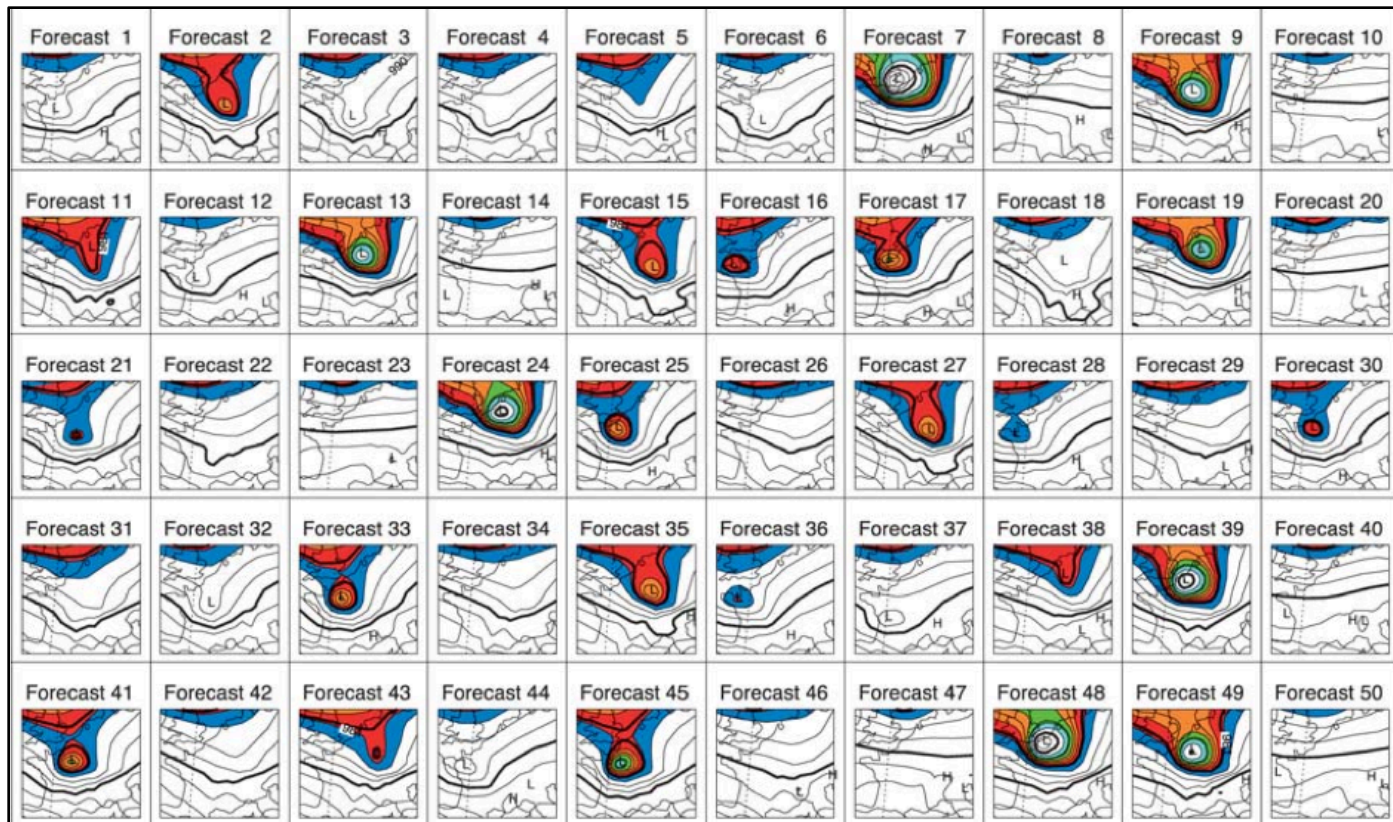


Ensemble-Stat



Presenter: Tina Kalb

Verifying Ensembles & Probability Fcsts with MET

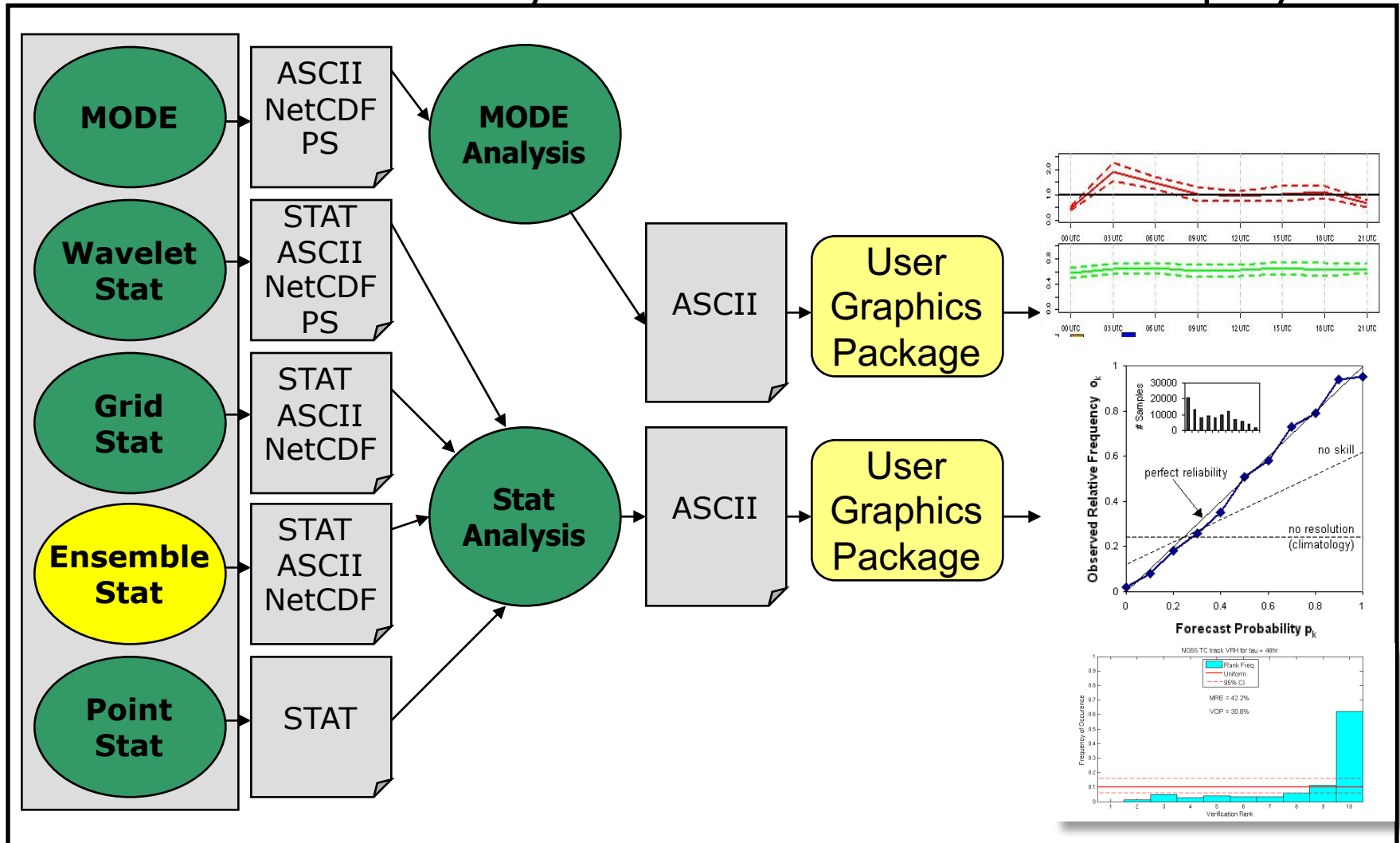
- Point-Stat and Grid-Stat Tool (probability)
 - Brier Score + Decomposition
 - Reliability Diagrams
 - Receiver Operating Characteristic Diagram + Area Under the Curve
 - Joint/Conditional factorization table
- **Ensemble-Stat Tool**
 - **Ensemble Mean Fields**
 - **Probability Fields**
 - **Rank, PIT, and RELP Histograms**
 - **Spread-Skill Calculation**

