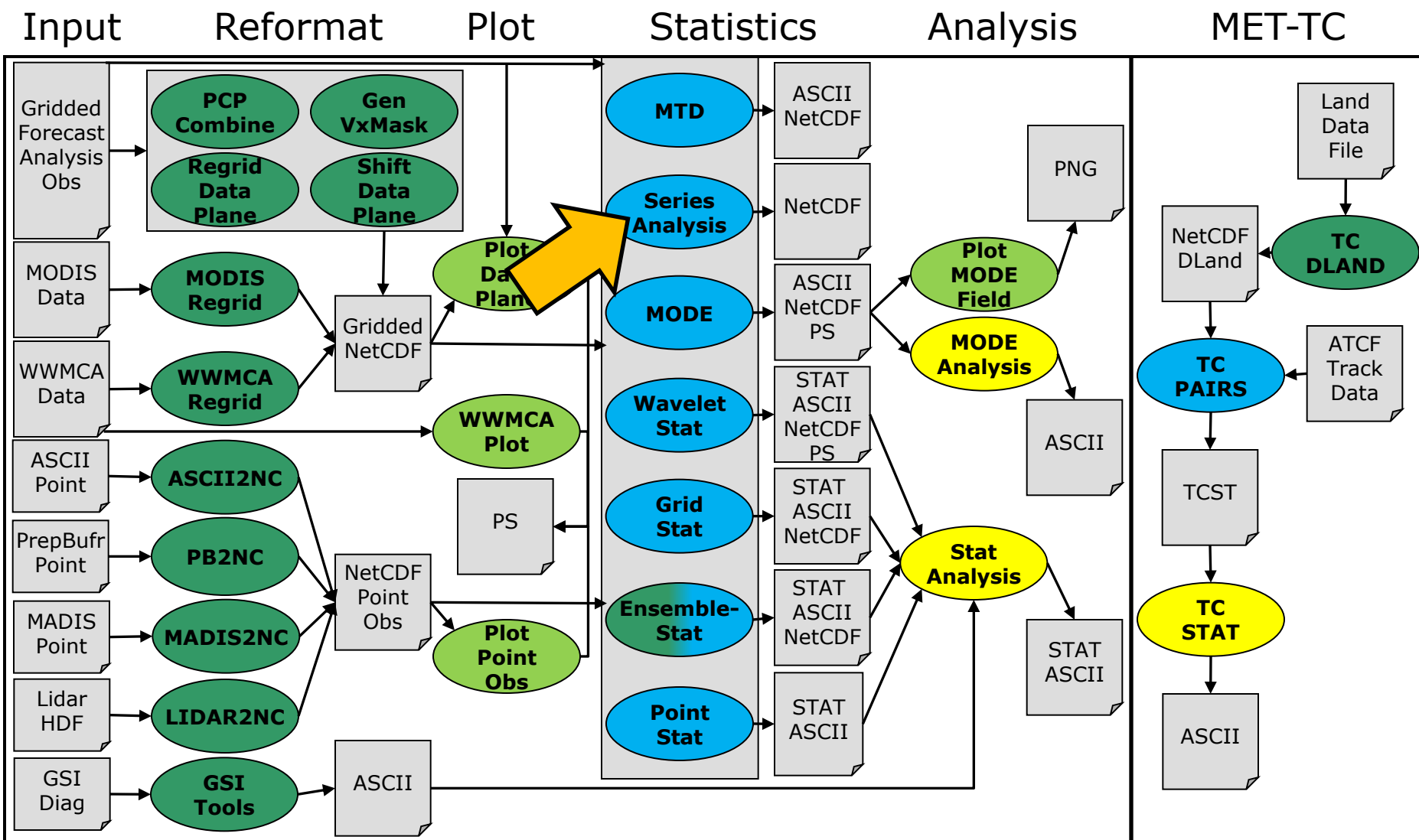


MET Series-AnalysisTool

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METplus Tutorial
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Series-Analysis Tool



Series-Analysis: Overview

- Grid-to-grid comparisons on common grid.
- **Grid-Stat** and **Point-Stat**:
 - Compute statistics aggregated over many grid points for a single point in time.
- **Series-Analysis** Tool:
 - Compute statistics aggregated through time for each point in the grid.

