

Hydrologic Ensemble Forecasting Service (HEFS)

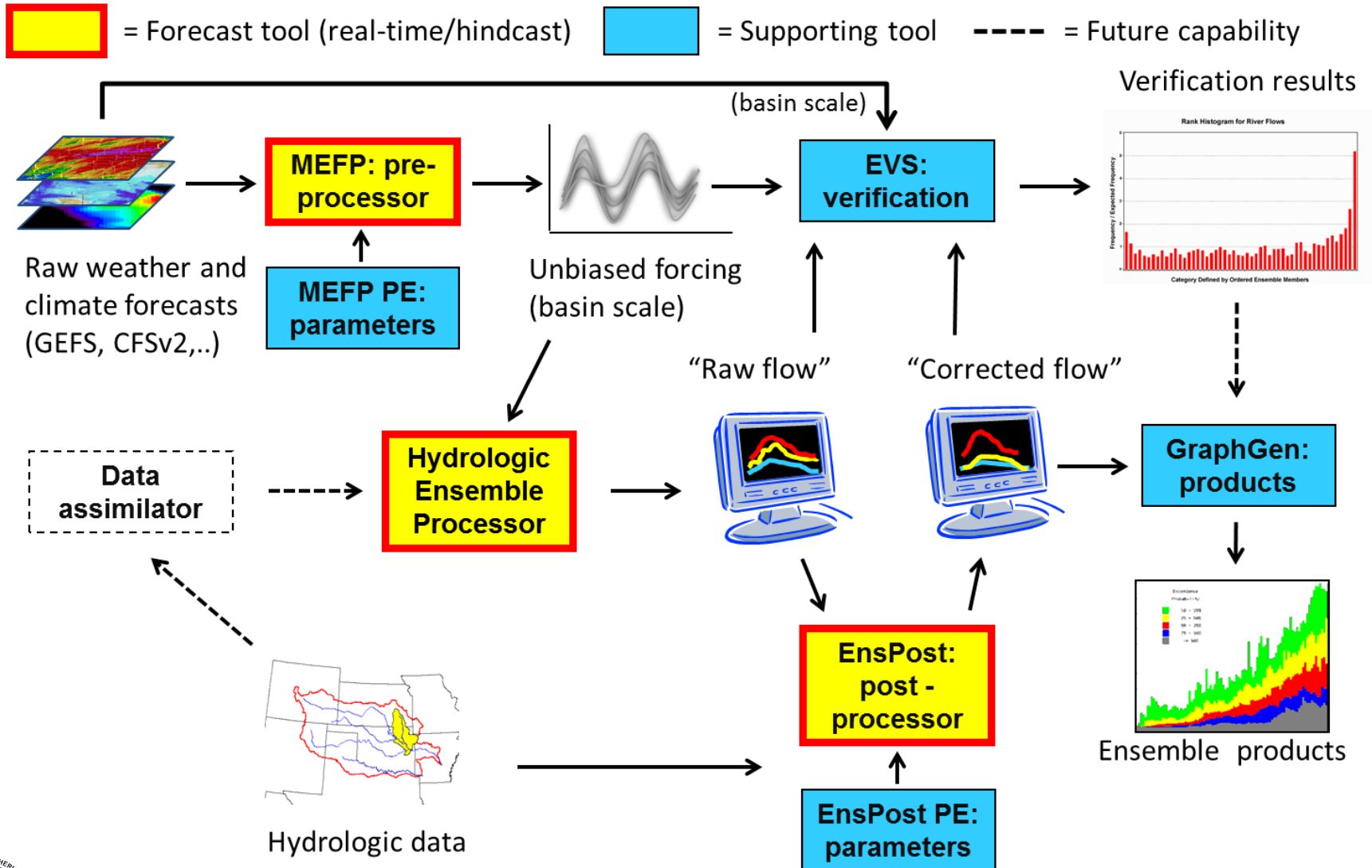
Seminar C Review MEFP Diagnostics

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February 25, 2014



HEFS Components



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 - o MEFPPE Tools
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- Parameter Diagnostics**
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Overview of Diagnostics

Types of Diagnostics

□ Two types of diagnostics currently available for MEFPPE

o Time series diagnostics

- Used to examine historical time series, RFC archive forecasts, and GEFS/CFSv2 reforecasts
- Identify bad/questionable data
- Data correction is done outside of MEFPPE

o Parameter diagnostics

- Used to examine estimated parameters of the MEFP
- Tweak estimation options
- Determine best operational run settings
 - e.g., if a forecast source should be used and the number of forecast days to use for that source

Overview of Diagnostics

Tools for Diagnostics

□ Tools to examine data and parameters

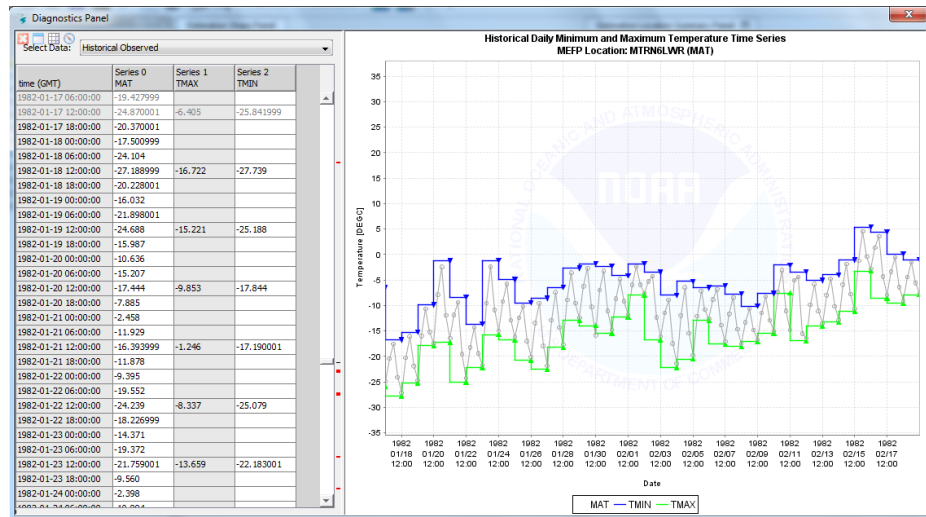
○ CHPS/FEWS Database Viewer

- Only useful for historical MAP/MAT and transformed TAMN/TAMX data

module	group	parameter	qualifiers	locationid	locationname	x	y	timeSeries	valueType	timeStep	start	end
Impor-MEFPPE	Temperature	MAT		MTRNLWLR	Cold Brook L...	-74.27111	42.01417	external_hist...	scalar	6 hour GMT +1	01-01-1982	12-31-1998
MEFP_MAT	Temperature	MAT	GHF sampled	MTRNLWLR	Cold Brook L...	-74.27111	42.01417	external_hist...	scalar	6 hour	01-30-1982	11-30-1998
MEFP_MAT	Temperature	TAMN		SEDWOLE	Sabrook Riv...	-74.36667	41.06	external_hist...	scalar	12:00	01-01-1989	12-31-1998
MEFP_MAT	Temperature	TAMX		MTRNLWLR	Cold Brook L...	-74.27111	42.01417	external_hist...	scalar	12:00	01-01-1989	12-31-1998
MEFP_MAT	Temperature	MAT		MTRNLWLR	Cold Brook L...	-74.27111	42.01417	external_hist...	scalar	12:00	01-31-1982	12-31-1982
MEFP_MAT	Temperature	TAMN		MTRNLWLR	Cold Brook ...	-74.27111	42.01417	external_hist...	scalar	12:00	01-01-1989	12-31-1998

○ MEFPPE Diagnostics Panel

- Displays time series and parameter diagnostics
- Accessible through buttons in the MEFPPE interface



Time Series Diagnostics

Why?

