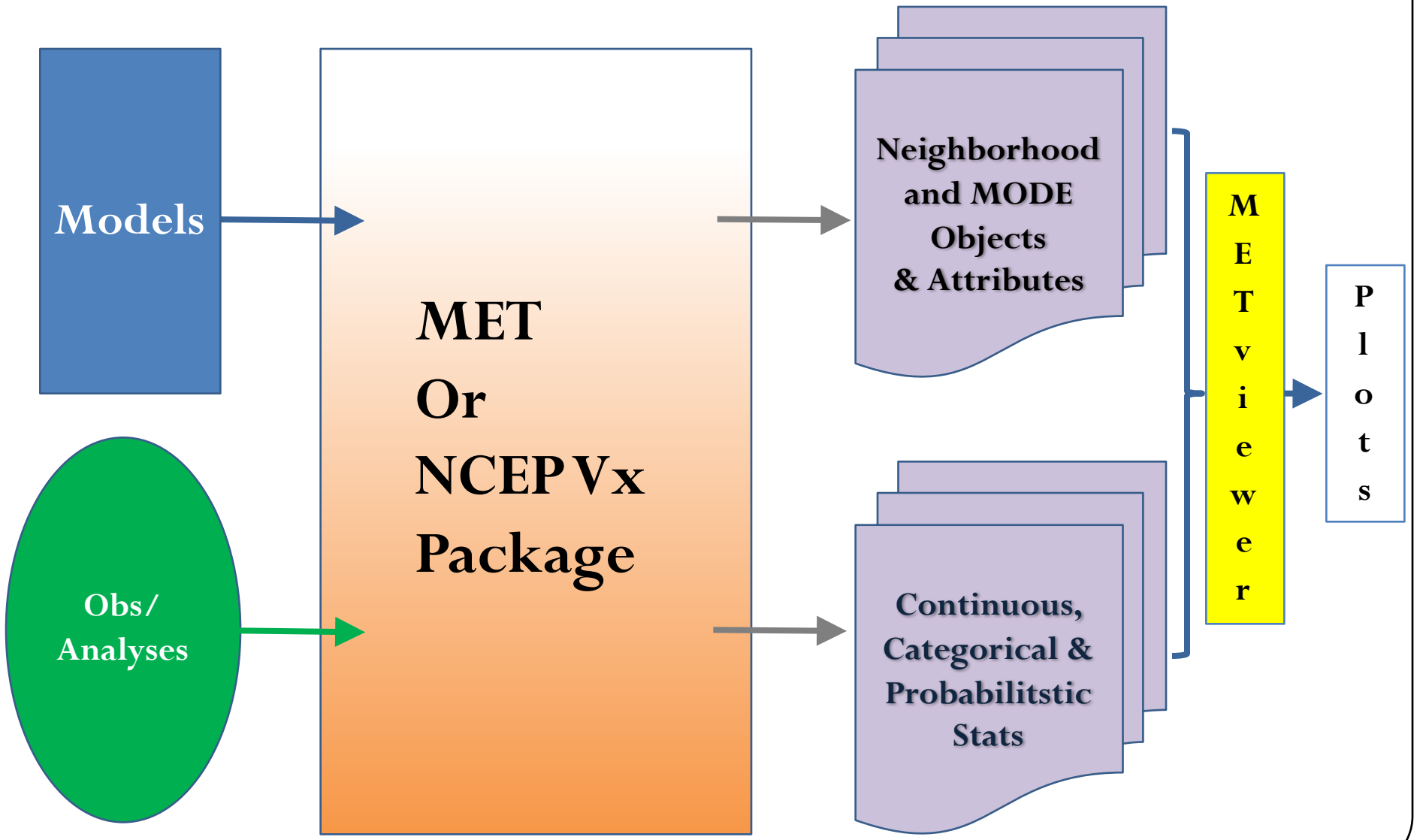
MET
Model Evaluation Tools

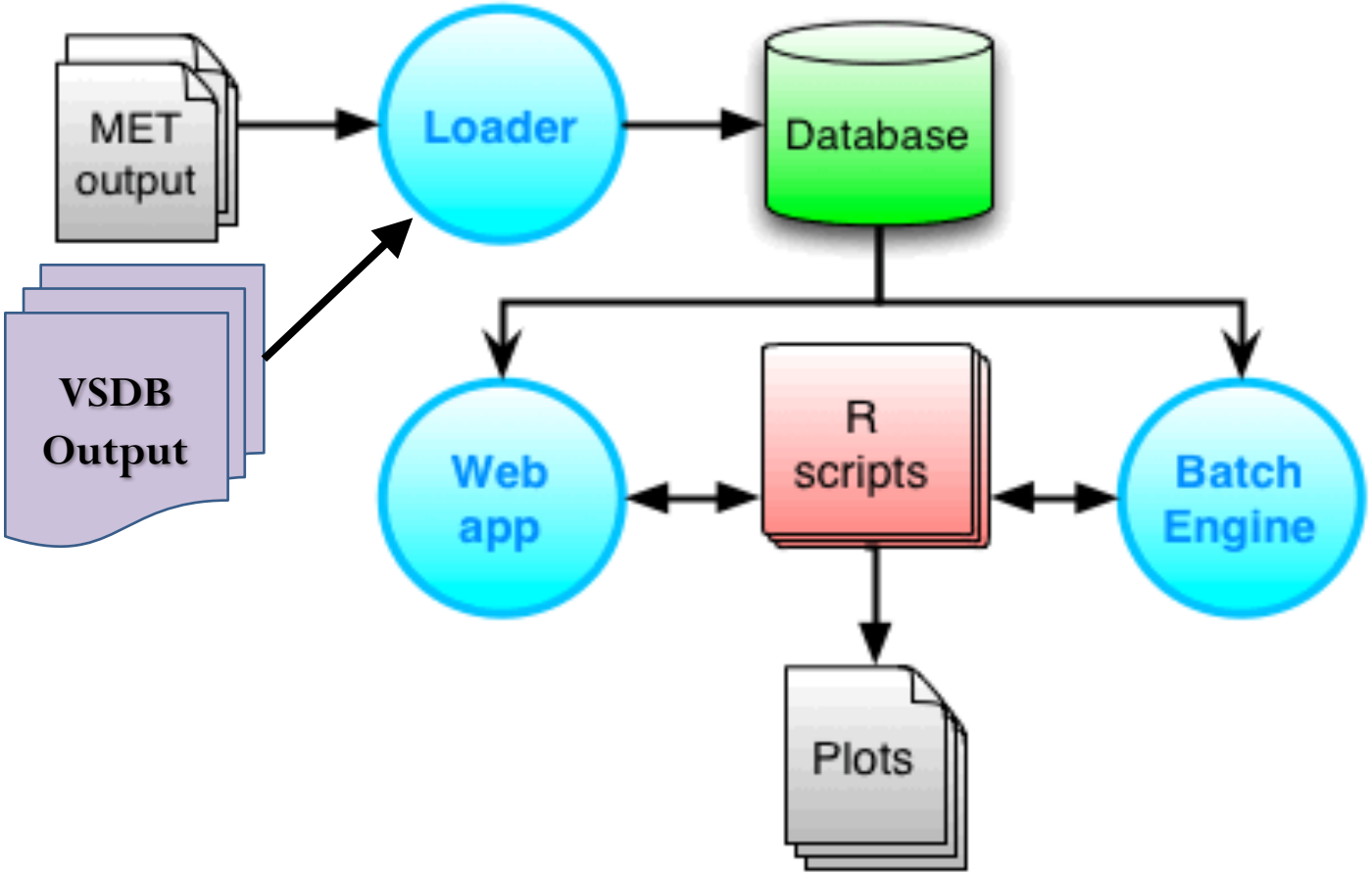
METviewer Training

Verification Dataflow



METviewer components

Packages: Java, Apache/Tomcat, MySQL, R statistics



What can be loaded into METviewer?

- STAT files (*.stat) files from MET packages
  - Grid-Stat
  - Point-Stat
  - Ensemble-Stat
  - MODE (.obj and ctc.stat)
  - MODE-TD (.obj and ctc.stat)

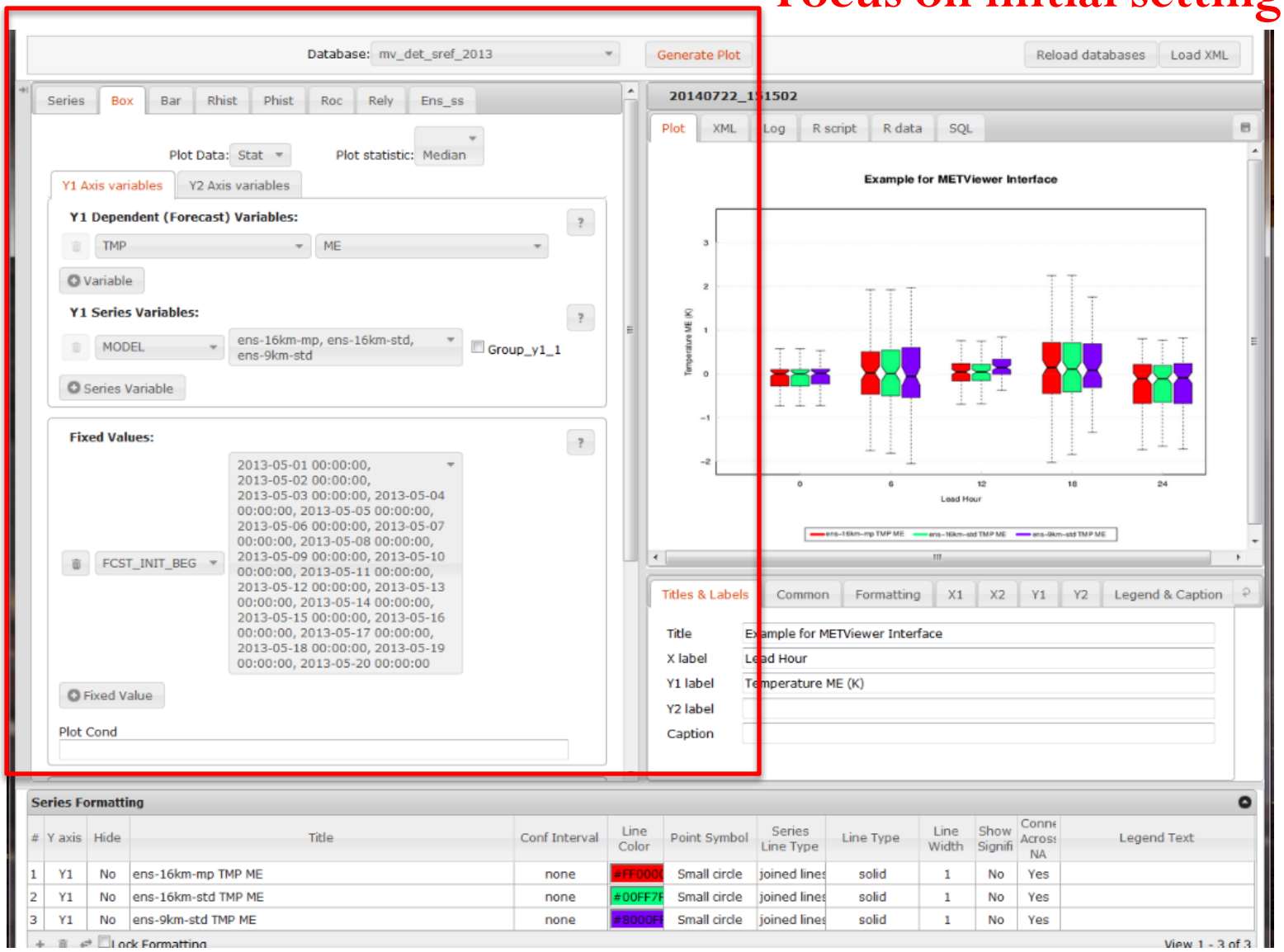
- VSDB files from NCEP verification packages
  - Grid-to-Obs
  - Grid-to-Obs_e*
  - Grid-to-Grid
  - Grid-to-Grid_e*

