



Evaluation of Extra-Tropical Cyclones Using a Feature-Relative Method

Tara L. Jensen^{1,3}, John Halley Gotway^{1,3}, Paul Kucera¹, Brian Colle², Julie Prestopnik^{1,3}, Minna Win^{1,3}, Barb Brown^{1,3}

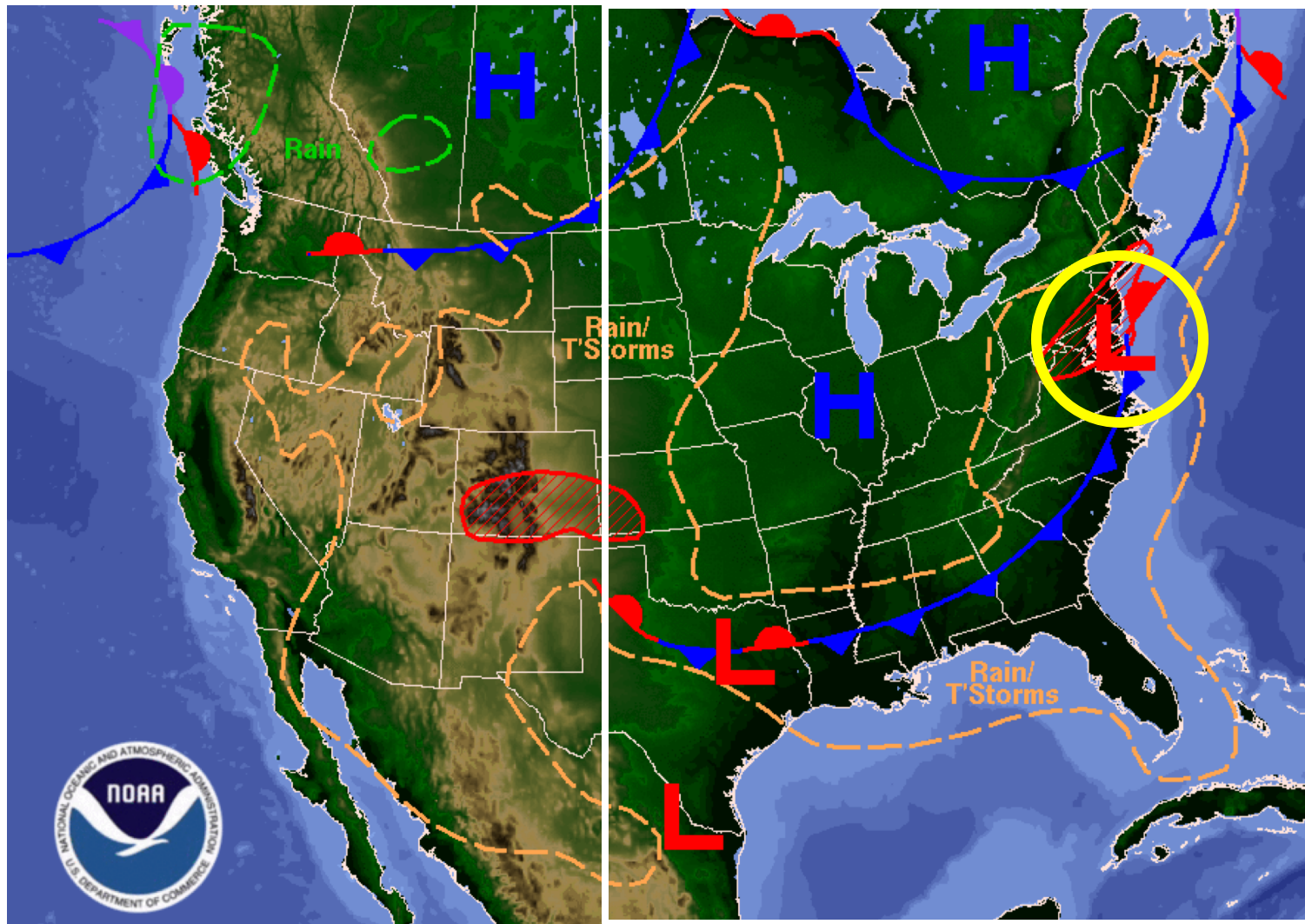
¹NCAR/Research Applications Laboratory, Boulder, Colorado, USA

²State University of New York, Stony Brook, Stony Brook, New York, USA

³Developmental Testbed Center, Boulder, Colorado, USA

METplus Tutorial
July 31 – August 2, 2019
NRL – Monterey, CA

What is Feature Relative?