Series-Analysis: Usage

Usage: `series_analysis`

`-fcst file_1 ... file_n | fcst_file_list`

`-obs file_1 ... file_n | obs_file_list`

`[-both file_1 ... file_n | both_file_list]`

`[-paired]`

`-out file`

`-config file`

`[-log file]`

`[-v level]`

`[-compress level]`

<code>-fcst</code>	Gridded forecast files or ASCII file list
<code>-obs</code>	Gridded observation files or ASCII file list
<code>-both</code>	Set <code>-fcst</code> and <code>-obs</code> to the same list of files (i.e. Grid-Stat NetCDF pairs)
<code>-paired</code>	Input <code>-fcst</code> and <code>-obs</code> files are paired
<code>-out</code>	Output NetCDF file name
<code>-config</code>	ASCII configuration file
<code>-log</code>	Output directory to be used
<code>-v</code>	Level of logging

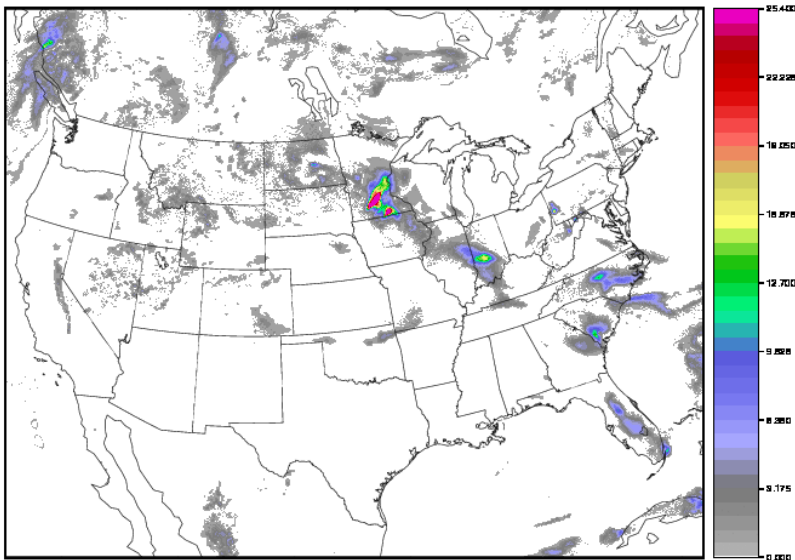
Series-Analysis: Input/Output

- Input Files
 - Gridded forecast and observation files
 - GRIB1 output of Unified Post-Processor (or other)
 - GRIB2 from NCEP (or other)
 - NetCDF from PCP-Combine, p_interp, or CF-compliant
 - Python Interface
 - ASCII configuration file
- Output File
 - NetCDF file containing one or more statistics computed for each grid point.

Series-Analysis: Define Series

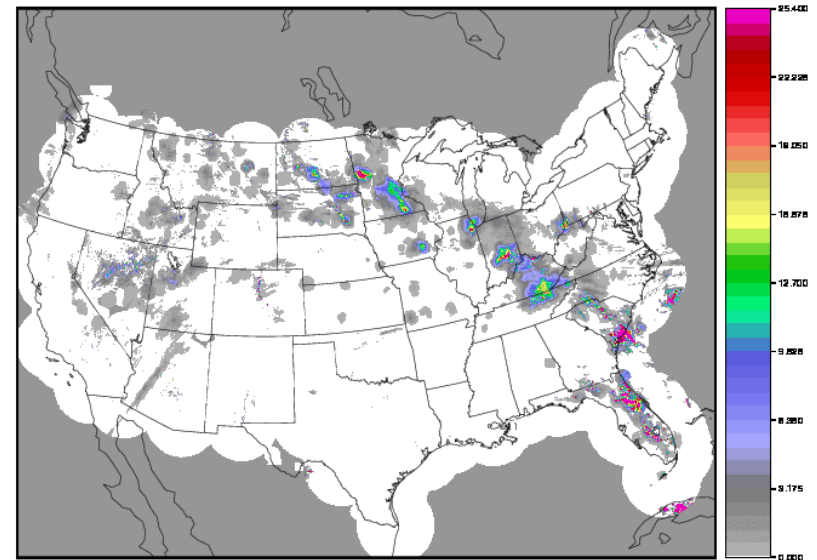
- Define series as:
 - Same field from multiple files (*time series most common*).
 - Different fields from the same file (*multiple vertical levels less common*).
 - Example: 24hr NAM fcst of 3hr APCP vs Stagell