**** Some variables in ensemble VSDB currently not available for loading but will be soon***

Interface Basics

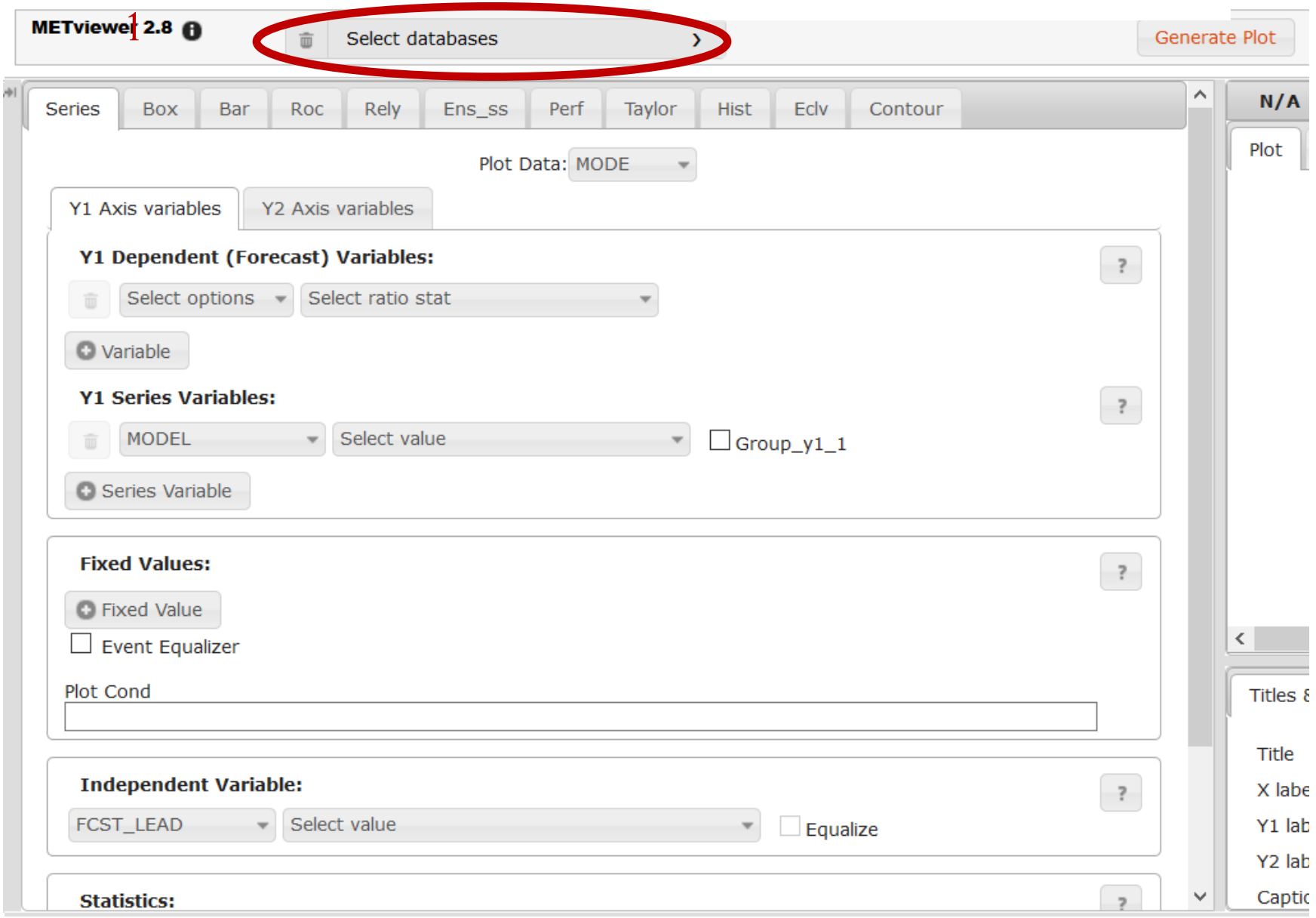
General Layout

Focus on initial settings



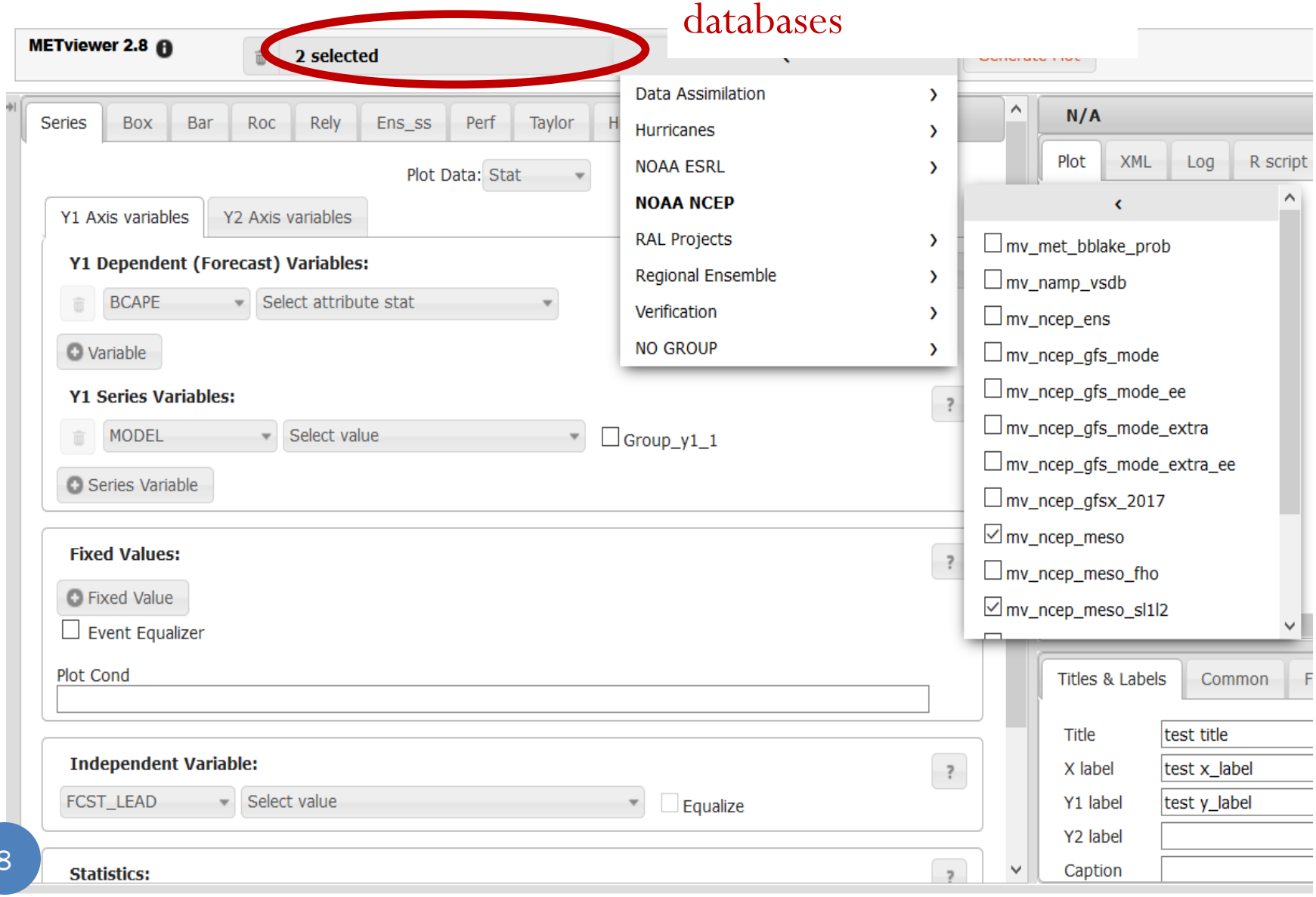
METviewer

Click on down arrow to pick one or more databases

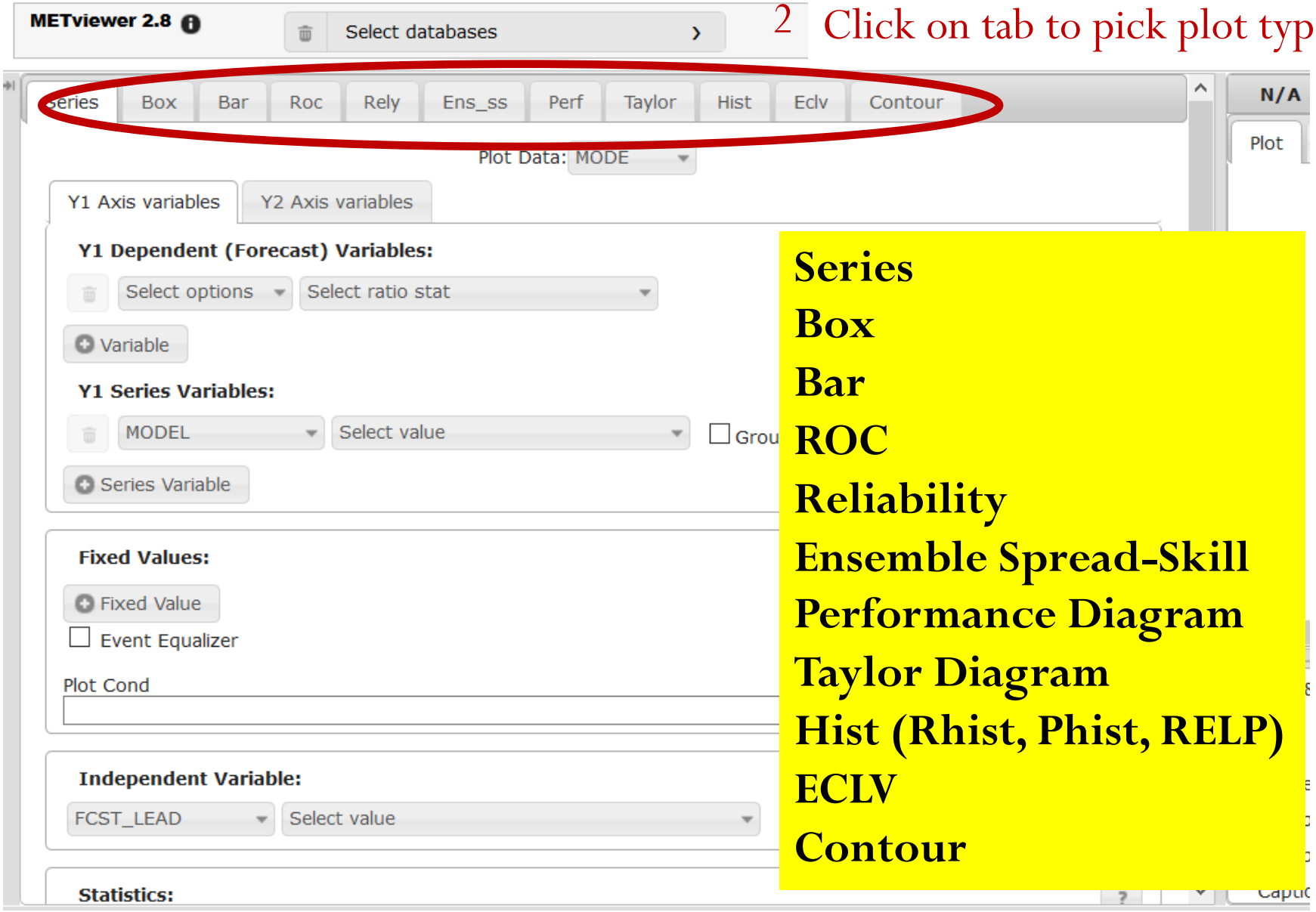


METviewer

Click on down arrow to pick one or more databases

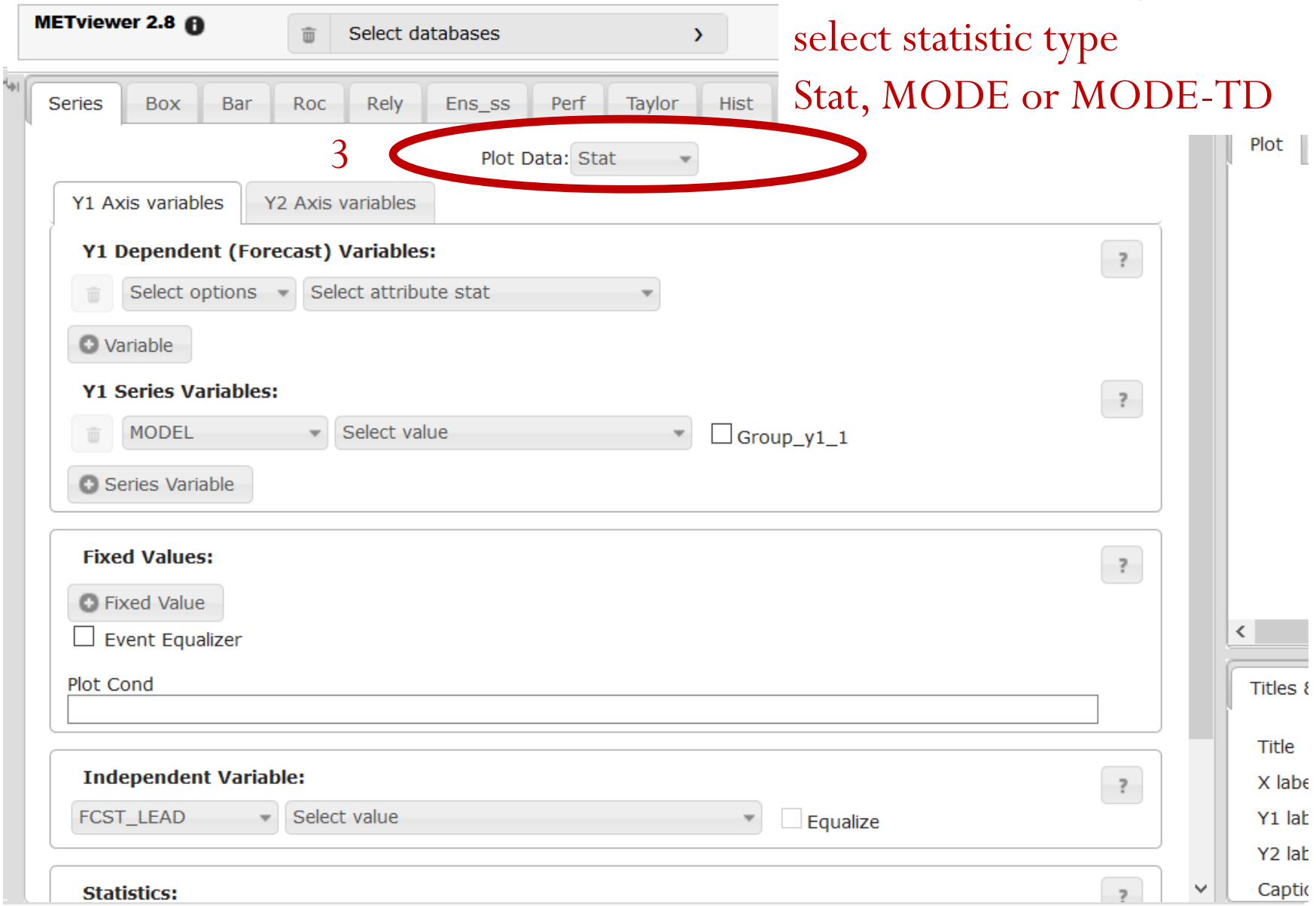


METviewer

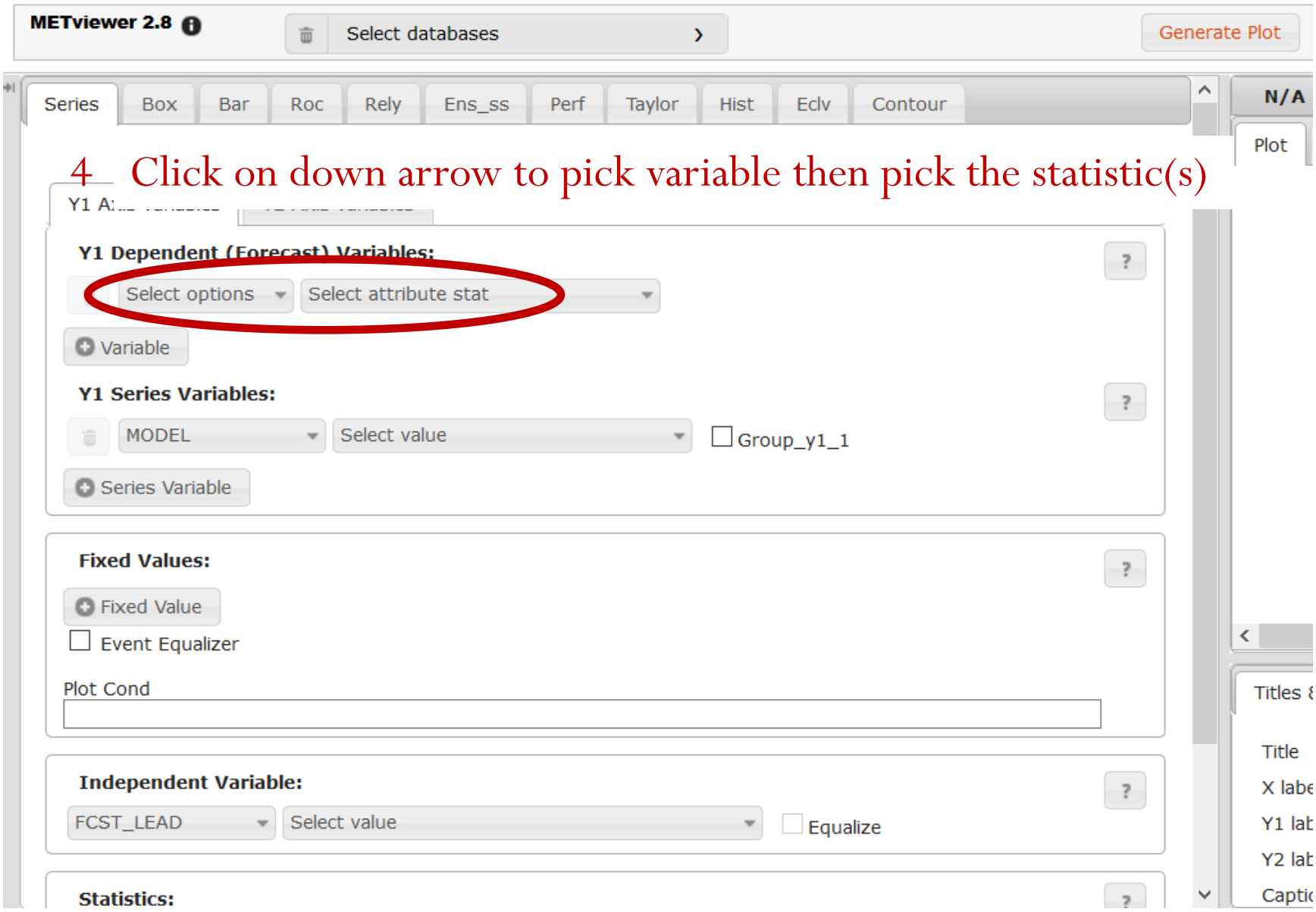

METviewer 2.8
Select databases
2
Click on tab to pick plot type
Series
Box
Bar
Roc
Rely
Ens_ss
Perf
Taylor
Hist
Eclv
Contour
N/A
Plot
Plot Data: MODE
Y1 Axis variables
Y2 Axis variables
Y1 Dependent (Forecast) Variables:
Select options
Select ratio stat
Variable
Y1 Series Variables:
MODEL
Select value
Series Variable
Fixed Values:
Fixed Value
Event Equalizer
Plot Cond
Independent Variable:
FCST_LEAD
Select value
Statistics:
Series
Box
Bar
ROC
Reliability
Ensemble Spread-Skill
Performance Diagram
Taylor Diagram
Hist (Rhist, Phist, RELP)
ECLV
Contour

METviewer

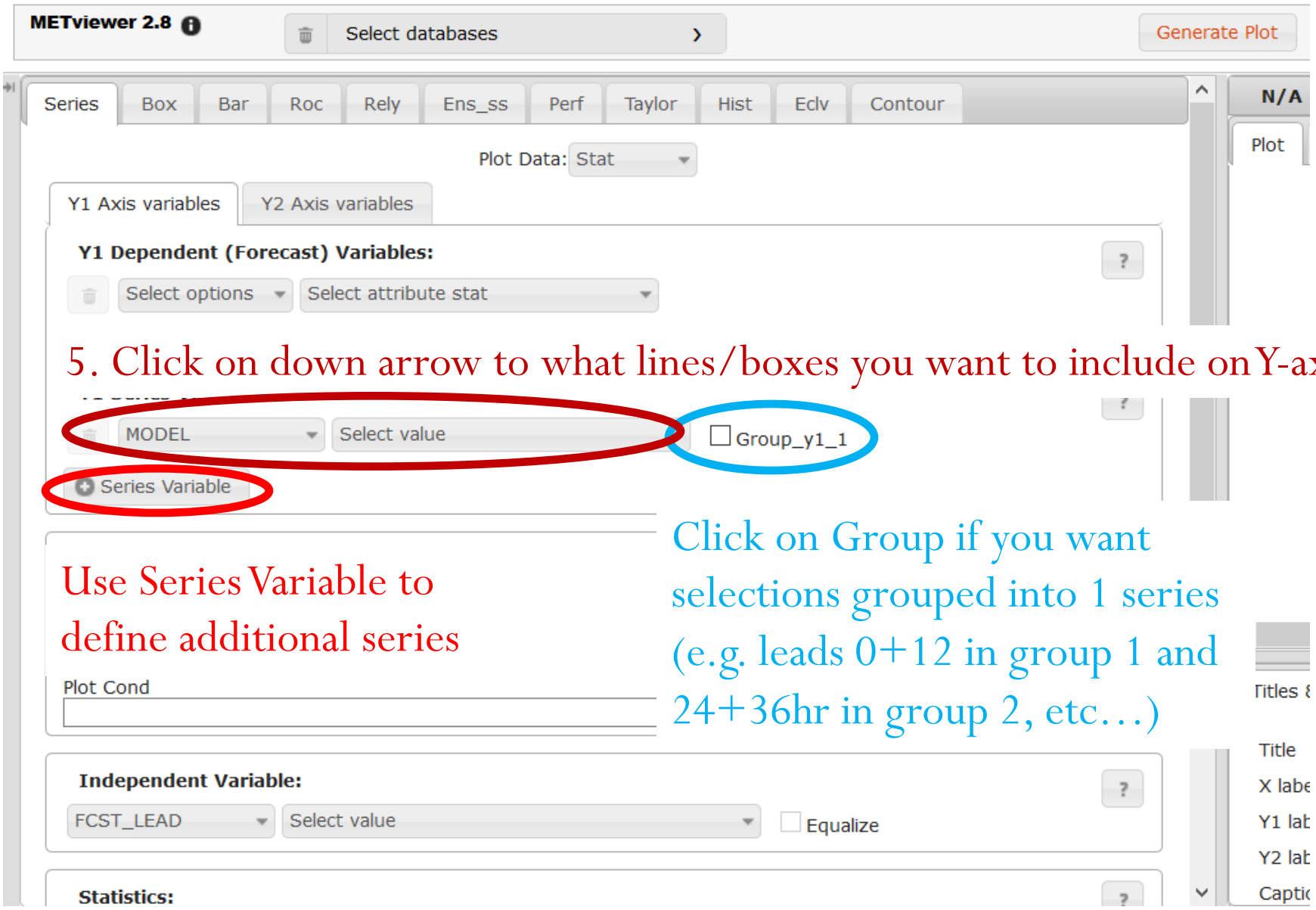
If there is more than one type of data in a database, click to select statistic type
Stat, MODE or MODE-TD



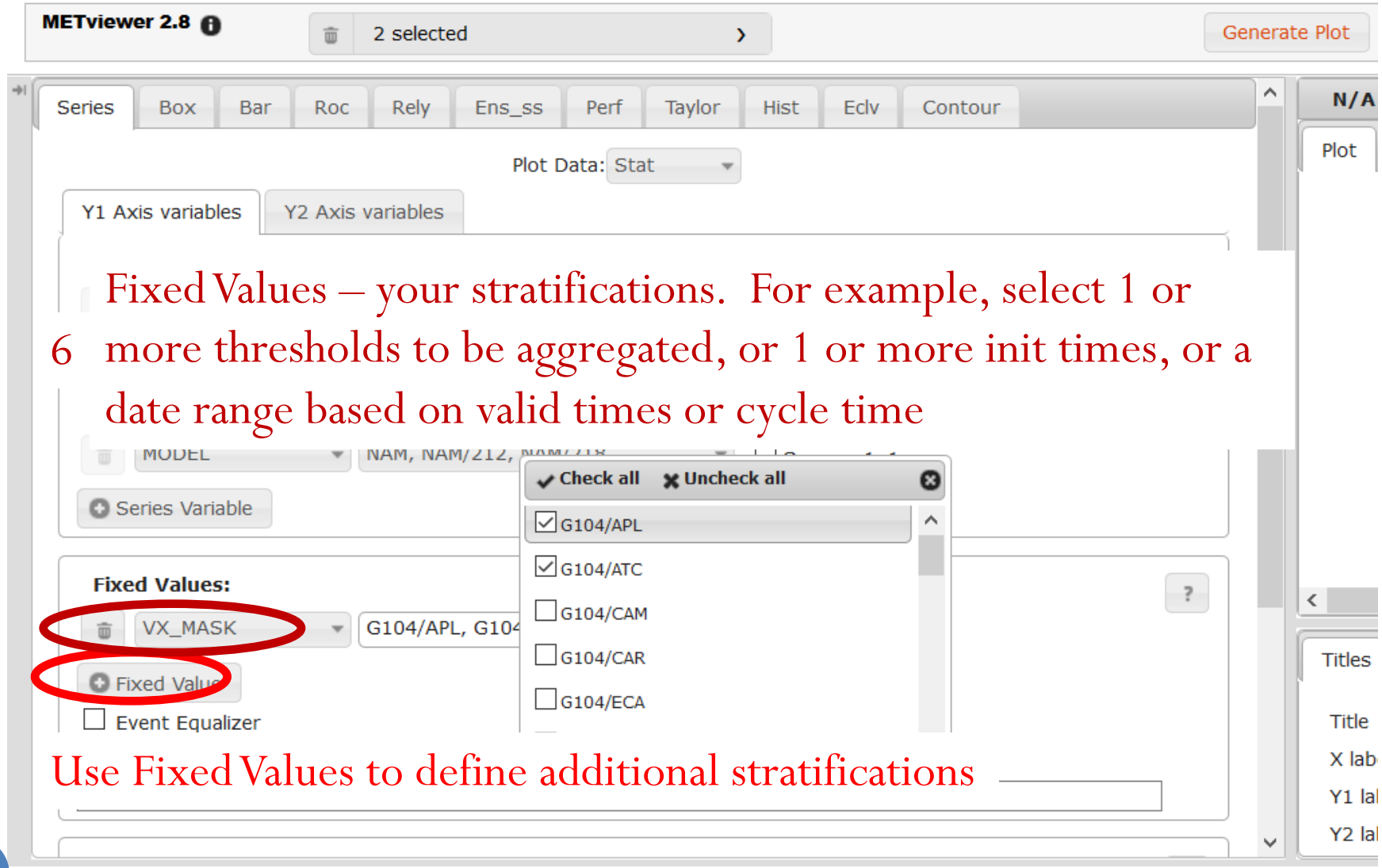
METviewer


METviewer 2.8
Select databases
Generate Plot
Series
Box
Bar
Roc
Rely
Ens_ss
Perf
Taylor
Hist
Eclv
Contour
N/A
Plot
4 Click on down arrow to pick variable then pick the statistic(s)
Y1 Dependent (Forecast) Variables:
Select options
Select attribute stat
Variable
Y1 Series Variables:
MODEL
Select value
Group_y1_1
Series Variable
Fixed Values:
Fixed Value
Event Equalizer
Plot Cond
Independent Variable:
FCST_LEAD
Select value
Equalize
Statistics:
Titles &
Title
X labe
Y1 lab
Y2 lab
Captio

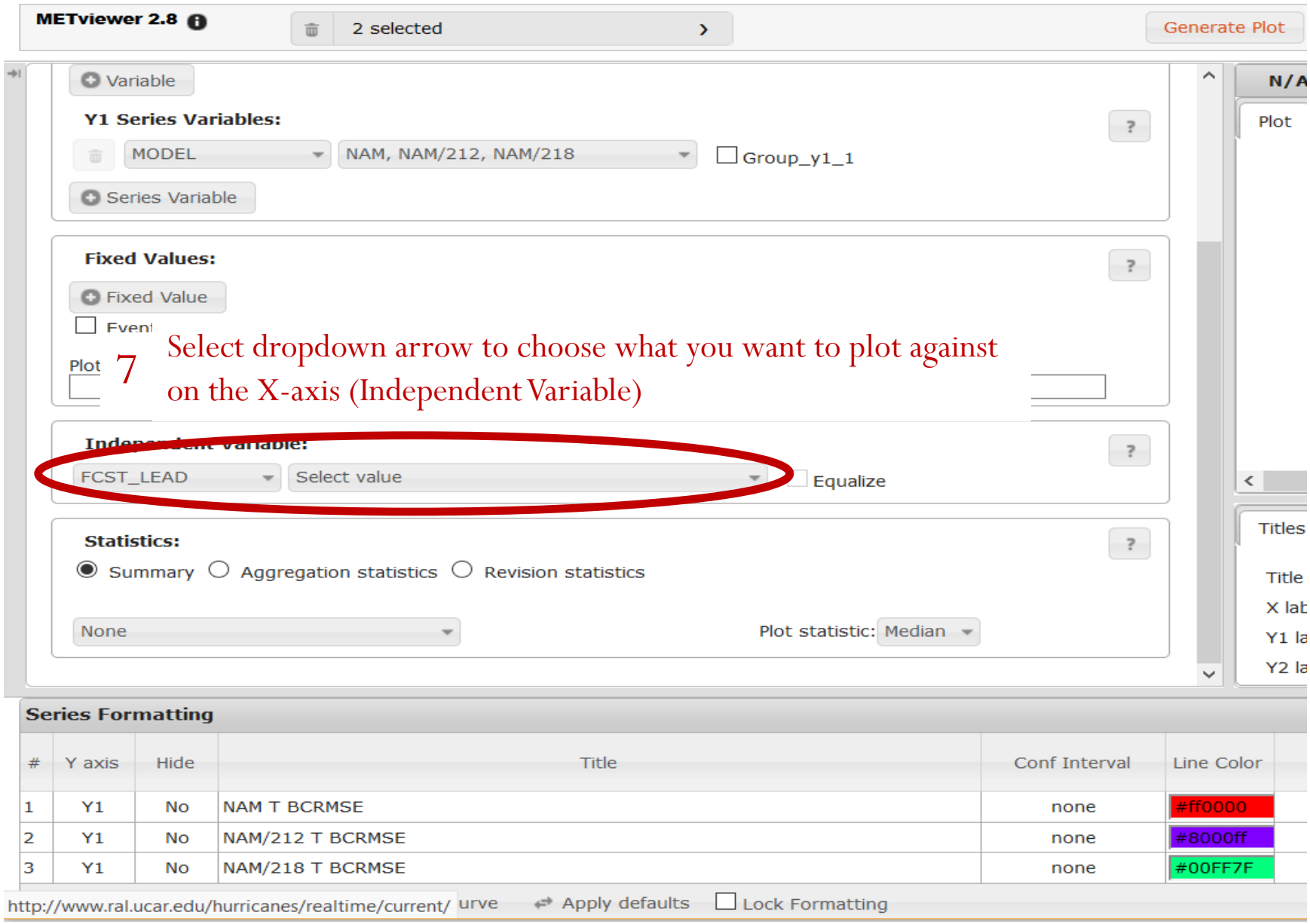
METviewer


METviewer 2.8
Select databases
Generate Plot
Series
Box
Bar
Roc
Rely
Ens_ss
Perf
Taylor
Hist
Eclv
Contour
N/A
Plot
Plot Data: Stat
Y1 Axis variables
Y2 Axis variables
Y1 Dependent (Forecast) Variables:
Select options
Select attribute stat
5. Click on down arrow to what lines/boxes you want to include on Y-axis
MODEL
Select value
Group_y1_1
Series Variable
Use Series Variable to define additional series
Click on Group if you want selections grouped into 1 series (e.g. leads 0+12 in group 1 and 24+36hr in group 2, etc…)
Plot Cond
Independent Variable:
FCST_LEAD
Select value
Equalize
Statistics:
Titles &
Title
X labe
Y1 lab
Y2 lab
Captio