❑ Bad input can lead to bad parameters and/or bad MEFP output

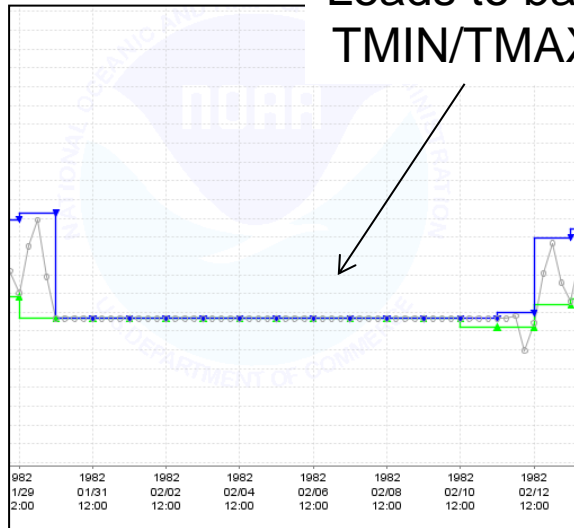
MTRN6LWR Datacard Snippet

1828146	27.135	13.485	3.495	33.280	33.280	33.280
1828147	39.500	33.280	33.280	33.280	33.280	33.280
2828148	33.585	33.280	33.280	33.280	33.280	33.280
2828149	33.280	33.280	36.708	33.280	33.280	33.280
2828150	33.280	33.280	33.280	33.280	33.280	33.280
2828151	33.280	33.280	33.280	33.280	4.869	33.280
2828152	33.280	33.280	-2.398	33.280	33.280	33.280
2828153	7.537	33.280	33.280	33.280	33.280	33.280
2828154	33.280	33.280	33.280	33.280	33.280	33.280

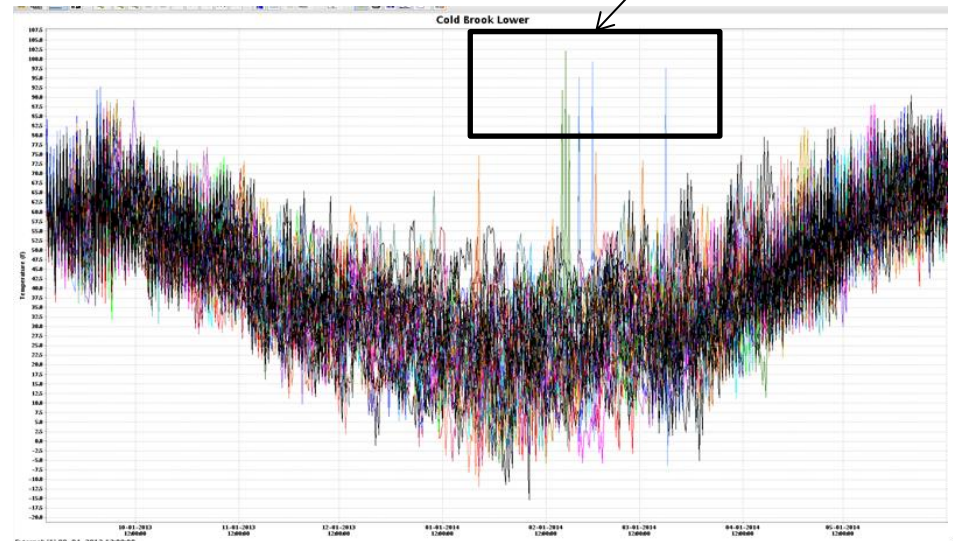
Many repeated 33.280 values
Does not fit diurnal pattern

Unreasonable spikes

Leads to bad
TMIN/TMAX



MEFP Output



Time Series Diagnostics

Why?

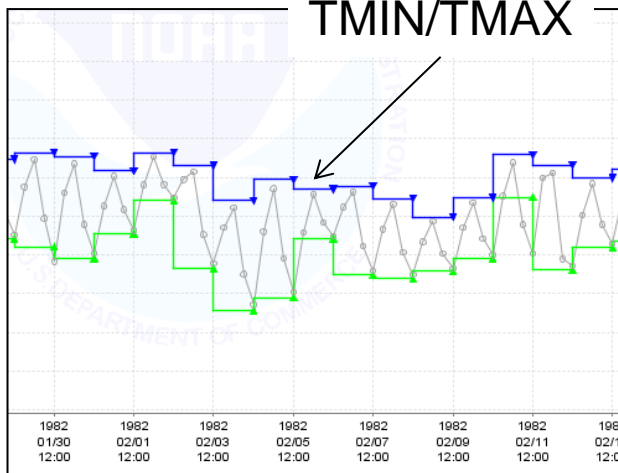
- ❑ After fixing the bad input, MEFPE/MEFP output becomes more reasonable

MTRN6LWR Datacard Snippet

1828146	27.135	13.485	3.495	19.469	26.166	12.036
1828847	5.417	16.394	23.322	15.514		
2828148	10.707	21.242	27.728	21.349	18.255	22.532
2828149	24.357	9.755	3.070	11.340	15.978	0.550
2828150	-6.595	10.380	20.414	4.162	-3.521	10.214
2828151	19.079	12.559	9.330	16.076	19.620	7.120
2828152	1.337	10.990	16.736	5.610	0.384	8.048
2828153	12.795	5.378	1.866	11.441	17.117	8.858
2828154	4.936	18.668	26.480	12.085	5.312	22.893

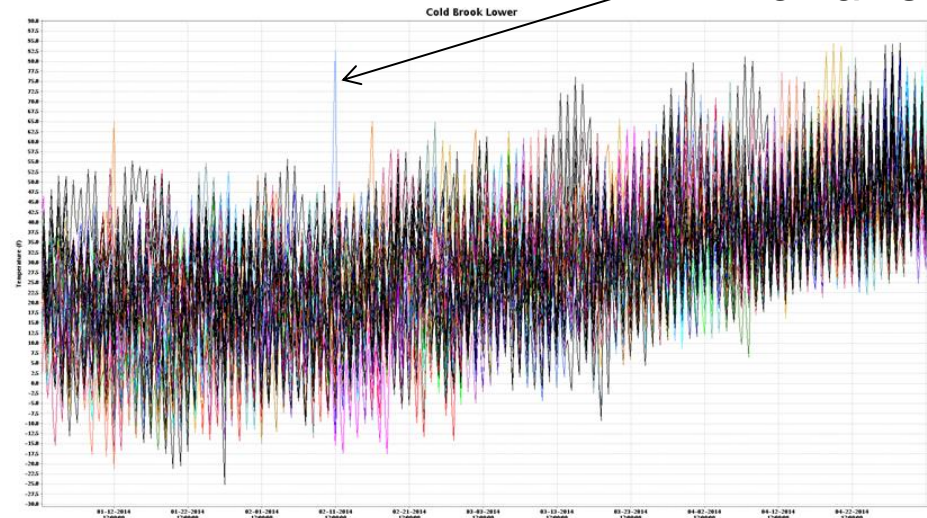
Copied from another year to fit the diurnal pattern

Reasonable
TMIN/TMAX



MEFP Output (zoomed in)

Only one spike remains



Time Series Diagnostics

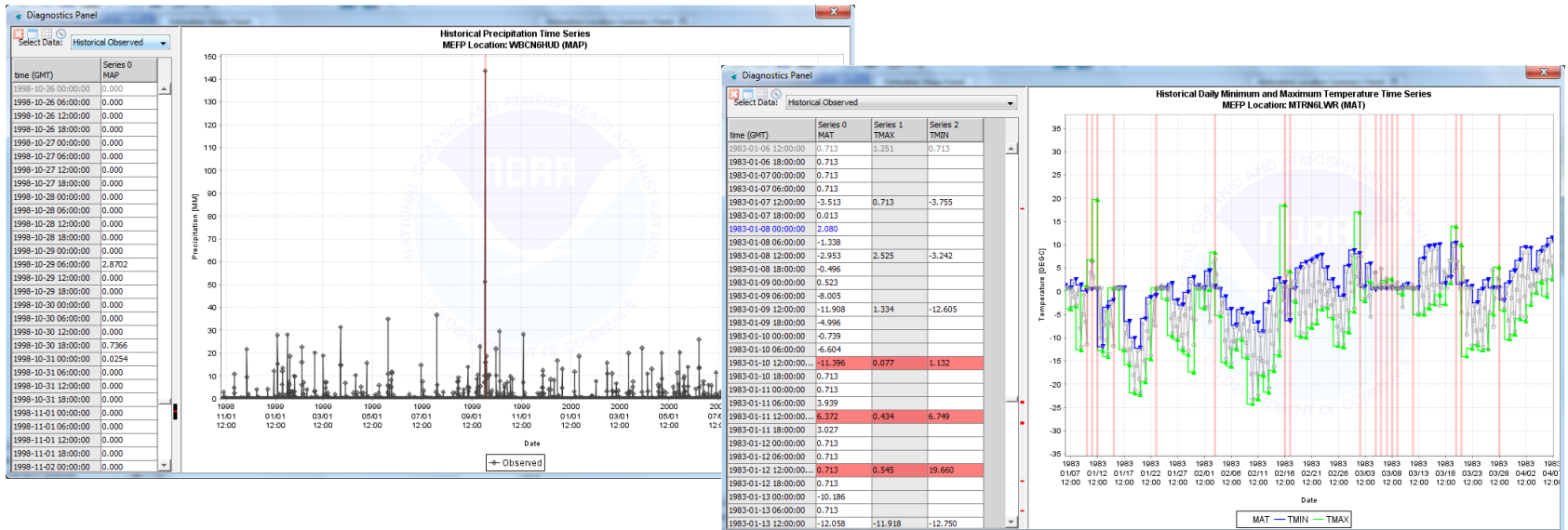
MEFPPE Tools

□ Time series diagnostics panel for historical data

o Automatic data quality checks

- Missing data
- Gross range (0 – 100 mm for precip, -100 – 100 degC for temperature)
- Minimum temperature exceeds maximum temperature
- Check results are stored in a file within the MEFPPE run area