3-hour Accumulated Precipitation



nam_2009061600_021_024.nc

3-hour Accumulated Precipitation



ST2m(2009061700.03h.nc

Series-Analysis: Configuration

- Precipitation accumulated over 3 hours.
 - NetCDF fcst and obs
- Threshold precip at 0.01" and 0.10".
- Do not restrict the analysis area in any way (no masking).
- Process 100,000 grid points in each pass.
- Require 75% of matched pairs in series to be valid.
- Compute contingency table statistics listed.

```
fcst = {  
  cat_thresh = [ >0.254, >2.540 ];  
  field = [  
    { name = "APCP_03";  
      level = [ "(*,*)" ]; }  
  ];  
};  
obs = fcst;
```

```
mask = {  
  grid = "";  
  poly = "";  
};
```

```
block_size = 100000;  
vld_thresh = 0.75;
```

```
output_stats = {  
  fho = [];  
  ctc = [];  
  cts = [  
    "TOTAL",  
    "BASER",  
    "GSS",  
    "FBIAS",  
    "HK",  
    "HSS"  
  ];  
  mctc = [];  
  mcts = [];  
  cnt = [];  
  sl112 = [];  
  sal112 = [];  
  pct = [];  
  pstd = [];  
  pjc = [];  
  prc = [];  
};
```

Series-Analysis: Run

- series_analysis \
 - fcst nam_24hr_fcst_summer \
 - obs st2_00Z_vld_summer \
 - config SeriesAnalysisConfig \
 - out series_nam_st2_24hr_fcst_summer.nc -v 2

```
DEBUG 1: Reading ASCII file list: nam_24hr_fcst_summer
DEBUG 1: Reading ASCII file list: st2_00Z_vld_summer
DEBUG 1: Default Config File: met-X.Y/share/met/data/config/SeriesAnalysisConfig_default
DEBUG 1: User Config File: SeriesAnalysisConfig
DEBUG 1: Length of configuration "fcst.field" = 1
DEBUG 1: Length of configuration "obs.field" = 1
DEBUG 1: Length of forecast file list = 92
DEBUG 1: Length of observation file list = 92
DEBUG 1: Series defined by the forecast file list of length 92.
DEBUG 2: Computing statistics using a block size of 100000, requiring 10 passes through the 1121 x 881 grid.
DEBUG 2: Processing data pass number 1 of 10 for grid points 1 to 100000.
DEBUG 2: Processing series entry 1 of 92: APCP_03(*,*) versus APCP_03(*,*)
DEBUG 2: Found data for APCP_03(*,*) in NAM_4km_03h/2009061600/nam_2009061600_021_024.nc
DEBUG 2: Found data for APCP_03(*,*) in ST2_4km_03h/ST2ml2009061700.03h.nc
DEBUG 2: Processing data pass number 2 of 10 for grid points 100001 to 200000.
DEBUG 2: Processing data pass number 3 of 10 for grid points 200001 to 300000.
DEBUG 2: Processing data pass number 4 of 10 for grid points 300001 to 400000.
DEBUG 2: Processing data pass number 5 of 10 for grid points 400001 to 500000.
DEBUG 2: Processing data pass number 6 of 10 for grid points 500001 to 600000.
DEBUG 2: Processing data pass number 7 of 10 for grid points 600001 to 700000.
DEBUG 2: Processing data pass number 8 of 10 for grid points 700001 to 800000.
DEBUG 2: Processing data pass number 9 of 10 for grid points 800001 to 900000.
DEBUG 2: Processing data pass number 10 of 10 for grid points 900001 to 987601.
DEBUG 1: Output file: out/series_nam_st2_24hr_fcst_summer.nc
```