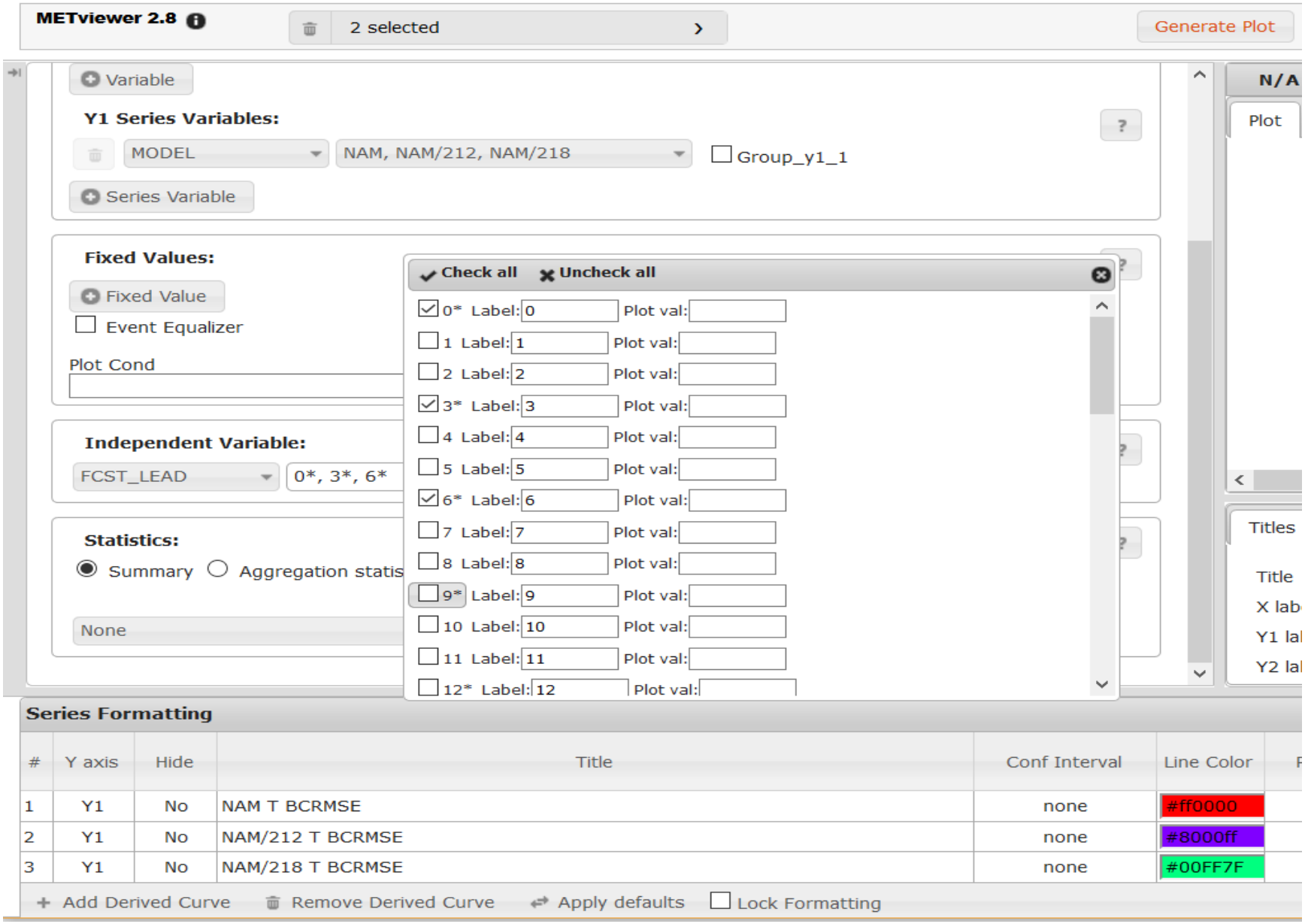
Stratifications



METviewer

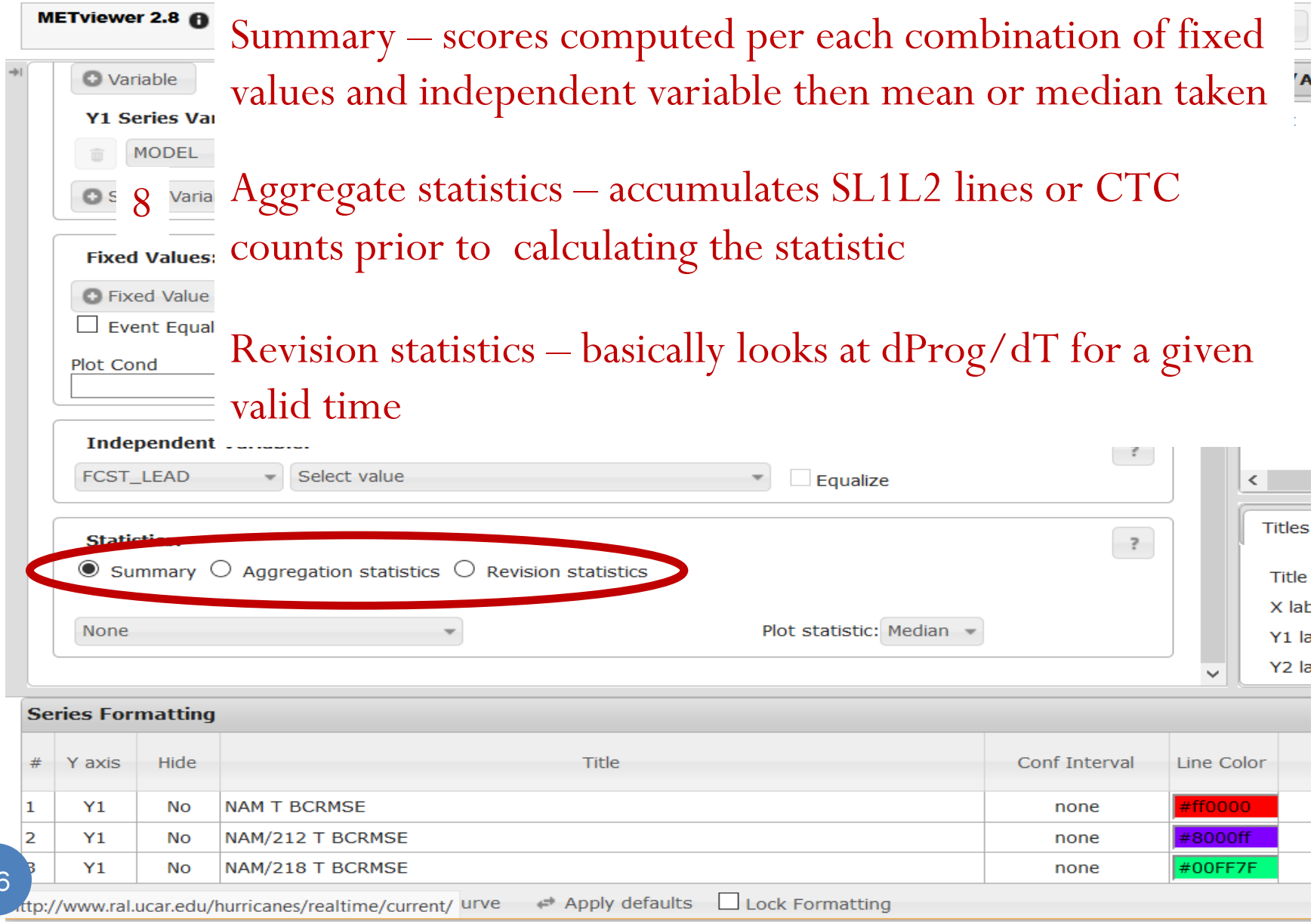

METviewer 2.8
2 selected
Generate Plot
Variable
Y1 Series Variables:
MODEL
NAM, NAM/212, NAM/218
Group_y1_1
Series Variable
Fixed Values:
Fixed Value
Plot
7
Select dropdown arrow to choose what you want to plot against on the X-axis (Independent Variable)
FCST_LEAD
Select value
Equalize
Statistics:
Summary
Aggregation statistics
Revision statistics
None
Plot statistic:
Median
Plot
Titles
Title
X lab
Y1 la
Y2 la
Series Formatting
| Y axis | Hide | Title | Conf Interval | Line Color
1 | Y1 | No | NAM T BCRMSE | none | #ff0000
2 | Y1 | No | NAM/212 T BCRMSE | none | #8000ff
3 | Y1 | No | NAM/218 T BCRMSE | none | #00FF7F
http://www.ral.ucar.edu/hurricanes/realtime/current/
Apply defaults
Lock Formatting

METviewer



#	Y axis	Hide	Title	Conf Interval	Line Color
1	Y1	No	NAM T BCRMSE	none	#ff0000
2	Y1	No	NAM/212 T BCRMSE	none	#8000ff
3	Y1	No	NAM/218 T BCRMSE	none	#00FF7F

How to compute statistics



Summary – scores computed per each combination of fixed values and independent variable then mean or median taken

Aggregate statistics – accumulates SL1L2 lines or CTC counts prior to calculating the statistic

Revision statistics – basically looks at dProg/dT for a given valid time

Summary vs. Aggregation

Summary for example

Computes RMSE for each day, fcst lead combination

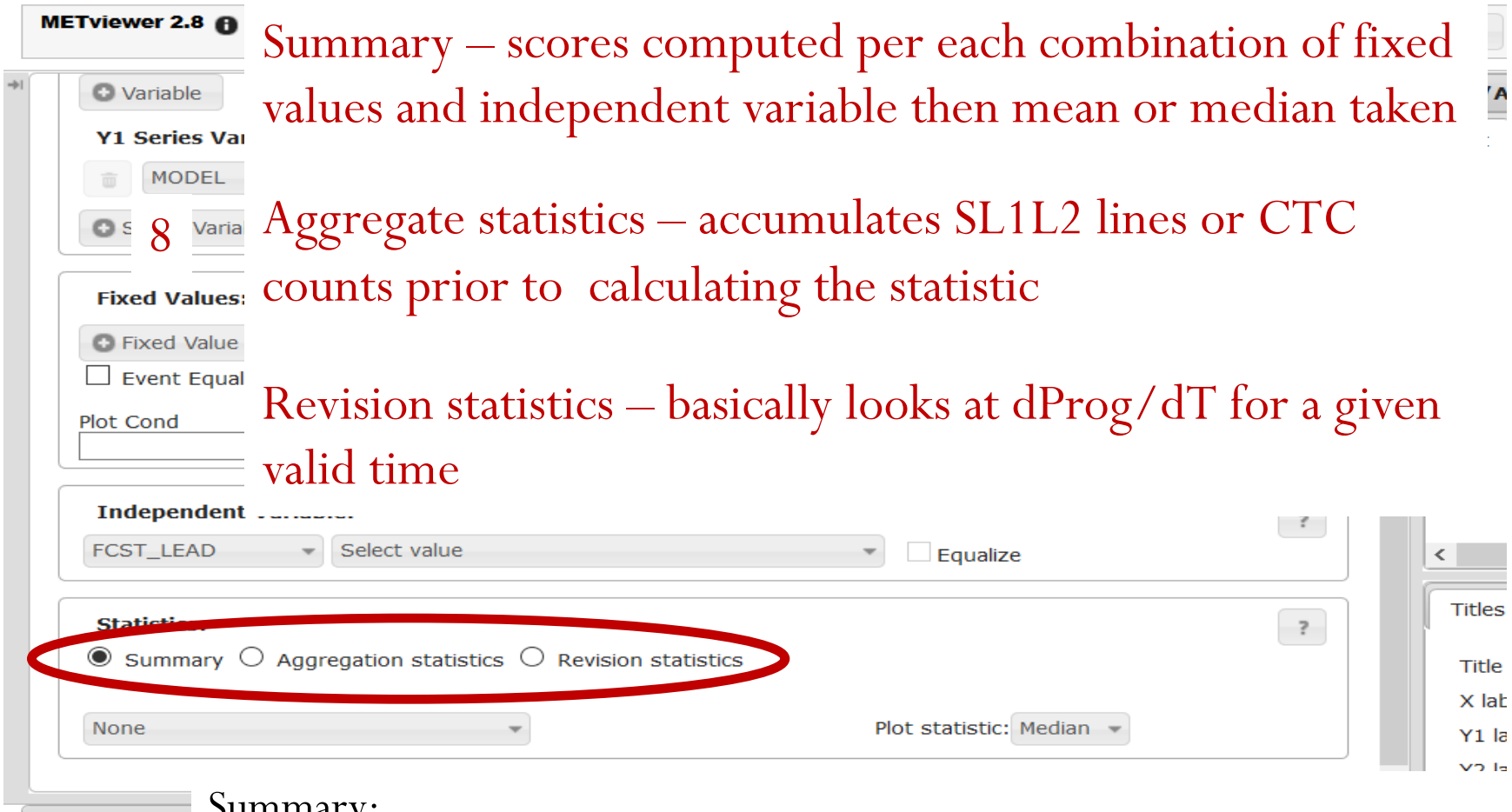
Aggregation

from partial sums

model	fcst_init_beg	lead	fcst_var	stat_name	stat_value	Mean	Median	Agg
GFS/212	8/5/2014 0:00	0	T	RMSE	0.917			
GFS/212	8/6/2014 0:00	0	T	RMSE	0.815			
GFS/212	8/7/2014 0:00	0	T	RMSE	0.883	**0.876**	**0.883**	0.878
GFS/212	8/8/2014 0:00	0	T	RMSE	0.823			
GFS/212	8/9/2014 0:00	0	T	RMSE	0.942			
GFS/212	8/4/2014 0:00	24	T	RMSE	1.211			
GFS/212	8/5/2014 0:00	24	T	RMSE	1.125			
GFS/212	8/6/2014 0:00	24	T	RMSE	1.127	**1.180**	**1.127**	1.182
GFS/212	8/7/2014 0:00	24	T	RMSE	1.308			
GFS/212	8/8/2014 0:00	24	T	RMSE	1.127			
GFS/212	8/3/2014 0:00	48	T	RMSE	1.919			
GFS/212	8/4/2014 0:00	48	T	RMSE	1.390			
GFS/212	8/5/2014 0:00	48	T	RMSE	1.570	**1.533**	**1.561**	1.547
GFS/212	8/6/2014 0:00	48	T	RMSE	1.226			
GFS/212	8/7/2014 0:00	48	T	RMSE	1.561			

Example:
Y1 Variable: RMSE **Y1 Series:** GFS/212 **Fixed:** 5 days, 0 UTC **X-axis:** 3 lead times

How to compute statistics



Summary – scores computed per each combination of fixed values and independent variable then mean or median taken

Aggregate statistics – accumulates SL1L2 lines or CTC counts prior to calculating the statistic

Revision statistics – basically looks at dProg/dT for a given valid time

Summary:

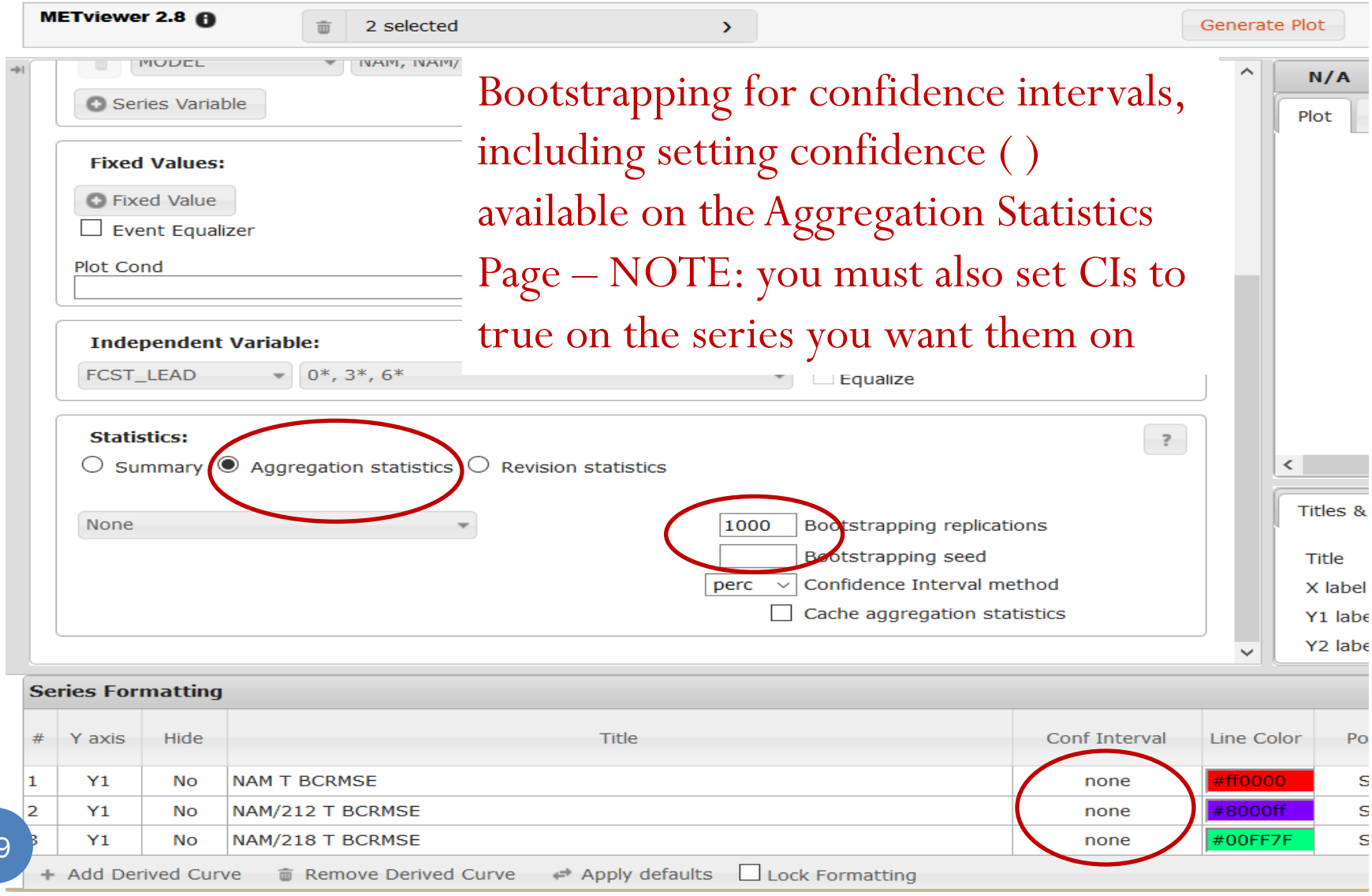
None is if using MET output and statistics are already computed

Pick SL1L2 if plotting continuous statistics (RMSE, MAE etc…)

Pick CTC (aka FHO) if plotting categorical statistics (ETS, TSS, Freq. Bias etc…)

