RMSESS_PER (ABRN1)
RMSESS_PER (FLLN1)
RMSESS_PER (SNCK1)
RMSESS_PER (UION1)
RMSESS_PER (FFXM7)
RMSESS_PER (MYVM7)
RMSESS_PER (SMHM7)
RMSESS_PER (AGYM7)
RMSESS_PER (LGNI4)
RMSESS_PER (SSTM7)

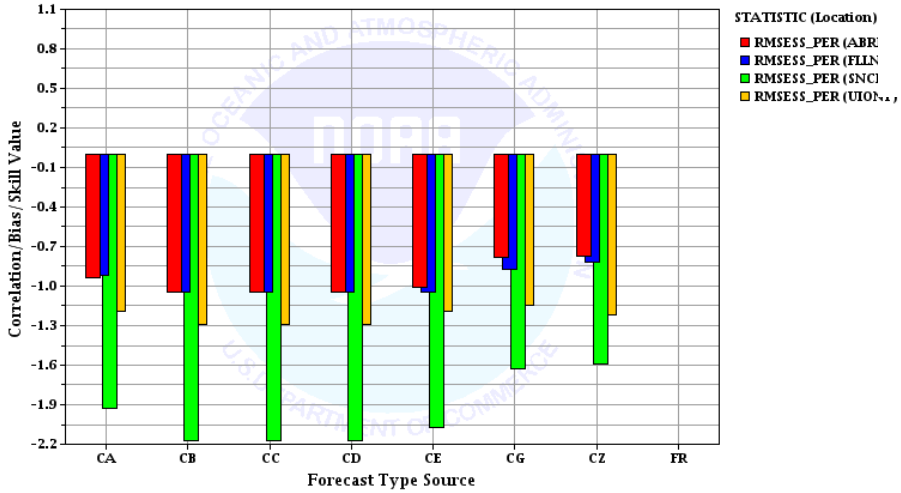
Plot of Instantaneous Height Correlation, Bias, and/or Skill against Forecast Type Source for MBRFC
Compared Over Location
Time Period: 2009-06-01 00:00:00 GMT – 2009-09-30 23:59:59 GMT
Lead times: 0 hours – 24 hours
Locations: ATCI4, BDFI4, HMBI4, HNKI4, ICLI4, PSGI4, RDOI4, RDPI4
Response Times: FAST



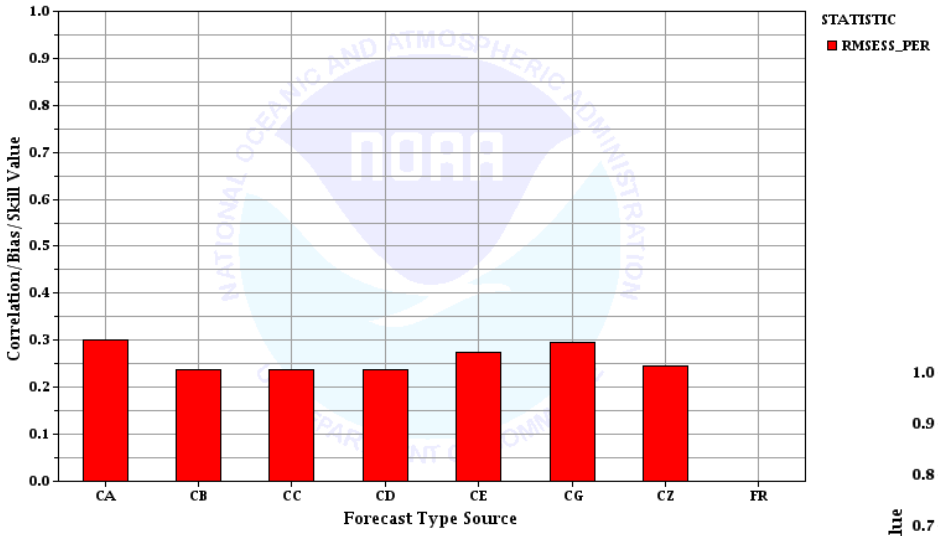
Plot of Instantaneous Height Correlation, Bias, and/or Skill against Forecast Type Source for MBRFC
Compared Over Location
Time Period: 2009-06-01 00:00:00 GMT – 2009-09-30 23:59:59 GMT
Lead times: 0 hours – 24 hours
Locations: FFXM7, MYVM7, SMHM7
Response Times: FAST



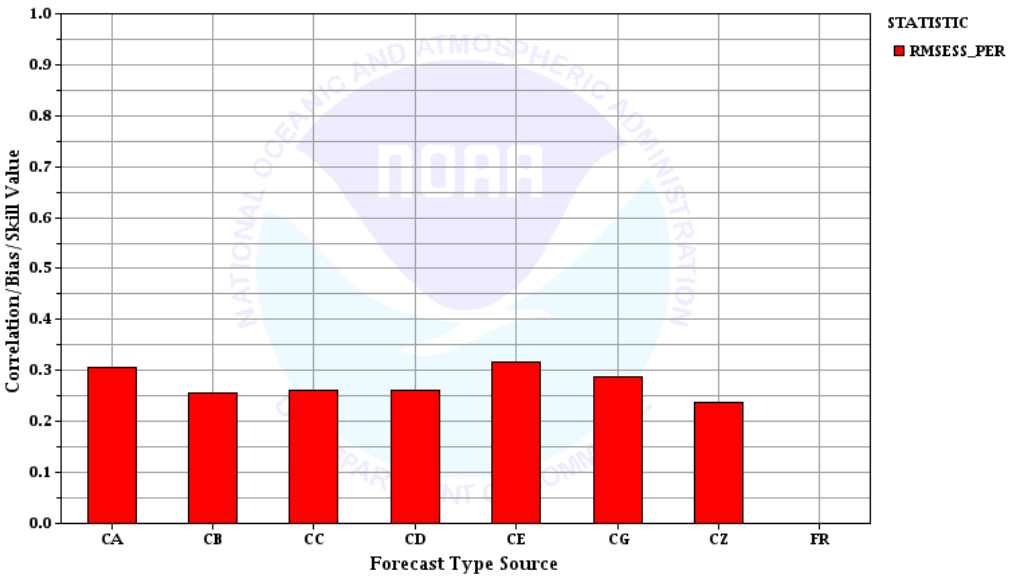
Plot of Instantaneous Height Correlation, Bias, and/or Skill against Forecast Type Source for MBRFC
Compared Over Location
Time Period: 2009-06-01 00:00:00 GMT – 2009-09-30 23:59:59 GMT
Lead times: 0 hours – 24 hours
Locations: ABRN1, FLLN1, SNCK1, UION1
Response Times: FAST



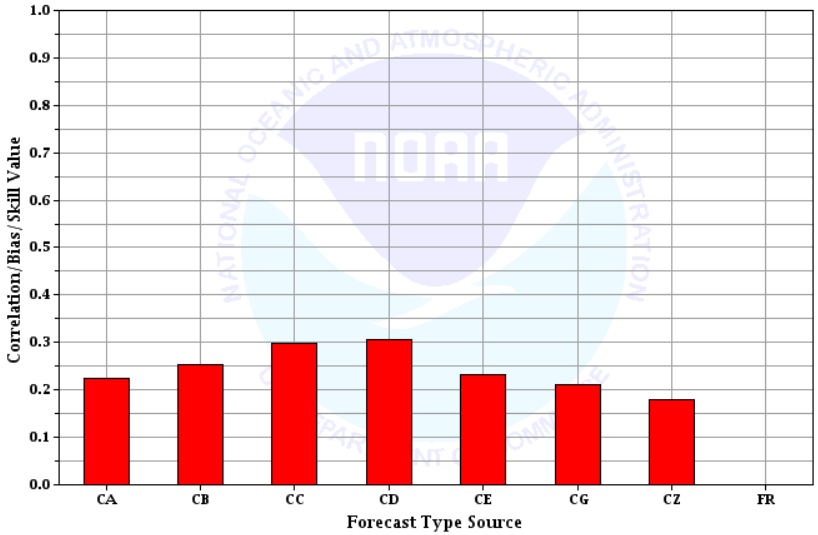
Plot of Instantaneous Height Correlation, Bias, and/or Skill against Forecast Type Source for MBRFC
Time Period: 2009-06-01 00:00:00 GMT – 2009-09-30 23:59:59 GMT
Lead times: 0 hours – 24 hours
Locations: DVSI4, TTZM7, GAZM7, CHZM7, SNZM7, PRMI4, CHTI4, MOLI4, NVZM7, PRIM7



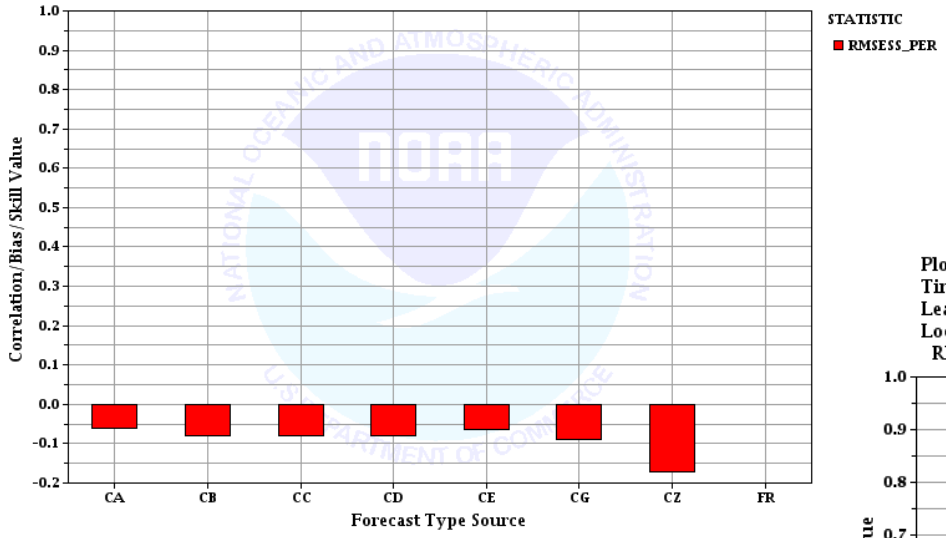
Plot of Instantaneous Height Correlation, Bias, and/or Skill against Forecast Type Source for MBRFC
Time Period: 2009-06-01 00:00:00 GMT – 2009-09-30 23:59:59 GMT
Lead times: 24 hours – 48 hours
Locations: DVSI4, TTZM7, GAZM7, CHZM7, SNZM7, PRMI4, CHTI4, MOLI4, NVZM7, PRIM7



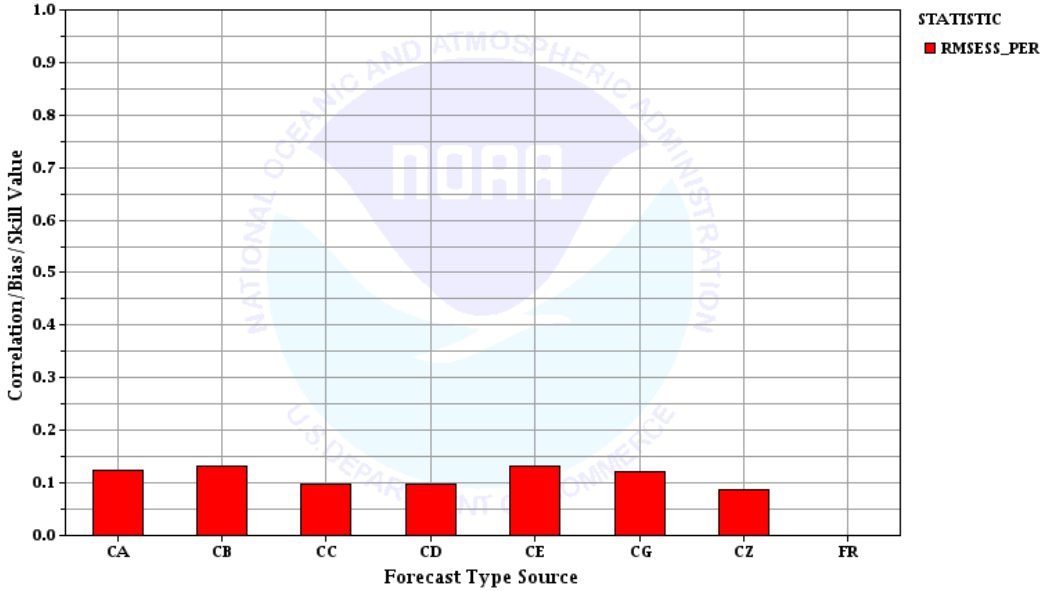
Plot of Instantaneous Height Correlation, Bias, and/or Skill against Forecast Type Source for MBRFC
Time Period: 2009-06-01 00:00:00 GMT – 2009-09-30 23:59:59 GMT
Lead times: 48 hours – 72 hours
Locations: DVSI4, TTZM7, GAZM7, CHZM7, SNZM7, PRMI4, CHTI4, MOLI4, NVZM7, PRIM7