Day 3 National Forecast Chart

Valid Sat, Jul 29, 2017, issued 4:56 AM EDT Thu, Jul 27, 2017
DOC/NOAA/NWS/NCEP/Weather Prediction Center
Prepared by McCreynolds with WPC/SPC/NHC forecasts

Rain

Rain and T'Storms

Rain and Snow

Snow

Flash Flooding Possible (hatched)

Severe T'Storms Possible (hatched)

Freezing Rain Possible (hatched)

Heavy Snow Possible (hatched)

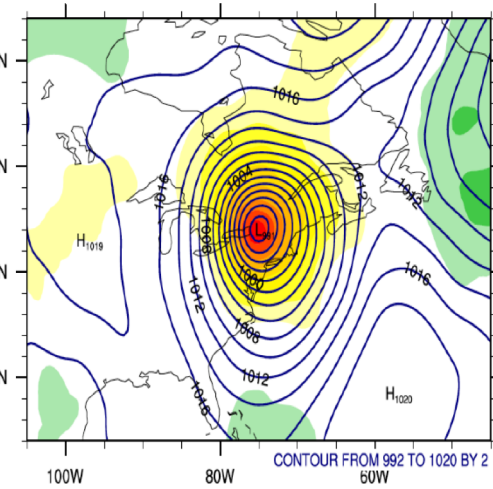
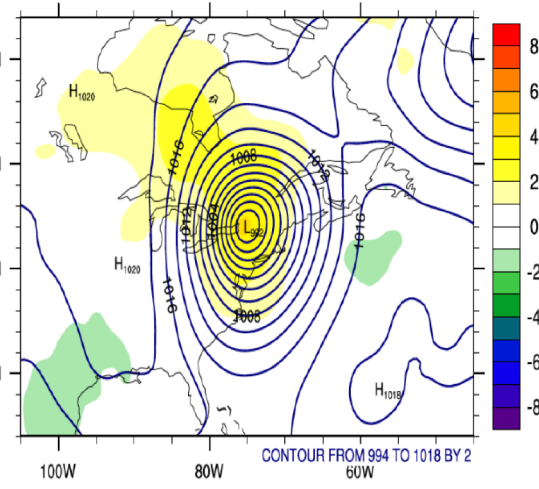
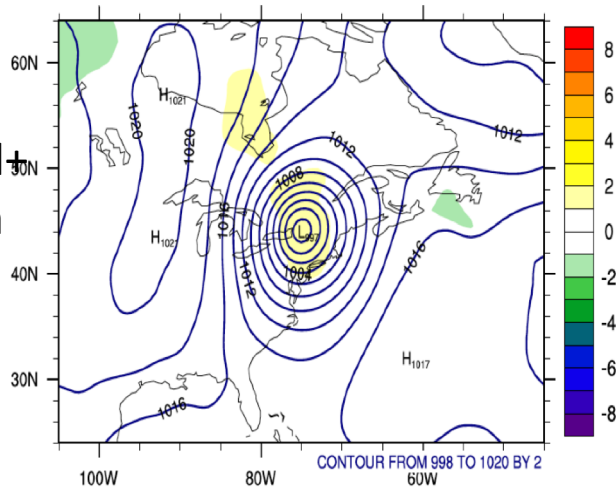
Cyclone Relative Approach –Stony Brook Univ. Software