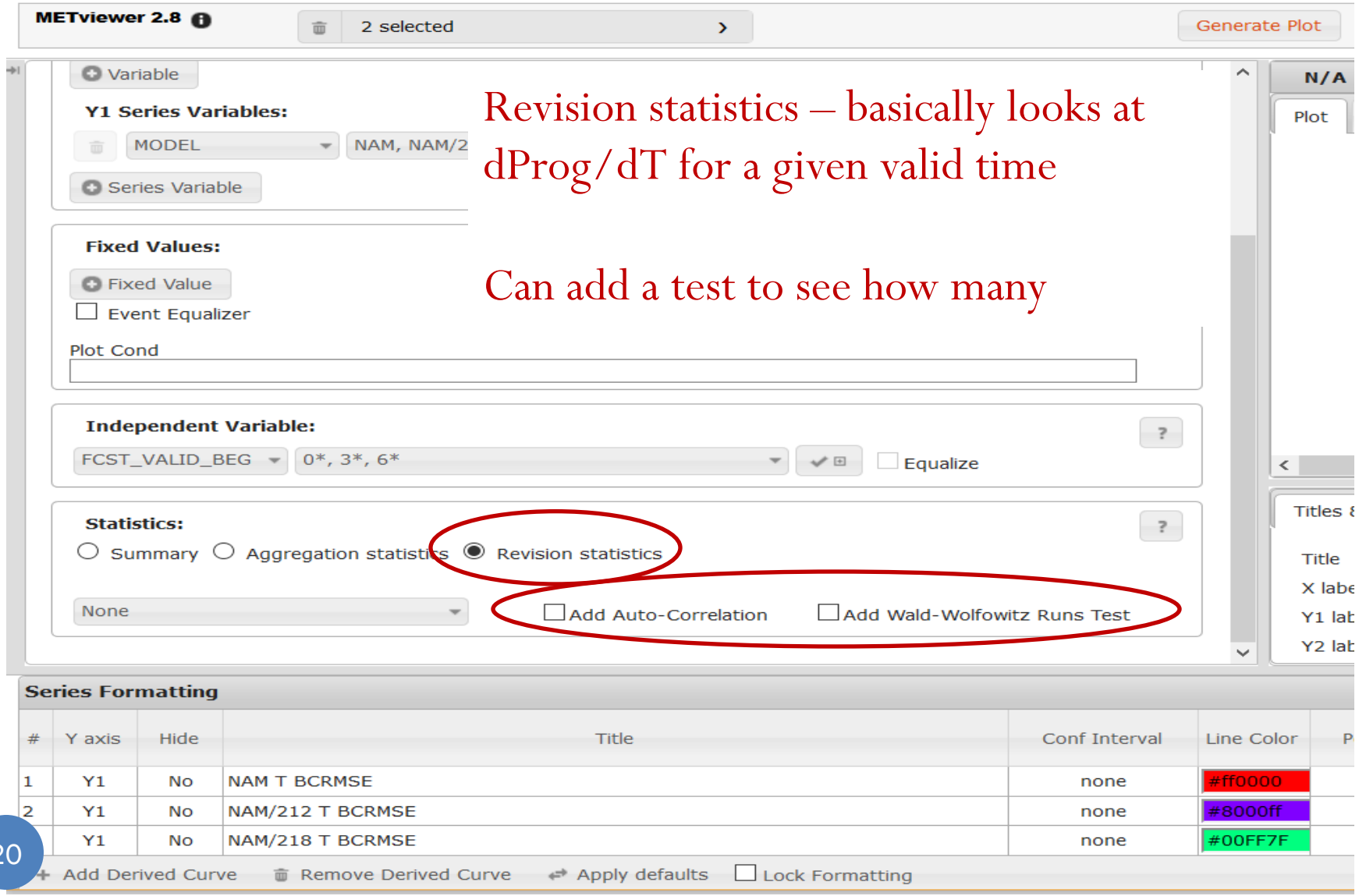
SAL1L2, VL1L2, VAL1L2, and Grad for S1 statistics

Aggregation and Bootstraping



Bootstrapping for confidence intervals, including setting confidence ( ) available on the Aggregation Statistics Page – NOTE: you must also set CIs to true on the series you want them on

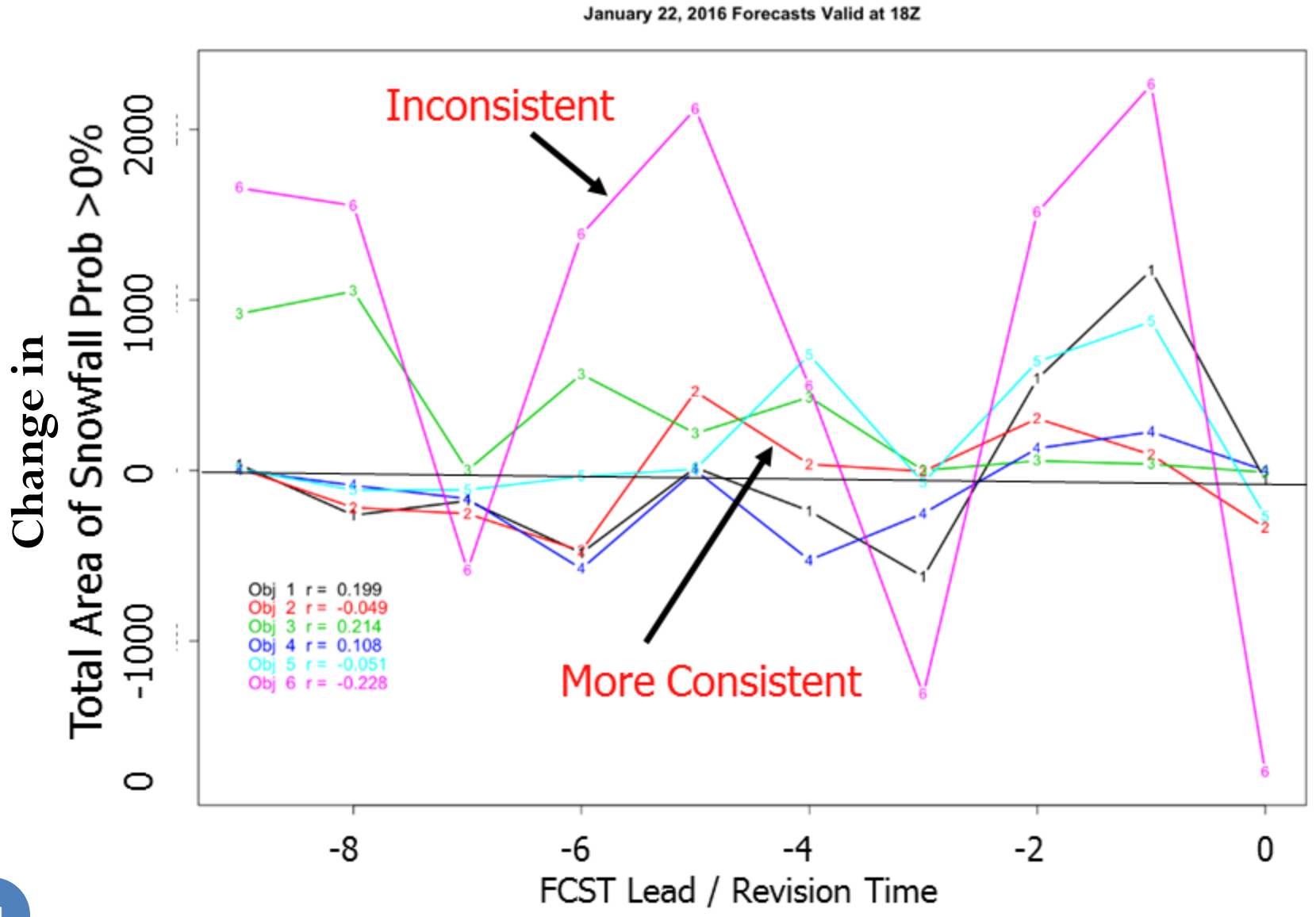
Revision Series



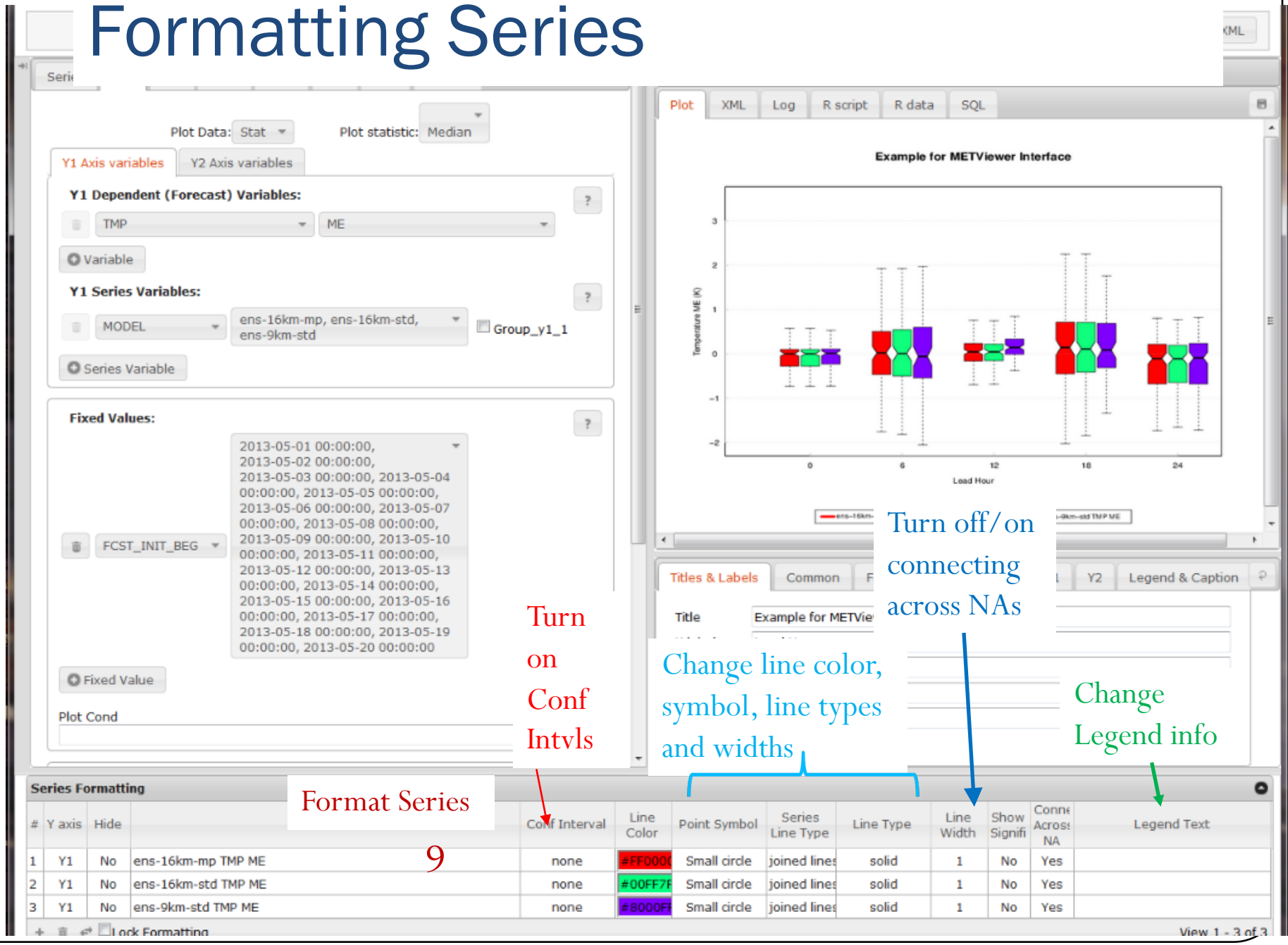
Revision statistics – basically looks at dProg/dT for a given valid time