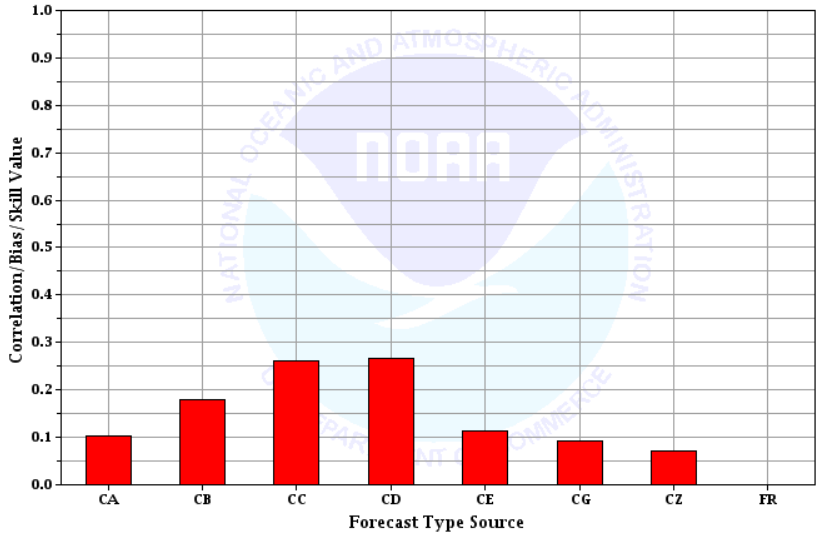
Plot of Instantaneous Height Correlation, Bias, and/or Skill against Forecast Type Source for MBRFC
Time Period: 2009-06-01 00:00:00 GMT – 2009-09-30 23:59:59 GMT
Lead times: 0 hours – 24 hours
Locations: KBRM7, KCCM7, LKCM7, RICM7, CAXM7, VLYM7, BLVM7,
OTTM7, FYTM7, BONM7, JCMM7, WPHM7, HZLM7, JRMM7, RIFM7,...



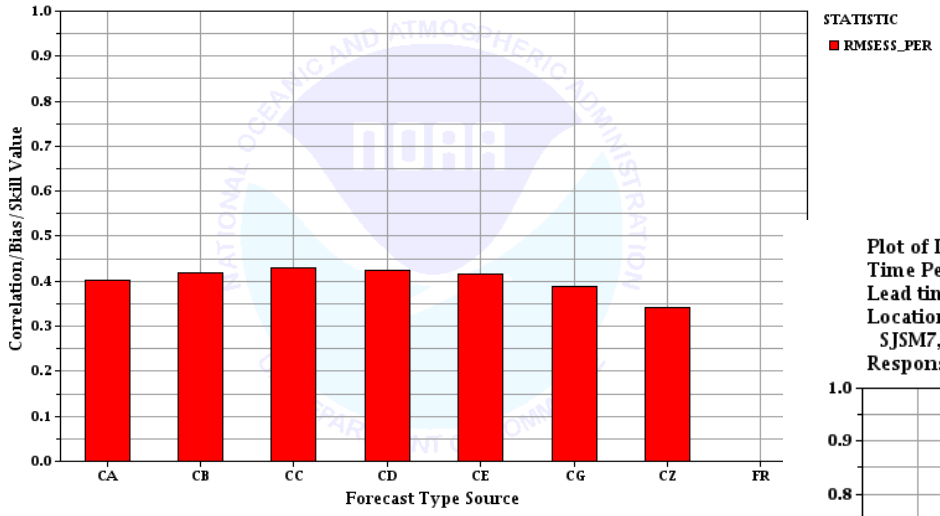
Plot of Instantaneous Height Correlation, Bias, and/or Skill against Forecast Type Source for MBRFC
Time Period: 2009-06-01 00:00:00 GMT – 2009-09-30 23:59:59 GMT
Lead times: 24 hours – 48 hours
Locations: ATCI4, BDFI4, HMBI4, HNKI4, ICLI4, PSGI4, RDOI4,
RDPI4, ABRN1, FLLN1, SNCK1, UION1, FFXM7, MYVM7, SMHM7,...



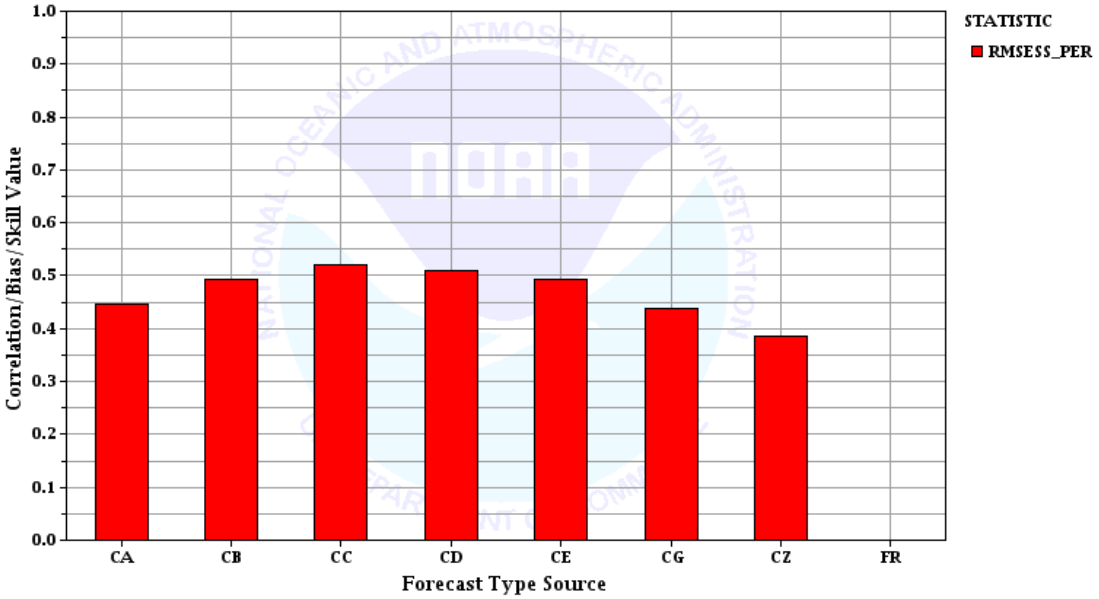
Plot of Instantaneous Height Correlation, Bias, and/or Skill against Forecast Type Source for ME
Time Period: 2009-06-01 00:00:00 GMT – 2009-09-30 23:59:59 GMT
Lead times: 48 hours – 72 hours
Locations: KBRM7, KCCM7, LKCM7, RICM7, CAXM7, VLYM7, BLVM7,
OTTM7, FYTM7, BONM7, JCMM7, WPHM7, HZLM7, JRMM7, RIFM7,...



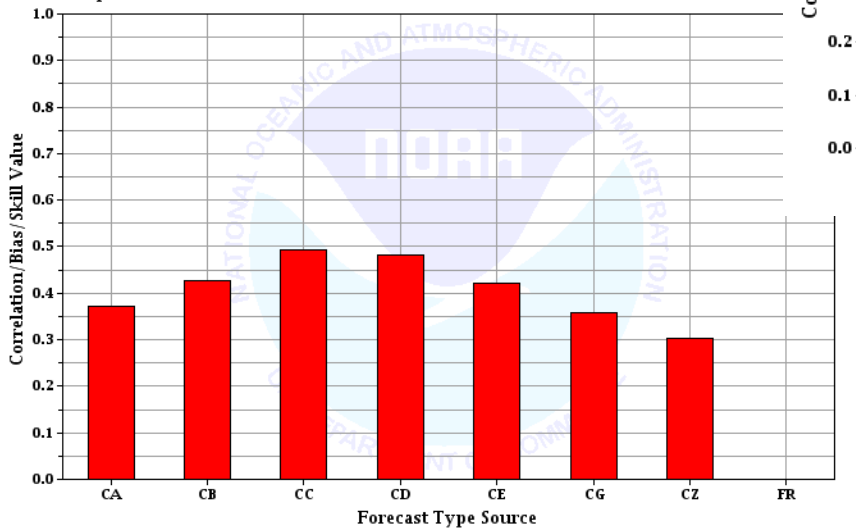
Plot of Instantaneous Height Correlation, Bias, and/or Skill against Forecast Type Source for MBRFC
Time Period: 2009-06-01 00:00:00 GMT – 2009-09-30 23:59:59 GMT
Lead times: 0 hours – 24 hours
Locations: SSCN1, DCTN1, BLAN1, OMHN1, NEBN1, BRON1, RULN1,
SJSM7, KCDM7, NAPM7, WVYM7, GLZM7, BOZM7, JFFM7, HRNM7,...
Response Times: SLOW



Plot of Instantaneous Height Correlation, Bias, and/or Skill against Forecast Type Source for MBRFC
Time Period: 2009-06-01 00:00:00 GMT – 2009-09-30 23:59:59 GMT
Lead times: 24 hours – 48 hours
Locations: SSCN1, DCTN1, BLAN1, OMHN1, NEBN1, BRON1, RULN1,
SJSM7, KCDM7, NAPM7, WVYM7, GLZM7, BOZM7, JFFM7, HRNM7,...
Response Times: SLOW



Plot of Instantaneous Height Correlation, Bias, and/or Skill against Forecast Type Sou
Time Period: 2009-06-01 00:00:00 GMT – 2009-09-30 23:59:59 GMT
Lead times: 48 hours – 72 hours
Locations: SSCN1, DCTN1, BLAN1, OMHN1, NEBN1, BRON1, RULN1,
SJSM7, KCDM7, NAPM7, WVYM7, GLZM7, BOZM7, JFFM7, HRNM7,...
Response Times: SLOW