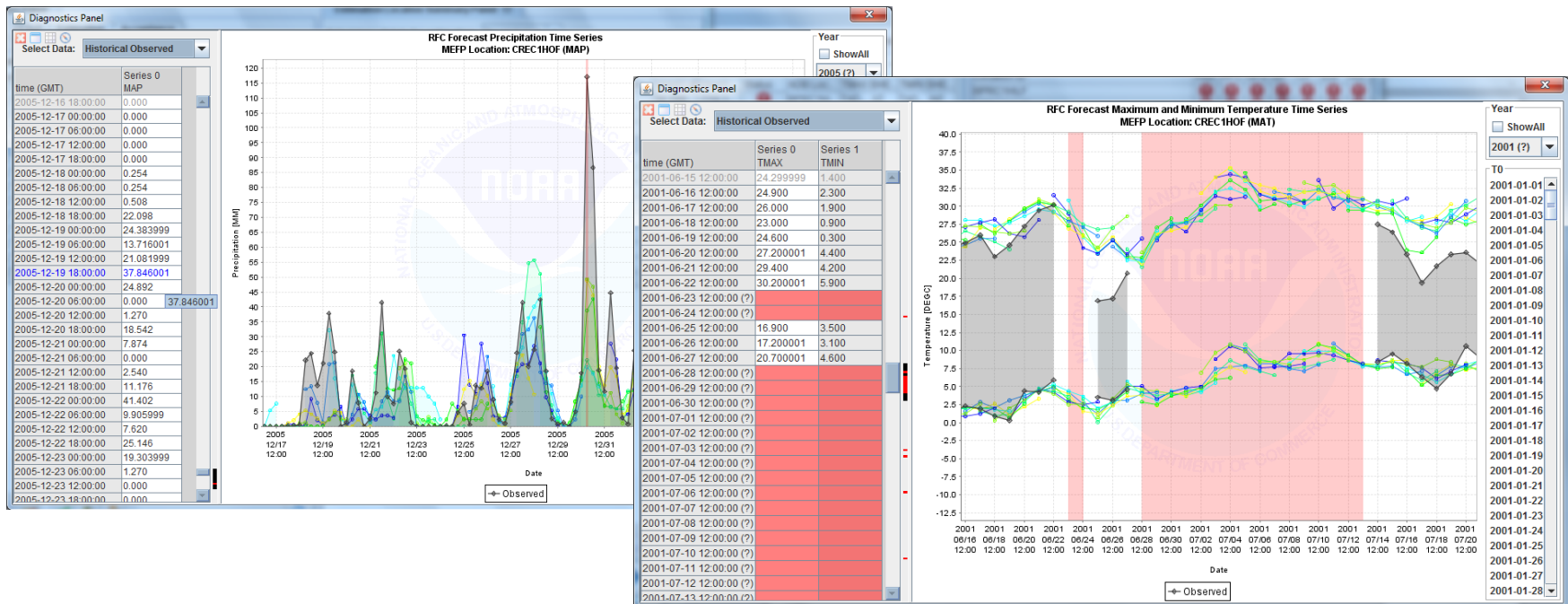
o Questionable data highlighted in **Diagnostics Panel**:



Time Series Diagnostics

MEFPPE Tools

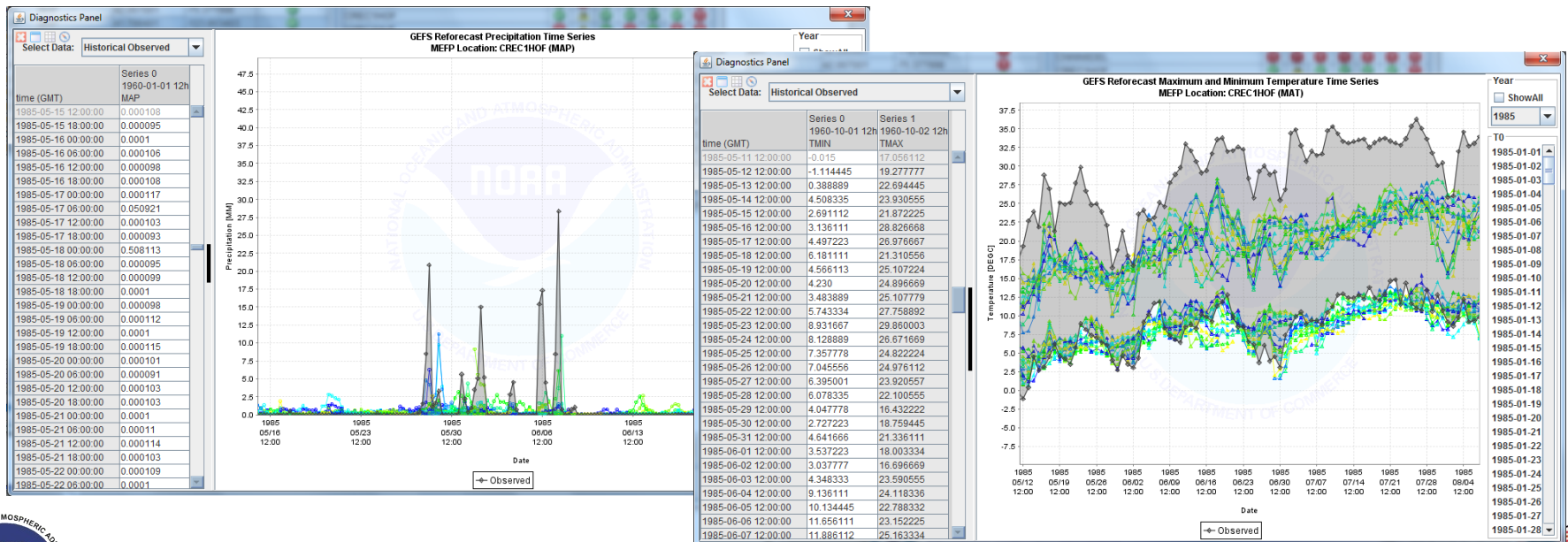
- ❑ Time series diagnostics panel for RFC archive forecasts and observations (if available)
 - Automatic data quality checks
 - Same checks are performed as for historical data
 - Questionable data highlighted in **Diagnostics Panel**:



Time Series Diagnostics

MEFPPE Tools

- Time series diagnostics panel for GEFs/CFSv2 reforecasts
 - o No automatic data quality checks are performed
 - Basic QC was performed at OHD
 - Data should not be modified
 - o Data can be viewed alongside historical data in **Diagnostics Panel**
 - Historical data is that provided as historical (typically datacard) data augmented by RFC observations if available



Time Series Diagnostics

Tools for Fixing Data

□ Tools to fix bad data

o Manual editing

• Historical Data:

- Edit datacard data, re-import, and reacquire data from PI-service

• RFC data:

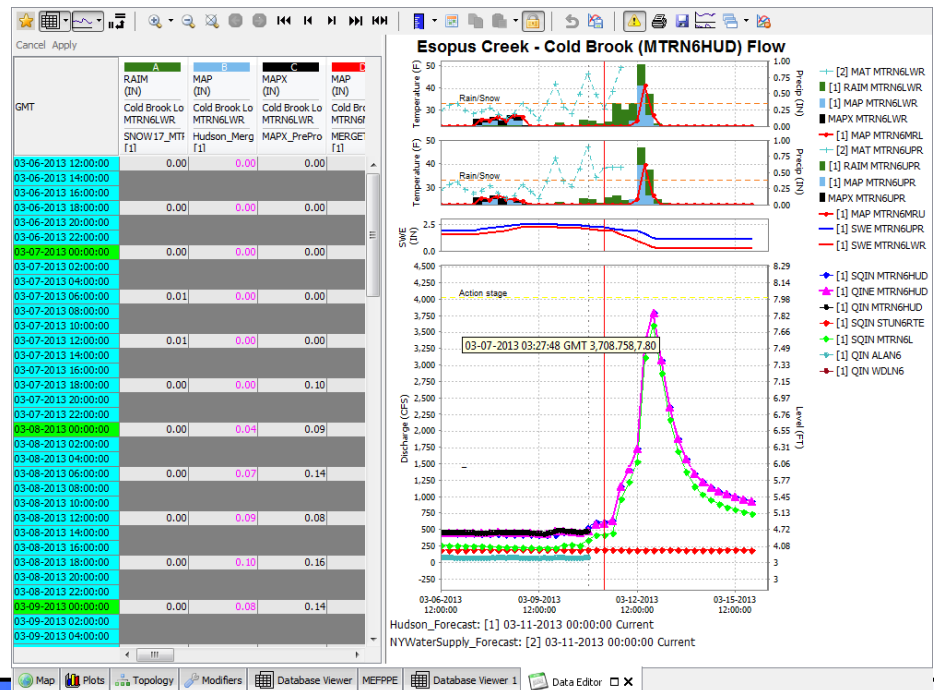
- Edit RFC files directly via text editor and re-import the files
- Change data in archive database, use IVP to rebuild pairs, and perform RFC step again