Run time approx
30 minutes

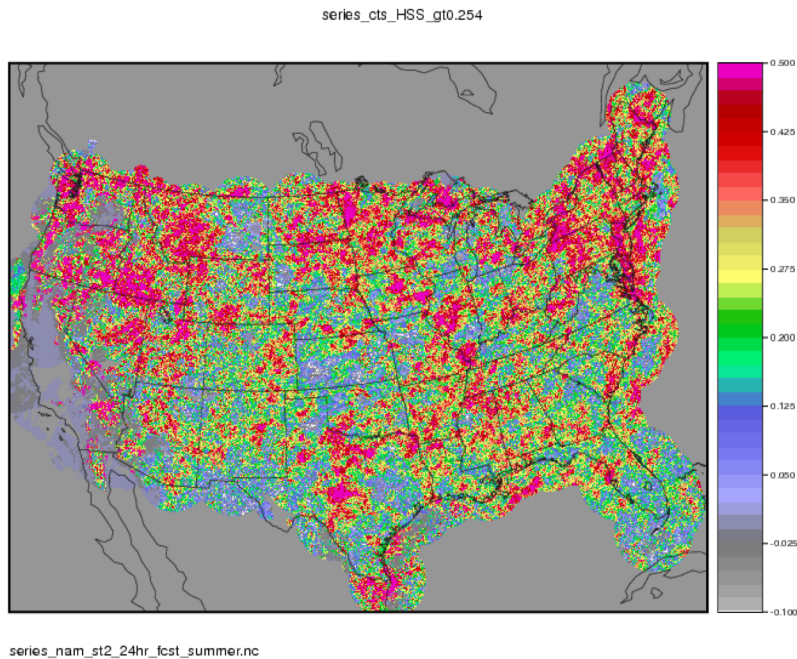
Set block_size
higher to reduce
passes and run
faster