Hour 54-72

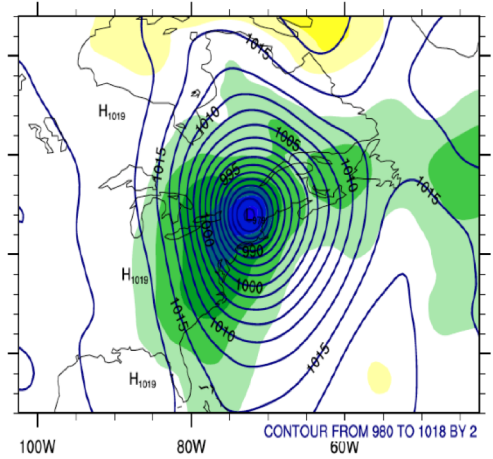
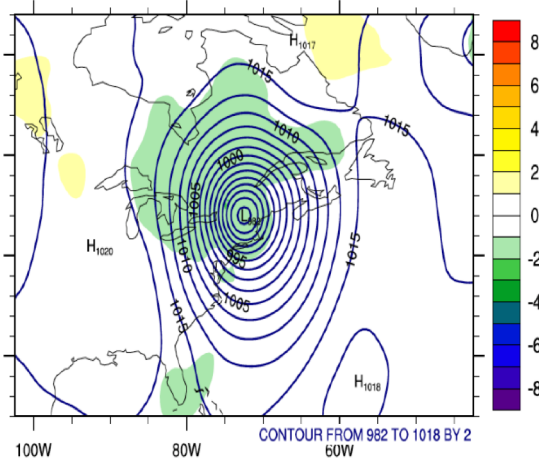
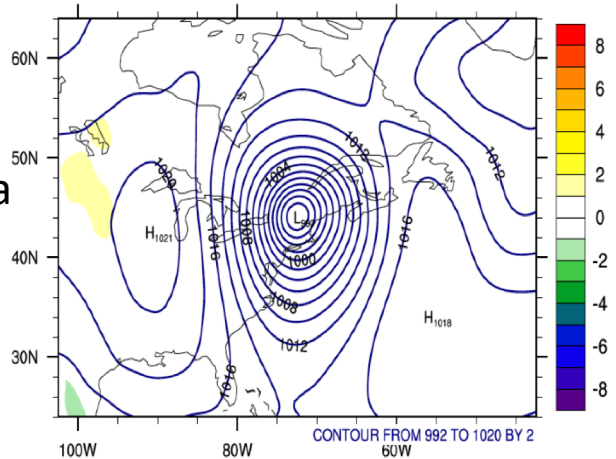
Hour 78-96

Hour 102-120

GEFS
Control
+7.5 hPa
Bias
60
storms



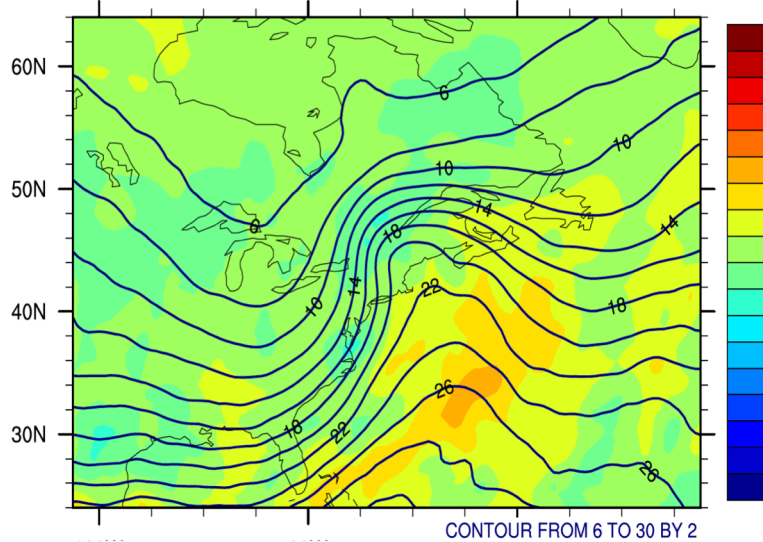
GEFS
Control
-7.5 hPa
Bias
52
storms



Cyclone Relative Approach: Integrated Moisture Errors for Over- and Under-predicted Storms

Hour 54-72

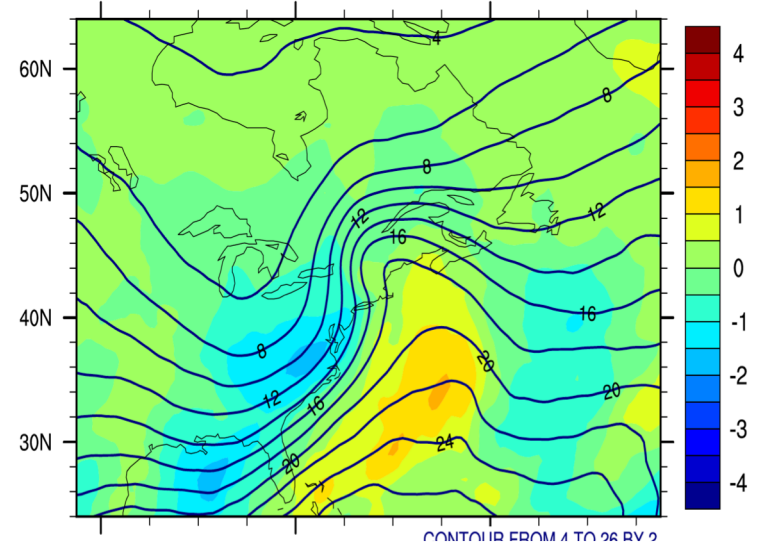
total water bias evol for (-)495 cases h54-72(kg/m²)