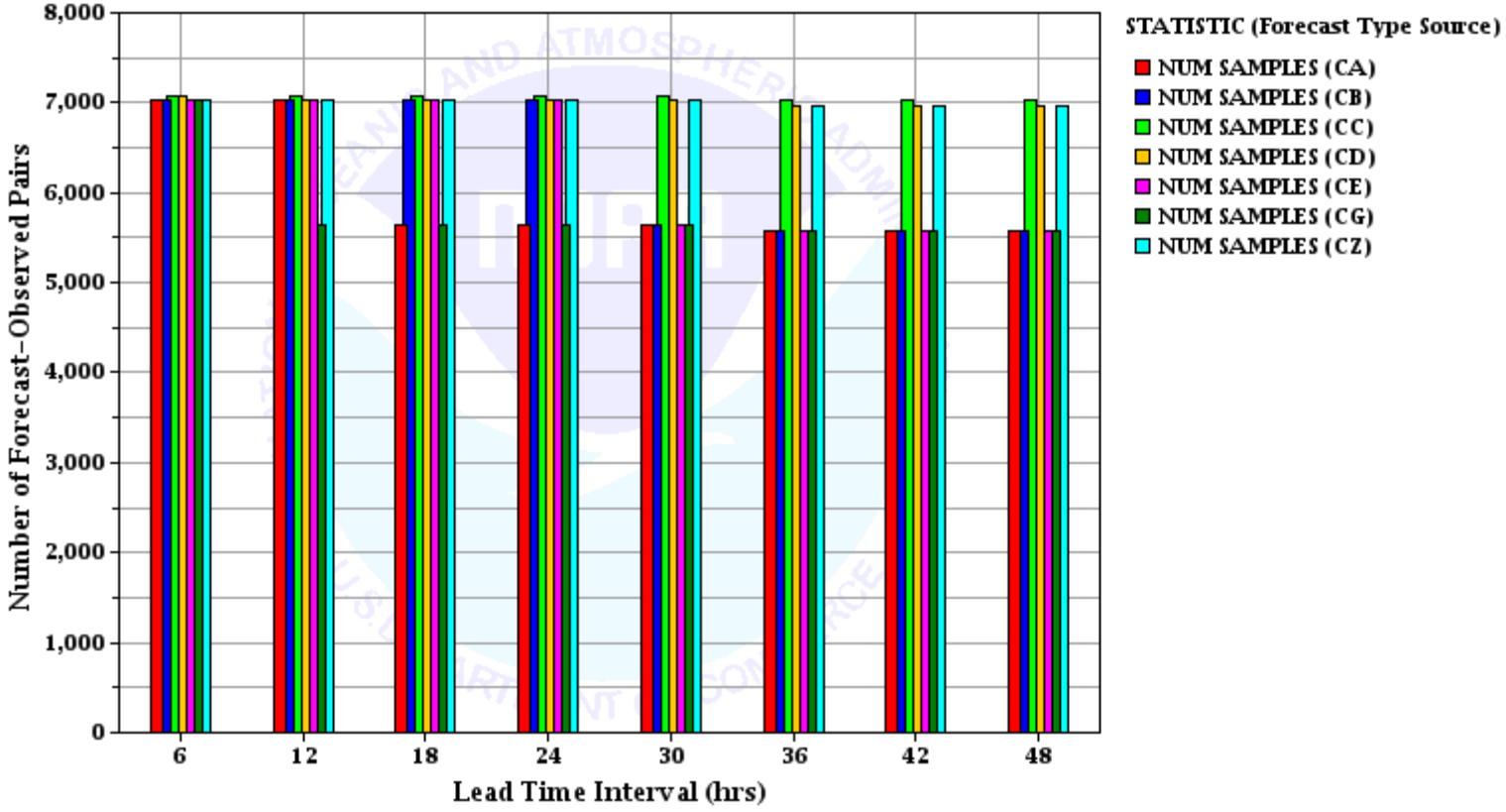


Precipitation Analysis

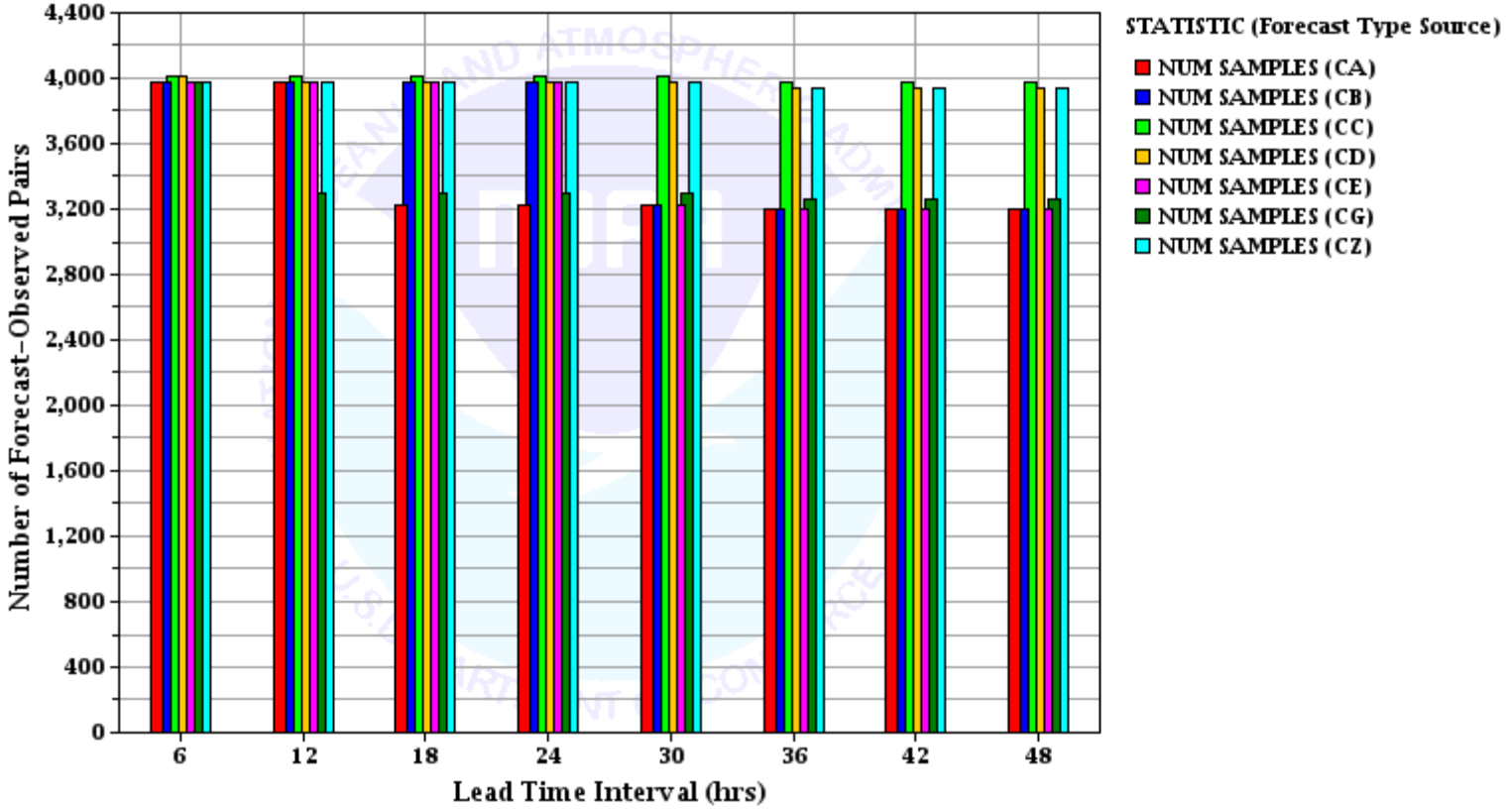
Primary statistic used for this initial look were

- sample size
- by categories
- mean error
- mean absolute error

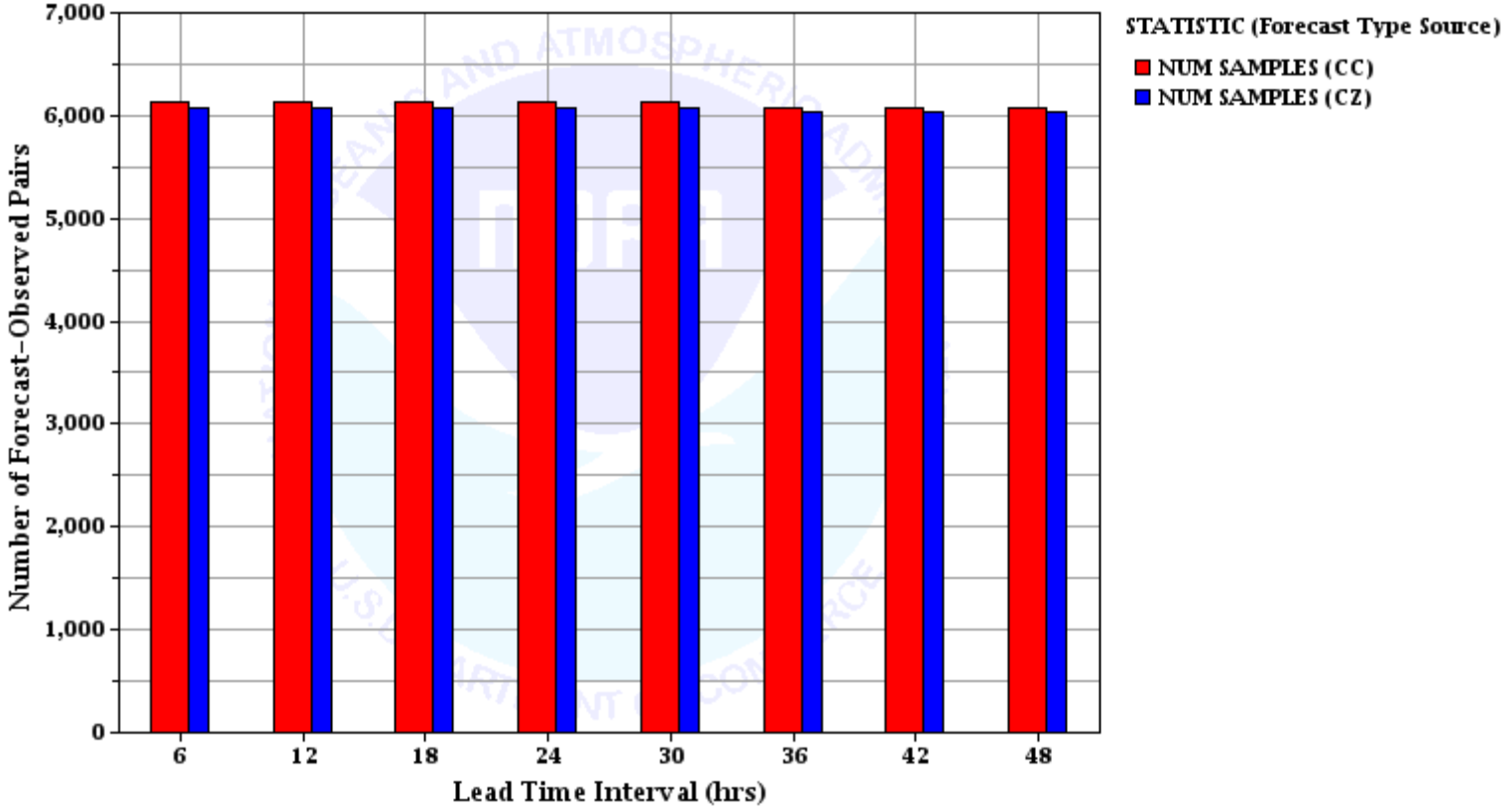
Plot of 6-Hourly Precipitation Amount Sample Size against Leadtime Interval for MBRFC
Compared Over Forecast Type Source
Time Period: 2009-06-01 00:00:00 GMT - 2009-09-30 23:59:59 GMT
Lead times: 0 hours - 48 hours
Locations: 901, 947, 933, 934, 948, 935, 938, 902, 903, 915,
944, 916, 945, 919, 936, 937, 904, 905, 907, 906, 908, 909,...



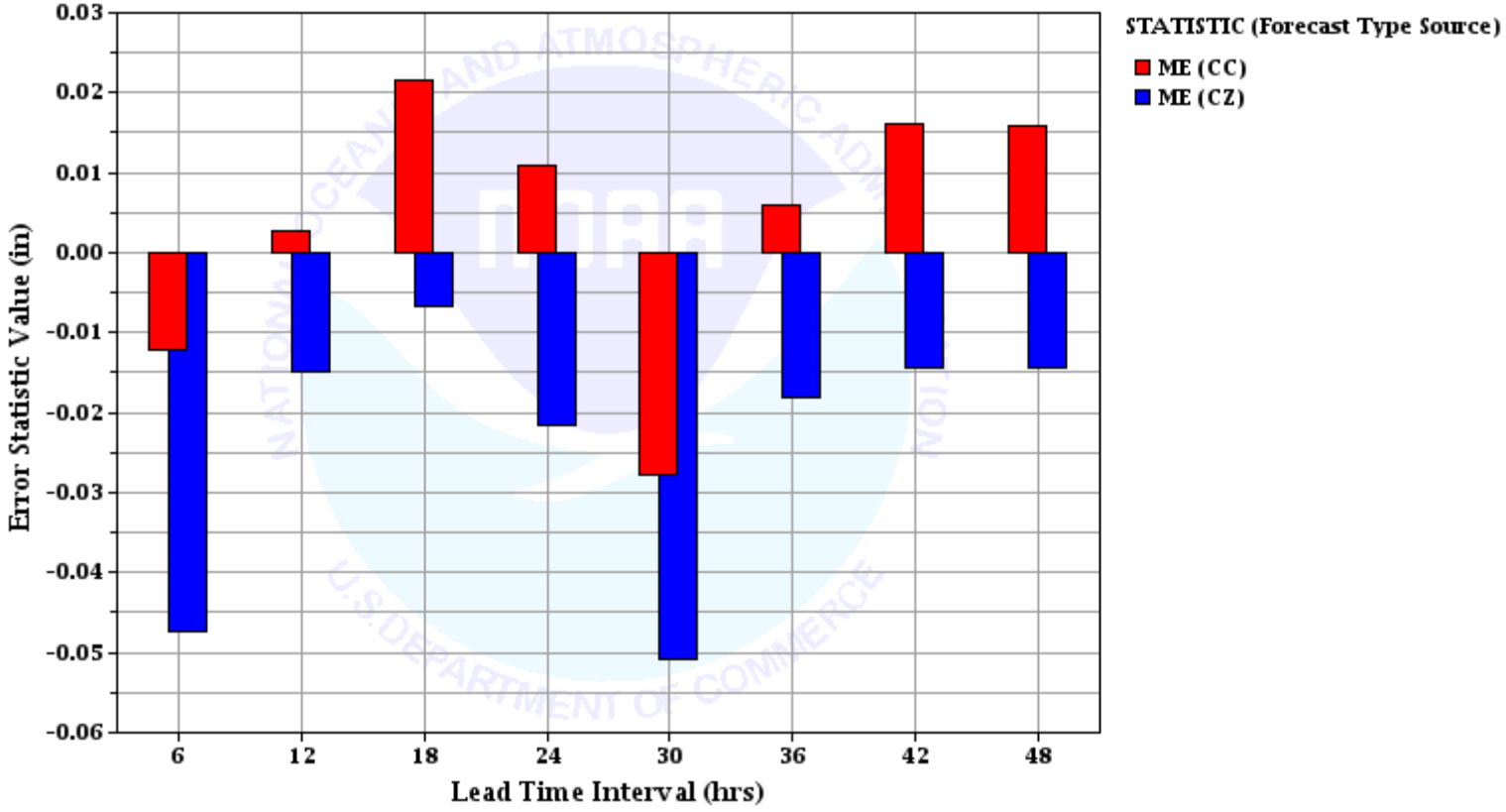
Plot of 6-Hourly Precipitation Amount Sample Size against Leadtime Interval for MBRFC
Compared Over Forecast Type Source
Time Period: 2009-06-01 00:00:00 GMT - 2009-09-30 23:59:59 GMT
Lead times: 0 hours - 48 hours
Locations: 1601, 1632, 1631, 1603, 1604, 1605, 1630, 1606,
1607, 1608, 1609, 1610, 1611, 1636, 1612, 1613, 1616, 1614,...