Series-Analysis: ncdump

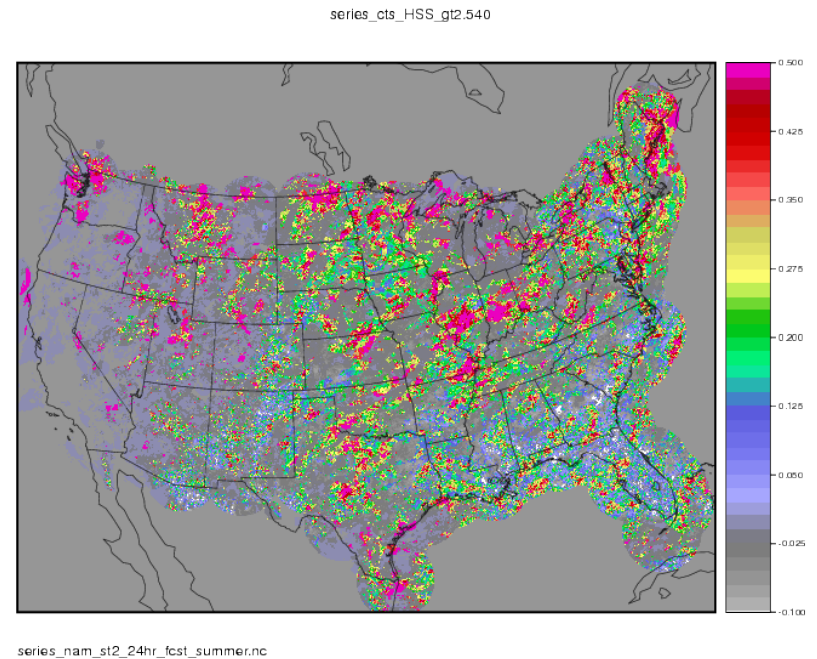
```
netcdf series_nam_st2_24hr_fcst_summer {
dimensions:
    lat = 881 ;
    lon = 1121 ;
variables:
    int n_series ;
        n_series:long_name = "length of series" ;
    float series_cts_TOTAL_gt0.254(lat, lon) ;
        series_cts_TOTAL_gt0.254:_FillValue = -9999.f ;
        series_cts_TOTAL_gt0.254:name = "TOTAL" ;
        series_cts_TOTAL_gt0.254:long_name = "Total number of matched pairs" ;
        series_cts_TOTAL_gt0.254:fcst_thresh = ">0.254" ;
        series_cts_TOTAL_gt0.254:obs_thresh = ">0.254" ;
    float series_cts_BASER_gt0.254(lat, lon)
        series_cts_BASER_gt0.254:_FillValue = -9999.f ;
        series_cts_BASER_gt0.254:name = "BASER" ;
        series_cts_BASER_gt0.254:long_name = "Base rate" ;
        series_cts_BASER_gt0.254:fcst_thresh = ">0.254" ;
        series_cts_BASER_gt0.254:obs_thresh = ">0.254" ;
    float series_cts_GSS_gt0.254(lat, lon) ;
        series_cts_GSS_gt0.254:_FillValue = -9999.f ;
        series_cts_GSS_gt0.254:name = "GSS" ;
        series_cts_GSS_gt0.254:long_name = "Gilbert Skill Score" ;
        series_cts_GSS_gt0.254:fcst_thresh = ">0.254" ;
        series_cts_GSS_gt0.254:obs_thresh = ">0.254" ;
    float series_cts_FBIAS_gt0.254(lat, lon) ;
        series_cts_FBIAS_gt0.254:_FillValue = -9999.f ;
        series_cts_FBIAS_gt0.254:name = "FBIAS" ;
        series_cts_FBIAS_gt0.254:long_name = "Frequency bias" ;
        series_cts_FBIAS_gt0.254:fcst_thresh = ">0.254" ;
        series_cts_FBIAS_gt0.254:obs_thresh = ">0.254" ;
    float series_cts_HK_gt0.254(lat, lon) ;
        series_cts_HK_gt0.254:_FillValue = -9999.f ;
        series_cts_HK_gt0.254:name = "HK" ;
        series_cts_HK_gt0.254:long_name = "Hanssen-Kuipers discriminant" ;
        series_cts_HK_gt0.254:fcst_thresh = ">0.254" ;
        series_cts_HK_gt0.254:obs_thresh = ">0.254" ;
```

Series-Analysis: Statistics

3hr APCP > 0.254 mm
(0.01 in)



