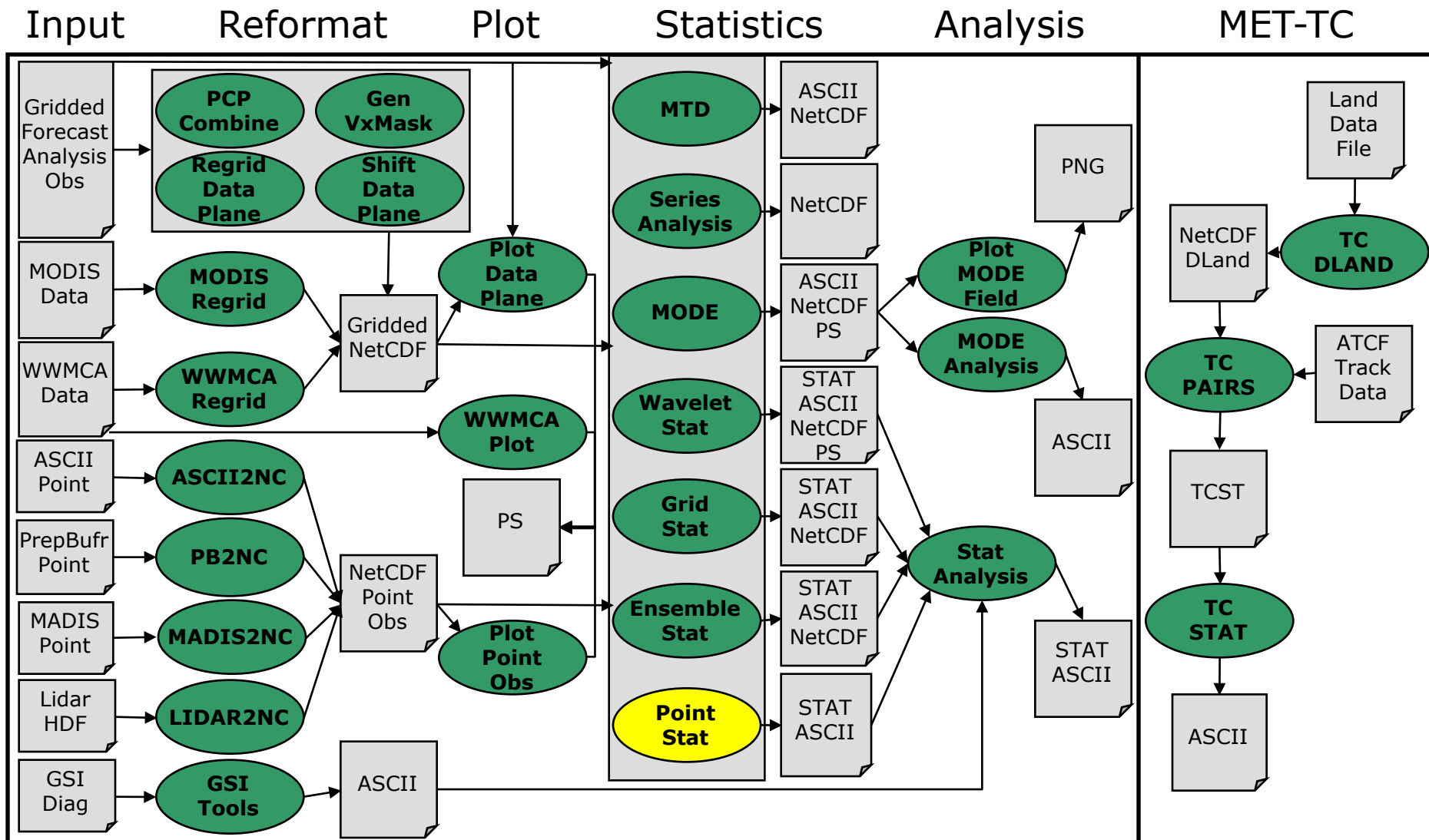
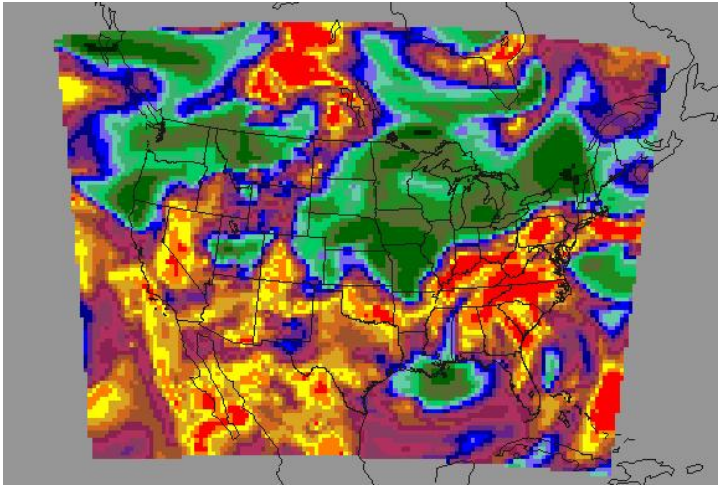