Can add a test to see how many

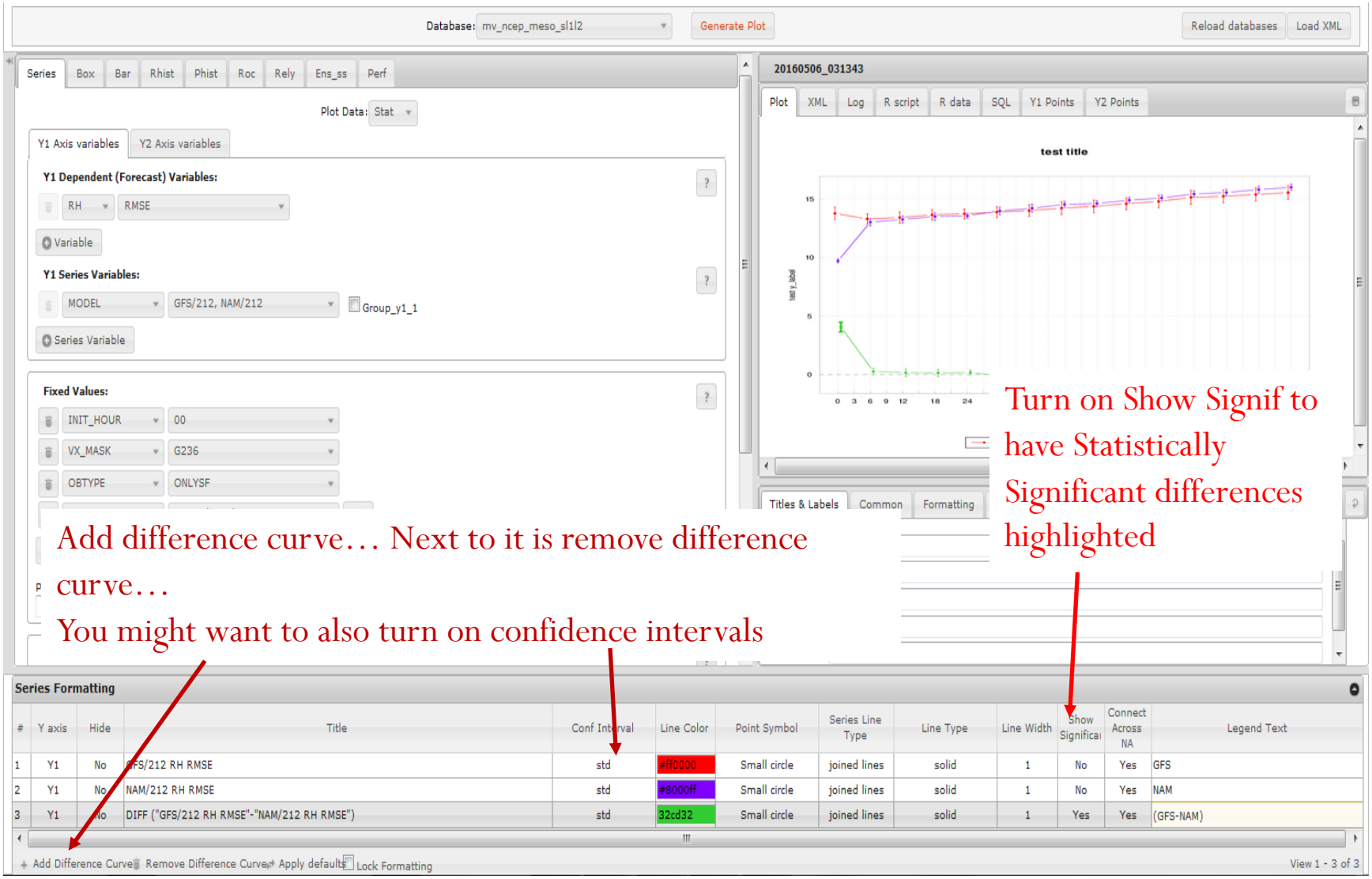
Revision Series



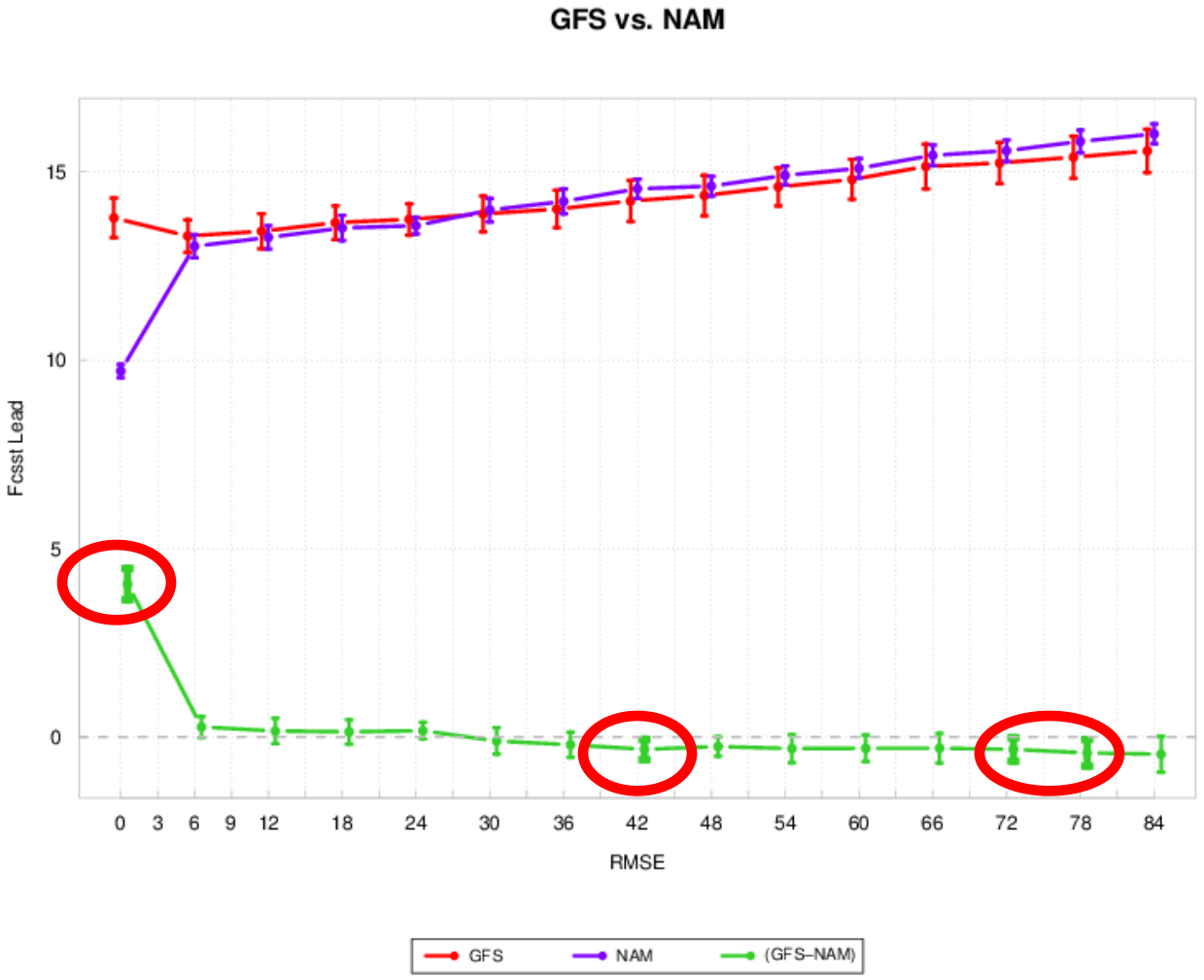
Formatting Series



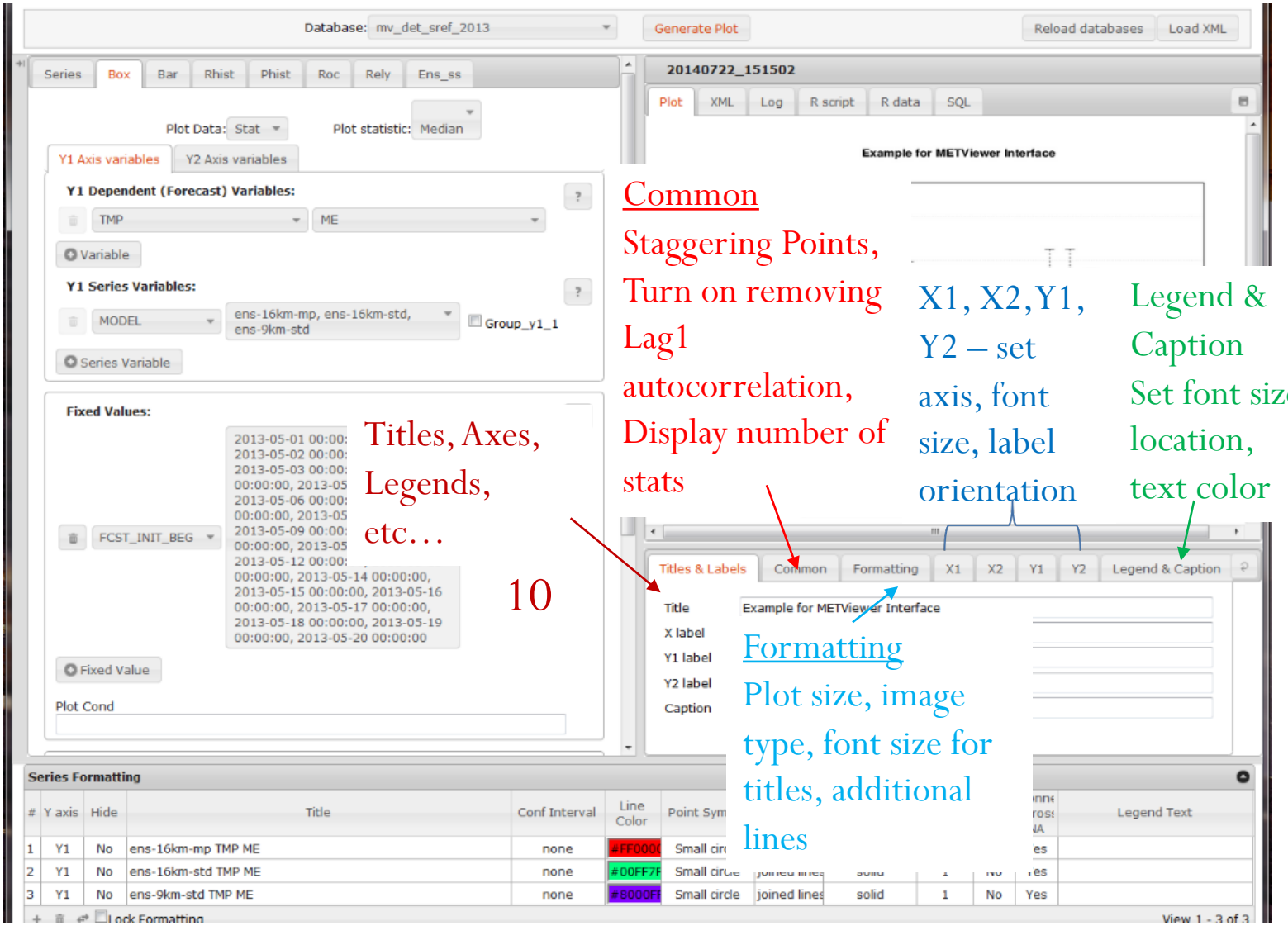
Difference Curves and StatSignificance

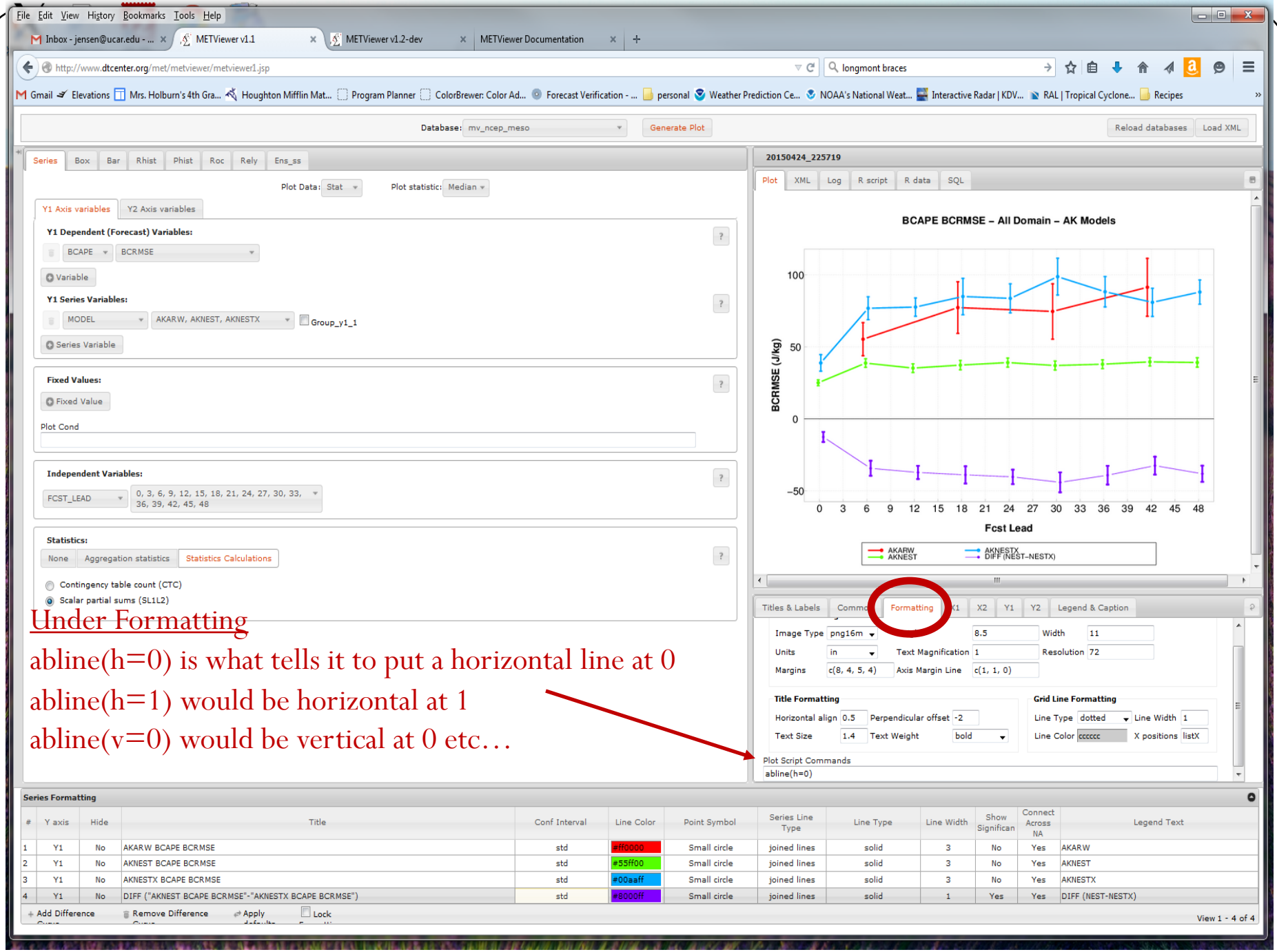


Statistically Significant Plot



Formatting the Plot





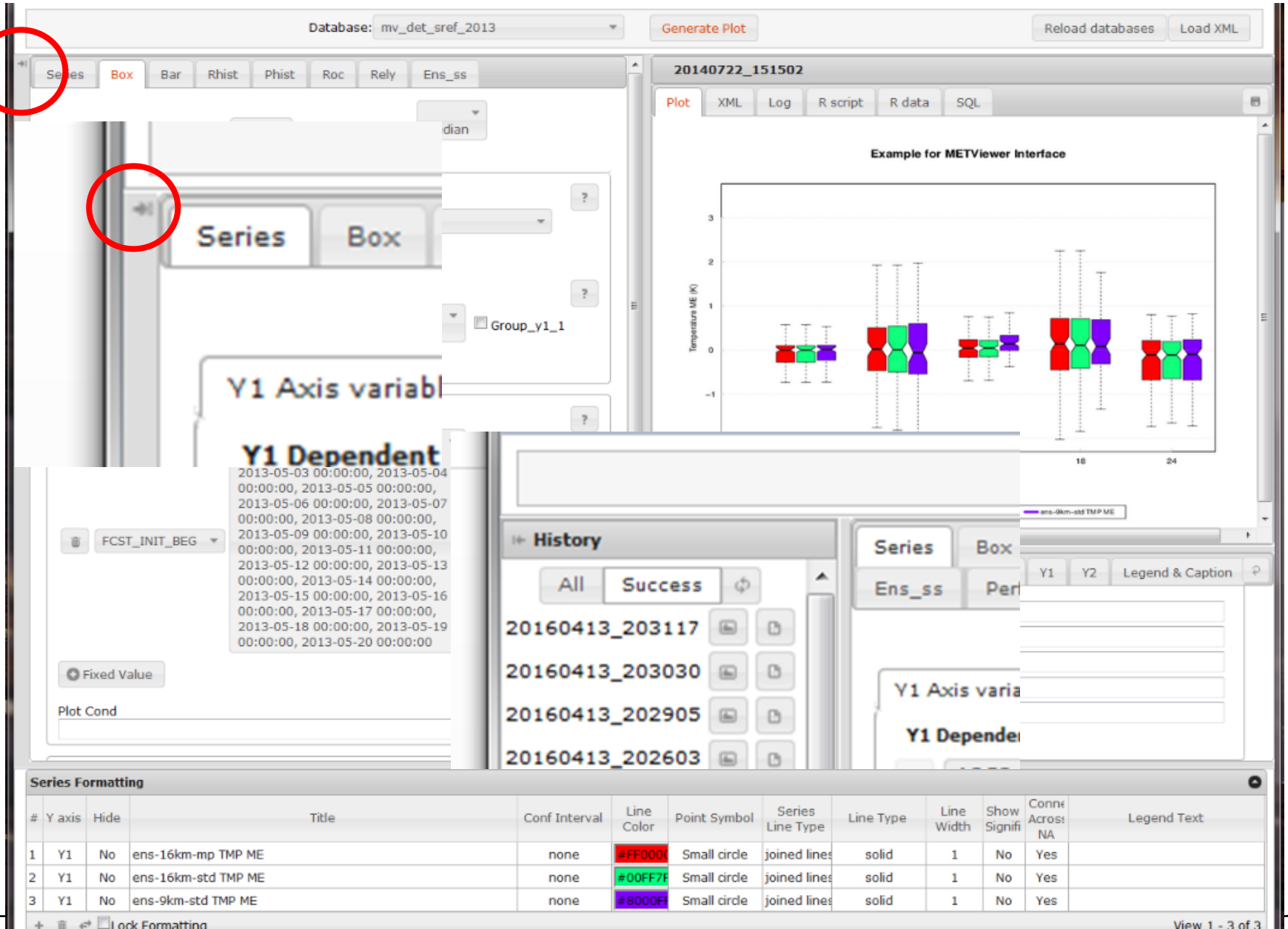
Under Formatting

abline(h=0) is what tells it to put a horizontal line at 0

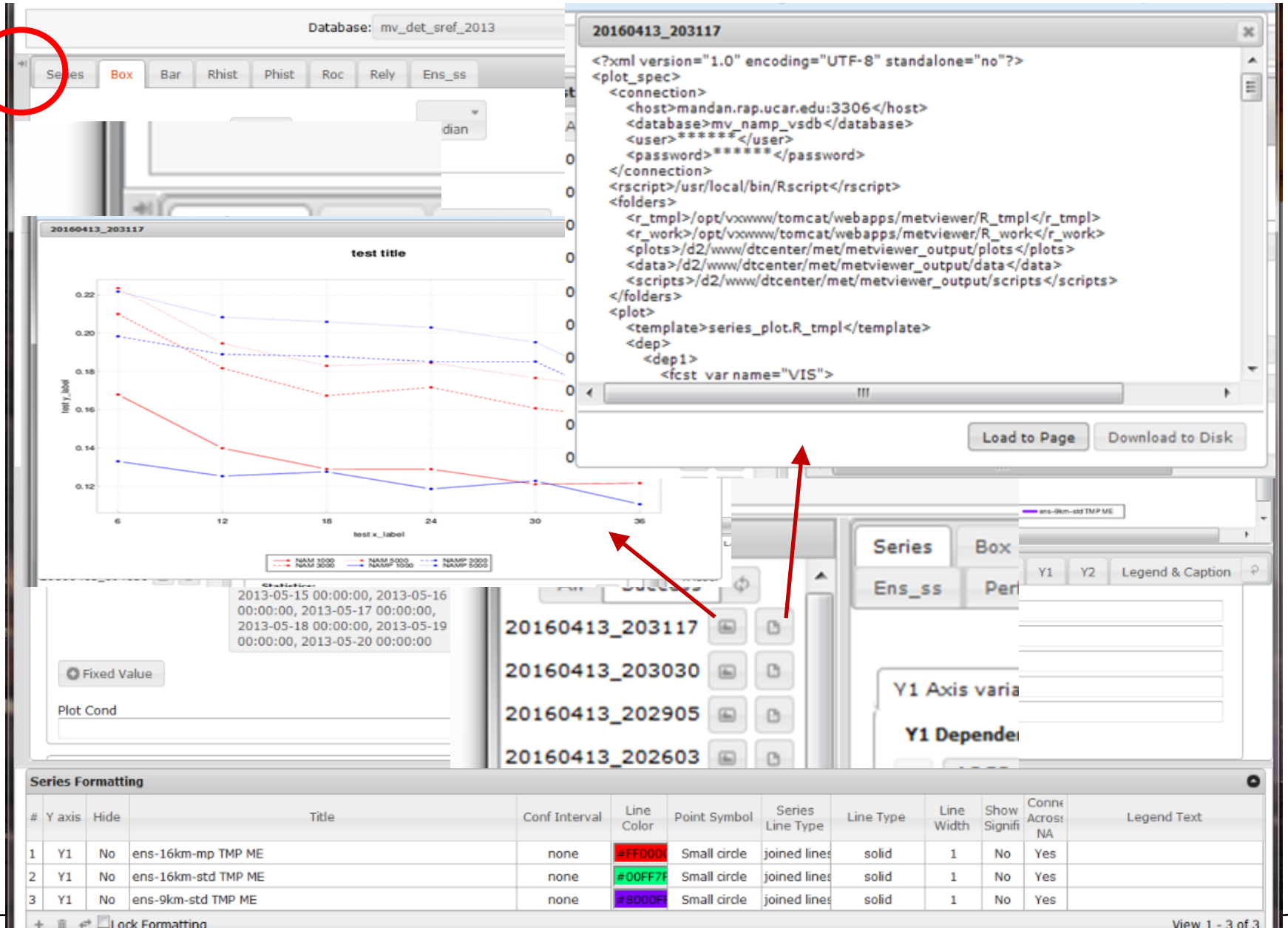
abline(h=1) would be horizontal at 1

abline(v=0) would be vertical at 0 etc…

METviewer History

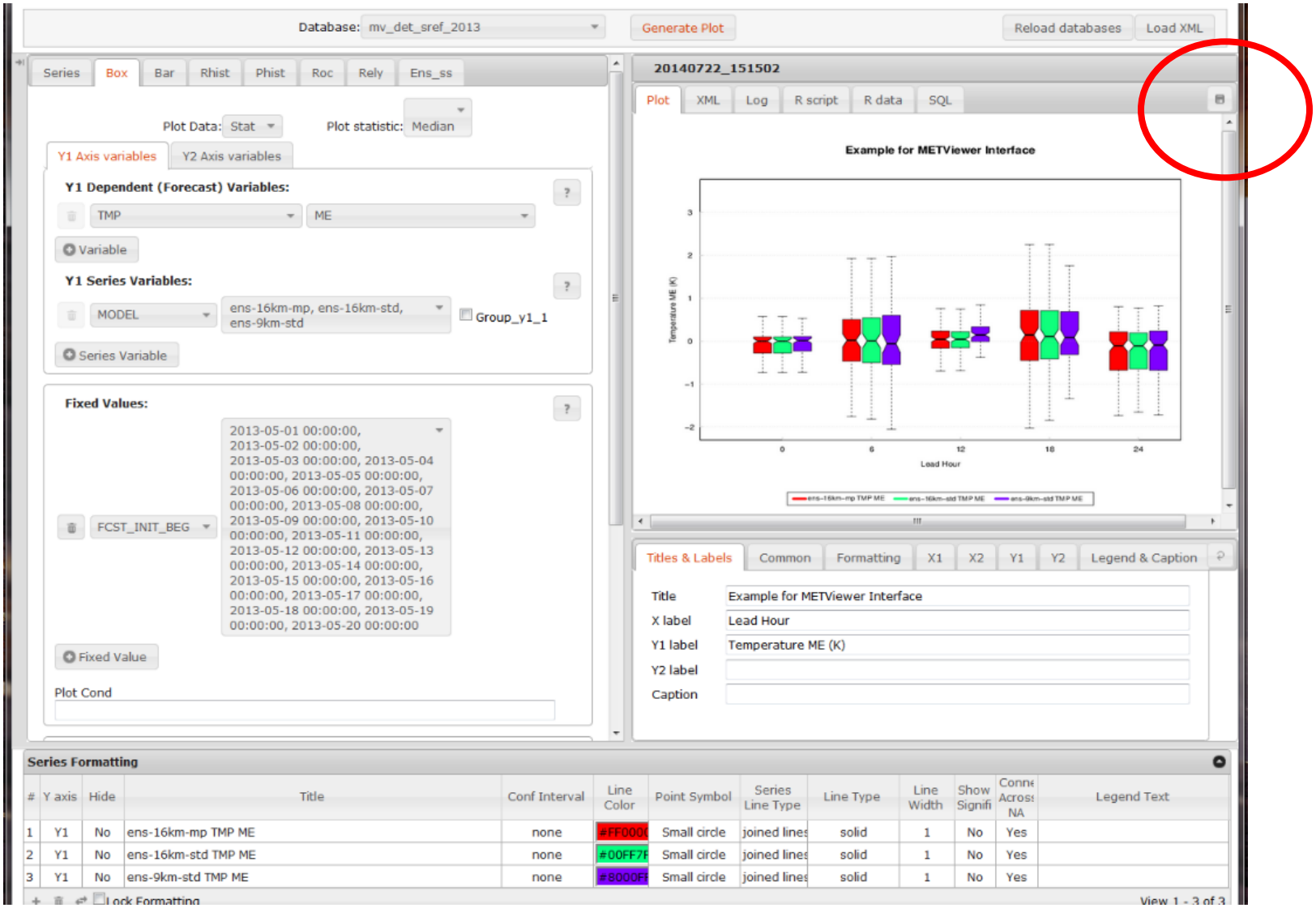


METviewer History



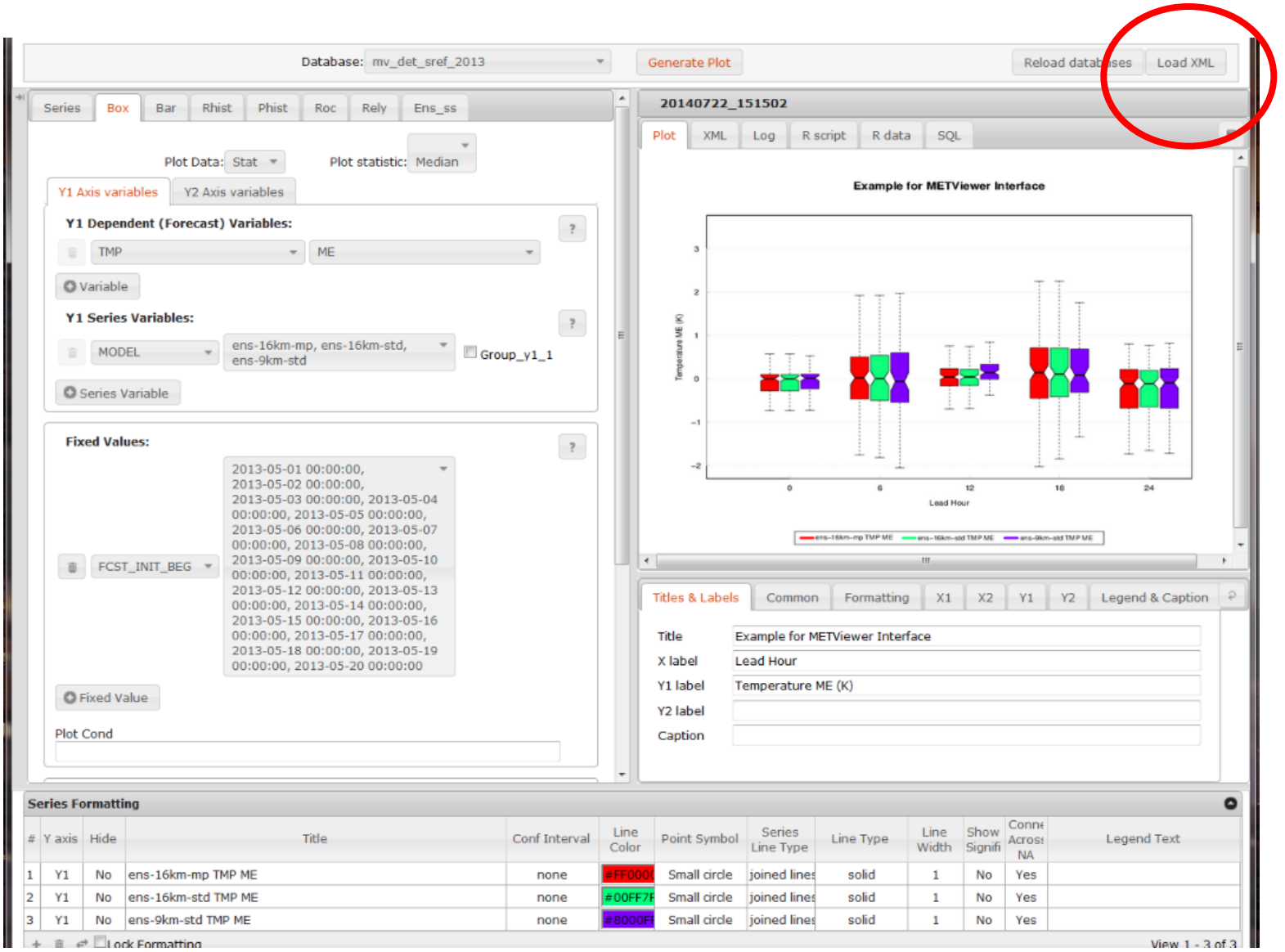
METviewer

Save Plots, XML,
Data, Rscrips, etc
**Based on which tab is selected



METviewer

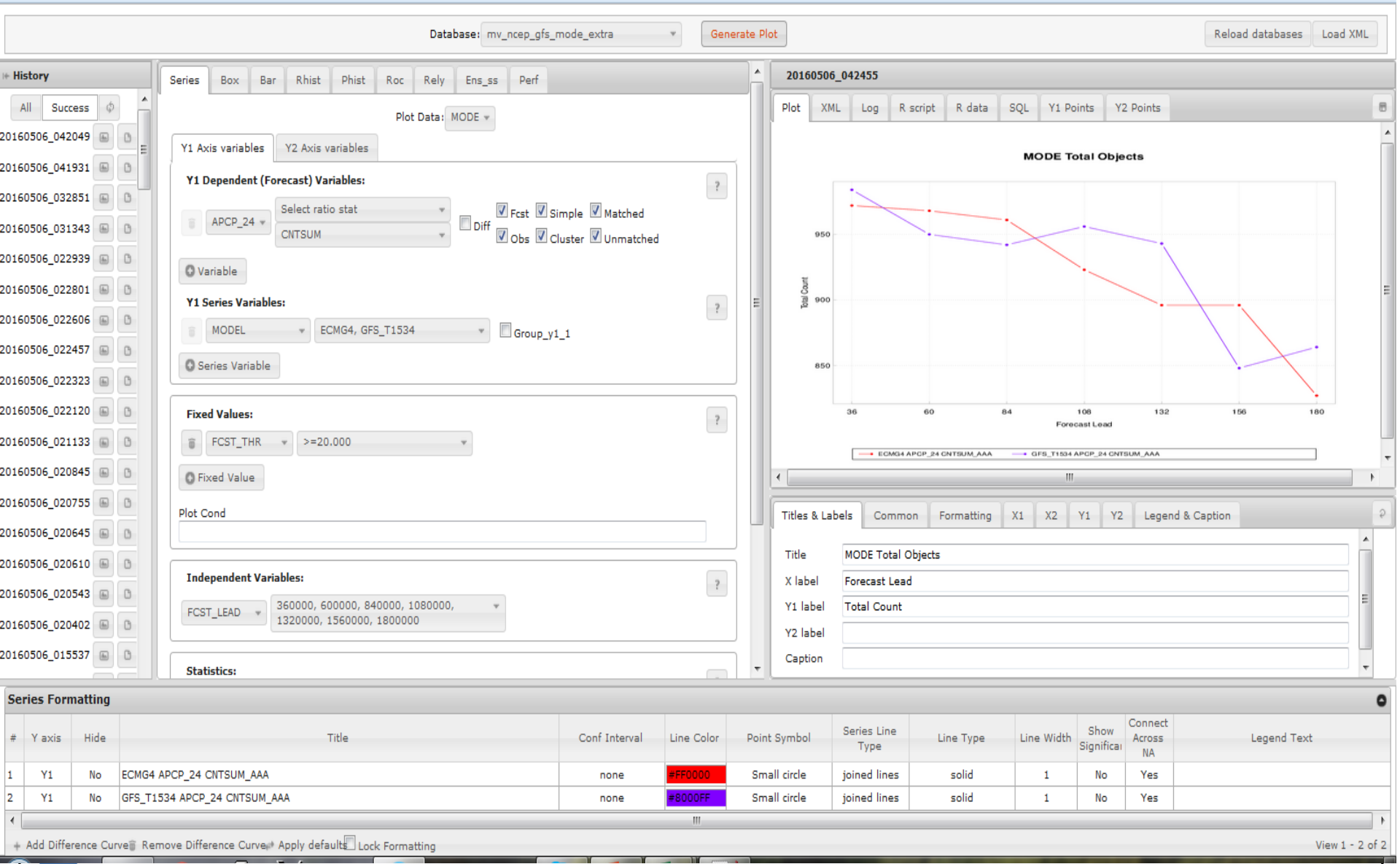
Upload XML scripts from your system



METviewer


Database: mv_det_sref_2013
Generate Plot
Reload databases
Load XML
Series
Box
Bar
Plot Data: Stat
Y1 Axis variables
Y2 Axis variables
Y1 Dependent (Forecast) Variables
TMP
ME
Variable
Y1 Series Variables:
MODEL
ens-16km-mp, ens-16km-std, ens-9km-std
Group_y1_1
Series Variable
Fixed Values:
FCST_INIT_BEG
Fixed Value
Plot Cond
Plot Data: Choose between Stat and MODE
SQL
for METViewer Interface
Temperature ME (K)
Lead Hour
Titles & Labels
Common
Formatting
X1
X2
Y1
Y2
Legend & Caption
Title
Example for METViewer Interface
X label
Lead Hour
Y1 label
Temperature ME (K)
Y2 label
Caption
Series Formatting
| Y axis | Hide | Title | Conf Interval | Line Color | Point Symbol | Series Line Type | Line Type | Line Width | Show Signifi | Conne Across NA | Legend Text
1 | Y1 | No | ens-16km-mp TMP ME | none | Small circle | joined lines | solid | 1 | No | Yes
2 | Y1 | No | ens-16km-std TMP ME | none | Small circle | joined lines | solid | 1 | No | Yes
3 | Y1 | No | ens-9km-std TMP ME | none | Small circle | joined lines | solid | 1 | No | Yes
Lock Formatting
View 1 - 3 of 3

MODE Interface



METviewer

- **NCAR Instance (public):**
  - **http://www.dtcenter.org/met/metviewer/metviewer1.jsp**
- **NCEP Instance (inside firewall):**
  - **http://metviewerdev.ncep.noaa.gov/metviewer1.jsp**

Databases

Each person can maintain their own (or several) databases within METviewer

For example:

mv_MMB_f2o (could have sl1l2 and fho in same database)

or

mv_MMB_sl1l2_f2o

mv_MMB_fho_f2o

mv_SREF_g2oe (could have data for rank histograms, reliability curves, roc diagrams, spread vs. skill diagrams and ensemble mean statistics all in the same database)

mv_GMB_g2o
mv_GMB_mode

Databases must have "**mv_**" at the beginning of name to be recognized by the user interface