Ensemble-Stat Tool

Statistics

Analysis

User Defined Display



Ensemble-Stat Capabilities

Reads:

- Gridded ensemble member files
- ***Gridded AND point*** observations files

Calculates:

- Ensemble Mean, Standard Deviations, Mean \pm 1 SD fields
- Ensemble Min, Max, and Range fields
- Ensemble Valid Data Count field
- Ensemble Relative Frequency by threshold fields (i.e. probability)
- Rank and PIT Histograms (if Obs Field Provided)
- Ensemble Spread-Skill (if Obs Field Provided)
- Relative Position (if Obs Field Provided)

Writes:

- Stat files with Rank Histogram, PIT Histogram, Relative position, Spread-Skill partial sums, and Point Observation Ranks
- Gridded NetCDF files: Ensemble Forecasts, Observation Ranks

Ensemble Stat Tool: Usage

Usage: ensemble_stat

n_ens *ens_file_1* \
... ens_file_n |
ens_file_list
config_file
[-grid_obs file]
[-point_obs file]
[-ssvar_mean file]
[-obs_valid_beg time]
[-obs_valid_end time]
[-compress level]
[-outdir path]
[-log file]
[-v level]

Number of Ensemble members followed by list of ensemble member names OR *ens_file_list* (the name of an ASCII file with names of members)

Config file name

Name of gridded or point observed file – Required if Rank Histograms desired (optional)

Specify an ensemble mean model data file for use in calculating ensemble spread-skill (optional)

YYYYMMDD[_HH[MMSS]] format to set the beginning and end of the matching observation time window (optional)

Desired level of compress for NetCDF variables (0-9)

Set output directory (optional)

Outputs log messages to the specified file (optional)

Set level of verbosity (optional)

Ensemble-Stat: Configuration

- Many configurable parameters
 - ens = fields to summarize
 - ens_thresh - All members must be available
 - vld_thresh – all data in grid must be valid
- 24hr Accumulated Precip (APCP)
- Composite Reflectivity (REFC)
- N-S component of Wind (UGRD)
- Thresholds used for Ensemble Relative Freq (i.e. probability)
- GRIB1_ptv = 129; Use GRIB Table 129 instead of Table 2

```
//  
// Ensemble product fields to be processed  
// (i.e. mean, min, max, stdev fields)  
//  
ens = {  
    ens_thresh = 1.0;  
    vld_thresh = 1.0;  
  
    field = [  
        {  
            name      = "APCP";  
            level     = [ "A24" ];  
            cat_thresh = [ >0.0, >=10.0 ];  
        },  
        {  
            name      = "REFC";  
            level     = [ "L0" ];  
            cat_thresh = [ >=35.0 ];  
            GRIB1_ptv = 129;  
        },  
        {  
            name      = "UGRD";  
            level     = [ "Z10" ];  
            cat_thresh = [ >=5.0 ];  
        },  
    ];  
}
```

Ensemble-Stat: Configuration

- Many configurable parameters
 - only set a few:
- Fcst specifies fields to be verified
- ADPSFC message type for point obs
- 24hr precip for gridded obs field
- Bin size for spread-skill calculation is 0.1 mm
- Bin size for probability integral transform statistics is 0.05 mm

```
// Forecast and observation fields to be
// verified (i.e. RHIST, PHIST, SSVAR)
//
fcst = {
    field = [
        {
            name          = "APCP";
            level          = [ "A24" ];
        }
    ];
}
obs = fcst;
```

```
// Point observation filtering options
// May be set separately in each "obs.field" entry
//
message_type    = [ "ADPSFC" ];
sid_exc         = [];
obs_thresh      = [ NA ];
obs_quality     = [];
duplicate_flag  = NONE;
obs_summary     = NONE;
obs_perc_value  = 50;
skip_const      = FALSE;

//
// Ensemble bin sizes
// May be set separately in each "obs.field" entry
//
ens_ssvr_bin_size = 0.1;
ens_phist_bin_size = 0.05;
```