Point-Stat Tool

Point-Stat Tool

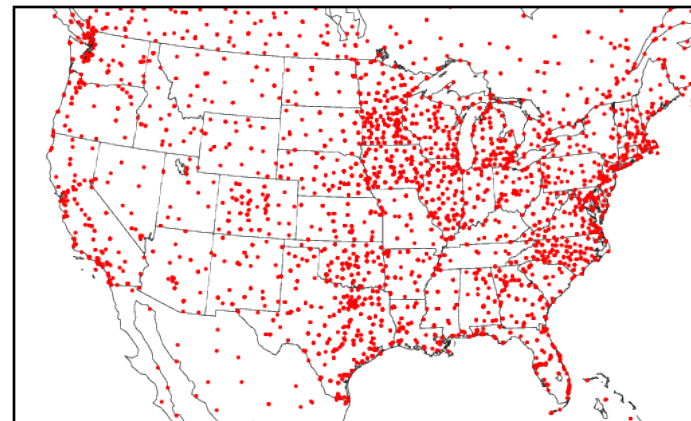


Point-Stat: Overview



- Compare **gridded forecasts** to **point observations**.
- Accumulate matched pairs over a defined area at a **single point in time**.
- Verify one or more variables/levels.
- Analysis tool provided to aggregate through time.

- Verification methods:
 - Continuous statistics for raw fields.
 - Single and Multi-Category counts and statistics for thresholded fields.
 - Parametric and non-parametric confidence intervals for statistics.
 - Compute **partial sums** for raw fields and/or the raw matched pair values.
 - Methods for **probabilistic** forecasts.
 - **HiRA** spatial verification method.



Point-Stat: Input/Output

- Input Files
 - Gridded forecast file
 - GRIB1 output of Unified Post-Processor (or other)
 - GRIB2 from NCEP (or other)
 - NetCDF from PCP-Combine, wrf_interp, or CF-compliant
 - Point observation file
 - NetCDF output of PB2NC, ASCII2NC, MADIS2NC, or LIDAR2NC
 - ASCII configuration file
- Output Files
 - ASCII statistics file with all output lines (end with “.stat”)
 - Optional ASCII files sorted by line type with a header row (ends with “_TYPE.txt”)

Point-Stat: Usage

Usage: point_stat

fcst_file

obs_file

config_file

[-point_obs netcdf_file]

[-obs_valid_beg time]

[-obs_valid_end time]

[-outdir path]

[-log file]

[-v level]

fcst_file	Gridded forecast file
obs_file	NC point observation file
config_file	ASCII configuration file
-point_obs	Additional NC point observation files
-obs_valid_beg	Beginning of valid time window for matching
-obs_valid_end	End of valid time window for matching
-outdir	Output directory to be used
-log	Optional log file
-v	Level of logging

Point-Stat: Configuration

- Many configurable parameters – only set a few:
 - 2-meter temperature.
 - Threshold temperatures near freezing.
 - Match to obs at the surface.
- Accumulate stats over all the points in the domain.
- Match observation to the nearest forecast value.
- Generate all output line types other than vector and probabilistic.

```
fcst = {
  message_type = [ "ADPSFC" ];
  field = [
    {
      name       = "TMP";
      level      = [ "Z2" ];
      cat_thresh = [ >273.0, >283.0, >293.0 ];
    }
  ];
};
obs = fcst;
```