Databases

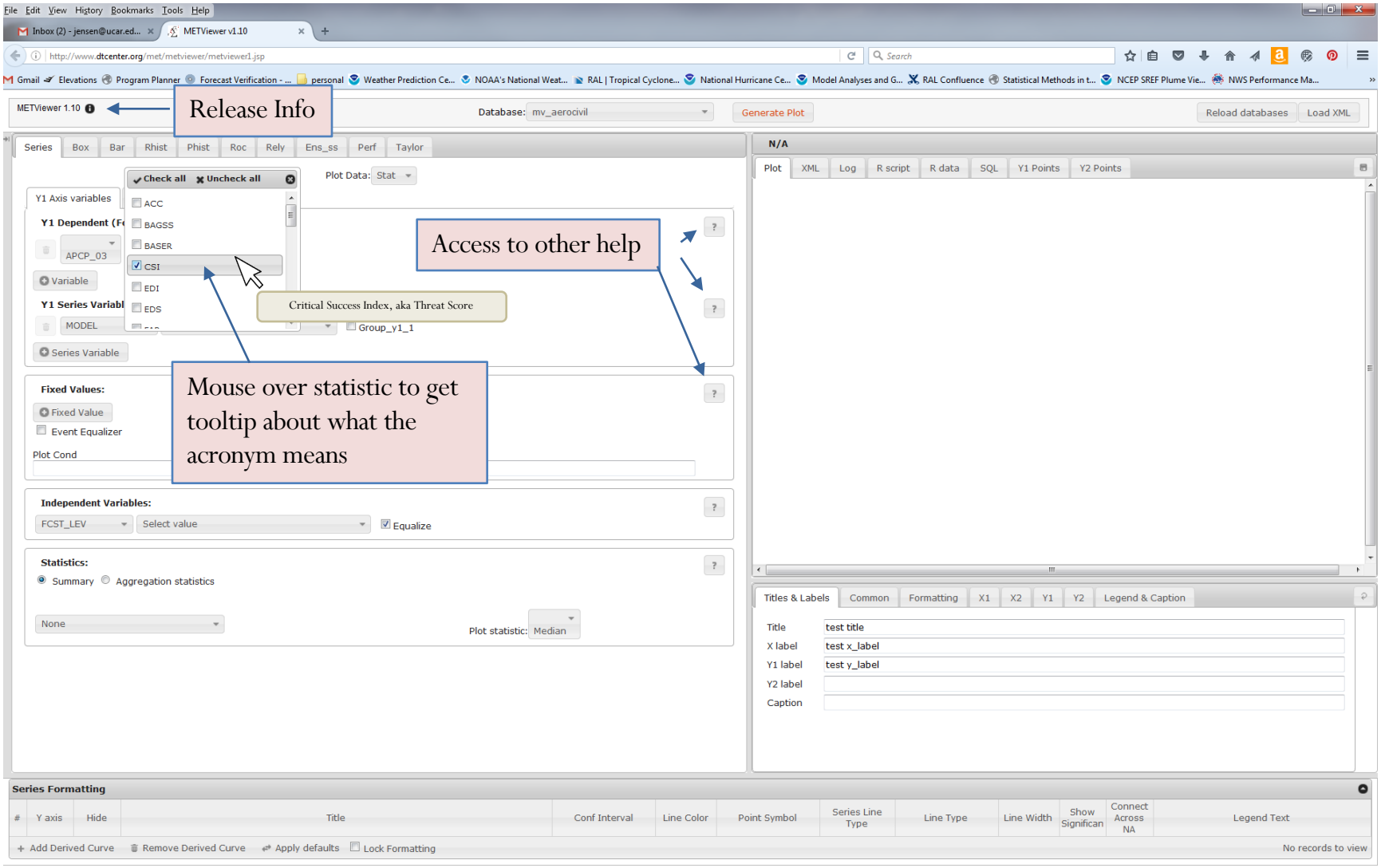
Currently data must be in same database to be plotted together

Partitioning of individual databases to speed up performance is possible – send request to met_help@ucar.edu.

To gain permission to load data into your own database, send a request to NCO helpdesk and ask for access to METviewer

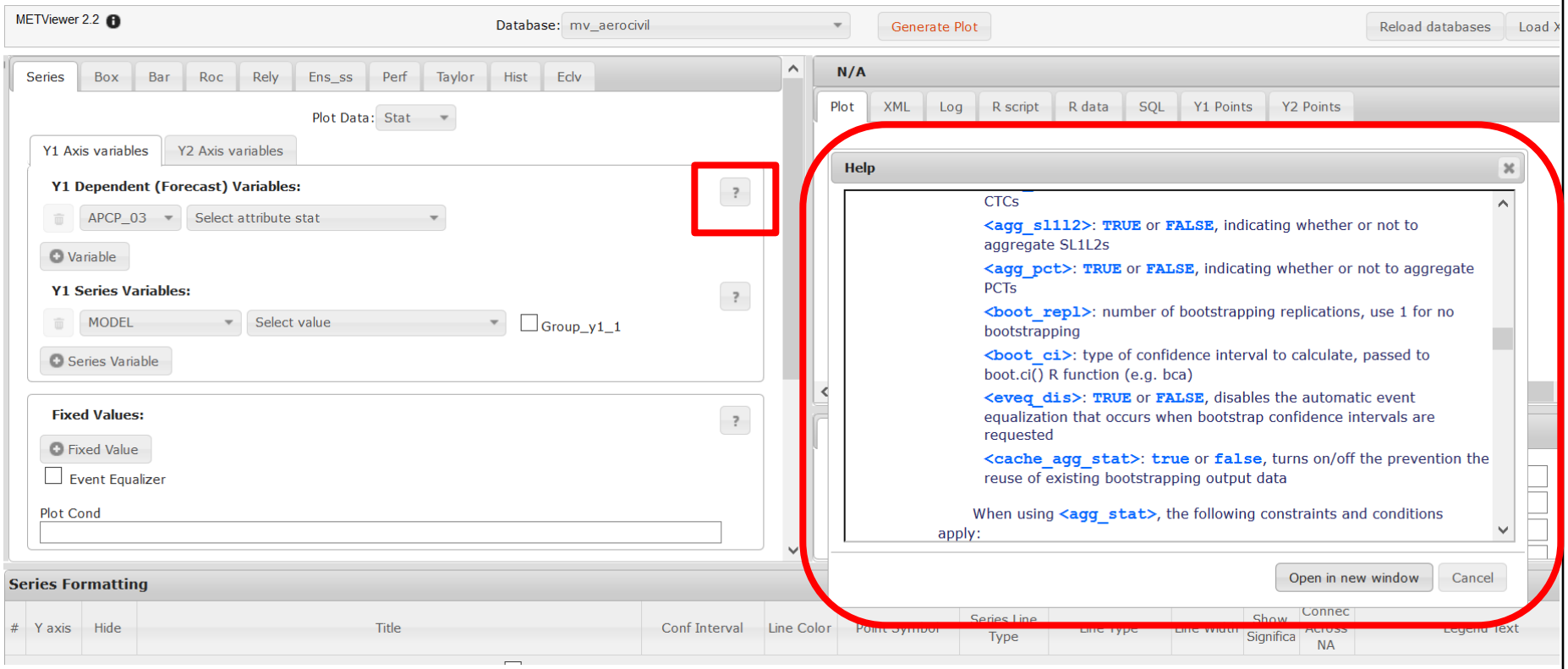
Databases must have "**mv_**" at the beginning of name to be recognized by the user interface

GUI Help


Release Info
Access to other help
Critical Success Index, aka Threat Score
Mouse over statistic to get tooltip about what the acronym means

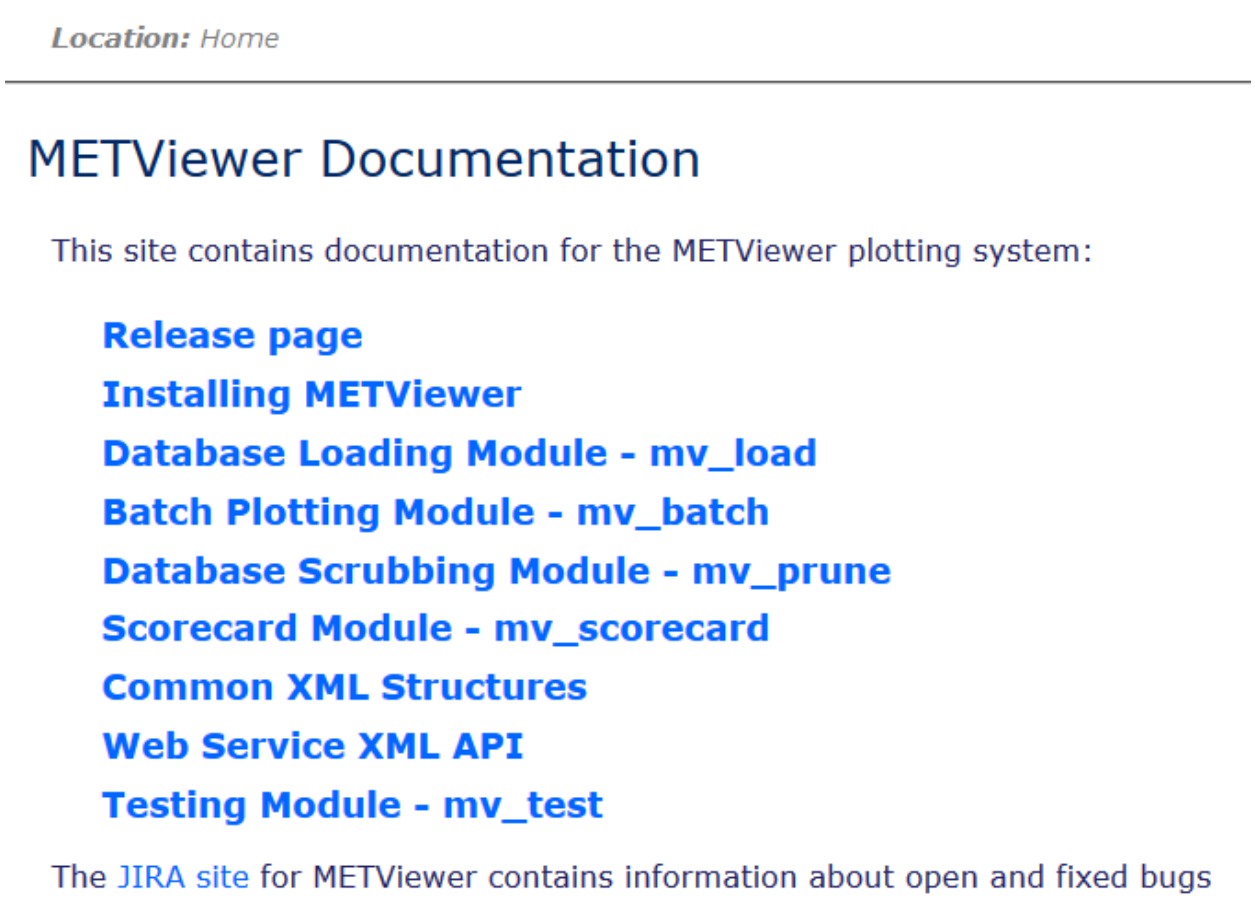
METviewer Documentation

- http://www.dtcenter.org/met/metviewer/doc/index.html



What's available

- http://www.dtcenter.org/met/metviewer/doc/index.html



Location: Home

METViewer Documentation

This site contains documentation for the METViewer plotting system:

Release page
Installing METViewer
Database Loading Module - mv_load
Batch Plotting Module - mv_batch
Database Scrubbing Module - mv_prune
Scorecard Module - mv_scorecard
Common XML Structures
Web Service XML API
Testing Module - mv_test

The JIRA site for METViewer contains information about open and fixed bugs

What can be loaded into METviewer?

- STAT files (*.stat) files from MET packages
  - Grid-Stat
  - Point-Stat
  - Ensemble-Stat
  - MODE
- VSDB files from NCEP verification packages
  - Grid-to-Obs
  - Grid-to-Obs_e*
  - Grid-to-Grid
  - Grid-to-Grid_e*
  - Precip

**** Some variables in ensemble VSDB currently not available for loading but will be soon***

NCEP's METviewer Instance

http://vm-lnx-metviewdev-app1.ncep.noaa.gov:8080/met/metviewer.jsp

You can also play with some sample data at:

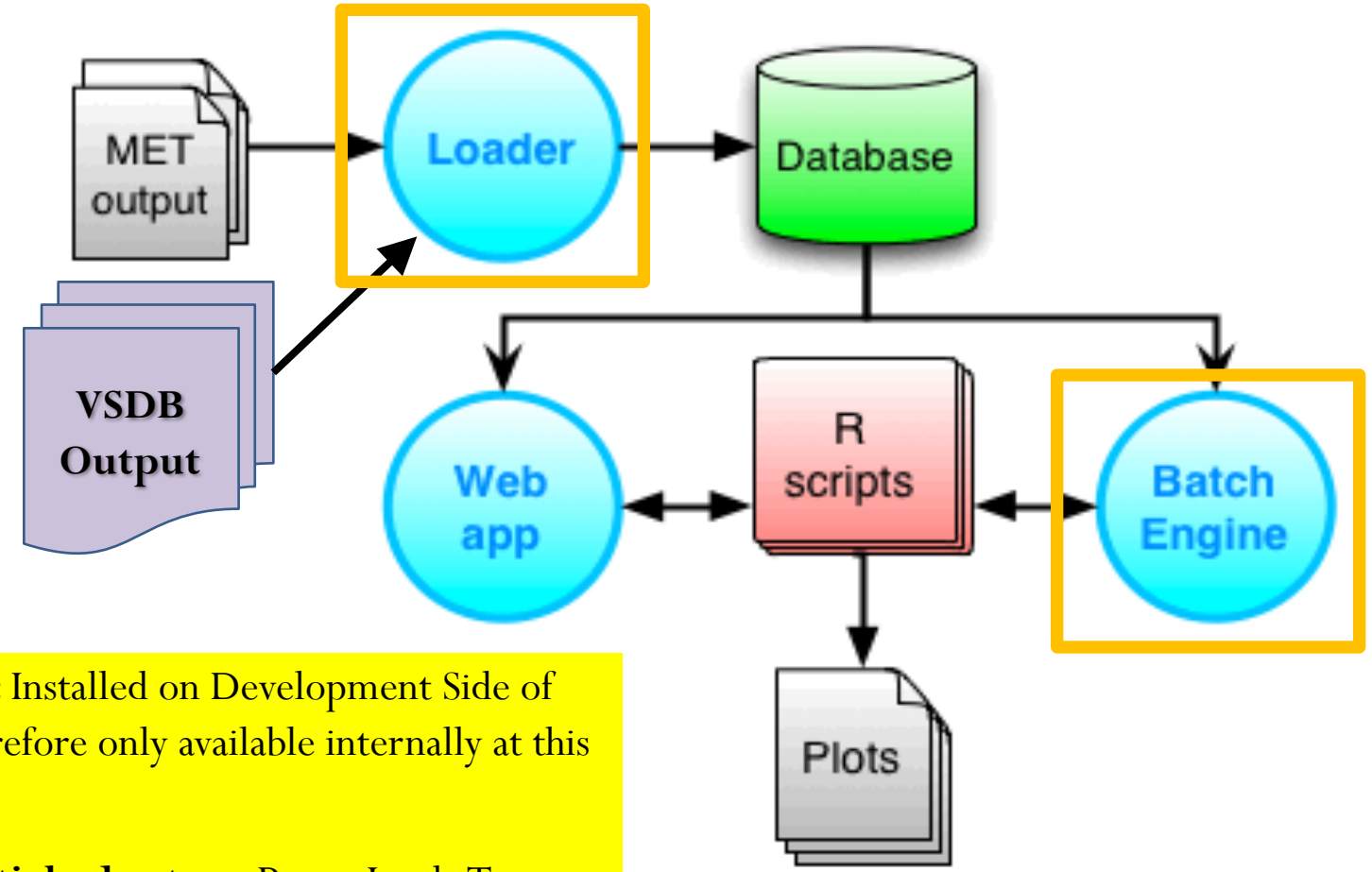
http://www.dtcenter.org/met/metviewer.jsp

Always Set in Load or Batch XML:

1. Server
2. Database

METviewer components

Packages: Java, Apache/Tomcat, MySQL, R statistics



At NCEP: Installed on Development Side of IDP – therefore only available internally at this time

Local initial adopters: Perry, Jacob, Tracey, Binbin, Ying

Loading

- To be able to load your own data – send a helpdesk ticket to NCO requesting access to METviewer
- They will get approval from your supervisor
- They will then give you an account on the staging and computing areas and give you instructions on how to use the metviewer account to load data

- ***Storage in staging area is limited so please clean up after yourself when loading***

Loading

Loading XML script examples may be found in: /usr1/metviewer

/usr1/metviewer/load_test.xml_fulldata

Entries you need to change are:

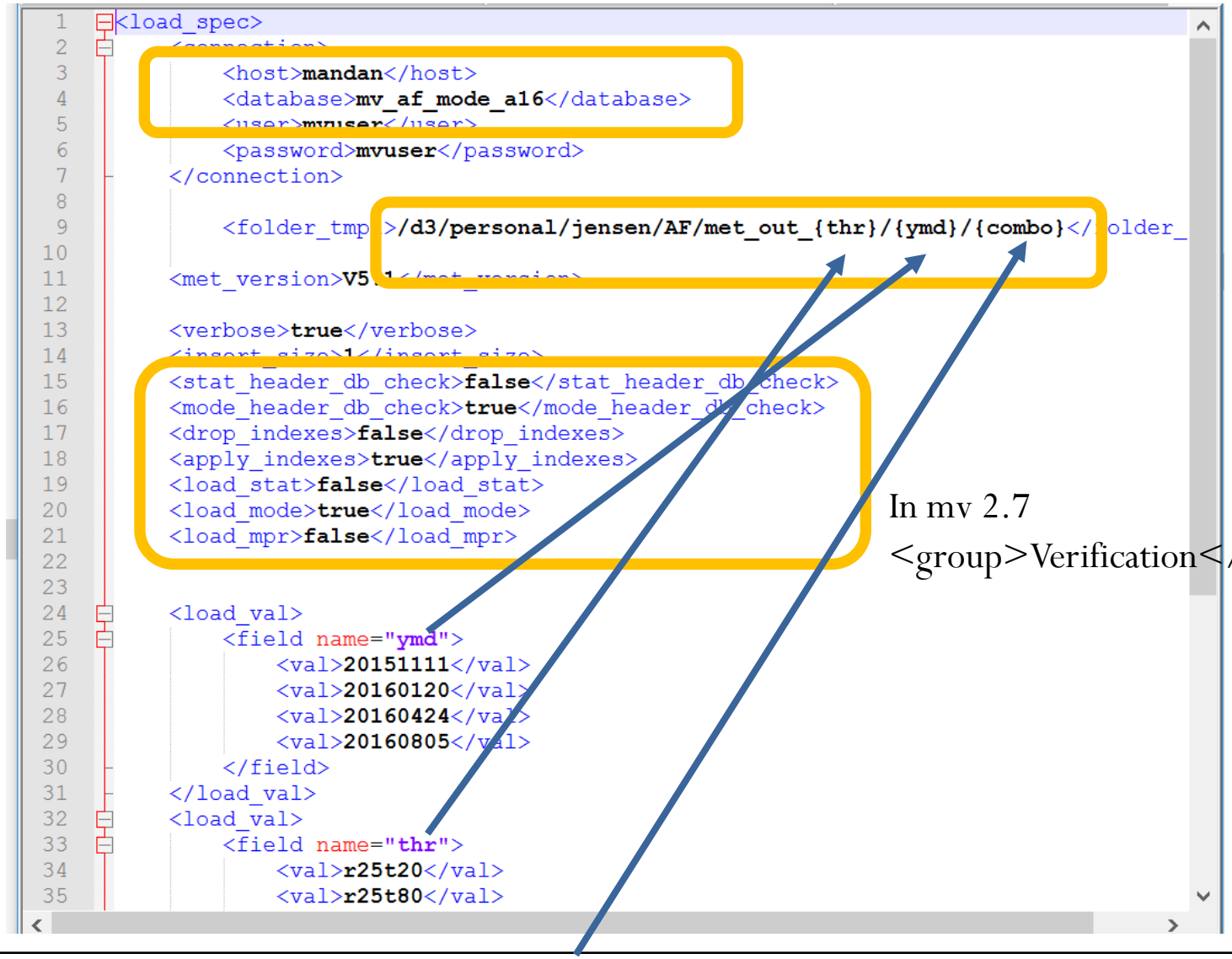
<database>mv_{your-favorite-name}</database>

<folder_tmpl> /metviewer/staging/{path-to-model}/{model}

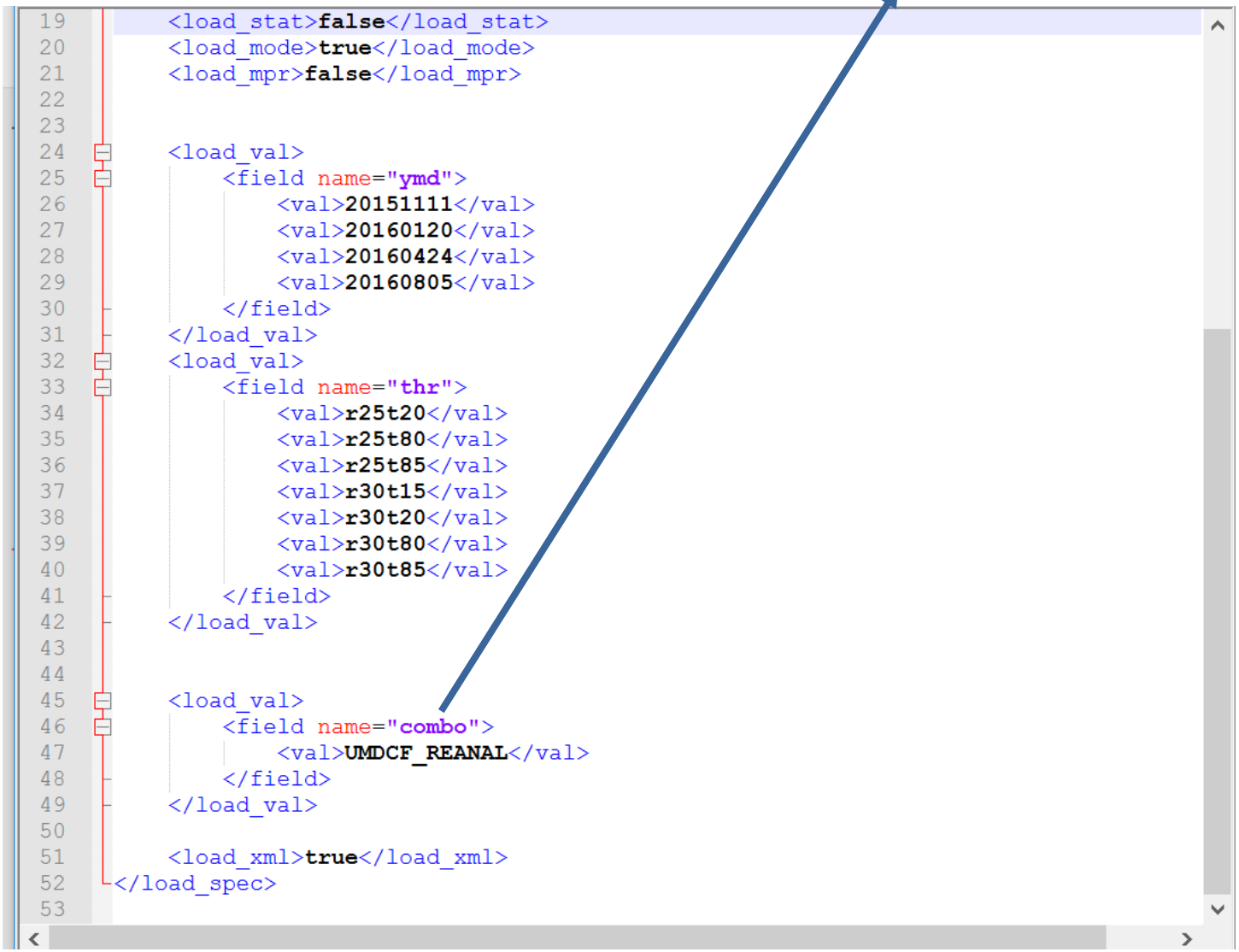
#note {model} is either the last directory before you get to your .vsdb or .stat files or could be part of a filename. It can also be called whatever is meaningful to you (e.g. var, region, etc…). The example below assumes you have .vsdb or .stat files in 3 different directories for the operational model, a parallel version 1 and a parallel version 2.

```
<field name="model">
        <val>model</val>
        <val>model-parallel1</val>
        <val>model-parallel2</val>
 </field>
```

Loading


1 <load_spec>
3 <host>mandan</host>
4 <database>mv_af_mode_a16</database>
6 <password>mvuser</password>
7 </connection>
9 <folder_tmp >/d3/personal/jensen/AF/met_out_{thr}/{ymd}/{combo}</ older_
11 <met_version>V5
13 <verbose>true</verbose>
15 <stat_header_db_check>false</stat_header_db_check>
16 <mode_header_db_check>true</mode_header_db_check>
17 <drop_indexes>false</drop_indexes>
18 <apply_indexes>true</apply_indexes>
19 <load_stat>false</load_stat>
20 <load_mode>true</load_mode>
21 <load_mpr>false</load_mpr>
24 <load_val>
25 <field name="ymd">
26 <val>20151111</val>
27 <val>20160120</val>
28 <val>20160424</val>
29 <val>20160805</val>
30 </field>
31 </load_val>
32 <load_val>
33 <field name="thr">
34 <val>r25t20</val>
35 <val>r25t80</val>
In mv 2.7
<group>Verification</group>

Loading



```
19      <load_stat>false</load_stat>
20      <load_mode>true</load_mode>
21      <load_mpr>false</load_mpr>
22
23
24      <load_val>
25          <field name="ymd">
26              <val>20151111</val>
27              <val>20160120</val>
28              <val>20160424</val>
29              <val>20160805</val>
30          </field>
31      </load_val>
32      <load_val>
33          <field name="thr">
34              <val>r25t20</val>
35              <val>r25t80</val>
36              <val>r25t85</val>
37              <val>r30t15</val>
38              <val>r30t20</val>
39              <val>r30t80</val>
40              <val>r30t85</val>
41          </field>
42      </load_val>
43
44
45      <load_val>
46          <field name="combo">
47              <val>UMDCF_REANAL</val>
48          </field>
49      </load_val>
50
51      <load_xml>true</load_xml>
52  </load_spec>
53
```

Loading

```
<load_spec>
    <connection>
        <host>mandan</host>
        <database>mv_af_mode_a16</database>
        <user>mvuser</user>
        <password>mvuser</password>
    </connection>

        <folder_tmpl>/d3/personal/jensen/AF/met_out_{thr}/{ymd}/{combo}</folder_

    <met_version>V5.1</met_version>

    <verbose>true</verbose>
    <insert_size>1</insert_size>
    <stat_header_db_check>false</stat_header_db_check>
    <mode_header_db_check>true</mode_header_db_check>
    <drop_indexes>false</drop_indexes>
    <apply_indexes>true</apply_indexes>
    <load_stat>false</load_stat>
    <load_mode>true</load_mode>
    <load_mpr>false</load_mpr>


    <load_val>
        <field name="ymd">
            <val>20151111</val>
            <val>20160120</val>
            <val>20160424</val>
            <val>20160805</val>
        </field>
    </load_val>
    <load_val>
        <field name="thr">
            <val>r25t20</val>
            <val>r25t80</val>
```

See demo for way to specify a date range including init start, end, by seconds

Basic Load Script

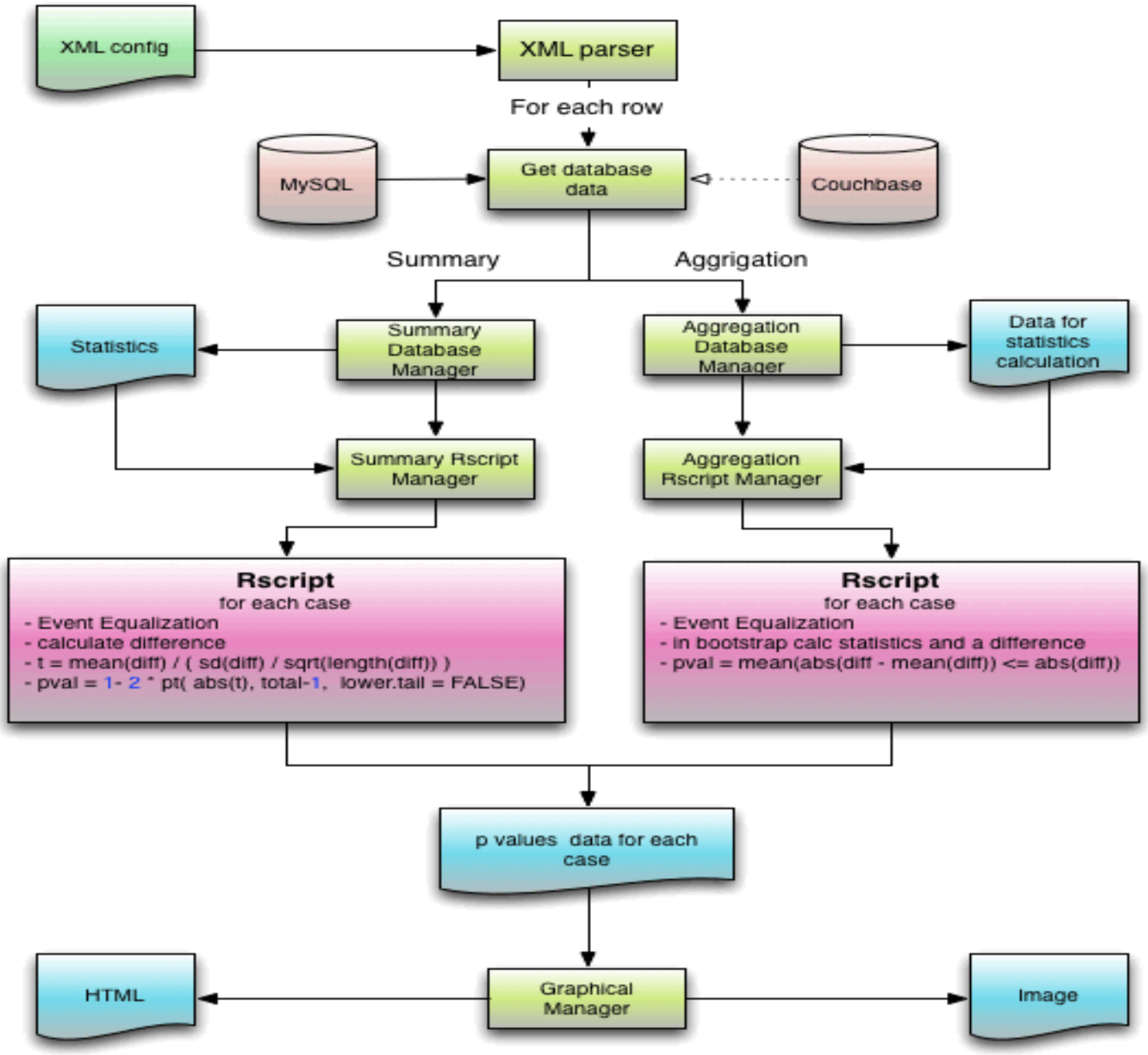
```
#!/bin/sh
dbname="mv__[your-favorite-name] “
host=“[NCEP hostname]”
metv=“[Path 2 metviewer on NCEP]“
path2data=“[Path2data in staging area]“
mvuser="mvuser“
mvpass="mvuser“
Loadxml=“[your load xml name]”

# Drop the database
mysql -h${host} -u${mvuser} -p${mvpass} -e"drop database ${dbname};"#
#Create the database
mysql -h${host} -u${mvuser} -p${mvpass} -e"create database ${dbname};“
# Apply the METviewer schema
mysql -h${host} -u${mvuser} -p${mvpass} ${dbname} < ${metv}/sql/mv_mysql.sql
# Load data
${metv}/bin/mv_load.sh ${path2data}/${loadxml}
```

MET
Model Evaluation Tools

Scorecard and Batch

Data Flow


XML config
XML parser
For each row
MySQL
Get database data
Couchbase
Summary
Aggrigation
Statistics
Summary Database Manager
Aggregation Database Manager
Data for statistics calculation
Summary Rscript Manager
Aggregation Rscript Manager
Rscript
for each case
- Event Equalization
- calculate difference
- t = mean(diff) / (sd(diff) / sqrt(length(diff)))
- pval = 1- 2 * pt(abs(t), total-1, lower.tail = FALSE)
Rscript
for each case
- Event Equalization
- in bootstrap calc statistics and a difference
- pval = mean(abs(diff - mean(diff)) <= abs(diff))
p values data for each case
HTML
Graphical Manager
Image

Setting up the scorecard

```
    <connection>
      <host>dakota.rap.ucar.edu:3306</host>
      <database>mv_scorecard_vsdb</database>
    ...
    </connection>
    ...
    <plot>
      <view_value>false</view_value>
      <view_symbol>true</view_symbol>
      <view_legend>false</view_legend>

      <stat_flag>NCAR</stat_flag>
      <!--stat_flag>EMC</stat_flag-->

<!-- This scorecard mimics EMS scorecard except for ME WIND. -->
<!-- We don't have VL1L2_ME to calculate it -->

      <template>scorecard.R_tmpl</template>

      <plot_fix>
        <field name="model">
          <val name="PR4RN_1405" />
          <val name="GFS2016" />
        </field>
        <field name="fcst_init_beg">
          <val name="2014-05-20 00:00:00" />
          <val name="2014-07-30 00:00:00" />
        </field>
        <field name="init_hour">
          <val name="00" />
          <!--val name="12" /-->
        </field>
      </plot_fix>
```

Change the database name to point to yours

True if you want it on image
False if you don't

1st Model is parallel
2nd Model is reference

Specify the date range and fix init hour

Setting up scorecard

```
<rows>
  <field name="stat">
    <val name="ANOM_CORR" />
    <field name="fcst_var">
      <val name="HGT" />
      <field name="fcst_lev">
        <val name="P250" label="250hPa"/>
        <val name="P500" />
        <val name="P700" />
        <val name="P1000" />
      </field>
    </field>
```

					N.A
			Day 1	Day 3	Day
ANOM_CORR	HGT	P250	▲		
		P500	▲		
		P700	▲		
		P1000	▲	▲	
	T	P250			▲
		P500	▼		
		P850			▲
	PMSL	MSL	▲	▲	

Set-up a "super-row":

This sets up the first, second and third columns of a super-row

Repeat to specify next super-row (e.g. for RMSE)

Setting up scorecard

If you wish, specify multiple fcst_leads to be aggregated or averaged together

```
<columns>
  <field name="vx_mask">
    <val name="G2/PNA" label="N.American" />
    <field name="fcst_lead">
      <val name="6,12,18, 24" label="Day 1" />
      <!--val name="30,36,42,48" label="Day 2" /-->
      <val name="54, 60, 66,72" label="Day 3" />
      <!--val name="78, 84, 90,96" label="Day 4" /-->
      <val name="102, 108, 114,120" label="Day 5" />
      <val name="126, 132, 138,144" label="Day 6" />
      <!--val name="150, 156, 162,168" label="Day 7" /-->
      <val name="174, 180, 186,192" label="Day 8" />
      <!--val name="198, 204, 210,216" label="Day 9" /-->
      <val name="222, 228, 234,240" label="Day 10" />
    </field>
  </field>

  <field name="vx_mask">
    <val name="G2/NHX" label="N.Hemisphere" />
    <field name="fcst_lead">
      <val name="6,12,18, 24" label="Day 1" />
```

Change the label that shows up on the image.