o FEWS Data Editor

- Historical data only
- Requires configuration
- Reacquire data from PI-service via MEFPPE

```

$ IDENTIFIER=MTRN6LWR DESCRIPTION=
$ PERIOD OF RECORD=01/1949 THRU 01/1999
$ SYMBOL FOR MISSING DATA=-999.00 SYMBOL FOR ACCUMULATED DATA=-998.00
$ TYPE=MAT UNITS=DEGF DIMENSIONS= DATA TIME INTERVAL= 6 HOURS
$ OUTPUT FORMAT=(3A4,2I2,I4,6F10.3)
DATA CARD MAT DEGF 6 MTRN6LWR MTRN6LWR
1 1949 12 1998 6 F10.3
149 1 17.093 20.678 22.794 18.902 17.071 22.640
149 2 25.885 20.678 18.216 23.202 25.861 17.003
149 3 12.901 24.238 31.244 25.089 22.081 32.773
149 4 39.241 32.893 29.816 38.129 42.728 31.429
149 5 26.160 34.960 40.412 32.931 29.369 37.438
    
```



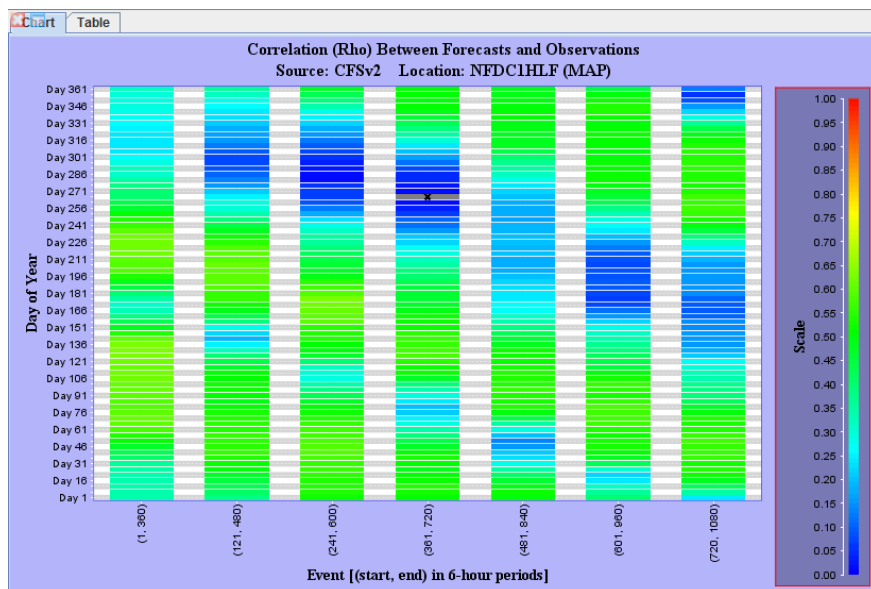
Parameter Diagnostics

Why?

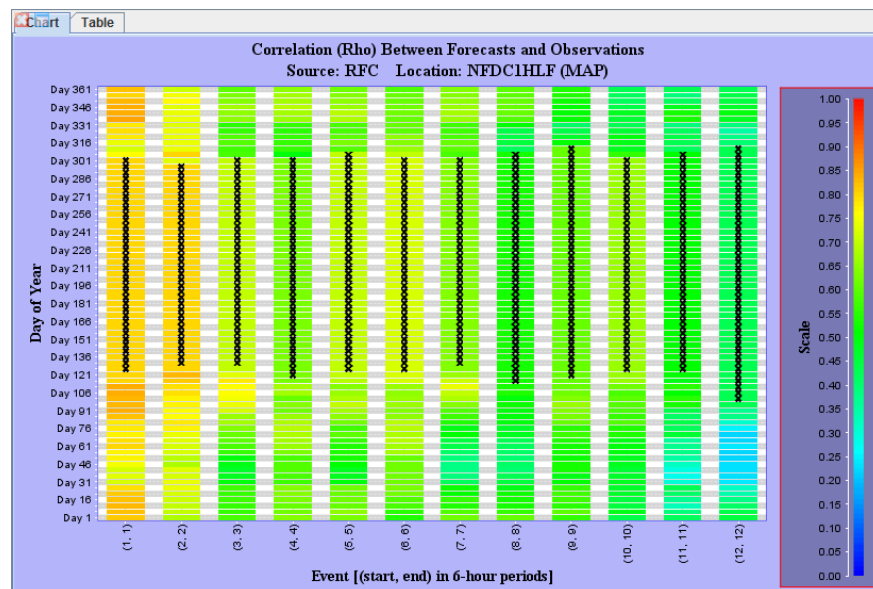
□ Identify/confirm expected patterns

- o Seasonal and lead time patterns are expected in most cases

Patterns in correlation visible by season
(y-axis: day of year source: CFSv2)



Correlation decreases with lead time
(x-axis: events with dur = 1 source: RFC)

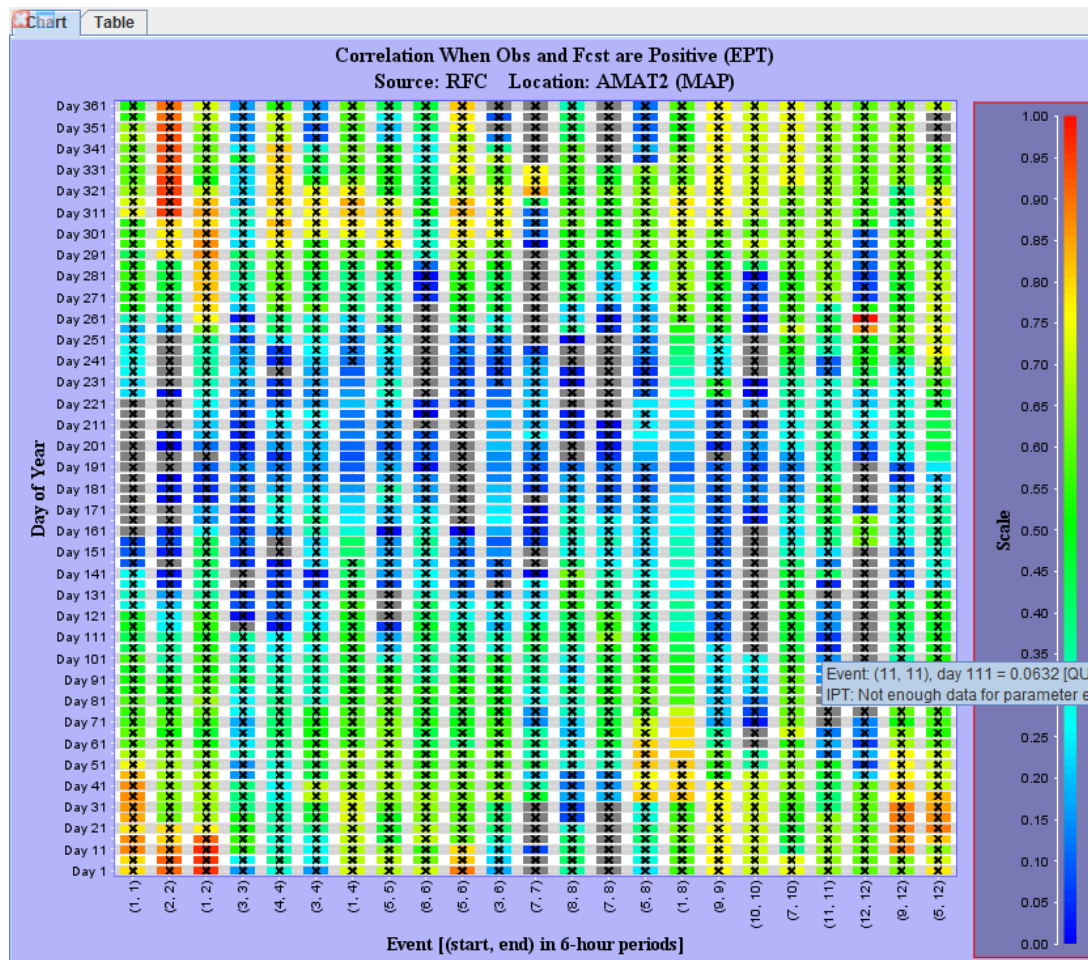


Parameter Diagnostics

Why?