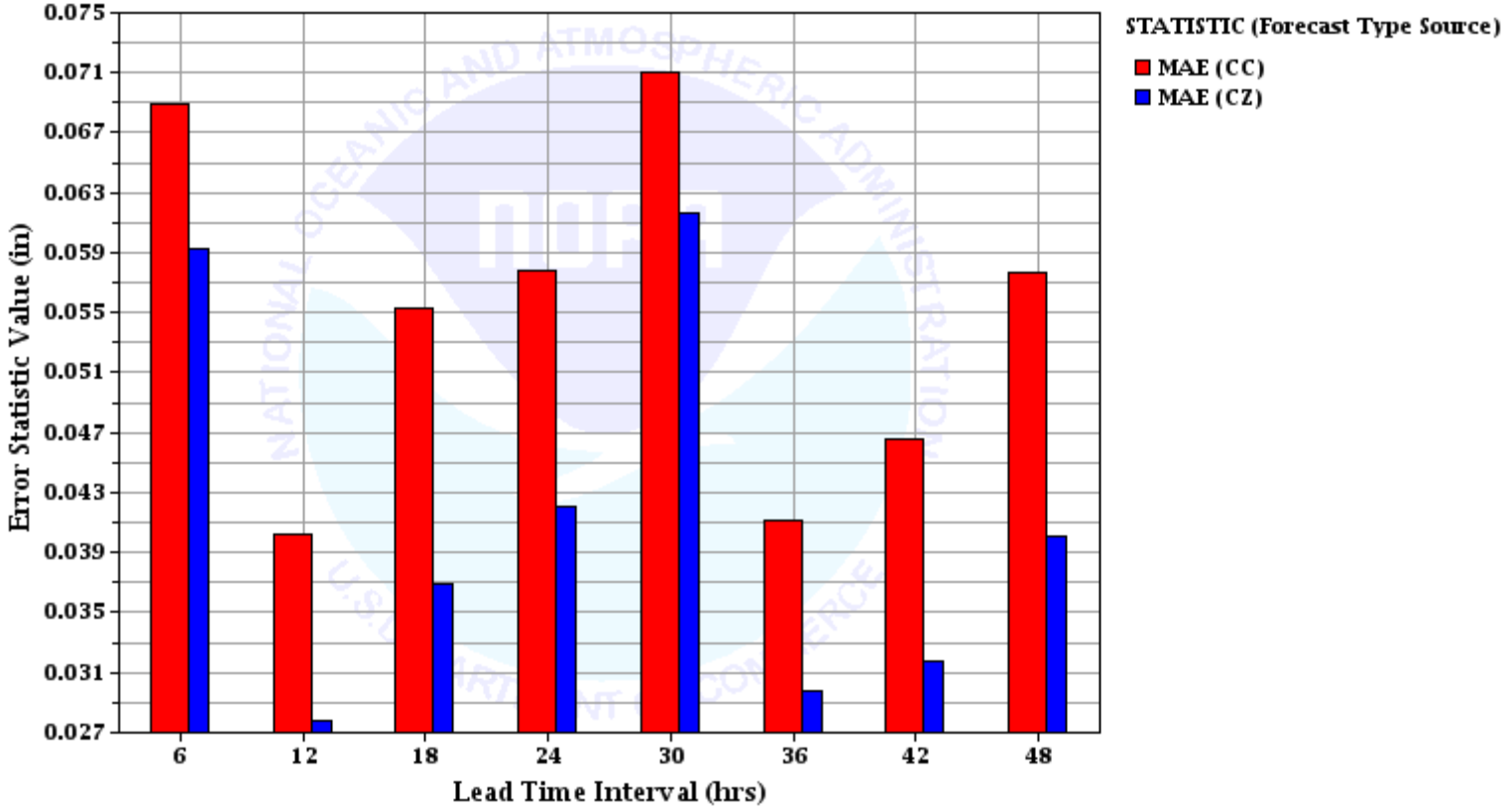
Plot of 6-Hourly Precipitation Amount Sample Size against Leadtime Interval for MBRFC
Compared Over Forecast Type Source
Time Period: 2009-06-01 00:00:00 GMT - 2009-09-30 23:59:59 GMT
Lead times: 0 hours - 48 hours
Locations: 1851, 1801, 1802, 1803, 1804, 1850, 1805, 1852,
1806, 1807, 1808, 1809, 1810, 1811, 1812, 1813, 1854, 1814,...



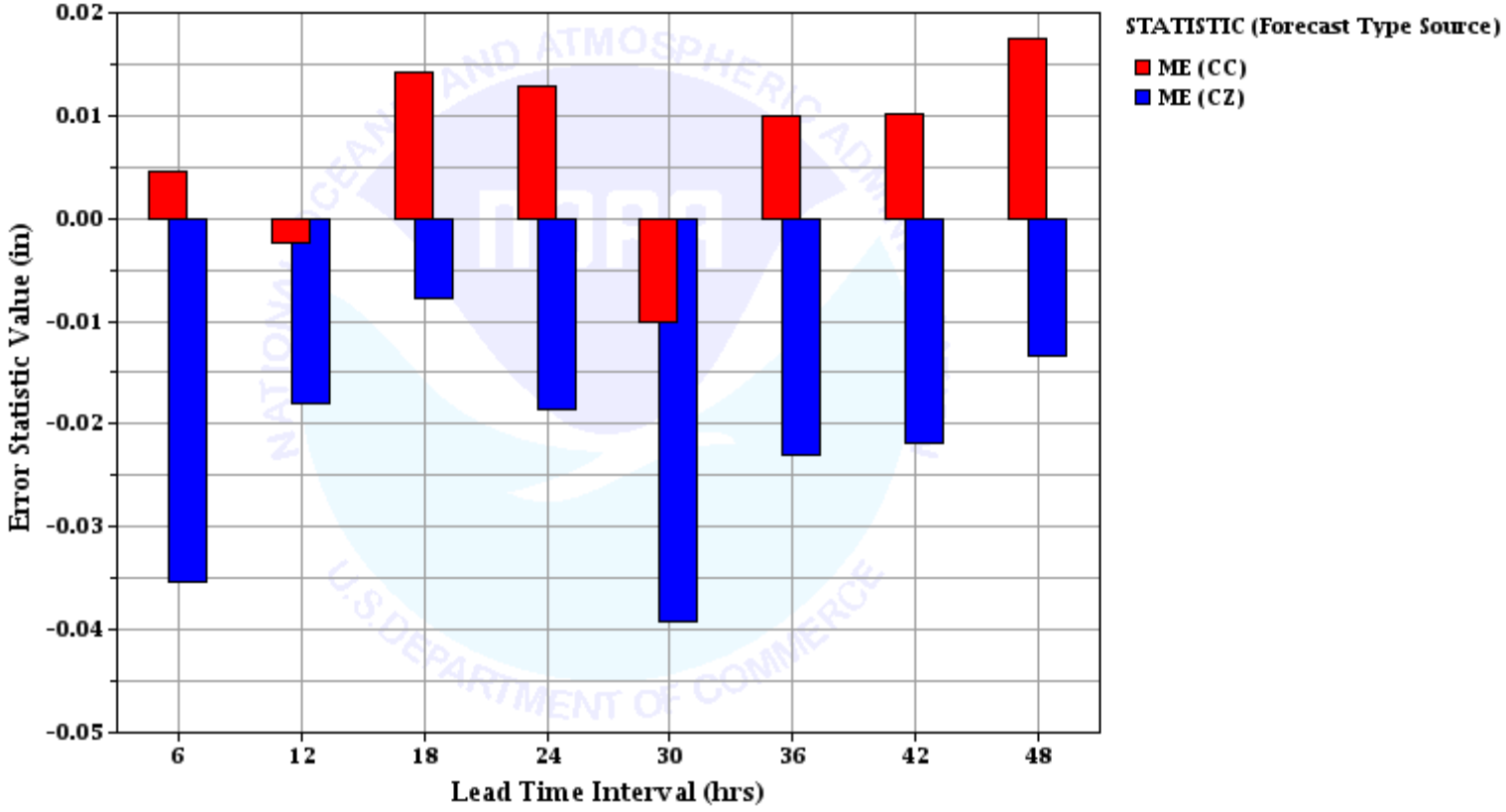
Plot of 6-Hourly Precipitation Amount Error Statistics against Leadtime Interval for MBRFC
Compared Over Forecast Type Source
Time Period: 2009-06-01 00:00:00 GMT - 2009-09-30 23:59:59 GMT
Lead times: 0 hours - 48 hours
Locations: 1851, 1801, 1802, 1803, 1804, 1850, 1805, 1852,
1806, 1807, 1808, 1809, 1810, 1811, 1812, 1813, 1854, 1814,...



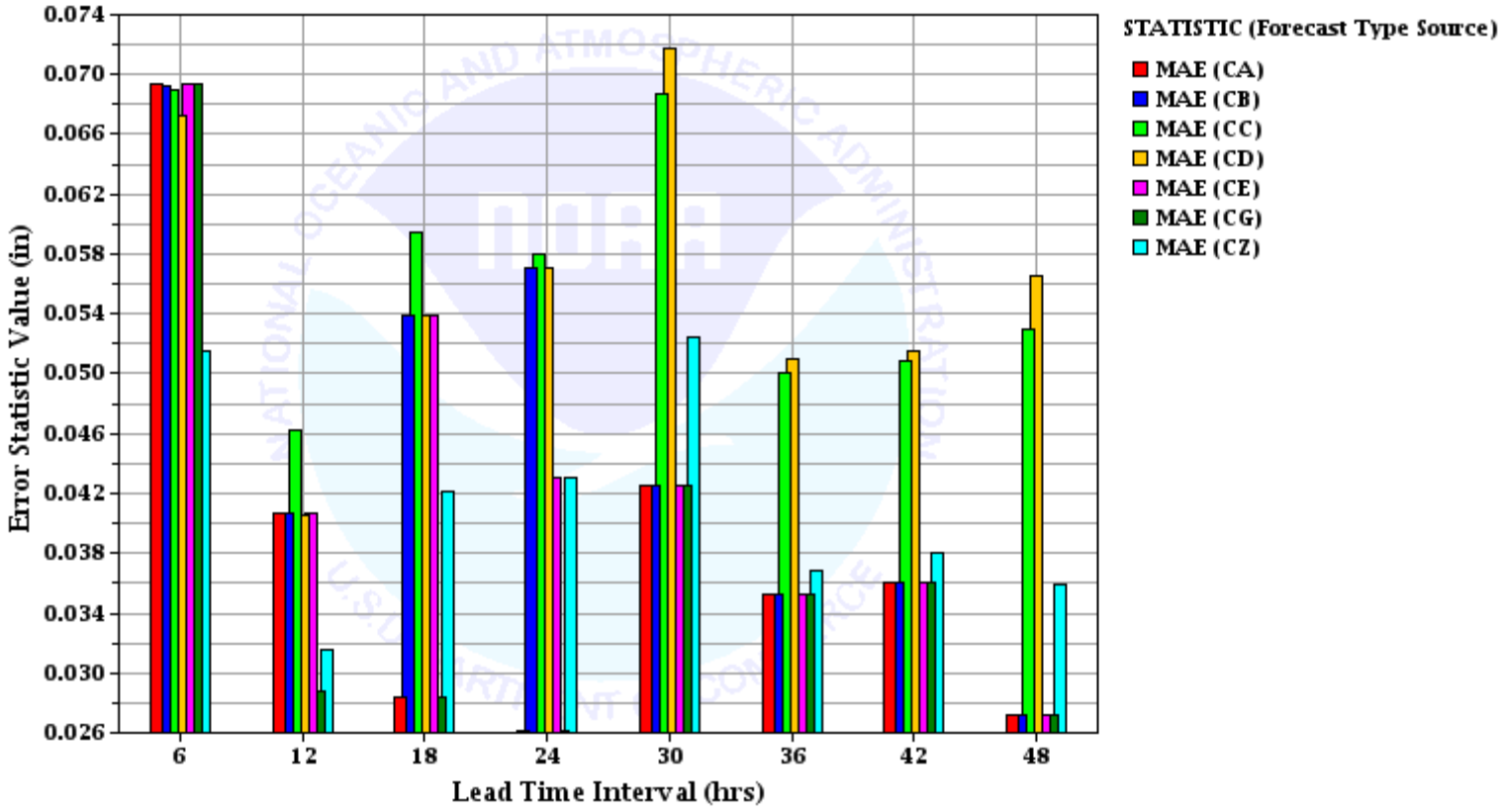
Plot of 6-Hourly Precipitation Amount Error Statistics against Leadtime Interval for MBRFC
Compared Over Forecast Type Source
Time Period: 2009-06-01 00:00:00 GMT - 2009-09-30 23:59:59 GMT
Lead times: 0 hours - 48 hours
Locations: 1851, 1801, 1802, 1803, 1804, 1850, 1805, 1852,
1806, 1807, 1808, 1809, 1810, 1811, 1812, 1813, 1854, 1814,...