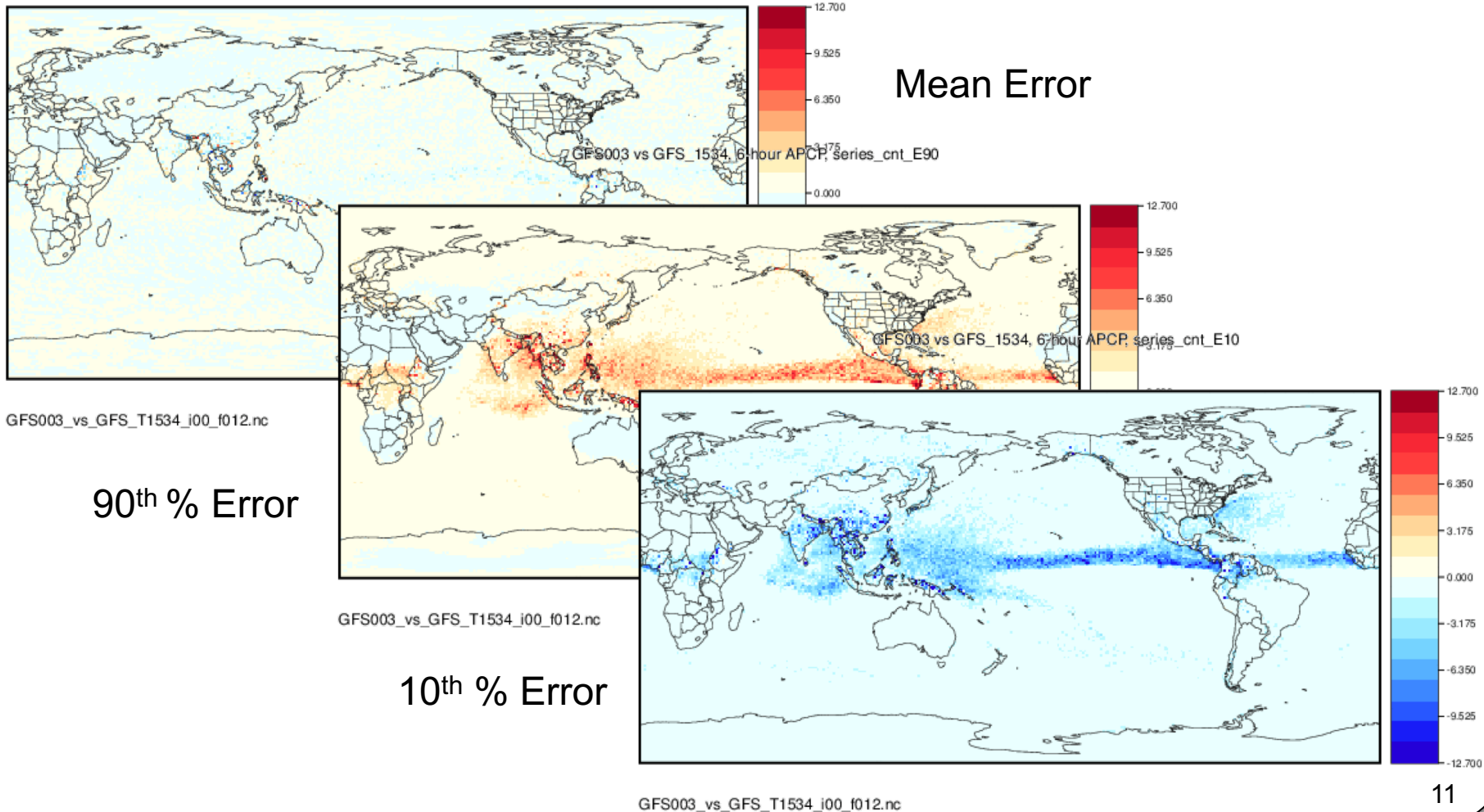
3hr APCP > 2.54 mm
(0.1 in)