□ Handle sample size issues

- o Modify estimation option to increase maximum data window width



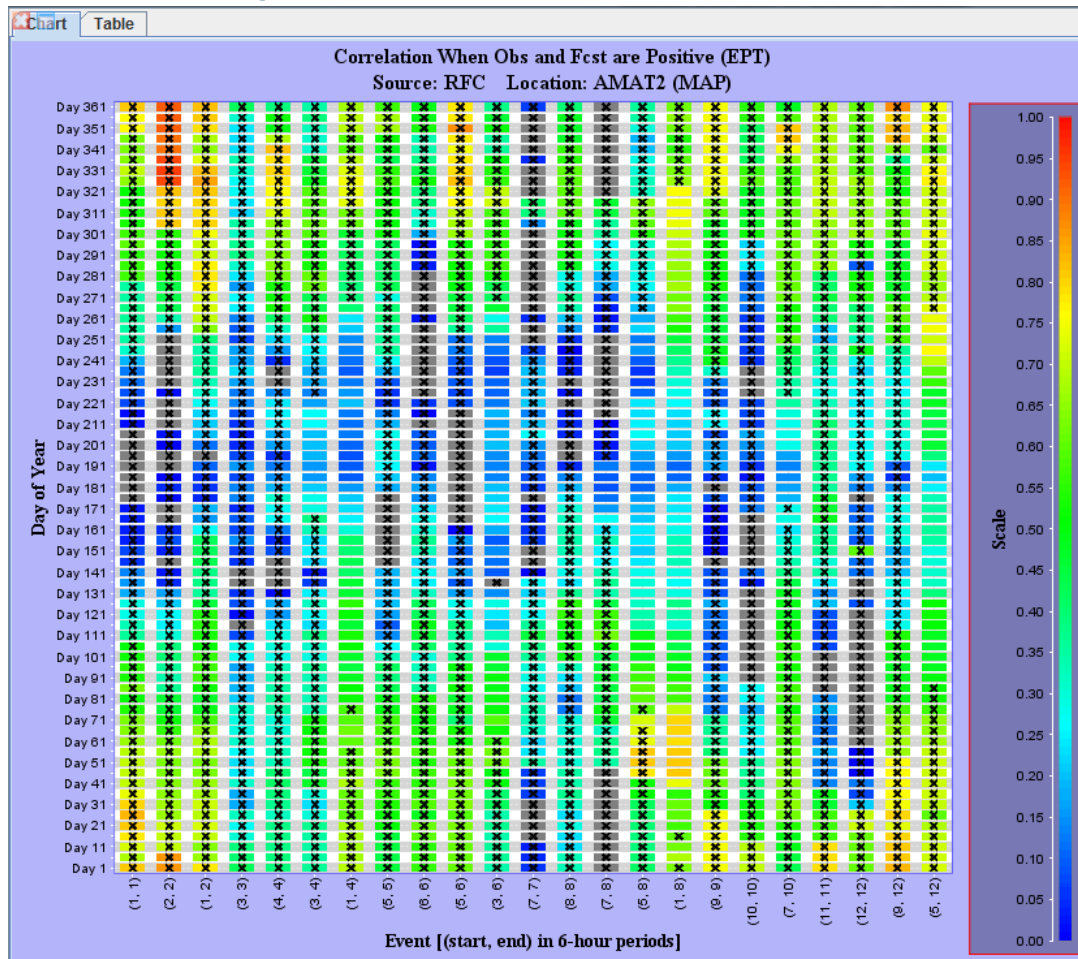
max = 61 days

Parameter Diagnostics

Why?

□ Handle sample size issues

- o Modify estimation option to increase maximum data window width

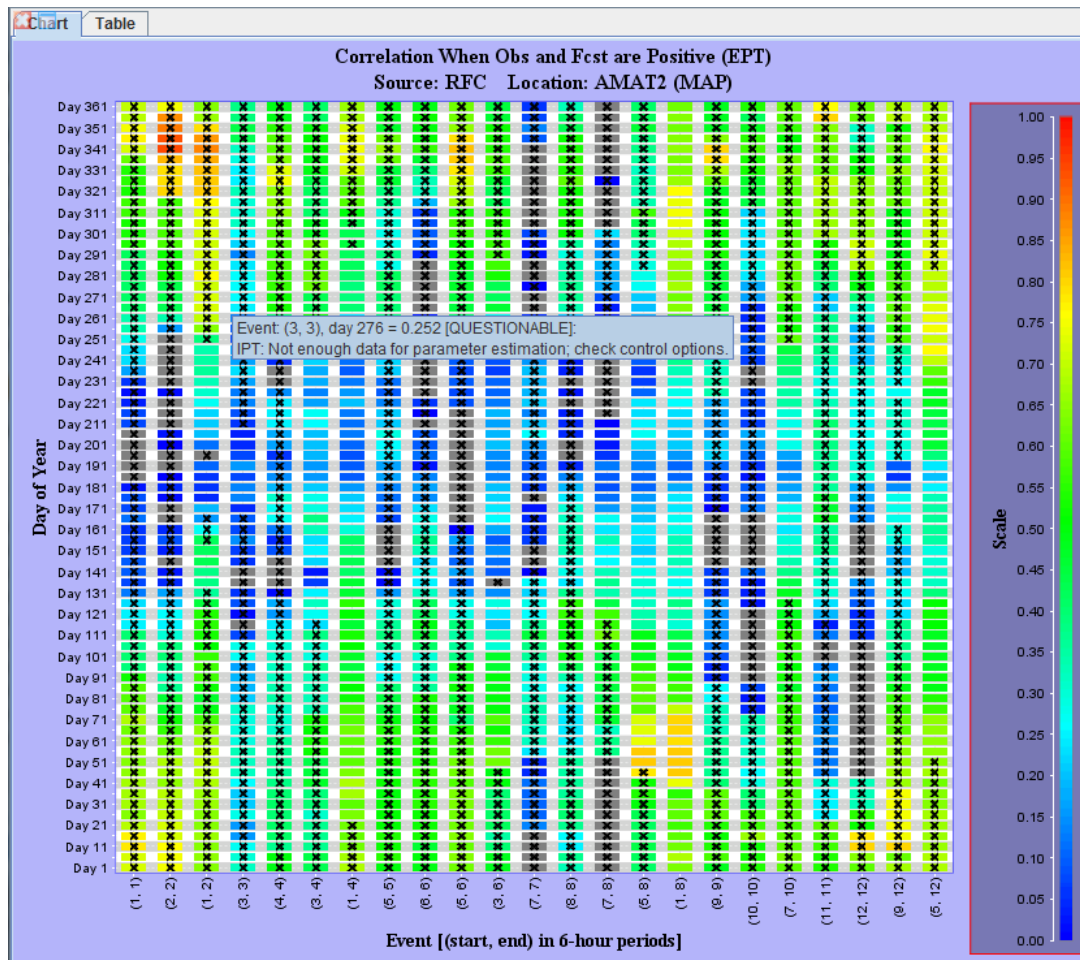


Parameter Diagnostics

Why?