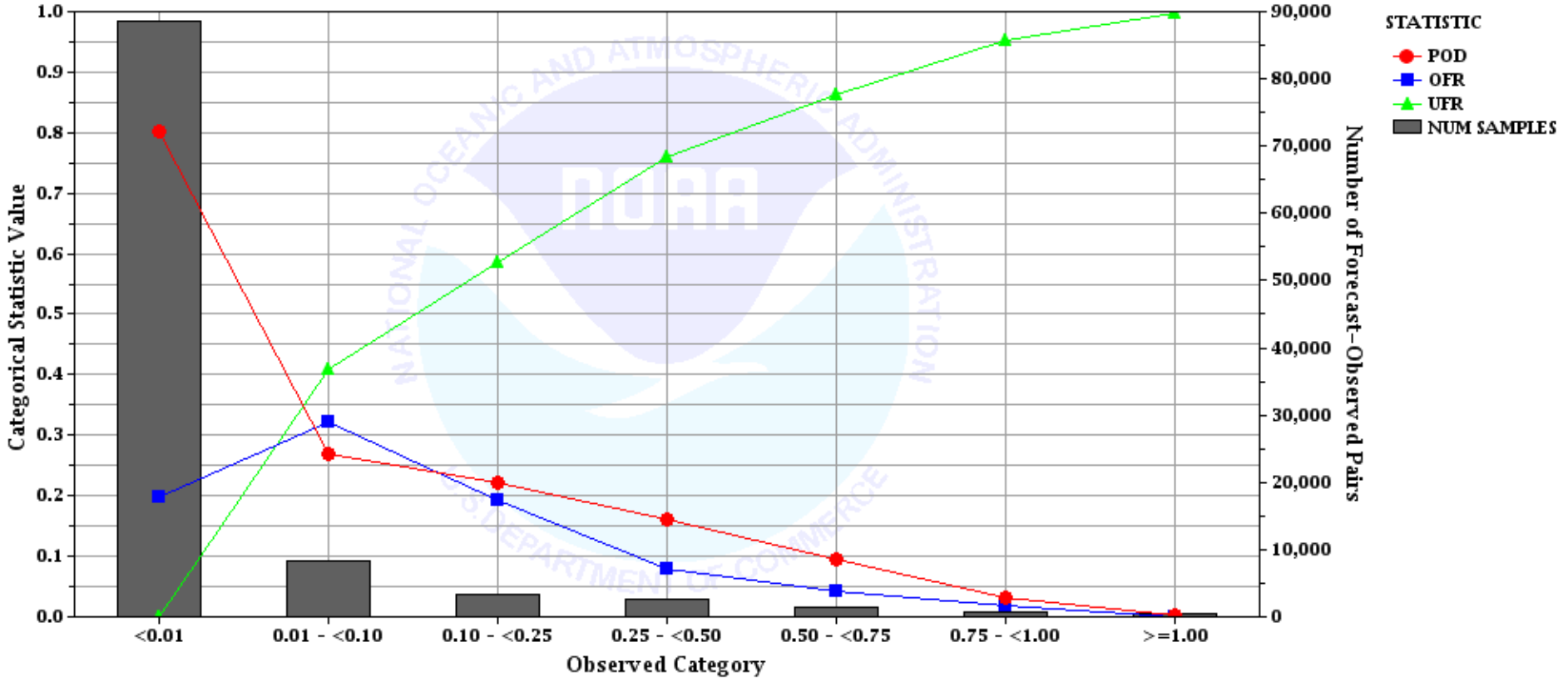
Plot of 6-Hourly Precipitation Amount Error Statistics against Leadtime Interval for MBRFC
Compared Over Forecast Type Source
Time Period: 2009-06-01 00:00:00 GMT - 2009-09-30 23:59:59 GMT
Lead times: 0 hours - 48 hours
Locations: 1722, 1724, 1723, 1701, 1702, 1703, 1704, 1721,
1705, 1706, 1707, 1708, 1720, 1709, 1710, 1711, 1712, 1713,...



Plot of 6-Hourly Precipitation Amount Error Statistics against Leadtime Interval for MBRFC
Compared Over Forecast Type Source
Time Period: 2009-06-01 00:00:00 GMT - 2009-09-30 23:59:59 GMT
Lead times: 0 hours - 48 hours
Locations: 1722, 1724, 1723, 1701, 1702, 1703, 1704, 1721,
1705, 1706, 1707, 1708, 1720, 1709, 1710, 1711, 1712, 1713,...



Plot of 6-Hourly Precipitation Amount Categorical Statistics against Observed Category for MBRFC
Time Period: 2009-06-01 00:00:00 GMT - 2009-09-30 23:59:59 GMT
Lead times: 0 hours - 48 hours
Locations: 901, 947, 933, 934, 948, 935, 938, 902, 903, 915,
944, 916, 945, 919, 936, 937, 904, 905, 907, 906, 908, 909,...



Summary

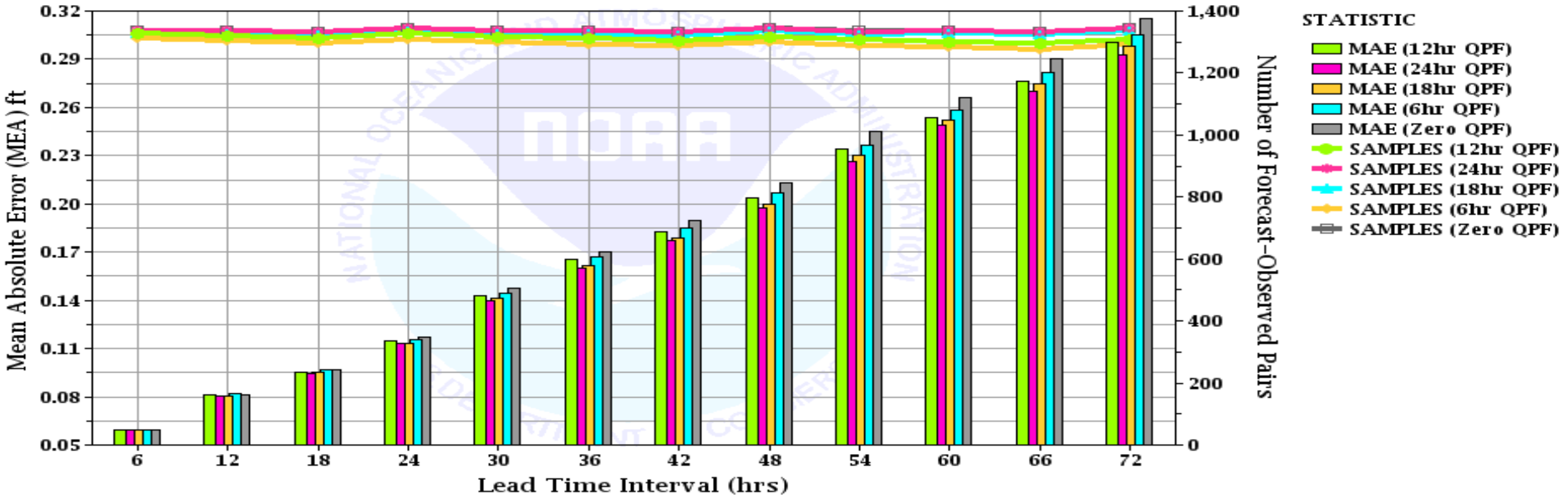
This early look has:

1) at MBRFC dataset for this study has shown that work needs to be done to fix the sample size issues when possible.

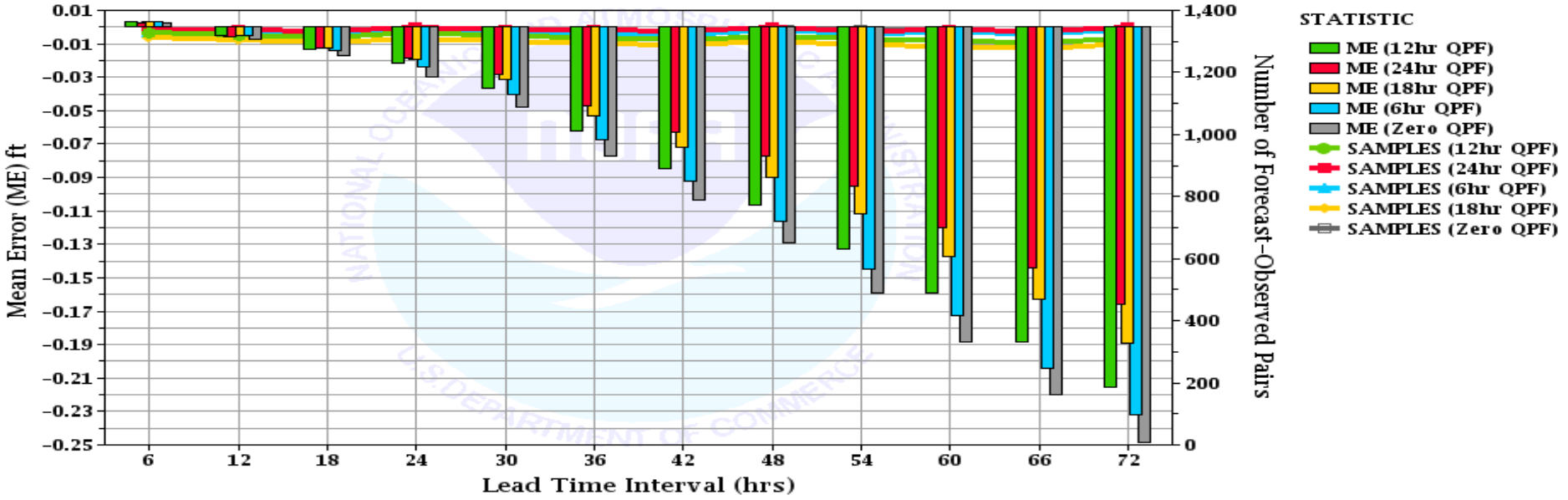
2) It has raised quite a few questions on how to look at the data; what statistics that are available in IVP are most useful