Ensemble-Stat Tool: Run

```
ensemble_stat \  
6 sample_fcst/2009123112/*gep*/d01_2009123112_02400.grib \  
config/EnsembleStatConfig \  
-grid_obs sample_obs/ST4/ST4.2010010112.24h \  
-point_obs out/ascii2nc/precip24_2010010112.nc \  
-outdir out/ensemble_stat -v 2
```

NOTE:

You can pass in a path with wildcards to pull out the files you would like to process or you can pass in an ASCII filename that contains a list of ensemble members

Gridded and Obs fields are included for use in calculating Rank Histogram, PIT Histogram, Relative Position, and Spread-Skill

Ensemble Stat Tool: Run

***** Running Ensemble-Stat on APCP using GRIB forecasts, point observations, and gridded observations *****

DEBUG 1: Default Config File: /d3/projects/MET/MET_releases/met-6.0/data/config/EnsembleStatConfig_default

DEBUG 1: User Config File: config/EnsembleStatConfig

GSL_RNG_TYPE=mt19937

GSL_RNG_SEED=1

DEBUG 1: Ensemble Files[6]:

DEBUG 1: ../data/sample_fcst/2009123112/arw-fer-gep1/d01_2009123112_02400.grib

DEBUG 1: ../data/sample_fcst/2009123112/arw-fer-gep5/d01_2009123112_02400.grib

DEBUG 1: ../data/sample_fcst/2009123112/arw-sch-gep2/d01_2009123112_02400.grib

DEBUG 1: ../data/sample_fcst/2009123112/arw-sch-gep6/d01_2009123112_02400.grib

DEBUG 1: ../data/sample_fcst/2009123112/arw-tom-gep3/d01_2009123112_02400.grib

DEBUG 1: ../data/sample_fcst/2009123112/arw-tom-gep7/d01_2009123112_02400.grib

DEBUG 1: Gridded Observation Files[1]:

DEBUG 1: ../data/sample_obs/ST4/ST4.2010010112.24h

DEBUG 1: Point Observation Files[1]:

DEBUG 1: ../out/ascii2nc/precip24_2010010112.nc

DEBUG 2:

DEBUG 2: -----

DEBUG 2:

DEBUG 2: Processing ensemble field: APCP/A24

...

Processing gridded verification APCP_24/A24 versus APCP_24/A24, for observation type MC_PCP, over region FULL, for interpolation method UW_MEAN(1), using 15480 pairs.

DEBUG 1: Output file: out/ensemble_stat/ensemble_stat_20100101_120000V.stat

DEBUG 1: Output file: out/ensemble_stat/ensemble_stat_20100101_120000V_rhist.txt

DEBUG 1: Output file: out/ensemble_stat/ensemble_stat_20100101_120000V_phist.txt

DEBUG 1: Output file: out/ensemble_stat/ensemble_stat_20100101_120000V_relp.txt

DEBUG 1: Output file: out/ensemble_stat/ensemble_stat_20100101_120000V_orank.txt

DEBUG 1: Output file: out/ensemble_stat/ensemble_stat_20100101_120000V_ssvr.txt

DEBUG 1: Output file: out/ensemble_stat/ensemble_stat_20100101_120000V_ens.nc

DEBUG 1: Output file: out/ensemble_stat/ensemble_stat_20100101_120000V_orank.nc

Ensemble-Stat: Output Files

- ASCII

- Up to 4 txt files and stat file
- Ranked histogram (CPSS, IGN)
- Probability integral transform histogram
- Skill/spread variance
 - e.g. FBAR, OBAR, MSE, RMSE, PR_CORR
- Relative position