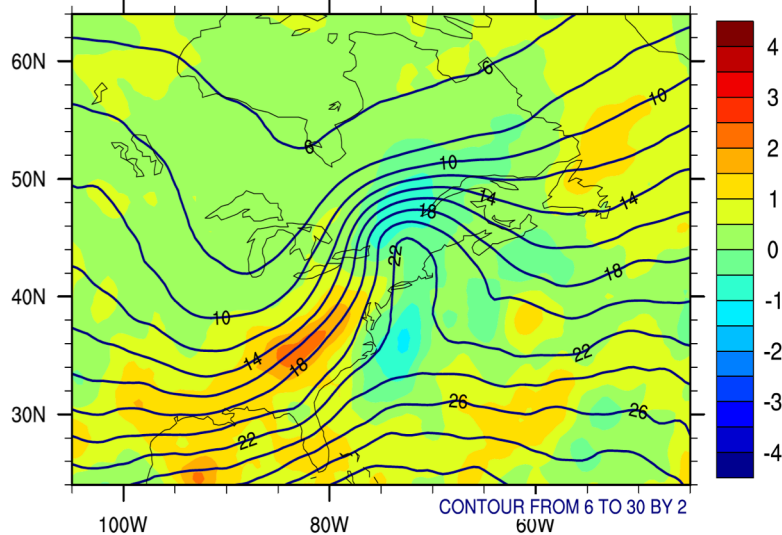
Day 5
GEFS
Control
-7.5 hPa
Bias
52
storms`

Hour 78-96

total water bias evol for (-)811 cases h78-96(kg/m²)

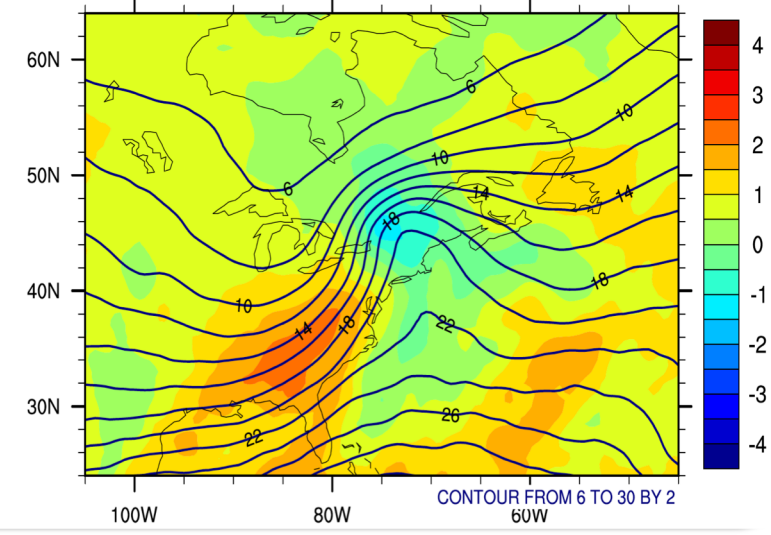


total water bias evol for (+)497 cases h54-72(kg/m²)



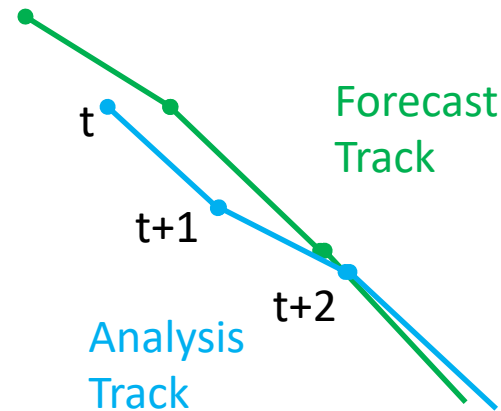
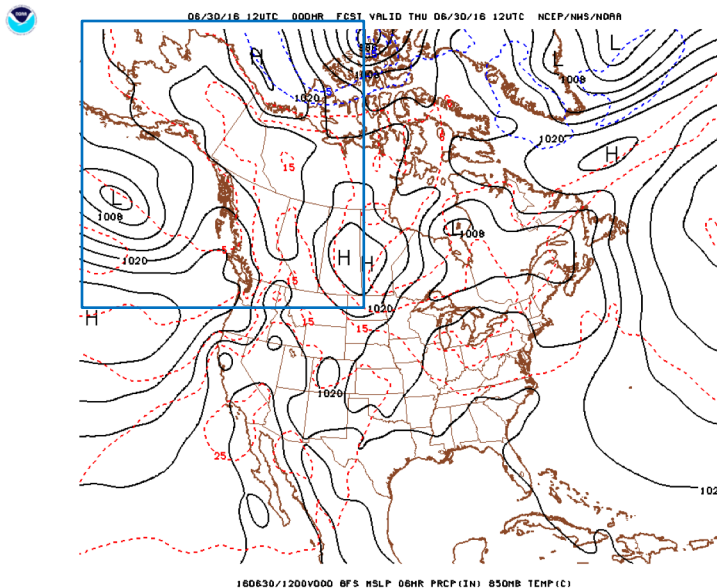
Day 5
GEFS
Control+
7.5 hPa
Bias
60
storms