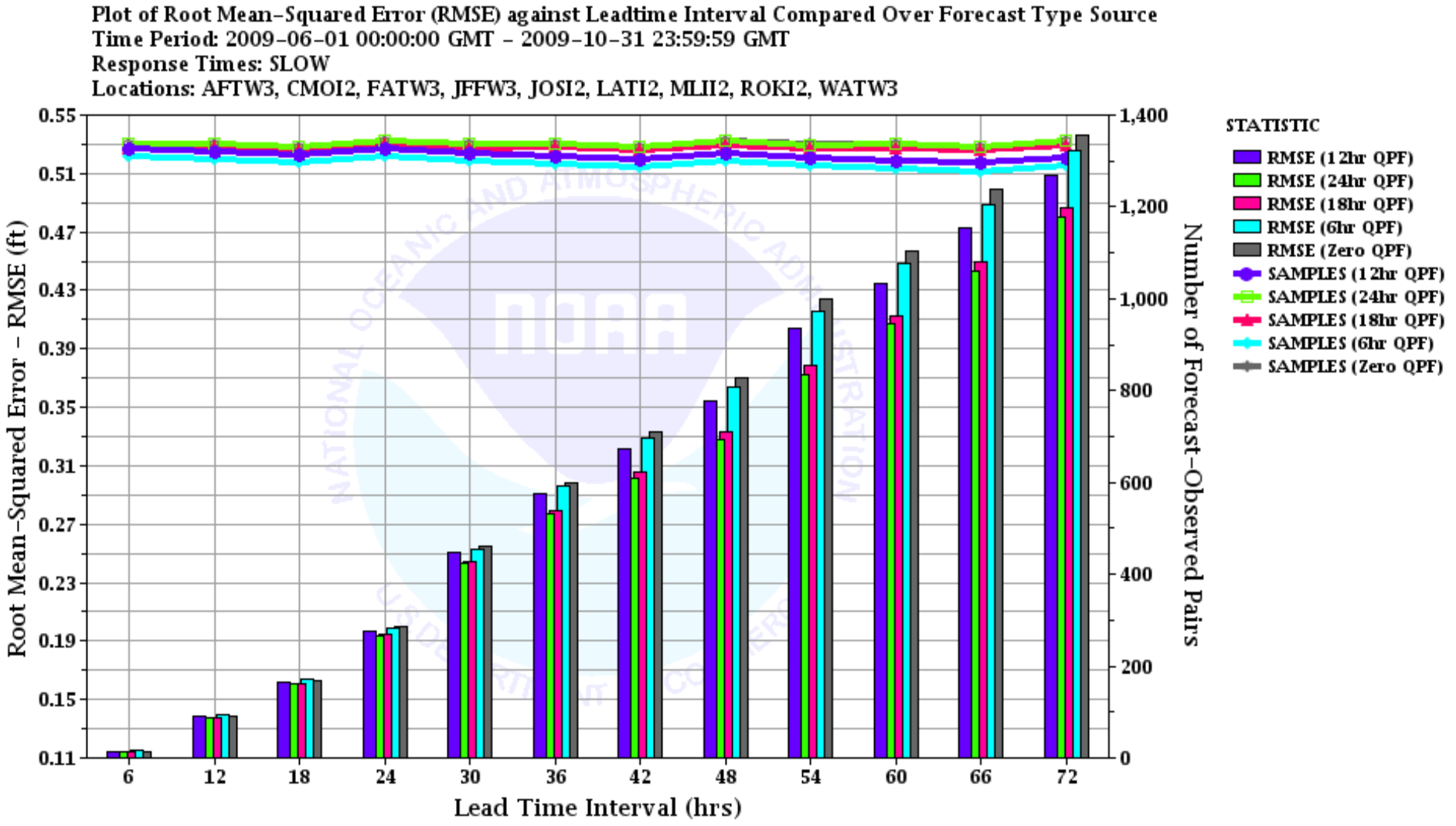
NCRFC

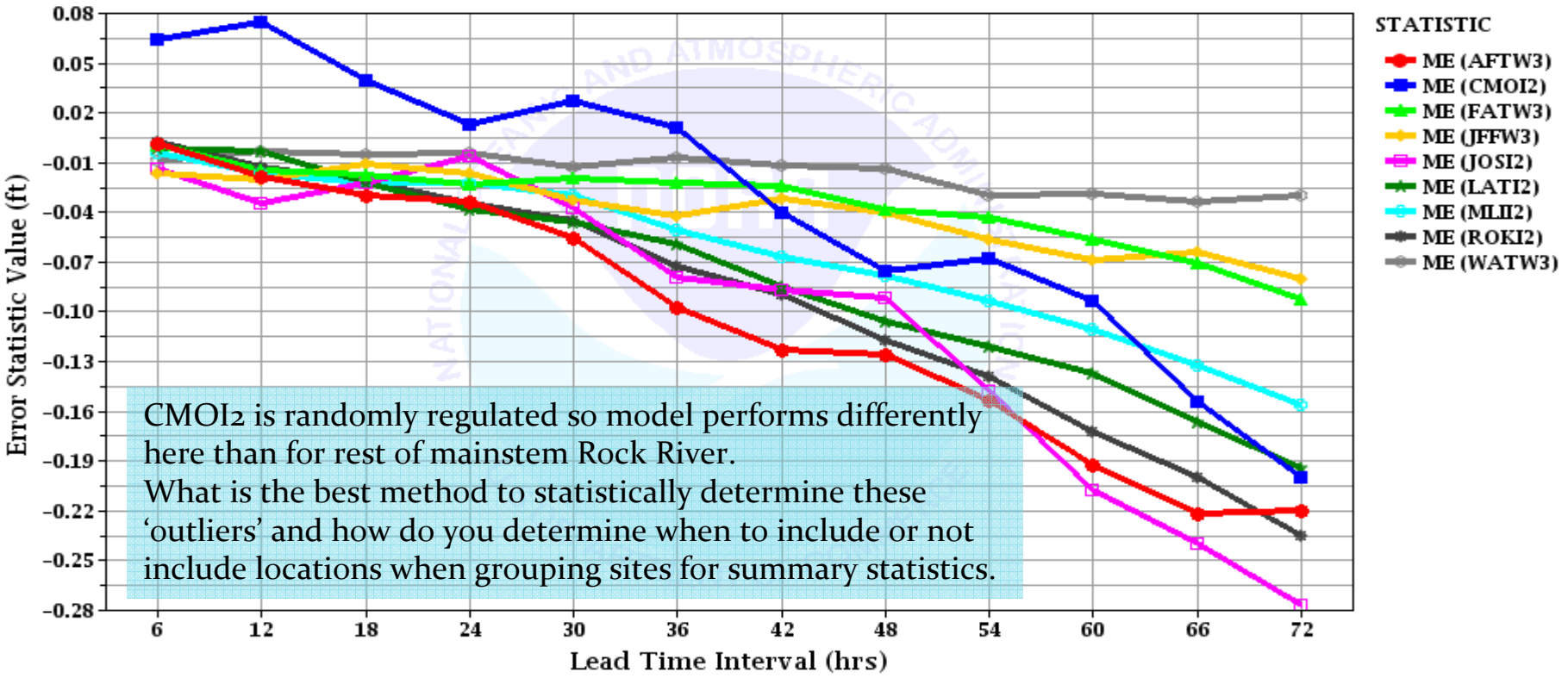
Plot of Mean Absolute Error (MAE) against Leadtime Interval Compared Over Forecast Type Source
Time Period: 2009-06-01 00:00:00 GMT - 2009-10-31 23:59:59 GMT
River Response: SLOW
Locations: WATW3, JFFW3, FATW3, AFTW3, ROKI2, LATI2, CMOI2, JOSI2, MLII2



Plot of Mean Error (ME) against Leadtime Interval Compared Over Forecast Type Source
Time Period: 2009-06-01 00:00:00 GMT - 2009-10-31 23:59:59 GMT
River Response: SLOW
Locations: WATW3, JFFW3, FATW3, AFTW3, ROKI2, LATI2, CMOI2, JOSI2, MLII2

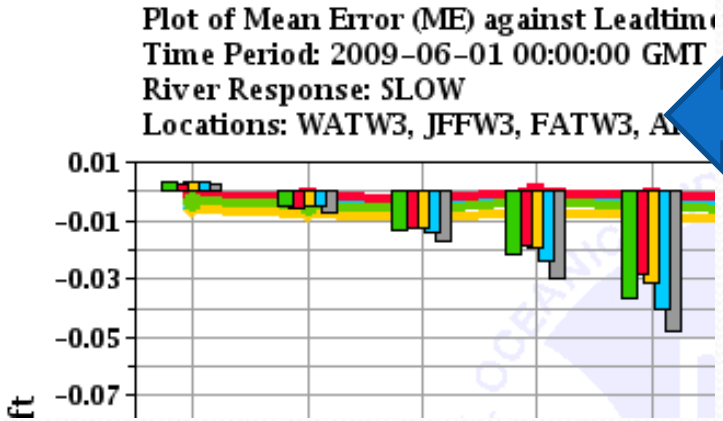



Plot of Root Mean-Squared Error (RMSE) against Leadtime Interval Compared Over Forecast Type Source
Time Period: 2009-06-01 00:00:00 GMT - 2009-10-31 23:59:59 GMT
Response Times: SLOW
Locations: AFTW3, CMOI2, FATW3, JFFW3, JOSI2, LATI2, MLII2, ROKI2, WATW3
Root Mean-Squared Error - RMSE (ft)
0.55
0.51
0.47
0.43
0.39
0.35
0.31
0.27
0.23
0.19
0.15
0.11
Number of Forecast-Observed Pairs
1,400
1,200
1,000
800
600
400
200
0
6
12
18
24
30
36
42
48
54
60
66
72
Lead Time Interval (hrs)
STATISTIC
RMSE (12hr QPF)
RMSE (24hr QPF)
RMSE (18hr QPF)
RMSE (6hr QPF)
RMSE (Zero QPF)
SAMPLES (12hr QPF)
SAMPLES (24hr QPF)
SAMPLES (18hr QPF)
SAMPLES (6hr QPF)
SAMPLES (Zero QPF)



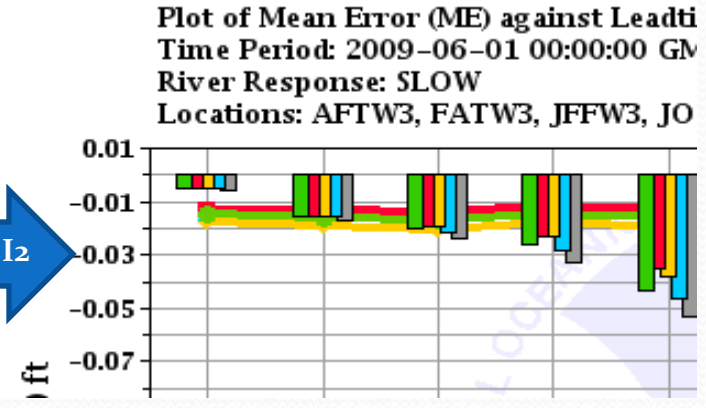
CMOI2 is randomly regulated so model performs differently here than for rest of mainstem Rock River.

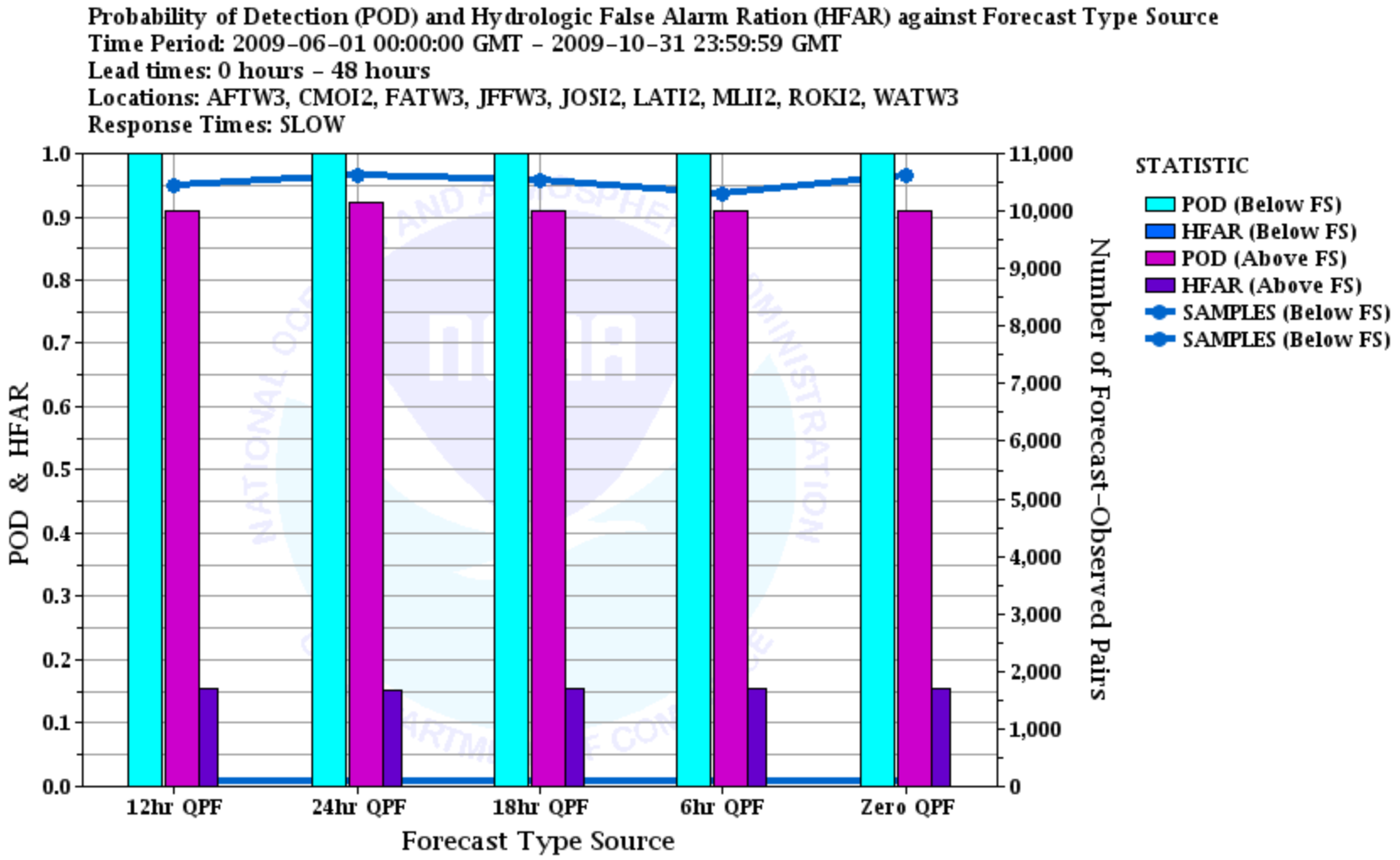
What is the best method to statistically determine these 'outliers' and how do you determine when to include or not include locations when grouping sites for summary statistics.