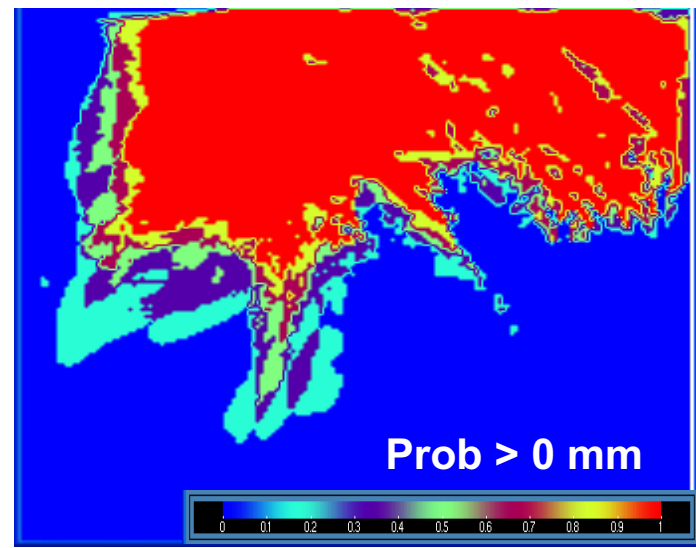
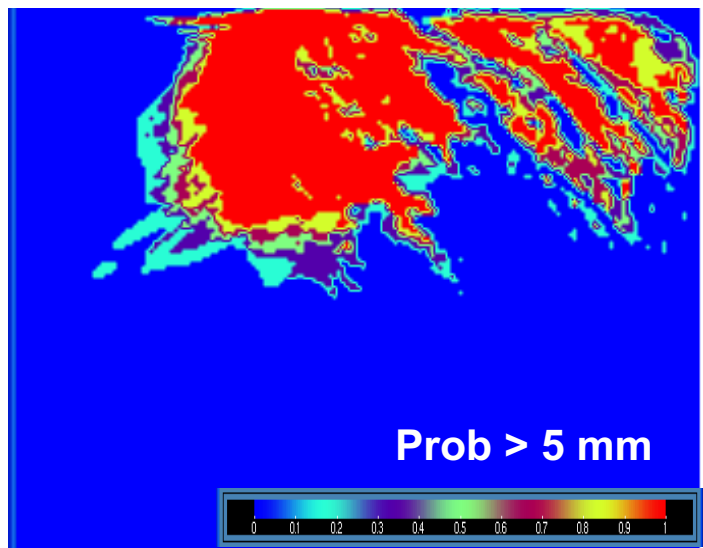
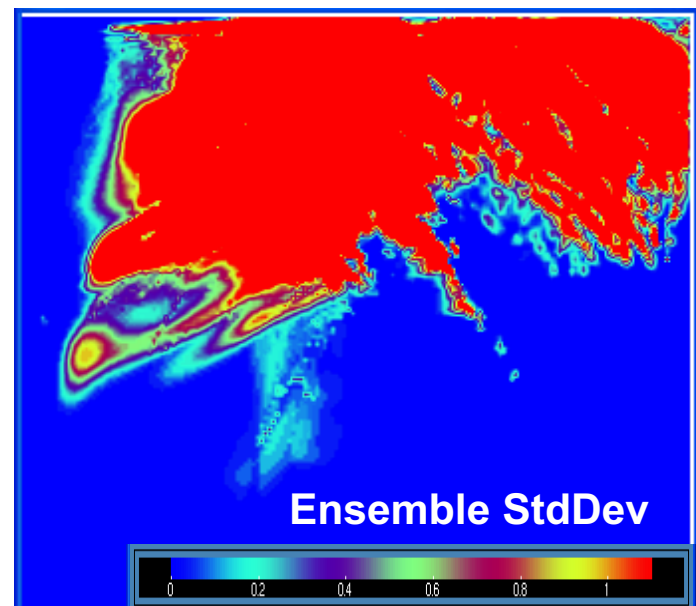
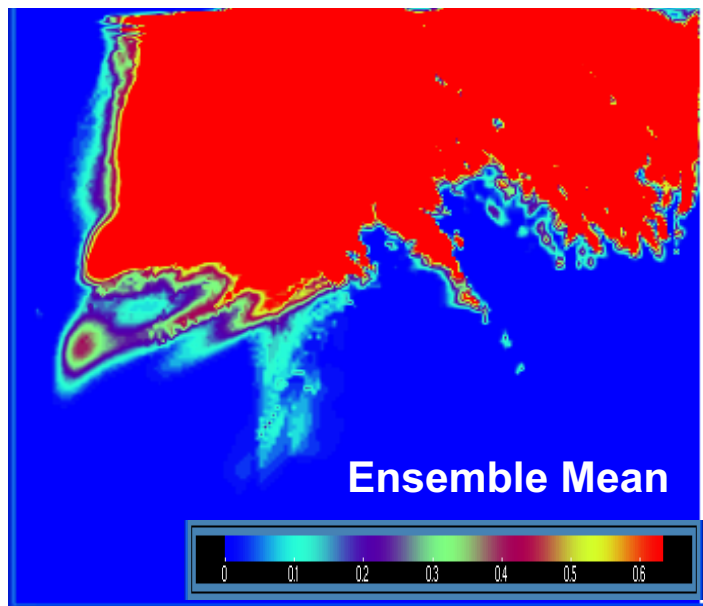
```
output_flag = {  
    rhist = BOTH;  
    phist = BOTH;  
    orank = BOTH;  
    ssvar = BOTH;  
    relp  = BOTH;  
};
```