Series-Analysis: Precip Bias

6 hour accumulated precipitation – Bias = FCST - OBS

GFS003 vs GFS_1534, 6-hour APCP, series_cnt_ME



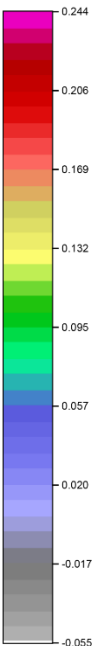
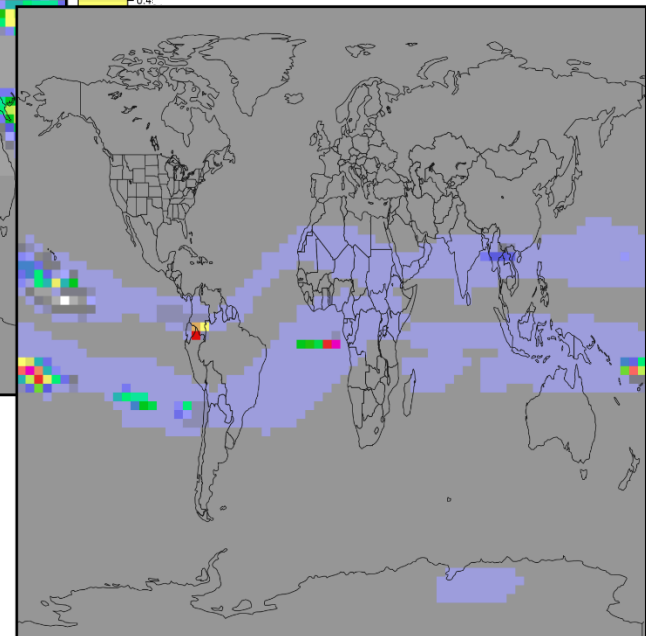
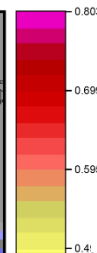
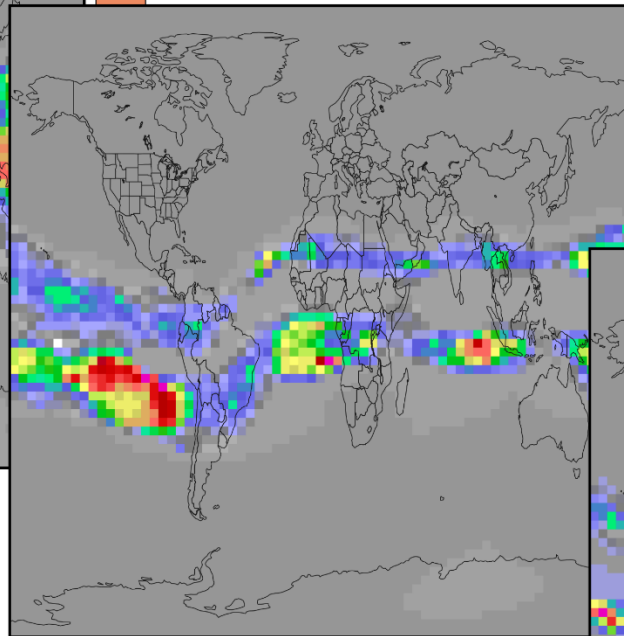
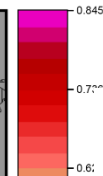
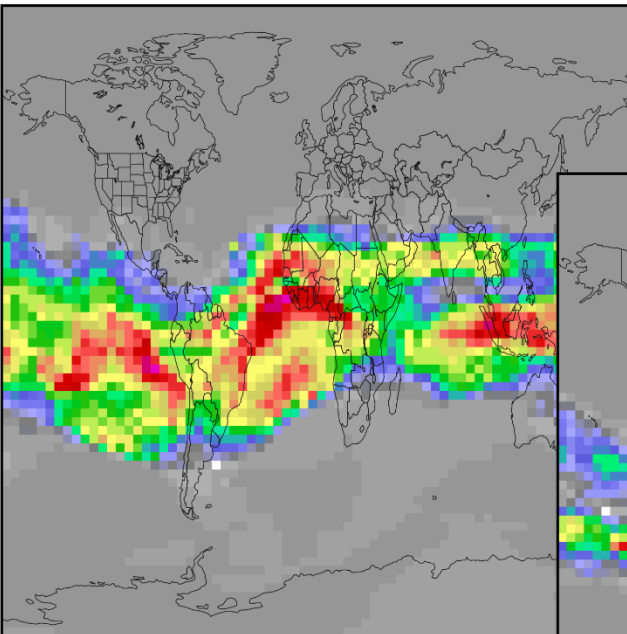
Series-Analysis: TEC GSS

Gilbert Skill Score ≥ 25

Evaluation of Ionosphere Total
Electron Count (TEC) prediction

Gilbert Skill Score ≥ 35 TEC units

Gilbert Skill Score ≥ 45



series_analysis_WAM_GloTEC_stats.nc

series_analysis_WAM_GloTEC_stats.nc

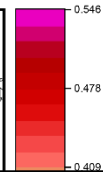
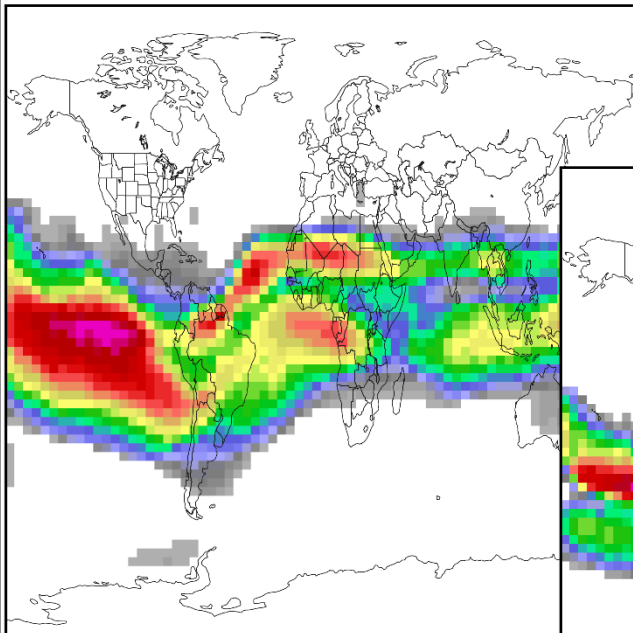
series_analysis_WAM_GloTEC_stats.nc