□ Handle sample size issues

- o Modify estimation option to increase maximum data window width



max = 121 days

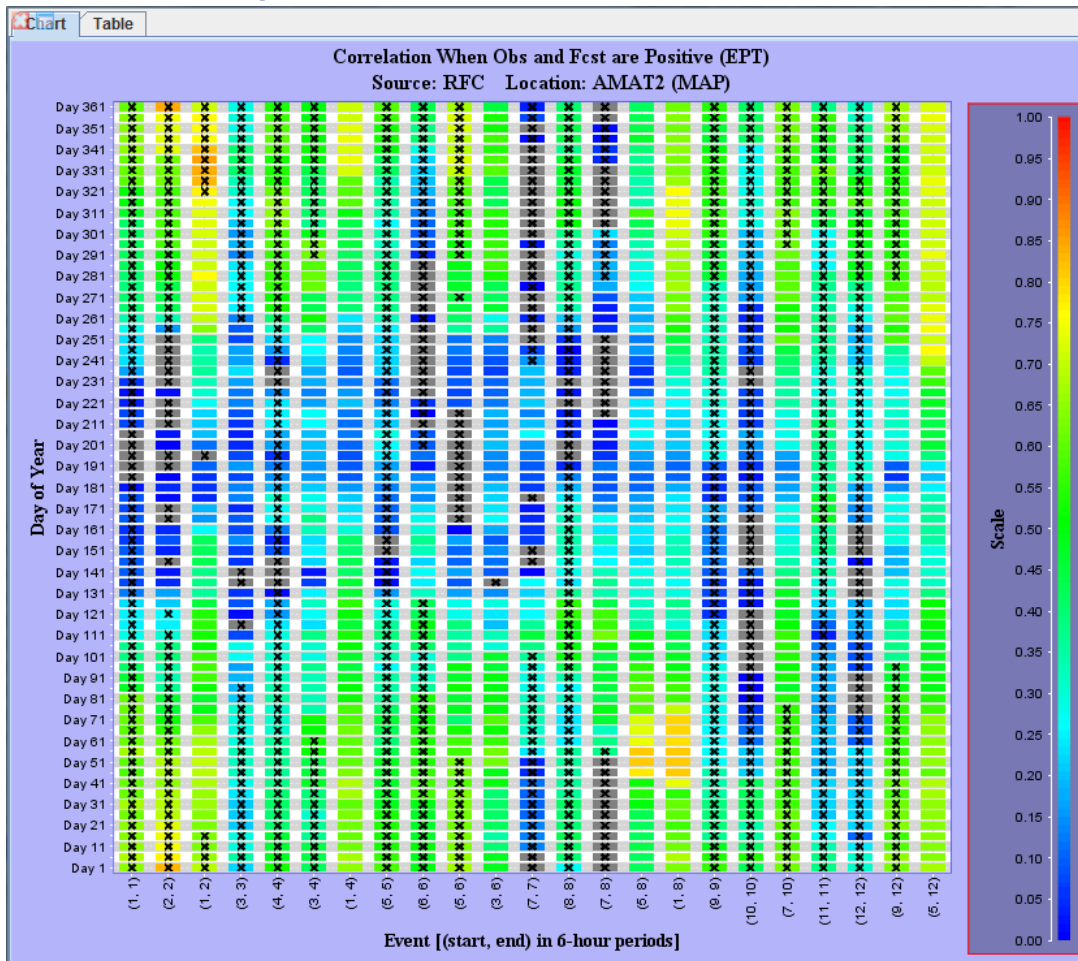


Parameter Diagnostics

Why?

□ Handle sample size issues

- o Modify estimation option to increase maximum data window width



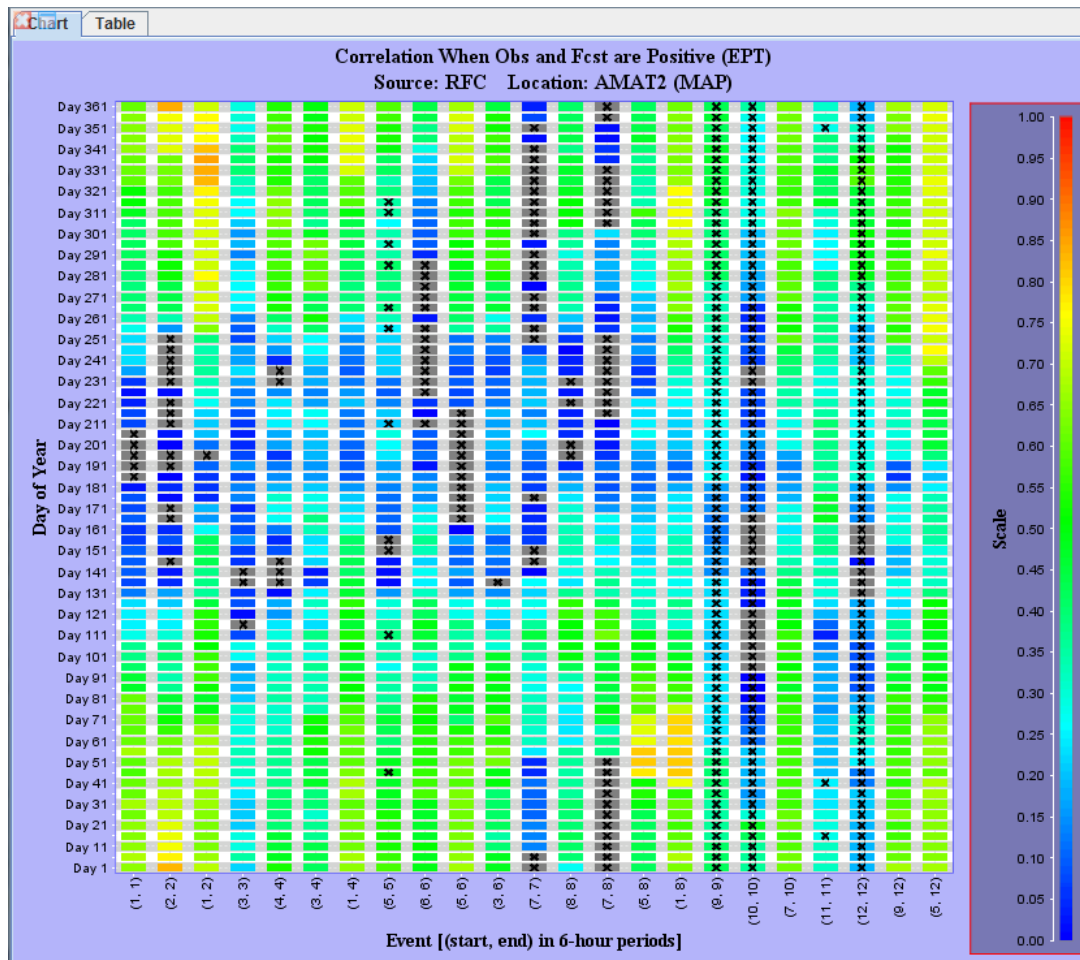
max = 181 days

Parameter Diagnostics

Why?

□ Handle sample size issues

- o Modify estimation option to increase maximum data window width

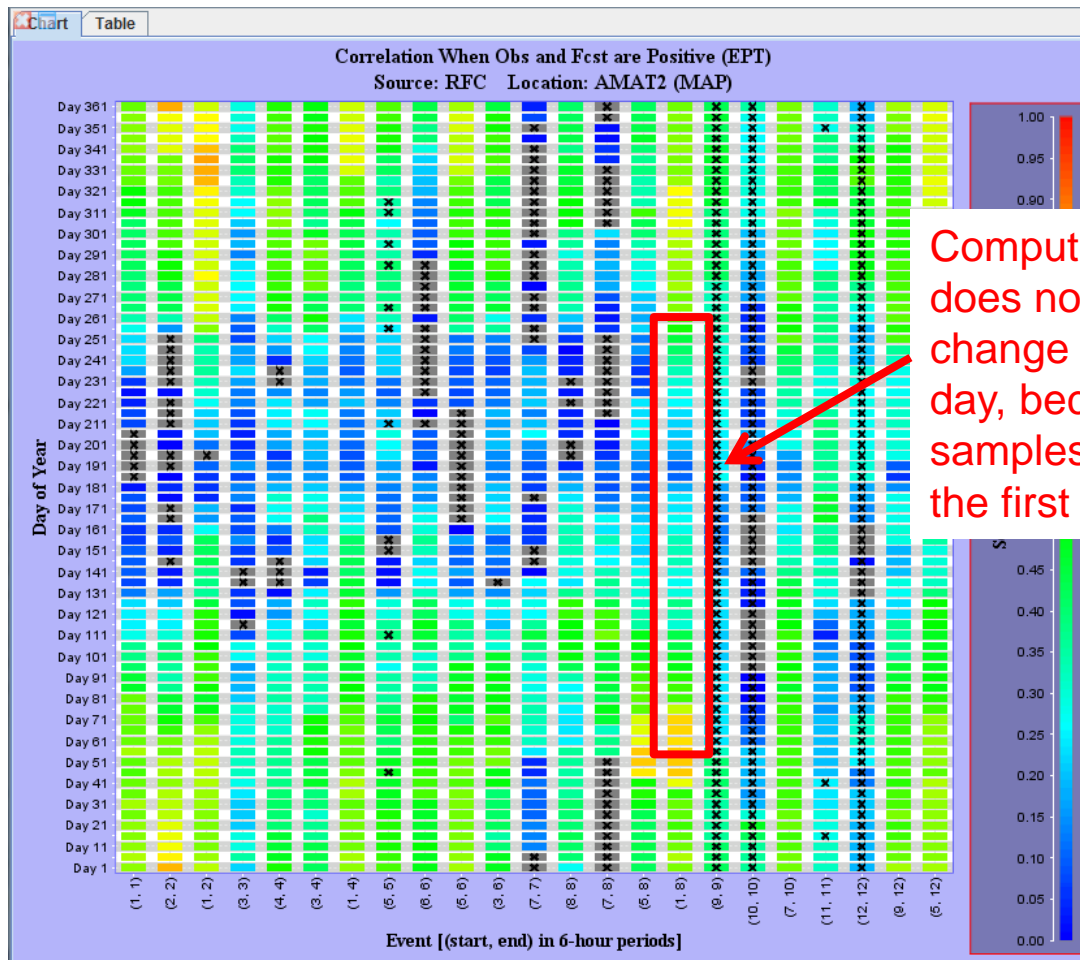


Parameter Diagnostics

Why?