- NetCDF

- Gridded ensemble mean, standard deviation, min, max, range, frequency
- “orank” file (gridded obs rank)

```
ensemble_flag = {  
    mean      = TRUE;  
    stdev     = TRUE;  
    minus     = TRUE;  
    plus      = TRUE;  
    min       = TRUE;  
    max       = TRUE;  
    range     = TRUE;  
    vld_count = TRUE;  
    frequency = TRUE;  
    rank      = TRUE;  
    weight    = FALSE;  
};
```

Ensemble Stat Tool: nc Output



Ensemble Stat Tool: txt Output

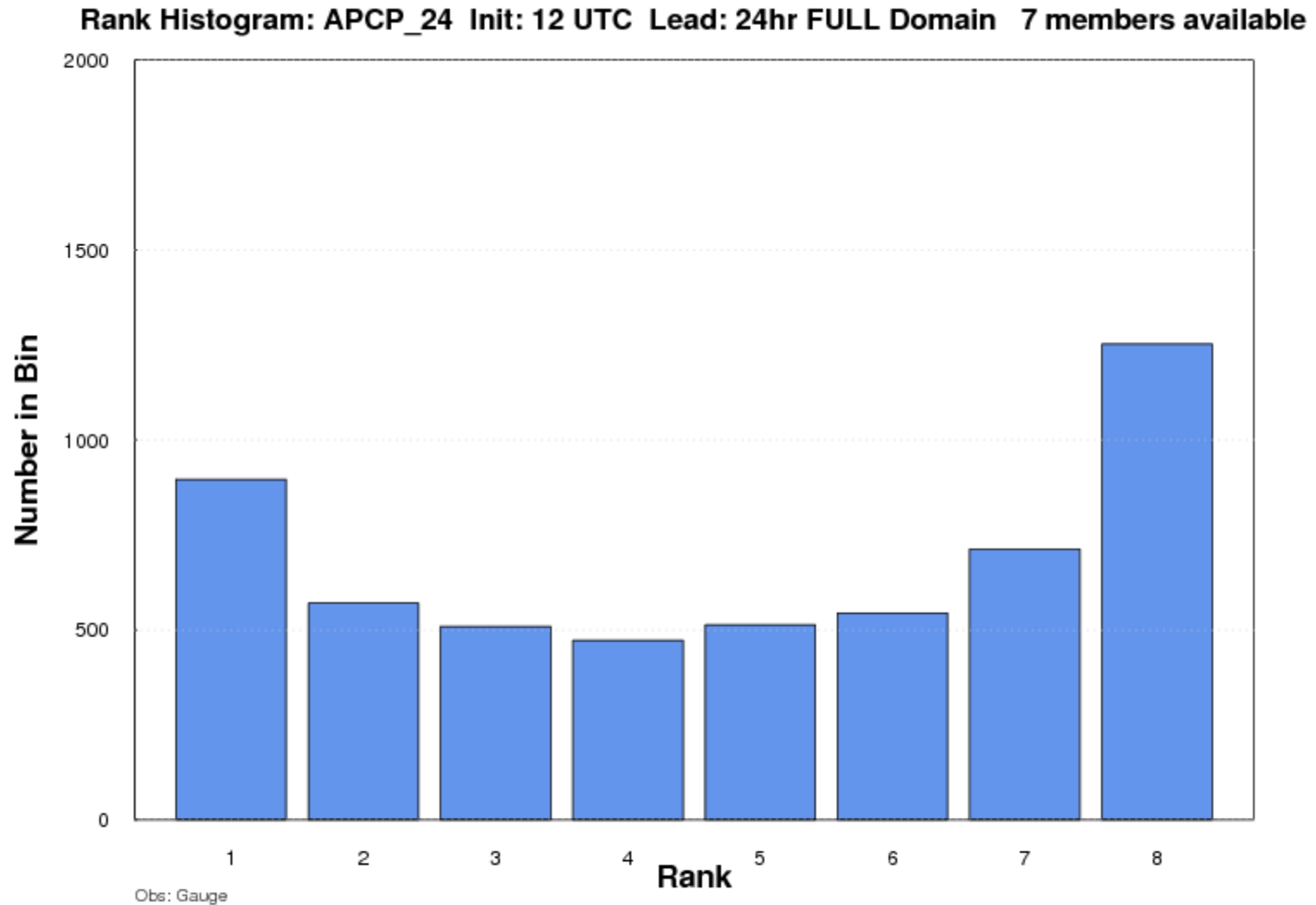
Output from *_rhist.txt

```
VERSION MODEL DESC FCST_LEAD FCST_VALID_BEG FCST_VALID_END OBS_LEAD
OBS_VALID_BEG OBS_VALID_END FCST_VAR FCST_LEV OBS_VAR OBS_LEV OBTYPE
VX_MASK INTERP_MTHD INTERP_PNTS FCST_THRESH OBS_THRESH COV_THRESH ALPHA
LINE_TYPE TOTAL CRPS IGN N_RANK RANK_1 RANK_2 RANK_3 RANK_4 RANK_5 RANK_6
RANK_7
V6.1 WRF 240000 20100101_120000 20100101_120000 000000 20100101_103000