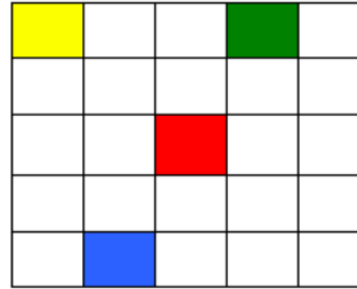
```
mask = {
  grid = [ "FULL" ];
  poly = [];
  sid  = "";
};
```

```
interp = {
  vld_thresh = 1.0;
  type = [
    {
      method = UW_MEAN;
      width  = 1;
    }
  ];
};
```

```
output_flag = {
  fho   = BOTH;
  ctc   = BOTH;
  cts   = BOTH;
  mctc  = BOTH;
  mcts  = BOTH;
  cnt   = BOTH;
  sl112 = BOTH;
  sal112 = BOTH;
  vl112 = NONE;
  val112 = NONE;
  pct   = NONE;
  pstd  = NONE;
  pjc   = NONE;
  prc   = NONE;
  eclv  = NONE;
  mpr   = BOTH;
};
```

Point-Stat: HiRA Framework

- High Resolution Assessment (HiRA) verification logic is applied to deterministic forecasts matched to point observations.
- Evaluate neighborhood fraction of events as a probability forecast.
- As with all neighborhood methods, allows for some spatial / temporal uncertainty in either model or observation by giving credit for being 'close'.
- Allows for comparison of deterministic and ensemble forecasts via the same set of probabilistic statistics.
- Also allows for comparison of models with different grid resolutions via adjustment of neighborhood size.



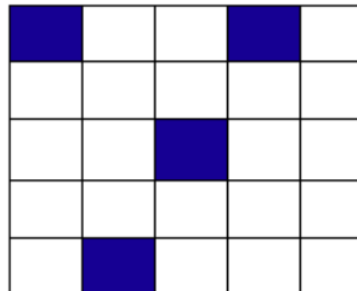
Model Forecast

White boxes = 0

Colored boxes > 0

Threshold Forecast

Blue boxes = event



HiRA Proportion

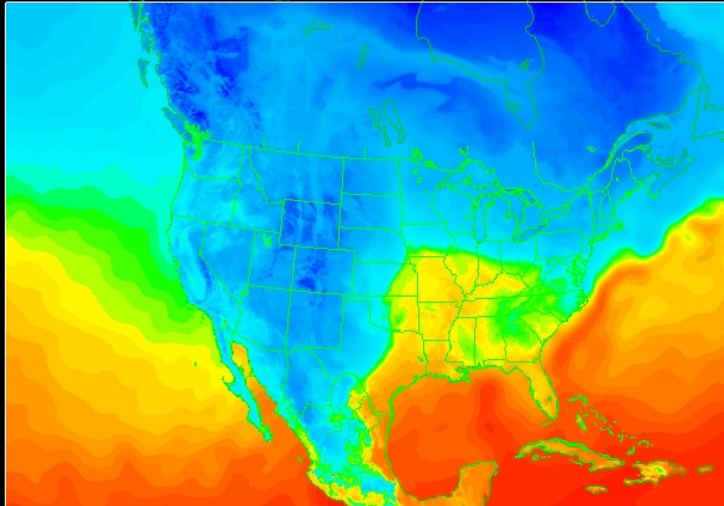
- 1x1 Neighborhood: 1/1
- 3x3 Neighborhood: 1/9
- 5x5 Neighborhood: 4/25

```
hira = {  
  // Enable or disable  
  flag      = TRUE;  
  // Neighborhood sizes (parity logic)  
  width     = [ 2, 3, 4, 5 ];  
  // Probability thresholds  
  cov_thresh = [ ==0.25 ];  
  // Neighborhood shape  
  shape     = SQUARE;  
};
```