total water bias evol for (+)923 cases h78-96(kg/m²)



Depiction of Cyclone Relative Evaluation

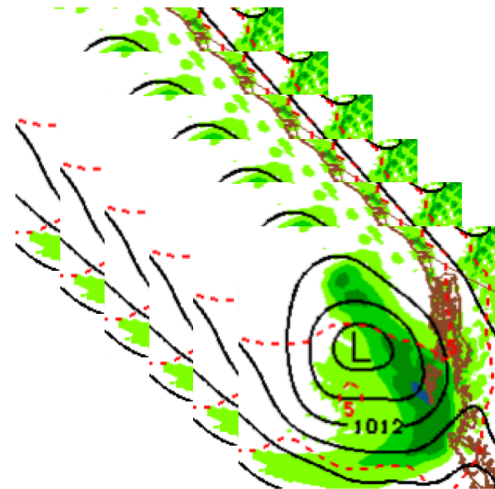
Area of Interest



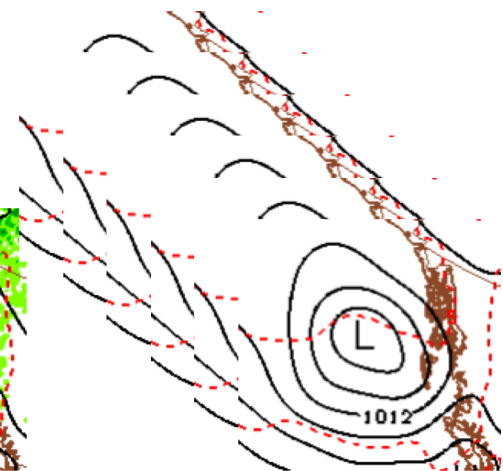
Methodology

- Run tracker on forecast and analysis field
- Use METplus to extract a tile centered on each lat/lon pair of track
- Use MET Series-Analysis to compute statistics for paired fields within tile irrespective of displacement