Set-up a "super-column":
This sets up the first, second row of the super-column
Repeat to specify next super-column (e.g. N.Hemisphere)

2014-05-20 00:00:00

			N.American						N.Hemispher			
			Day 1	Day 3	Day 5	Day 6	Day 8	Day 10	Day 1	Day 3	Day 5	Day 6
		P250	▲				▲		▲	-		

Setting up scorecard

```
    </columns>

    <agg_stat>false</agg_stat>
    <boot_repl>1000</boot_repl>
    <boot_random_seed>1</boot_random_seed>

    <tmpl>
      <data_file>scorecard_sum.data</data_file>
      <plot_file>scorecard_sum.png</plot_file>
      <title>Scorecard</title>
    </tmpl>

  </plot>
</plot_spec>
```

False = student-T/normal
True = bootstrapping

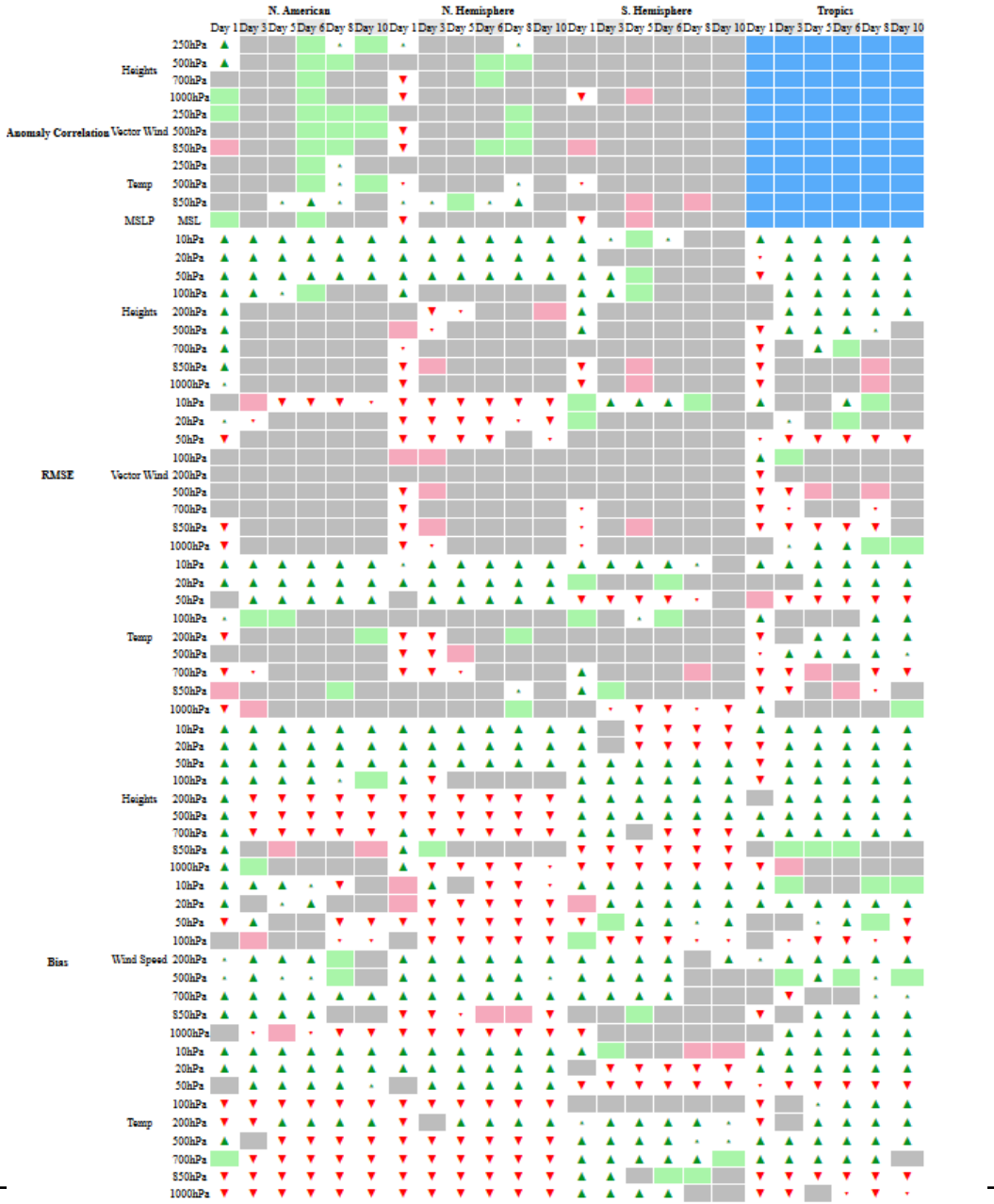
Give it unique filenames and title

mv_scorecard.sh

EMC

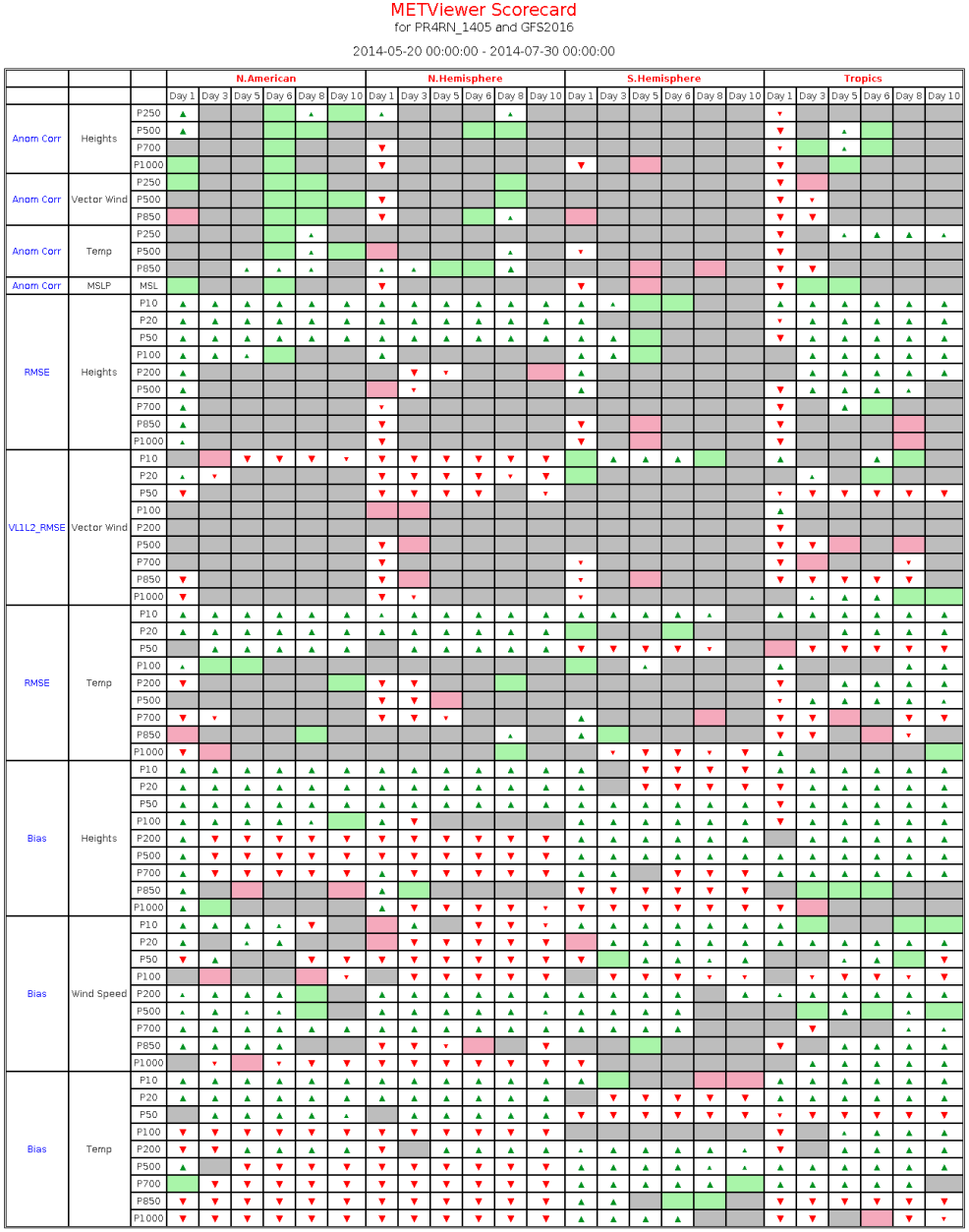
EMC Global Scorecard – PR4RN_1405 vs GFS2016

2014-05-20 to 2014-07-30



Comparison using VSDB Data

METviewer



Comparison using VSDB Data

Mixing Statistics

METViewer CAM Scorecard

for multip_ens_mean_hwt and singlp_ens_mean_hwt

2016-05-04 00:00:00 - 2016-06-04 00:00:00

			Continental US						East						West					
			6 hr	12 hr	18 hr	24 hr	30 hr	36 hr	6 hr	12 hr	18 hr	24 hr	30 hr	36 hr	6 hr	12 hr	18 hr	24 hr	30 hr	36 hr
CSI	1 hr Accumulated Precip	surface																		
CSI	3 hr Accumulated Precip	surface																		
CSI	Reflectivity	L0	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼			▼	▼	
RMSE	Temp	2 m	▲	▲			▲	▲	▲	▲			▲		▲	▲	▲		▲	▲
RMSE	Dew Point	2 m	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
RMSE	Wind	10 m	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Bias	Temp	2 m		▼	▲	▲	▲	▼	▼			▲	▲	▼	▼	▼	▲		▲	▼
Bias	Dew Point	2 m	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Bias	Wind	10 m	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲

Iterating on CAM Scorecard

Number of Stats with Range

for GFDLFV3 and HRRR

2018-04-30 00:00:00 - 2018-05-10 00:00:00

			Daily Domain											
			12 hr	14 hr	16 hr	18 hr	20 hr	22 hr	24 hr	26 hr	28 hr	30 hr	32 hr	34 hr	36 hr
CSI	Composite Reflectivity	>=25.0													
		>=30.0													
		>=35.0		▾											
		>=40.0													
		>=45.0	▼		▼										
		>=50.0	▼	▼	▲									▲	

▲	GFDLFV3 is better than HRRR at the 99.9% significance level
▴	GFDLFV3 is better than HRRR at the 99% significance level
	GFDLFV3 is better than HRRR at the 95% significance level
	No statistically significant difference between GFDLFV3 and HRRR
	GFDLFV3 is worse than HRRR at the 95% significance level
▾	GFDLFV3 is worse than HRRR at the 99% significance level
▼	GFDLFV3 is worse than HRRR at the 99.9% significance level
	Not statistically relevant

Iterating on CAM Scorecard

Number of Stats with 2 Ranges 1 symbol 1 color

for GFDLFV3 and HRRR

2018-04-30 00:00:00 - 2018-05-10 00:00:00

			Daily Domain											
			12 hr	14 hr	16 hr	18 hr	20 hr	22 hr	24 hr	26 hr	28 hr	30 hr	32 hr	34 hr	36 hr
CSI	Composite Reflectivity	>=25.0													
		>=30.0													
		>=35.0		B											
		>=40.0													
		>=45.0	B		B										
		>=50.0	B	B	A									A	

A	GFDLFV3 is better than HRRR at the 99.9% significance level
	GFDLFV3 is better than HRRR at the 95% significance level
	No statistically significant difference between GFDLFV3 and HRRR
	GFDLFV3 is worse than HRRR at the 95% significance level
B	GFDLFV3 is worse than HRRR at the 99.9% significance level
	Not statistically relevant

Need Help with MET or METviewer

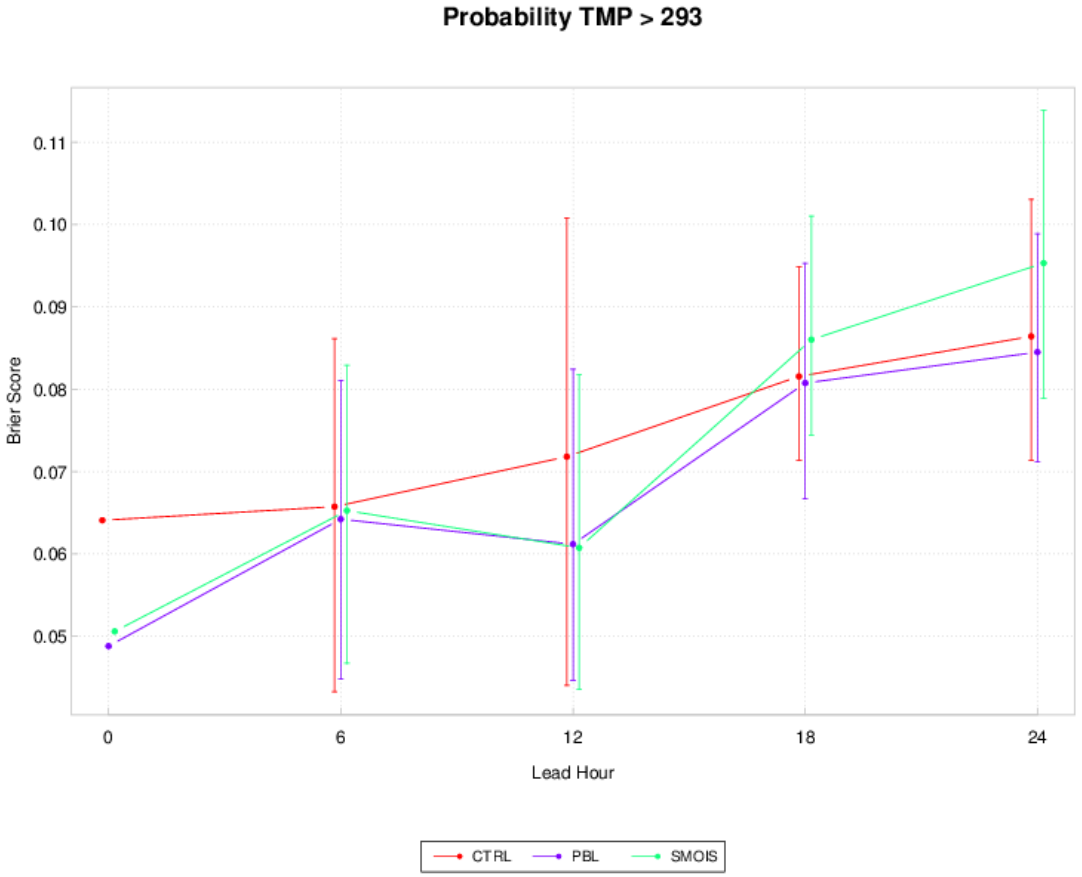
- Contact met_help@ucar.edu – MET staff will answer as quickly as possible – this includes:

- Help with running MET on Theia, WCOSS, Jet or Cheyenne
- Help with understanding output or error messages
- Help with METviewer GUI
- Help with loading METviewer
- Help with setting up and running a Scorecard in METviewer batch

Extra Slides

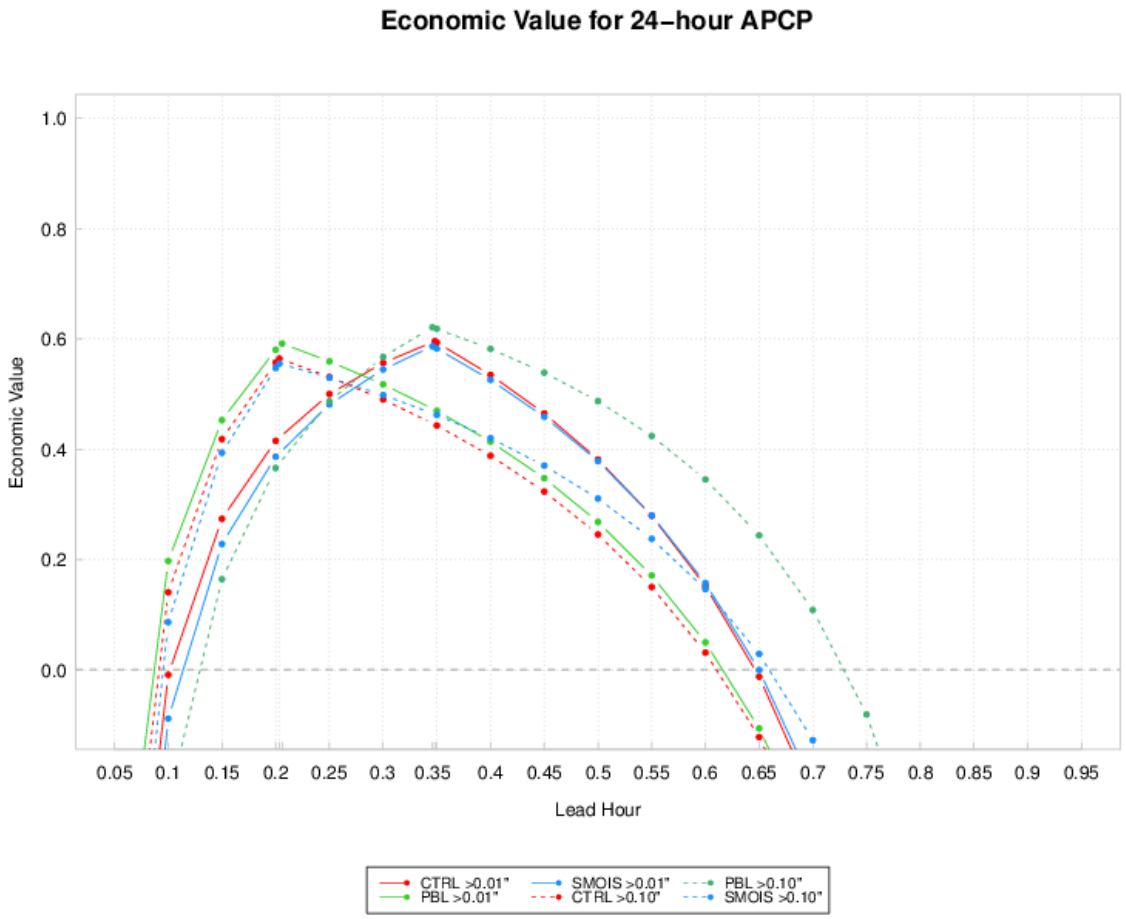
PCT

- Bootstrapping and CI are available for PCT line type statistics.
- PCT line type statistics can be used in the scorecard.



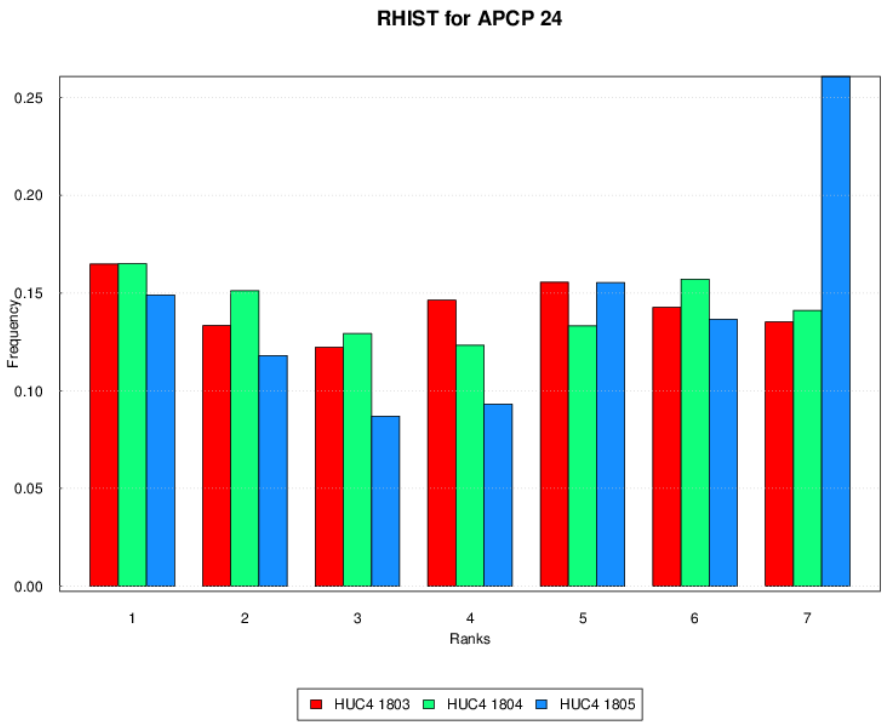
Economic Value

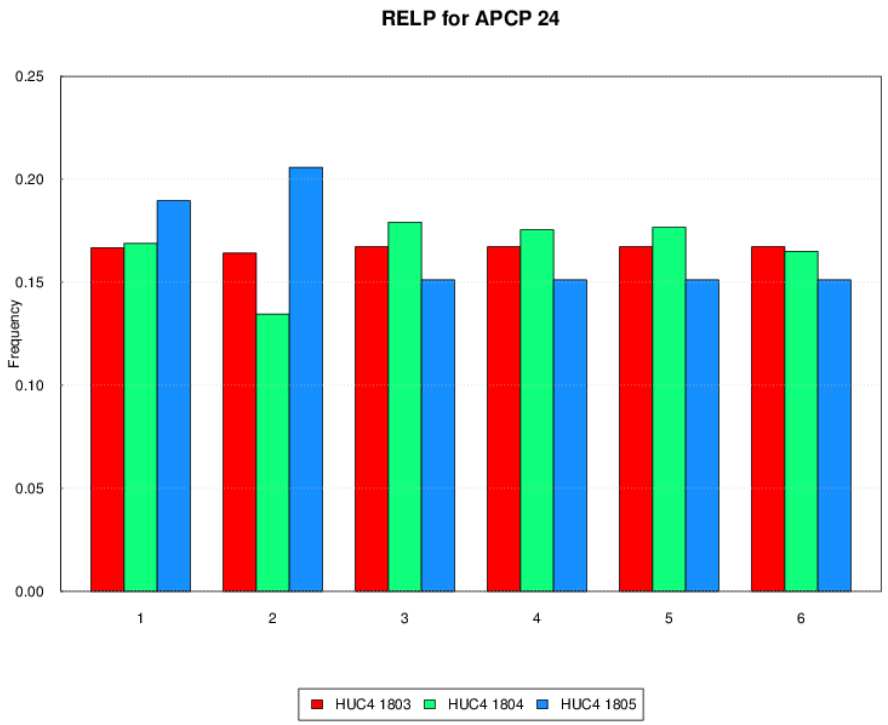
- MET ECLV, VSDB ECON, and RELP line types are available for loading and plotting.



HIST Tab

- RHIST/PHIST tabs combined into single HIST tab.
- Add support for loading and plotting RELP.
- User interface: allow empty strings in "X label" and "Y1 label" fields.
- 6 member ensemble: 7 RHIST bars and RELP bars.





METviewer Automated Testing

- NOAA GSD is developing infrastructure for automated METviewer GUI testing (Randy Pierce and Molly Smith).
- Define test **scenarios** to exercise specific METviewer features.
- Each scenario executes a series of human-readable steps to interact with a website (Chrome browser well supported).
- Scenario ***.feature*** files live in the repository with the METviewer code.
- These automated tests are useful in two ways:
  - Regression testing: Run all scenarios for two versions of METviewer and make sure the output is identical.
  - Training: Record the execution of each scenario as a movie to illustrate available METviewer features.
- Currently have 4 ***.feature*** files in **test/user_interface/features** directory:
  - metv_plot_boxplot_APCP_06_GSS.feature
  - metv_plot_boxplot_TMP_2m_RMSE.feature
  - metv_plot_series_APCP_06_AGG_GSS.feature
  - metv_plot_series_TMP_2m_AGG_RMSE.feature

METviewer Automated Testing

- View feature file: **timeSeries/basic/metv_plot_series_APCP_06_AGG_GSS.feature**
- Run **mvTest.sh -p 20**
- Future development:
  - Add many, many more automated feature tests.
  - Add tests for tracking performance and exceptions.
  - Save output files and set up logic for diffing results.
  - Capture test execution as individual animations.
  - Organize and post automated plotting examples to METviewer website.