□ Handle sample size issues

- o Modify estimation option to increase maximum data window width



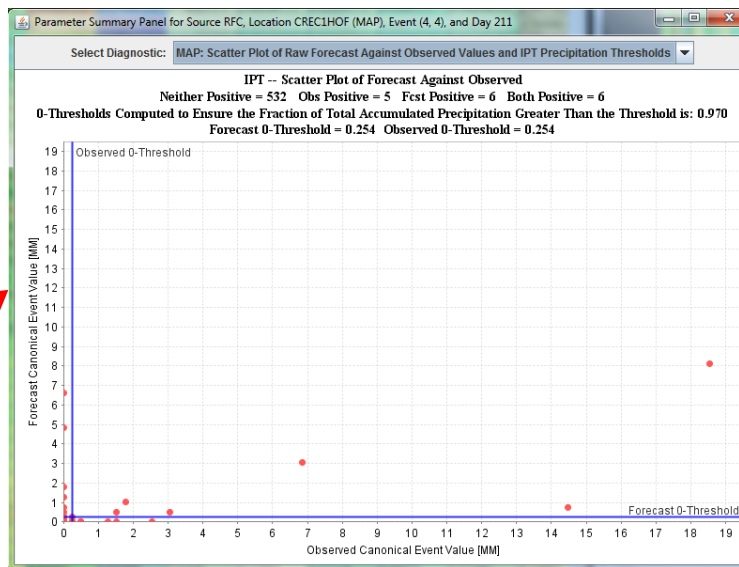
Parameter Diagnostics

Why?

□ Identify issues with forecast source

- Identify when computed correlations may not be reliable due to insufficient sample sizes
 - Look for rapid, inexplicable/unexpected changes in color

(3,3)	(4,4)	(3,4)	(1,1)
0.7939 (?)	0.47093 (?)	0.74238 (?)	0.0
0.87086 (?)	0.39187 (?)	0.72321 (?)	0.0
0.86684 (?)	0.17086 (?)	0.74623 (?)	0.0
0.81111 (?)	0.01307 (?)	0.68669 (?)	0.0
0.70289 (?)	-0.19988 (?)	0.63861 (?)	0.0
0.56471 (?)	-0.04961 (?)	0.59981 (?)	0.0
0.56952 (?)	0.12934 (?)	0.73918 (?)	0.0
0.54517 (?)	0.17099 (?)	0.55405 (?)	0.0
0.67835 (?)	0.43634 (?)	0.67897 (?)	0.0
0.51792 (?)	0.43634 (?)	0.68263 (?)	0.0
0.51792 (?)	0.78513 (?)	0.42338 (?)	0.0
0.51792 (?)	0.84021 (?)	0.51566 (?)	0.0
0.4837 (?)	0.78478 (?)	0.58436 (?)	0.0
0.38917 (?)	0	Event: (4, 4), day 211 = 0.84	0.0
0.46796 (?)	0	IPT: Not enough data for pa	0.0
0.43646 (?)	0.66471 (?)	0.49145 (?)	0.0



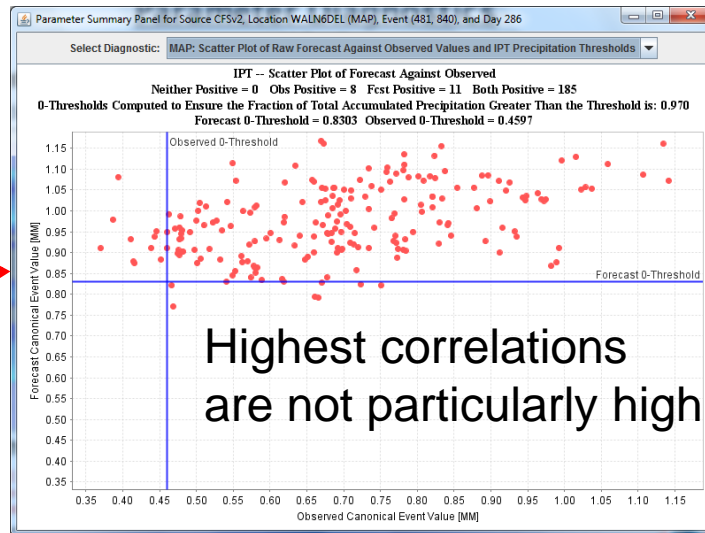
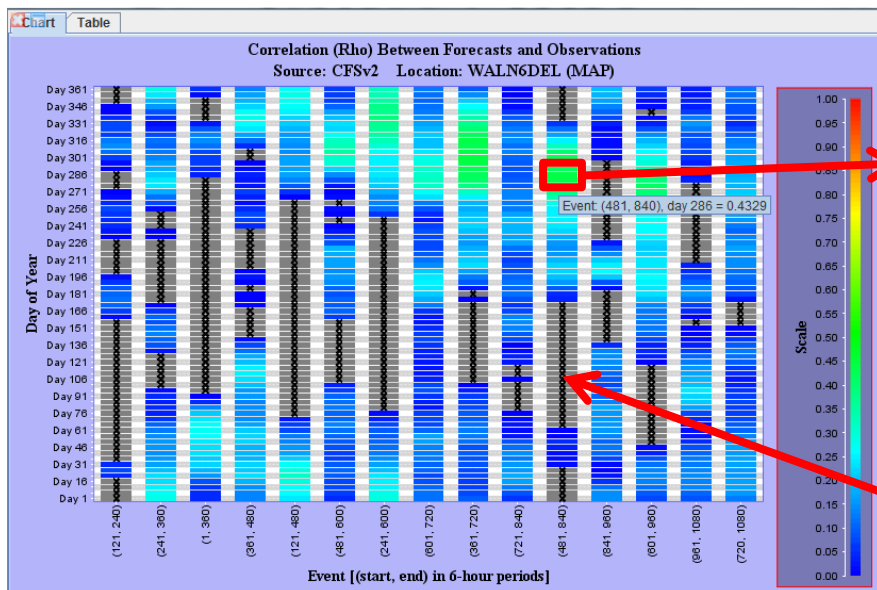
Only 6 pairs used to compute correlation

With so few pairs used to compute the correlation, should the parameters be used?

Parameter Diagnostics

Why?

- Identify problems with forecast source
 - o Identify when a source may not be skillful and should not be used



Questionable values are all negative correlations

With such low correlations, should the forecast source be used only at certain times of the year? Should it be used at all?

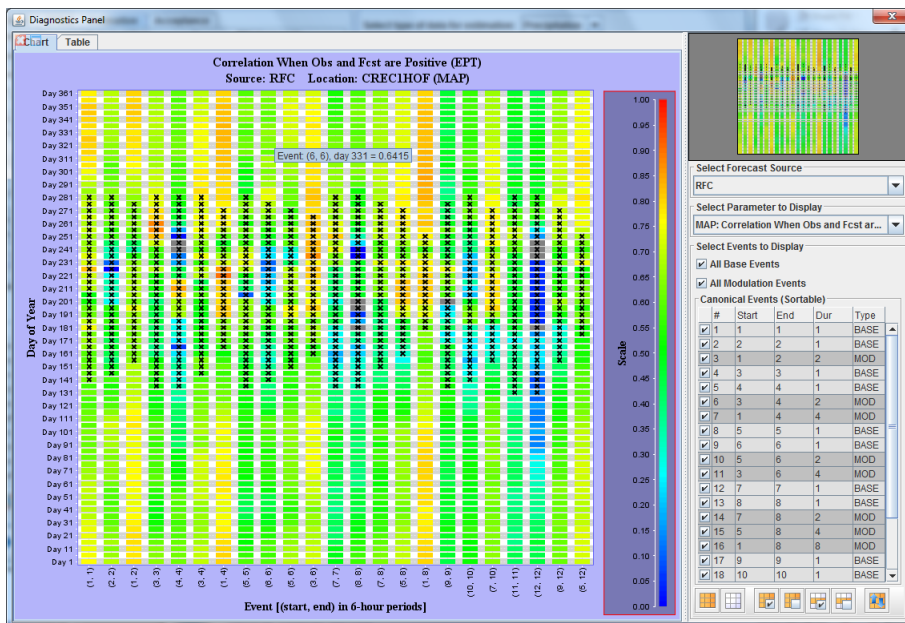
NOTE: The MEFPPE computed correlation coefficient is not necessarily an accurate measure of skill. To get a true sense of the skill of the forecast source, a verification study can be performed or additional more informative diagnostics may be added to MEFPPE in the future.