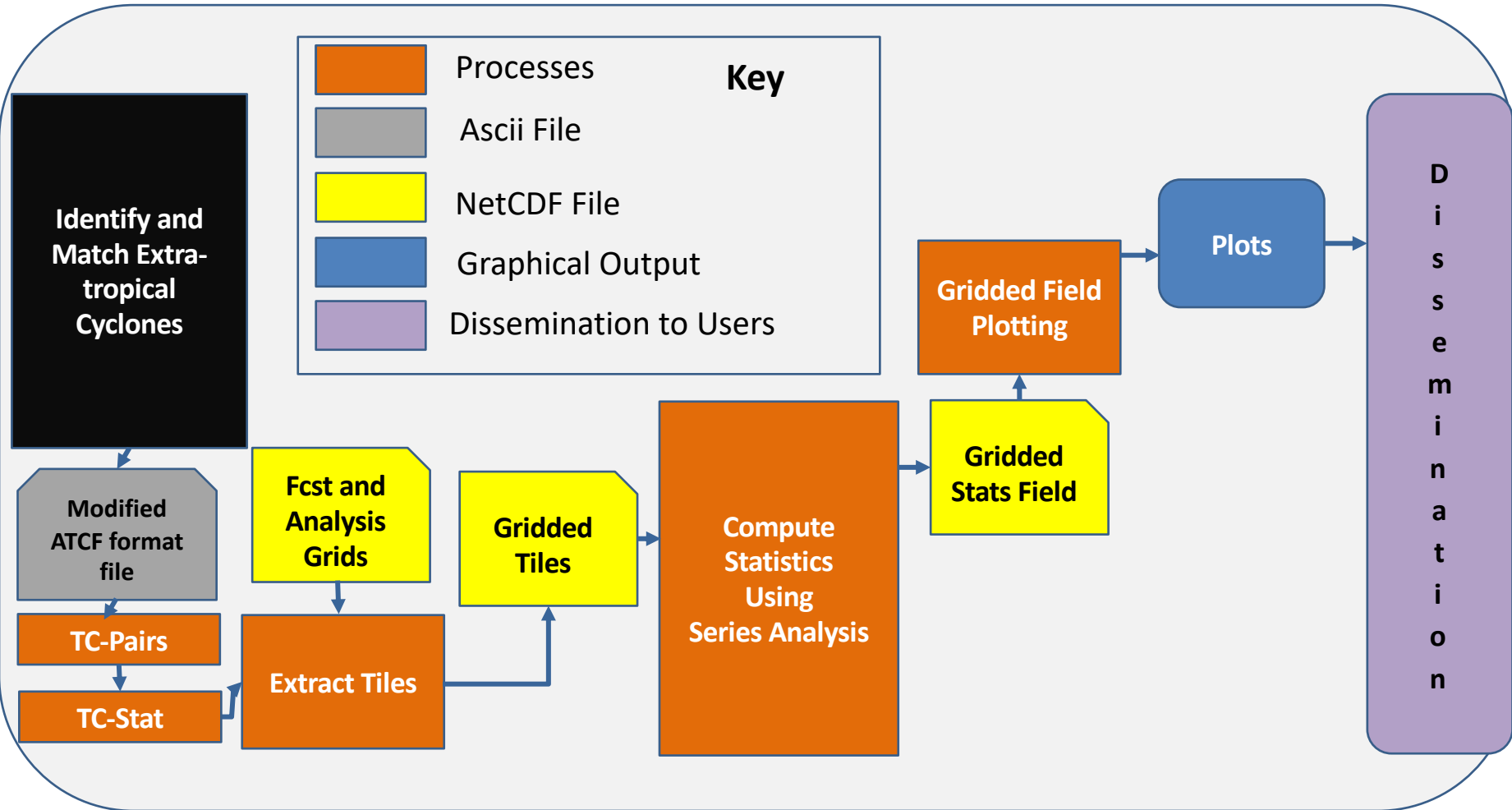
Forecast



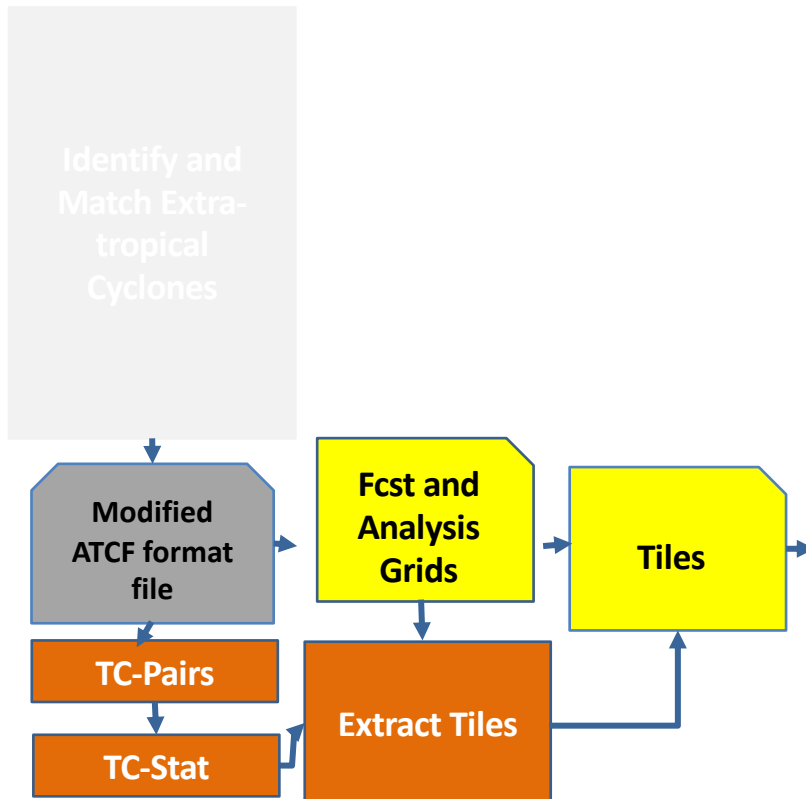
Analysis



Cyclone Relative Evaluation System within Model Evaluation Tools (MET)+



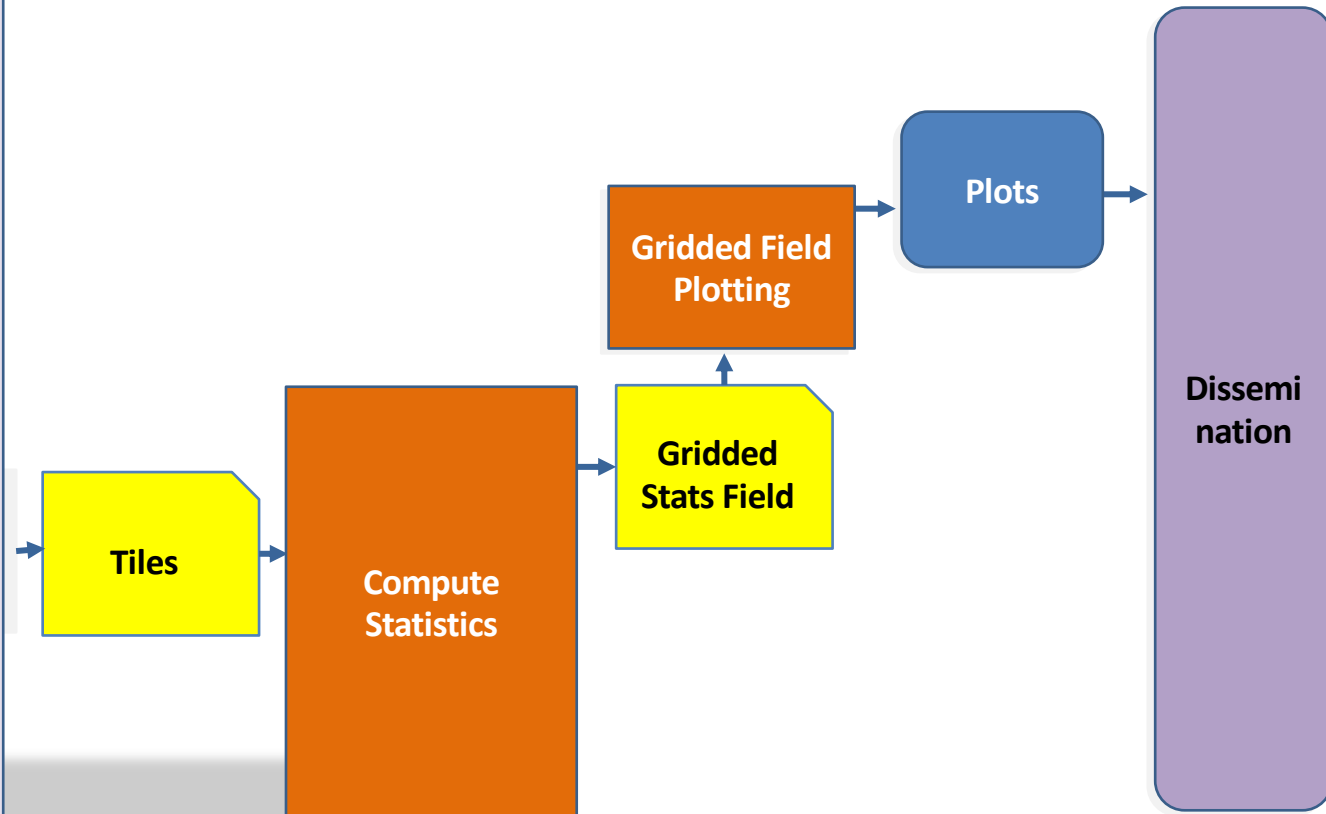
Cyclone Relative Evaluation System



- **Reformat modified ATCF file** into a format MET can read using scripting
- **Extract pertinent Lat/Lon pairs** from track info
- **Extract Tiles – dimensions user defined**
 - **Option 1** - extract to a separate file and throw away other data (saves space)
 - **Option 2** - Pass Lat/Lon to MET gen_vx_mask tool mask field on the fly (saves complexity)
- **NOTE:** Any field in the gridded files may be used (e.g. state variables and wind speeds, stability indices, precipitation)