Mittermaier, 2014

Point-Stat: Input

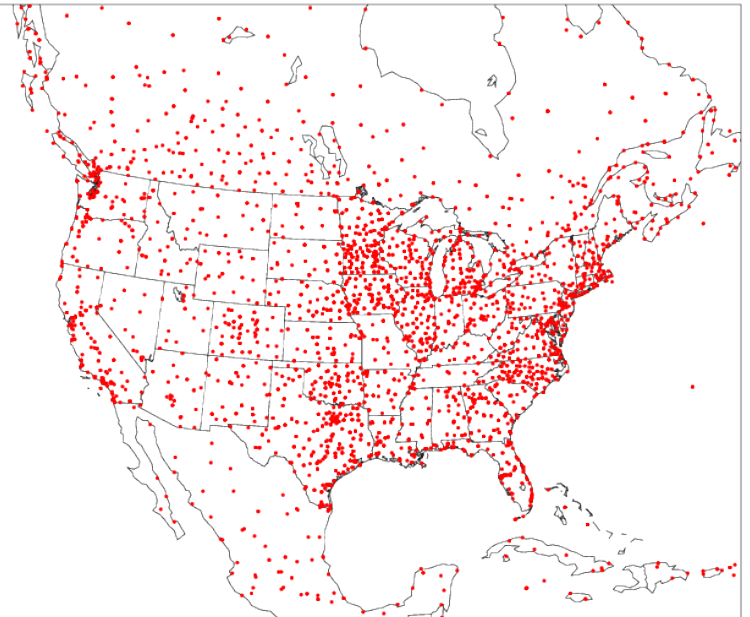
2-meter TMP
(IDV)



Temperature_surface - Color-Shaded Plan View 2007-03-31-12:00:00Z

4003 TMP ADPSFC Obs
(plot_point_obs)

sample_pb.nc



Point-Stat: Run

- `met-6.1/bin/point_stat \`
`sample_fcst.grb sample_pb.nc \`
`PointStatConfig_TMPZ2 -outdir out -v 2`

```
DEBUG 1: Default Config File: met-6.1/share/met/data/config/PointStatConfig_default
DEBUG 1: User Config File: PointStatConfig_TMPZ2
DEBUG 1: Forecast File: sample_fcst.grb
DEBUG 1: Climatology File: none
DEBUG 1: Observation File: sample_pb.nc
DEBUG 2: -----
DEBUG 2: Reading data for TMP/Z2.
DEBUG 2: For TMP/Z2 found 1 forecast levels and 0 climatology levels.
DEBUG 2: -----
DEBUG 2: Searching 87752 observations from 9396 messages.
DEBUG 2: -----
DEBUG 2: Processing TMP/Z2 versus TMP/Z2, for observation type ADPSFC, over region FULL, for interpolation method
UW_MEAN(1), using 4003 pairs.
DEBUG 2: Computing Categorical Statistics.
DEBUG 2: Computing Multi-Category Statistics.
DEBUG 2: Computing Continuous Statistics.
DEBUG 2: Computing Scalar Partial Sums.
DEBUG 2: -----
DEBUG 1: Output file: out/point_stat_360000L_20070331_120000V.stat
DEBUG 1: Output file: out/point_stat_360000L_20070331_120000V_fho.txt
DEBUG 1: Output file: out/point_stat_360000L_20070331_120000V_ctc.txt
DEBUG 1: Output file: out/point_stat_360000L_20070331_120000V_cts.txt
DEBUG 1: Output file: out/point_stat_360000L_20070331_120000V_mctc.txt
DEBUG 1: Output file: out/point_stat_360000L_20070331_120000V_mcts.txt
DEBUG 1: Output file: out/point_stat_360000L_20070331_120000V_cnt.txt
DEBUG 1: Output file: out/point_stat_360000L_20070331_120000V_sl112.txt
DEBUG 1: Output file: out/point_stat_360000L_20070331_120000V_sal112.txt
DEBUG 1: Output file: out/point_stat_360000L_20070331_120000V_mpr.txt
```

Point-Stat: ASCII Output Types

- Statistics line types: 16 possible
 - Categorical – Single Threshold
 - Contingency table counts and stats (FHO, CTC, CTS, ECLV)
 - Categorical – Multiple Thresholds
 - NxN Contingency table counts and stats (MCTC, MCTS)
 - Continuous - raw fields
 - Continuous statistics (CNT)
 - Partial Sums (SL1L2, SAL1L2, VL1L2, VAL1L2)
 - Probabilistic
 - Nx2 Contingency table counts and stats (PCT, PSTD)
 - Continuous statistics and ROC curve (PJC, PRC)
 - Economic Cost/Loss value (ECLV)
 - Matched pairs
 - Raw matched pairs – a lot of data! (MPR)
- 22 header columns common to all line types
- Remaining columns specific to each line type