Parameter Diagnostics

MEFPPE Tools

Block plot parameter display

- Questionable parameters indicated by an 'X'
- Chart and table views available
 - User selectable source, parameters, and sortable canonical events
 - Zoom-capable
 - Color coded blocks correspond to table cells



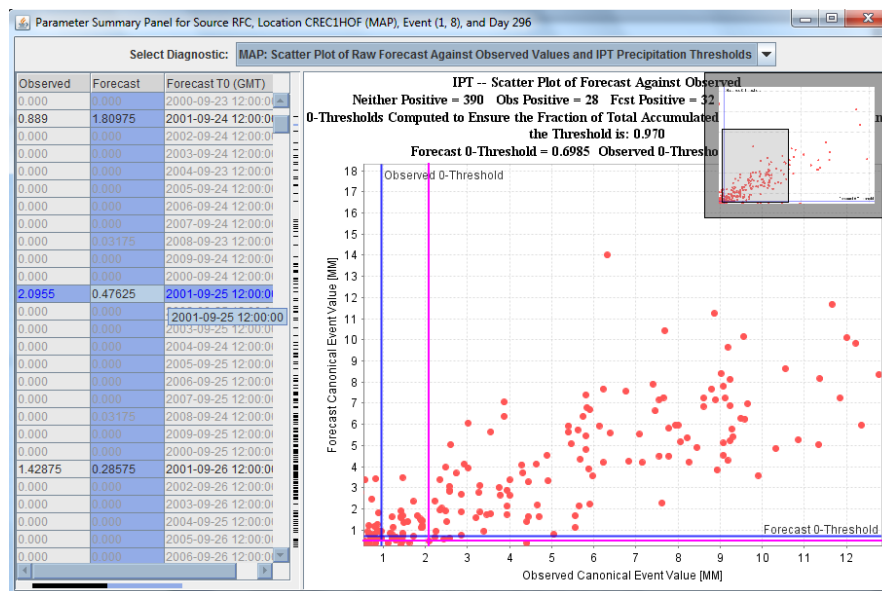
Day of Year	Day of Year	(1,1)	(2,2)	(1,2)	(3,3)	(4,4)	(3,4)	(1,4)	(5,5)	(6,6)
351	351	0.76489	0.68901	0.79729	0.65857	0.59597	0.6846	0.79457	0.5896	0.63571
356	356	0.77904	0.6812	0.7944	0.65037	0.57189	0.68487	0.79867	0.6209	0.61427
351	351	0.80419	0.67085	0.80575	0.67176	0.60256	0.71365	0.81755	0.63858	0.62525
346	346	0.80386	0.66895	0.80303	0.67107	0.5935	0.70546	0.81498	0.63225	0.59854
341	341	0.78742	0.65781	0.79616	0.69053	0.58473	0.73054	0.81476	0.62988	0.59872
336	336	0.78729	0.66998	0.787	0.68861	0.61027	0.75616	0.82205	0.59359	0.63065
331	331	0.7751	0.66536	0.777	0.67653	0.59552	0.74766	0.82223	0.57587	0.64153
326	326	0.8007	0.66213	0.789	0.66689	0.61231	0.74807	0.82321	0.60295	0.63142
321	321	0.7939	0.64139	0.77201	0.66457	0.61848	0.74349	0.81631	0.61095	0.63016
316	316	0.79597	0.63939	0.77159	0.67139	0.62662	0.74721	0.81676	0.61142	0.60815
311	311	0.77967	0.62427	0.76685	0.65031	0.60613	0.73786	0.81411	0.56348	0.6617
306	306	0.77195	0.58944	0.75279	0.66563	0.57266	0.74463	0.80356	0.54848	0.66184
301	301	0.74037	0.58362	0.72447	0.69211	0.57195	0.77009	0.8045	0.59778	0.62119
296	296	0.71763	0.60567	0.69289	0.69521	0.57054	0.77585	0.79938	0.49929	0.64284
291	291	0.68487	0.61809	0.68152	0.70244	0.54719	0.76788	0.78703	0.48625	0.66242
286	286	0.6531	0.6396	0.67433	0.71106	0.55005	0.78804	0.78327	0.49888	0.72159
281	281	0.67253 (?)	0.63223 (?)	0.6489	0.73198 (?)	0.53875 (?)	0.76455 (?)	0.79157	0.55708 (?)	0.73829
276	276	0.76533 (?)	0.57985 (?)	0.64596 (?)	0.72628 (?)	0.51787 (?)	0.72429 (?)	0.76379	0.645 (?)	0.6823 (?)
271	271	0.66251 (?)	0.5976 (?)	0.6134 (?)	0.78563 (?)	0.47148 (?)	0.71817 (?)	0.75406 (?)	0.63994 (?)	0.65493
266	266	0.70666 (?)	0.61407 (?)	0.60277 (?)	0.7939 (?)	0.47993 (?)	0.74238 (?)	0.76708 (?)	0.58724 (?)	0.61507
261	261	0.67676 (?)	0.59546 (?)	0.6549 (?)	0.87086 (?)	0.39187 (?)	0.72321 (?)	0.75182 (?)	0.51989 (?)	0.56468
256	256	0.69125 (?)	0.54417 (?)	0.60251 (?)	0.86884 (?)	0.17086 (?)	0.74623 (?)	0.68546 (?)	0.62954 (?)	0.5386 (?)
251	251	0.66079 (?)	0.56869 (?)	0.57185 (?)	0.81111 (?)	0.01307 (?)	0.68669 (?)	0.58543 (?)	0.56172 (?)	0.48279
246	246	0.6552 (?)	0.40377 (?)	0.42929 (?)	0.70289 (?)	-0.19988 (?)	0.63961 (?)	0.47422 (?)	0.55966 (?)	0.46128
241	241	0.66395 (?)	0.33022 (?)	0.34441 (?)	0.56471 (?)	-0.04961 (?)	0.59981 (?)	0.56448 (?)	0.68407 (?)	0.2259 (?)
236	236	0.72053 (?)	0.33022 (?)	0.53457 (?)	0.65952 (?)	0.12934 (?)	0.73918 (?)	0.66626 (?)	0.72022 (?)	0.23242
231	231	0.71847 (?)	0.40832 (?)	0.63518 (?)	0.54517 (?)	0.17099 (?)	0.55405 (?)	0.71283 (?)	0.72022 (?)	0.10181
226	226	0.81553 (?)	0.67352 (?)	0.67835 (?)	0.43634 (?)	0.67897 (?)	0.85114 (?)	0.68835 (?)	0.71211	
221	221	0.70401 (?)	0.26447 (?)	0.64002 (?)	0.51792 (?)	0.43634 (?)	0.68263 (?)	0.89916 (?)	0.59919 (?)	0.20851
216	216	0.68552 (?)	0.33591 (?)	0.67318 (?)	0.51792 (?)	0.78513 (?)	0.49268 (?)	0.80025 (?)	0.41666 (?)	0.1888 (?)
211	211	0.68552 (?)	0.33591 (?)	0.67318 (?)	0.51792 (?)	0.84021 (?)	0.51566 (?)	0.80025 (?)	0.41666 (?)	0.24349
206	206	0.69791 (?)	0.32845 (?)	0.67069 (?)	0.4837 (?)	0.78478 (?)	0.58436 (?)	0.78974 (?)	0.60514 (?)	0.28513
201	201	0.51343 (?)	0.26039 (?)	0.61092 (?)	0.38917 (?)	0.66471 (?)	0.51203 (?)	0.78467 (?)	0.64101 (?)	0.28574
196	196	0.60447 (?)	0.54286 (?)	0.73322 (?)	0.46796 (?)	0.66471 (?)	0.50119 (?)	0.80084 (?)	0.64101 (?)	0.56913
191	191	0.60447 (?)	0.51839 (?)	0.55891 (?)	0.43046 (?)	0.66471 (?)	0.49145 (?)	0.80073 (?)	0.64101 (?)	0.57109
186	186	0.68567 (?)	0.55678 (?)	0.65524 (?)	0.45589 (?)	0.25465 (?)	0.48393 (?)	0.63228 (?)	0.63991 (?)	0.57734
181	181	0.74067 (?)	0.60843 (?)	0.63768 (?)	0.49684 (?)	0.32734 (?)	0.52895 (?)	0.62261 (?)	0.61365 (?)	0.48914



Parameter Diagnostics

MEFPPE Tools

- Canonical event value (fcst, obs) pair scatter plot
 - Precipitation defining thresholds displayed
 - (Re)forecast T0 associated with pair is shown, allowing for outliers to be identified in historical data and reforecasts
 - Points/table cells can be selected to pinpoint the value
 - Zoom capable



Summary

- ❑ **Time series diagnostic tools are not likely to undergo further enhancements unless requested by RFCs**
 - If requested, the change would likely not be made available until after the rollout to the RFCs
 - Comments/Recommendations?
 - Mention it during this training
 - May need a FogBugz issue

- ❑ **Parameter diagnostic tools are still open to changes**
 - No changes planned for the Spring 2014 release
 - Exercises focus on how to use these tools to make decisions about parameter estimation options and operational run-time properties
 - Comments/Recommendations?
 - Mention it during this training
 - May need a FogBugz issue

Questions?



Exercise 2

- ❑ **Examine the parameters for CREC1HOF (CNRFC) and AMAT2 (ABRFC)**
 - Answer as many of the questions as you can