Gilbert Skill Score:

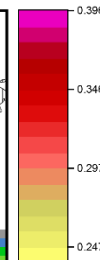
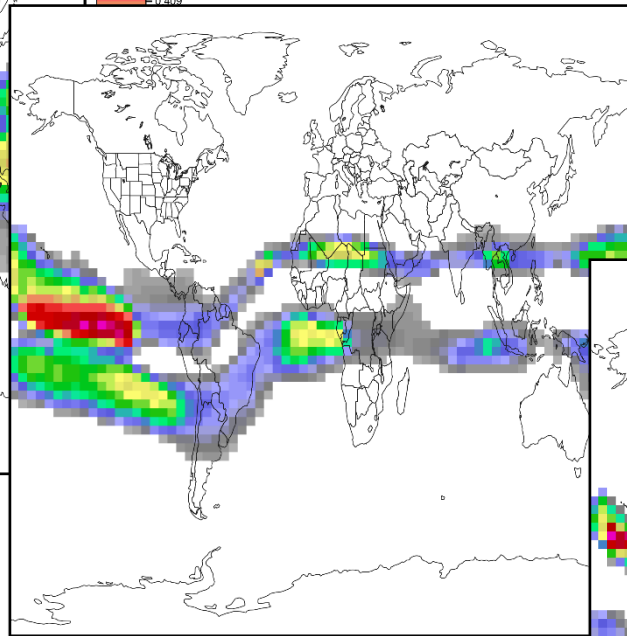
Measures the fraction of observed and/or forecast events that were correctly predicted, adjusted for hits associated with random chance

Series-Analysis: TEC BASER

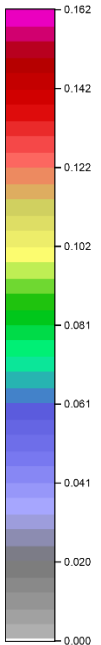
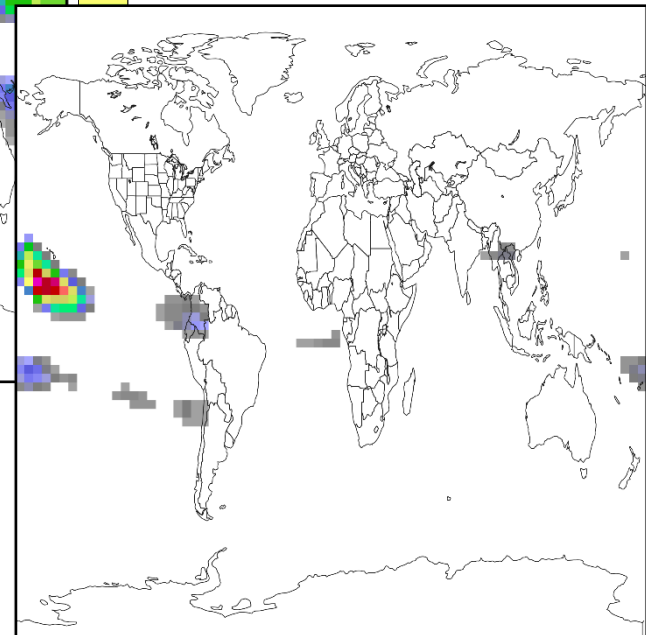
Base Rate ≥ 25



Base Rate ≥ 35



Base Rate ≥ 45



series_analysis_WAM_GloTEC_stats.nc

series_analysis_WAM_GloTEC_stats.nc

Base Rate:
Frequency of observations exceeding the given threshold

series_analysis_WAM_GloTEC_stats.nc