ME with CMOI2

ME without CMOI2

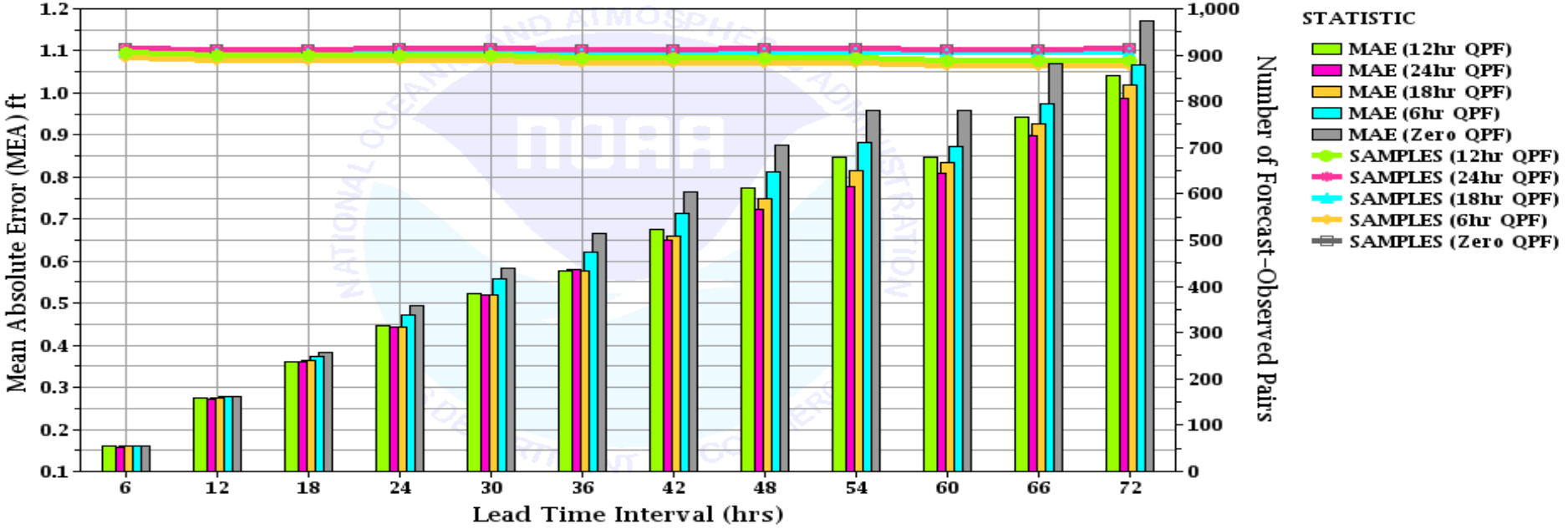




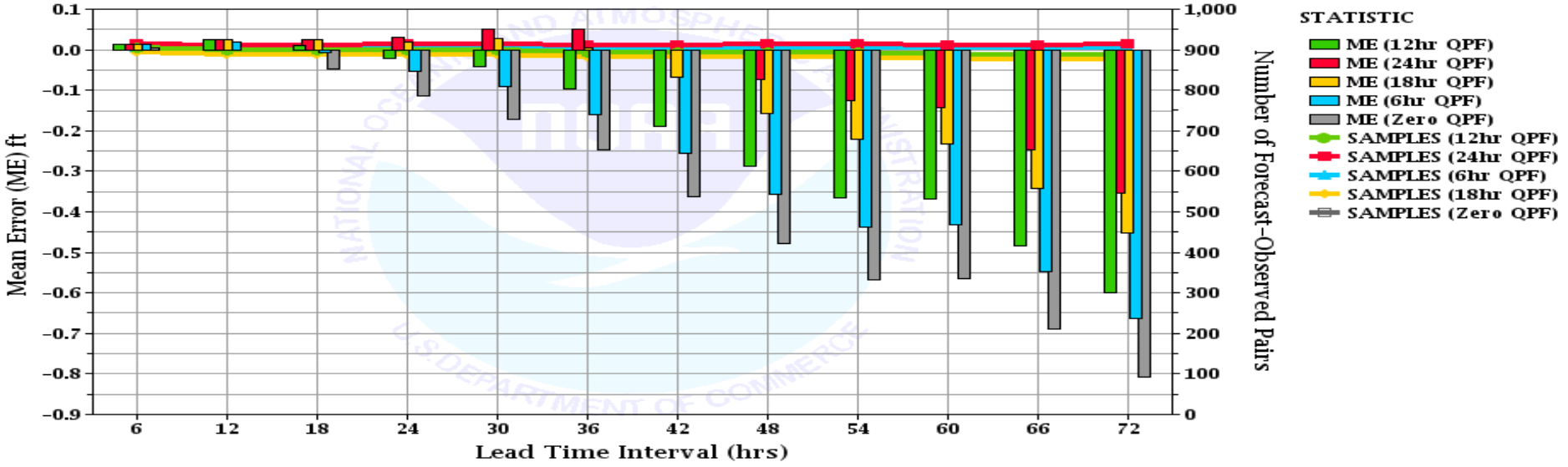
Probability of Detection: The probability that, given an observed value is within the category, the forecast value is also within the category.

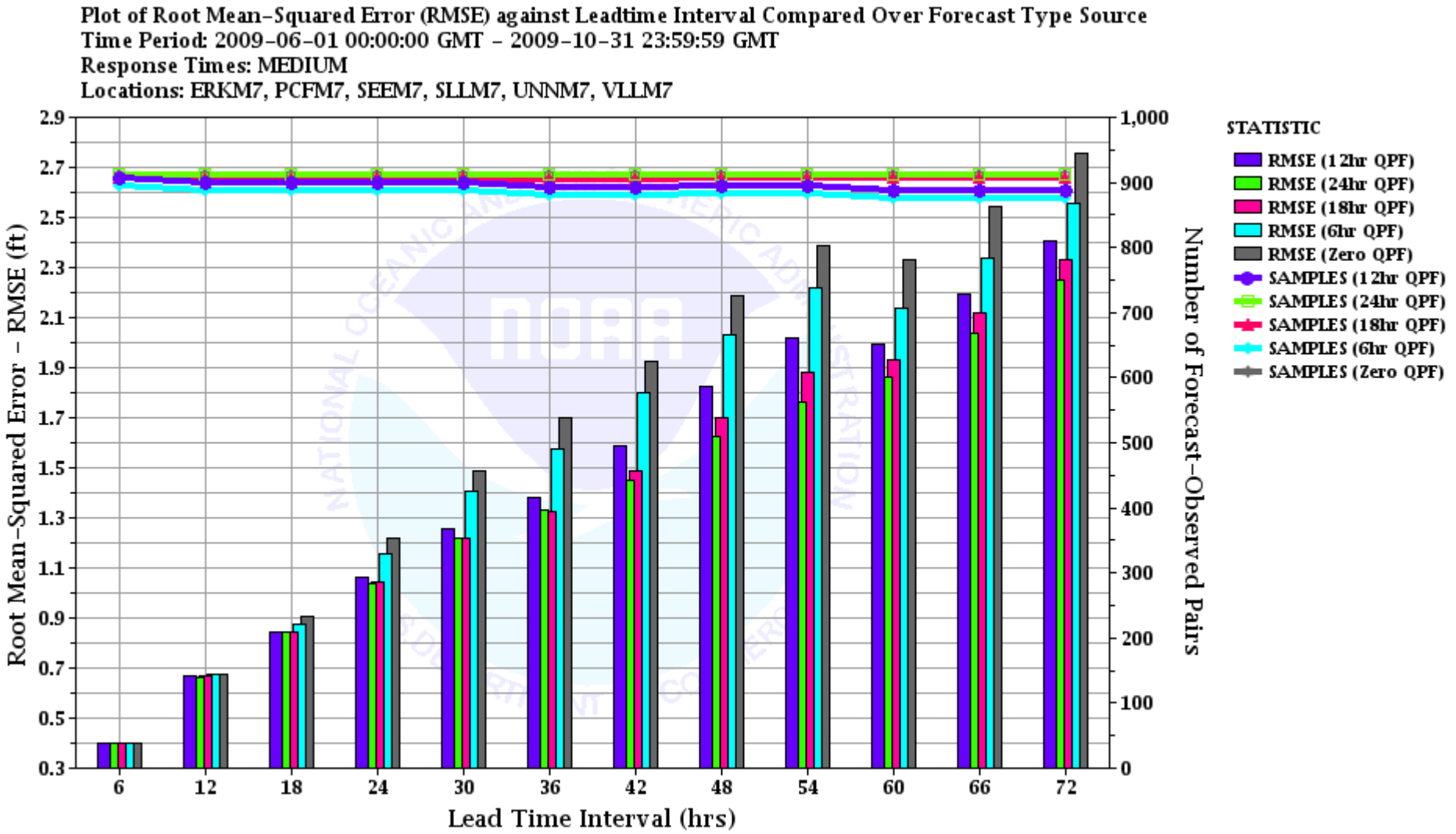
Hydrologic False Alarm Ratio: The probability that, given a forecast value is within the category, the observed value is below the category.

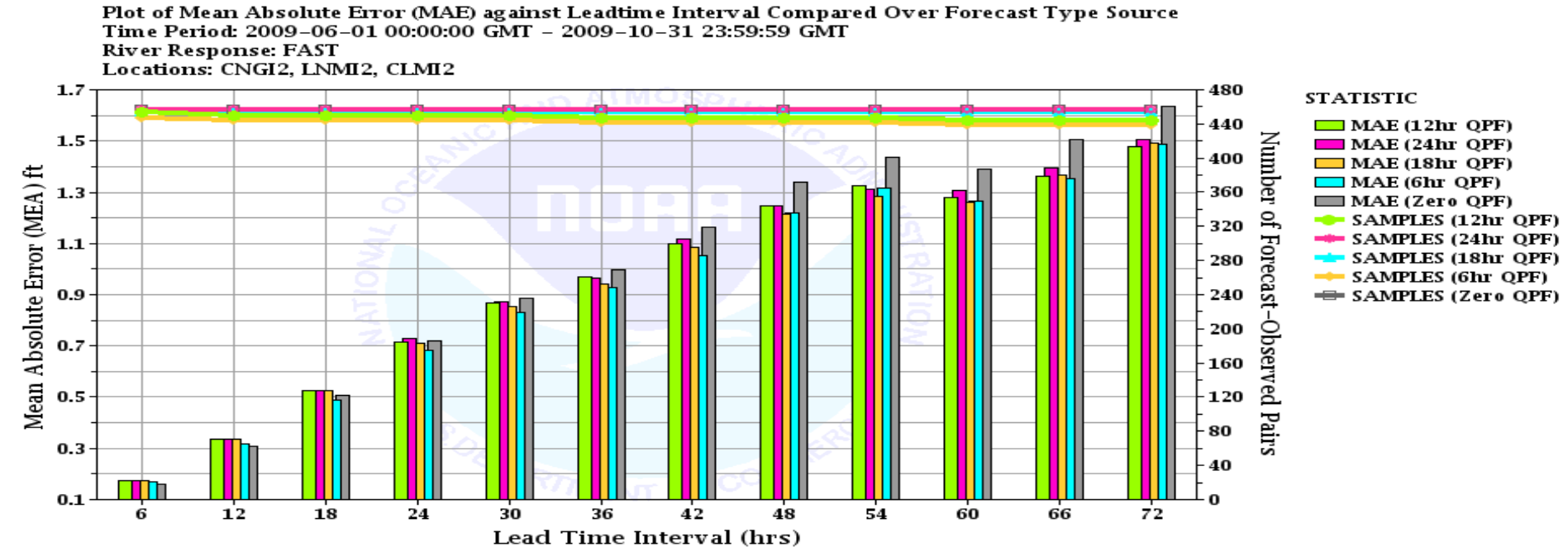
Plot of Mean Absolute Error (MAE) against Leadtime Interval Compared Over Forecast Type Source
Time Period: 2009-06-01 00:00:00 GMT - 2009-10-31 23:59:59 GMT
River Response: MEDIUM
Locations: SEEM7, SLLM7, UNNM7, PCFM7, ERKM7, VLLM7