20100101_133000 APCP_24 A24 APCP_24 A24 ADPSFC FULL UW_MEAN 1
NA NA NA NA RHIST 1125 8.21904 6.53721 7 261 160 138
141 149 111 165 CRPS IGN RANK HIST
```

Output from *_phist.txt

```
VERSION MODEL DESC FCST_LEAD FCST_VALID_BEG FCST_VALID_END OBS_LEAD
OBS_VALID_BEG OBS_VALID_END FCST_VAR FCST_LEV OBS_VAR OBS_LEV OBTYPE
VX_MASK INTERP_MTHD INTERP_PNTS FCST_THRESH OBS_THRESH COV_THRESH ALPHA
LINE_TYPE TOTAL BIN_SIZE N_BIN BIN_1 BIN_2 BIN_3 BIN_4 BIN_5 BIN_6 BIN_7 BIN_8 BIN_9
BIN_10 BIN_11 BIN_12 BIN_13 BIN_14 BIN_15 BIN_16 BIN_17 BIN_18 BIN_19 BIN_20
V6.1 WRF 240000 20100101_120000 20100101_120000 000000 20100101_103000
20100101_133000 APCP_24 A24 APCP_24 A24 ADPSFC FULL UW_MEAN 1
NA NA NA NA PHIST 55296 0.05 20 9261 3135 2565 2258 2237
2043 2084 2167 2059 2155 2205 2202 2198 2174 2097 2153 1992 2023 2315
5973 Probability integral transform histogram
```

Rank Histogram



Uses for Output from Ensemble-Stat

Statistics

Analysis

User Defined Display