Point-Stat: Sample Output

1. **STAT** file output for sample run:
 - 1 line each for **CNT**, **SL1L2**, **MCTC**, **MCTS**
 - 3 lines each for **FHO**, **CTC**, **CTS**
 - 4,003 lines for **MPR**!
2. Additional **TXT** files for each line type

```
Output file: out/point_stat_360000L_20070331_120000V.stat
Output file: out/point_stat_360000L_20070331_120000V_fho.txt
Output file: out/point_stat_360000L_20070331_120000V_ctc.txt
Output file: out/point_stat_360000L_20070331_120000V_cts.txt
Output file: out/point_stat_360000L_20070331_120000V_mctc.txt
Output file: out/point_stat_360000L_20070331_120000V_mcts.txt
Output file: out/point_stat_360000L_20070331_120000V_cnt.txt
Output file: out/point_stat_360000L_20070331_120000V_sl1l2.txt
Output file: out/point_stat_360000L_20070331_120000V_sal1l2.txt
Output file: out/point_stat_360000L_20070331_120000V_mpr.txt
```

Point-Stat: CTC Output Line

VERSION	V6.1
MODEL	WRF
DESC	NA
FCST_LEAD	360000
FCST_VALID_BEG	20070331_120000
FCST_VALID_END	20070331_120000
OBS_LEAD	000000
OBS_VALID_BEG	20070331_103000
OBS_VALID_END	20070331_133000
FCST_VAR	TMP
FCST_LEV	Z2
OBS_VAR	TMP
OBS_LEV	Z2
OBTYPE	ADPSFC

VX_MASK	FULL
INTERP_MTHD	UW_MEAN
INTERP_PNTS	1
FCST_THRESH	>273.000
OBS_THRESH	>273.000
COV_THRESH	NA
ALPHA	NA
LINE_TYPE	CTC
TOTAL	4003
FY_OY (hits)	3111
FY_ON (f.a.)	78
FN_OY (miss)	215
FN_ON (c.n.)	599

Point-Stat: Matched Pairs

- Matched Pair (MPR) line type contains 1 line for each matched pair.
- Data overload!

TOTAL	INDEX	OBS_SID	OBS_LAT	OBS_LON	OBS_LVL	OBS_ELV	FCST	OBS	OBS_QC	...
4003	1	71600	43.93000	-60.01000	1010.79999	4.01053	272.00000	271.95001	NA	
4003	2	71616	46.43000	-71.93000	1016.09998	102.04903	268.00000	269.64999	NA	
4003	3	71629	44.23000	-78.36000	1004.50000	191.44466	273.00000	272.64999	NA	
4003	4	71028	51.67000	-124.40000	916.50000	872.82202	264.00000	265.25000	NA	
4003	5	71066	58.61000	-117.16000	973.90002	337.50449	272.00000	271.45001	NA	
4003	6	71104	52.18000	-122.04000	906.50000	938.08594	271.00000	264.64999	NA	
4003	7	71109	50.68000	-127.36000	1020.20001	22.03931	275.00000	275.64999	NA	
4003	8	71150	50.45000	-100.59000	949.09998	562.38477	272.00000	271.75000	NA	
4003	9	71177	57.13000	-61.47000	899.70001	834.87476	259.00000	254.64999	NA	
4003	10	71197	47.56000	-59.16000	1000.90002	40.06803	272.00000	269.95001	NA	
4003	11	71378	47.41000	-72.79000	1006.90002	169.37592	267.00000	266.14999	NA	
4003	12	71415	45.76000	-62.68000	1014.00000	1.99518	269.00000	269.04999	NA	
4003	13	71425	49.24000	-65.33000	1014.90002	28.96468	264.00000	267.25000	NA	
4003	14	71437	43.29000	-79.79000	1017.79999	77.03765	274.00000	276.35001	NA	
4003	15	71473	48.78000	-123.04000	1015.70001	23.93772	278.00000	280.95001	NA	
4003	16	71486	52.93000	-118.31000	896.20001	1021.55963	265.00000	270.35001	NA	
4003	17	71573	42.87000	-80.55000	996.09998	231.62808	273.00000	276.54999	NA	
4003	18	71579	49.89000	-97.13000	989.70001	230.44473	276.00000	274.35001	NA	
4003	19	71598	47.78000	-64.83000	1016.70001	5.00338	266.00000	267.54999	NA	
4003	20	71860	50.02000	-100.32000	874.20001	474.10379	273.00000	273.54999	NA	