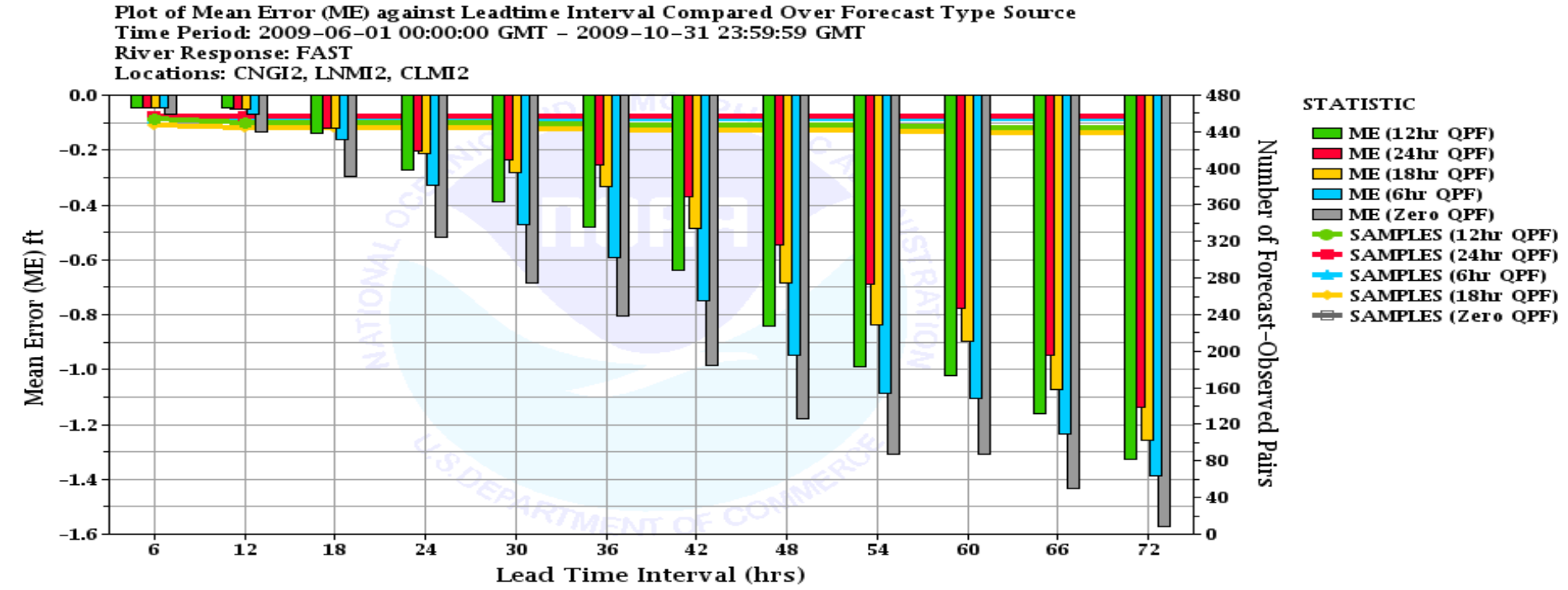


Plot of Mean Error (ME) against Leadtime Interval Compared Over Forecast Type Source
Time Period: 2009-06-01 00:00:00 GMT - 2009-10-31 23:59:59 GMT
River Response: MEDIUM
Locations: SEEM7, SLLM7, UNNM7, PCFM7, ERKM7, VLLM7

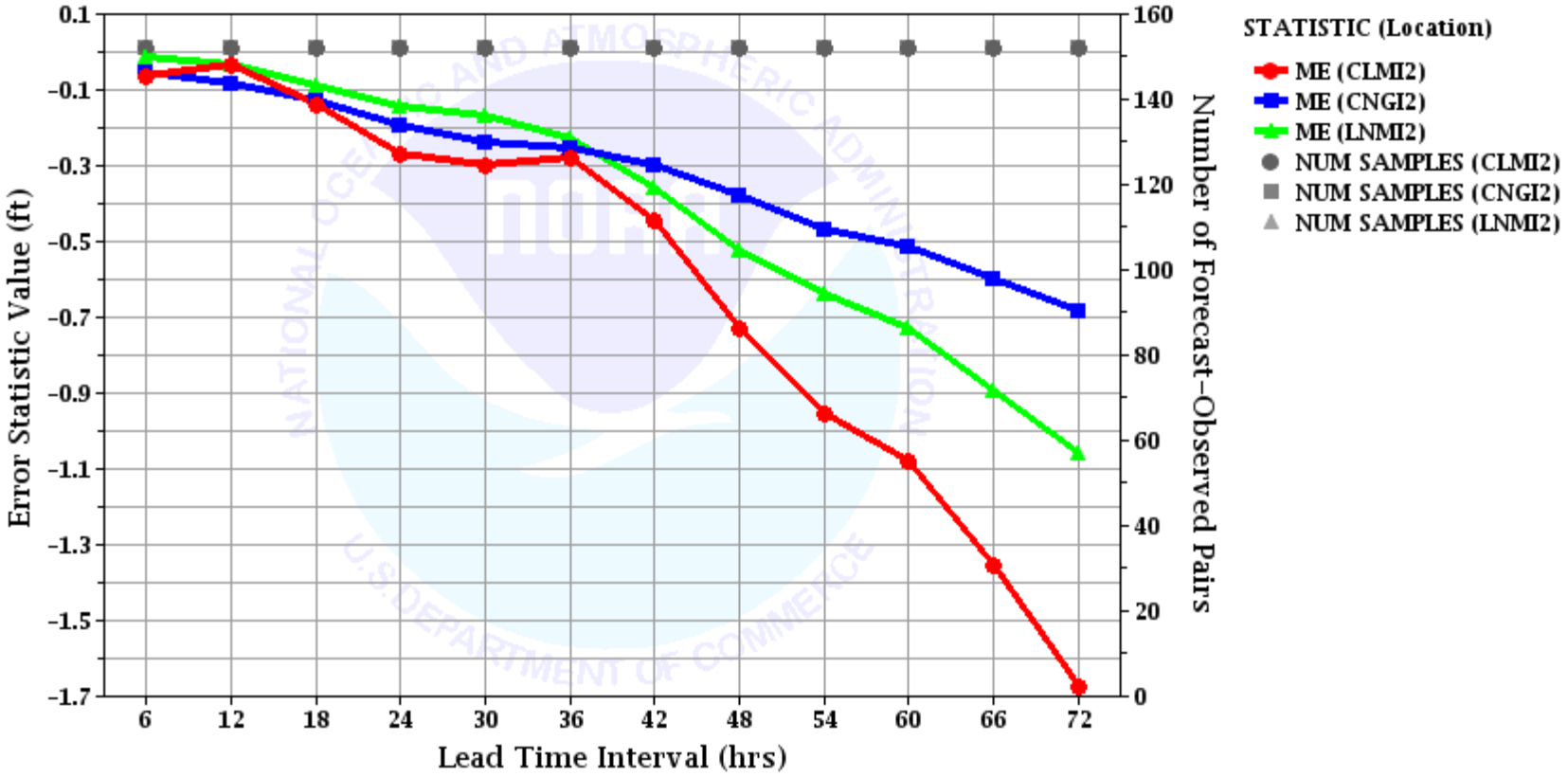


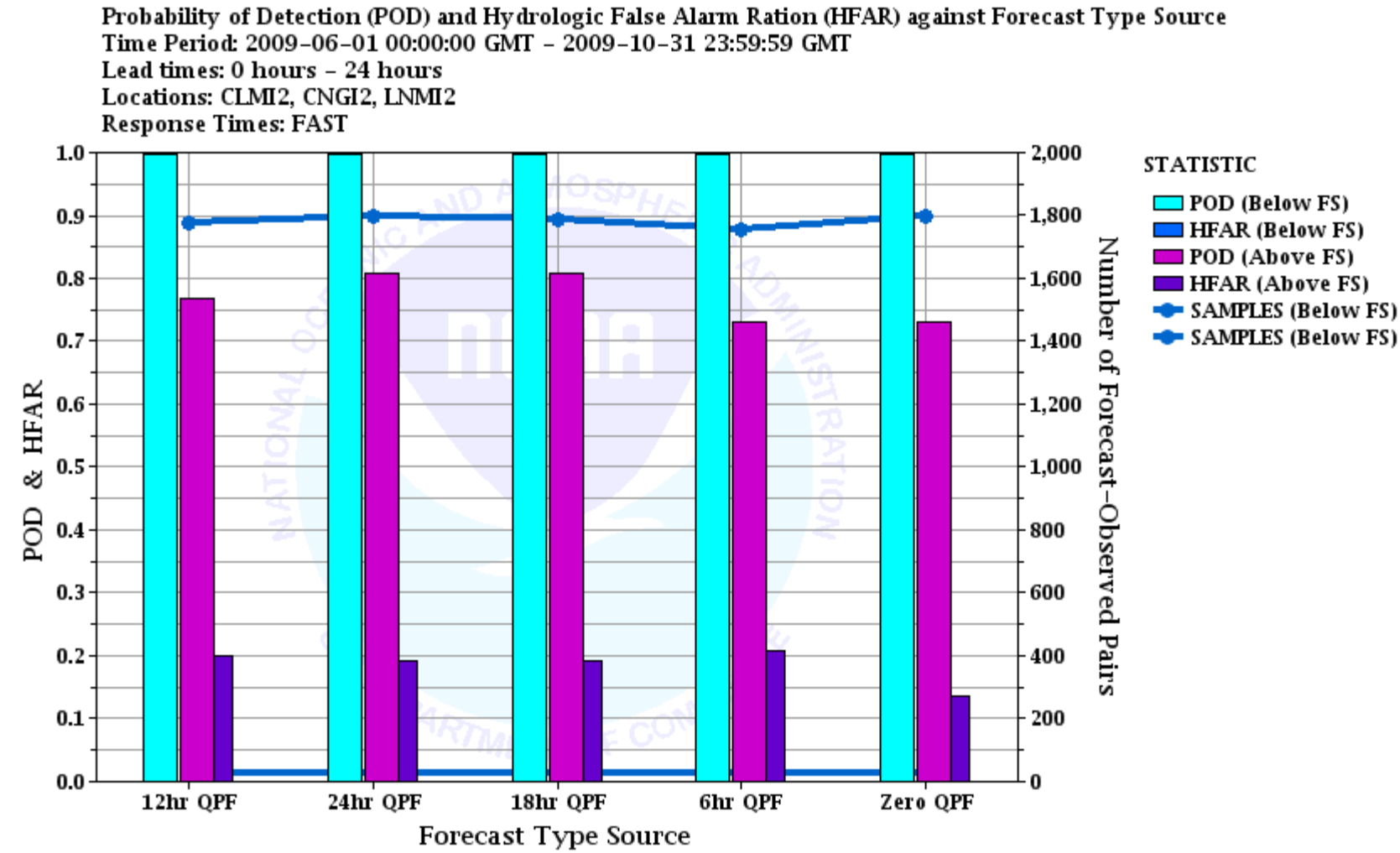

Plot of Root Mean-Squared Error (RMSE) against Leadtime Interval Compared Over Forecast Type Source
Time Period: 2009-06-01 00:00:00 GMT - 2009-10-31 23:59:59 GMT
Response Times: MEDIUM
Locations: ERKM7, PCFM7, SEEM7, SLLM7, UNNM7, VLLM7
Root Mean-Squared Error - RMSE (ft)
Number of Forecast-Observed Pairs
Lead Time Interval (hrs)
STATISTIC
RMSE (12hr QPF)
RMSE (24hr QPF)
RMSE (18hr QPF)
RMSE (6hr QPF)
RMSE (Zero QPF)
SAMPLES (12hr QPF)
SAMPLES (24hr QPF)
SAMPLES (18hr QPF)
SAMPLES (6hr QPF)
SAMPLES (Zero QPF)


Plot of Mean Absolute Error (MAE) against Leadtime Interval Compared Over Forecast Type Source
Time Period: 2009-06-01 00:00:00 GMT - 2009-10-31 23:59:59 GMT
River Response: FAST
Locations: CNGI2, LNMI2, CLMI2
Mean Absolute Error (MEA) ft
Number of Forecast-Observed Pairs
Lead Time Interval (hrs)
STATISTIC
MAE (12hr QPF)
MAE (24hr QPF)
MAE (18hr QPF)
MAE (6hr QPF)
MAE (Zero QPF)
SAMPLES (12hr QPF)
SAMPLES (24hr QPF)
SAMPLES (18hr QPF)
SAMPLES (6hr QPF)
SAMPLES (Zero QPF)


Plot of Mean Error (ME) against Leadtime Interval Compared Over Forecast Type Source
Time Period: 2009-06-01 00:00:00 GMT - 2009-10-31 23:59:59 GMT
River Response: FAST
Locations: CNGI2, LNMI2, CLMI2
Mean Error (ME) ft
Number of Forecast-Observed Pairs
Lead Time Interval (hrs)
STATISTIC
ME (12hr QPF)
ME (24hr QPF)
ME (18hr QPF)
ME (6hr QPF)
ME (Zero QPF)
SAMPLES (12hr QPF)
SAMPLES (24hr QPF)
SAMPLES (6hr QPF)
SAMPLES (18hr QPF)
SAMPLES (Zero QPF)

Plot of Instantaneous Height Error Statistics against Leadtime Interval for NCRFC
Compared Over Location
Time Period: 2009-06-01 00:00:00 GMT – 2009-10-31 23:59:59 GMT
Lead times: 0 hours – 72 hours
Locations: CLMI2, CNGI2, LNMI2




Probability of Detection (POD) and Hydrologic False Alarm Ration (HFAR) against Forecast Type Source
Time Period: 2009-06-01 00:00:00 GMT - 2009-10-31 23:59:59 GMT
Lead times: 0 hours - 24 hours
Locations: CLMI2, CNGI2, LNMI2
Response Times: FAST
POD & HFAR
Number of Forecast-Observed Pairs
Forecast Type Source
12hr QPF
24hr QPF
18hr QPF
6hr QPF
Zero QPF
STATISTIC
POD (Below FS)
HFAR (Below FS)
POD (Above FS)
HFAR (Above FS)
SAMPLES (Below FS)
SAMPLES (Below FS)