Cyclone Relative Evaluation System

- **Pass a series of tiles or masks into MET Series_Analysis tool**
- **Use new option “-force” to tell Series_Analysis to disregard displacement errors**
- **Compute statistics**
 - RMSE, Bias, etc...
 - CSI, ETS, Freq. Bias etc...
- **Gridded score fields and ascii output written**
- **Scores Plotted and Disseminated**



Preliminary Results

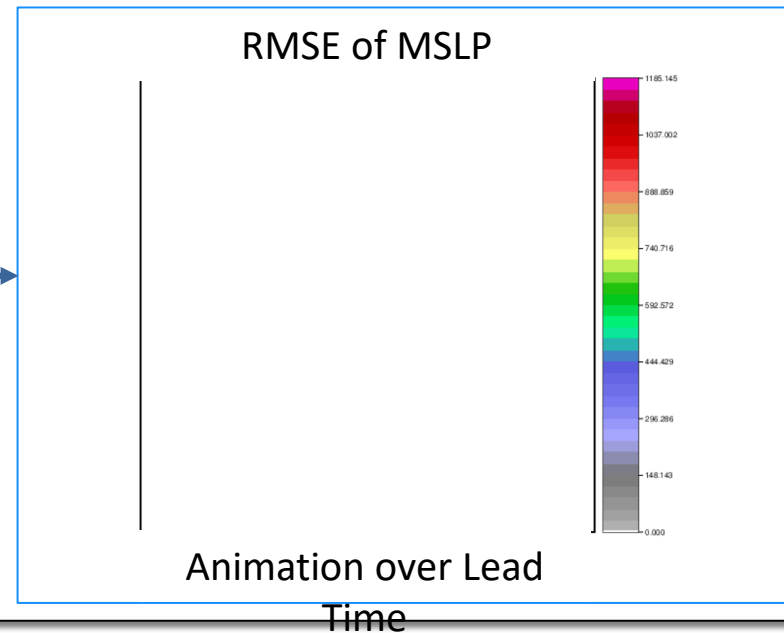
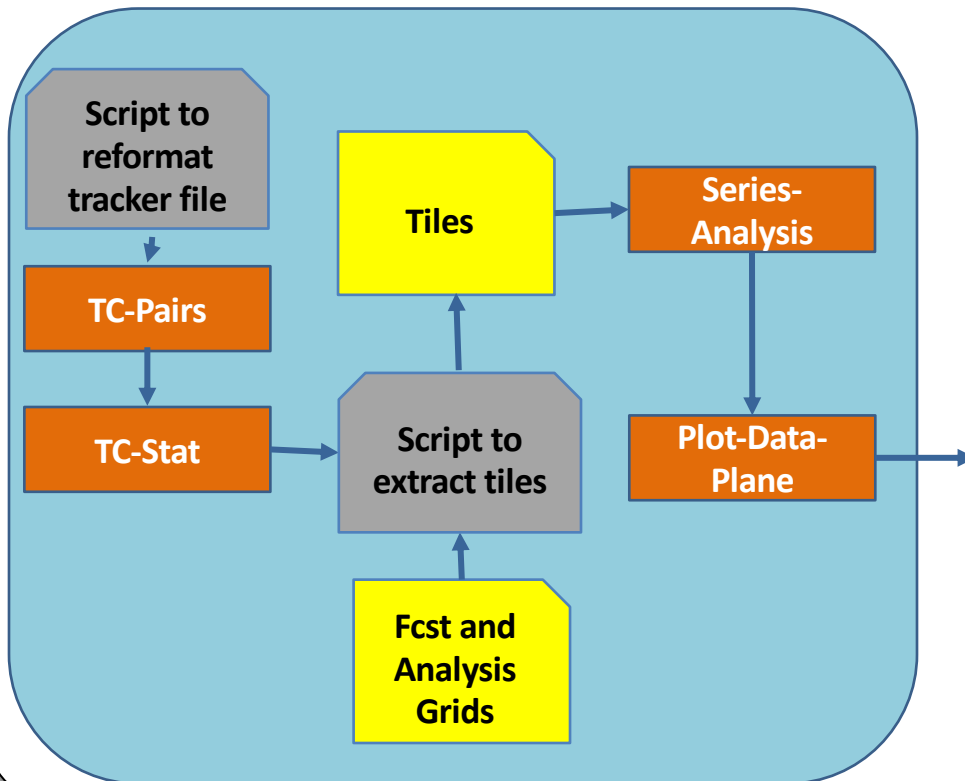
PI

Stony Brook Univ.

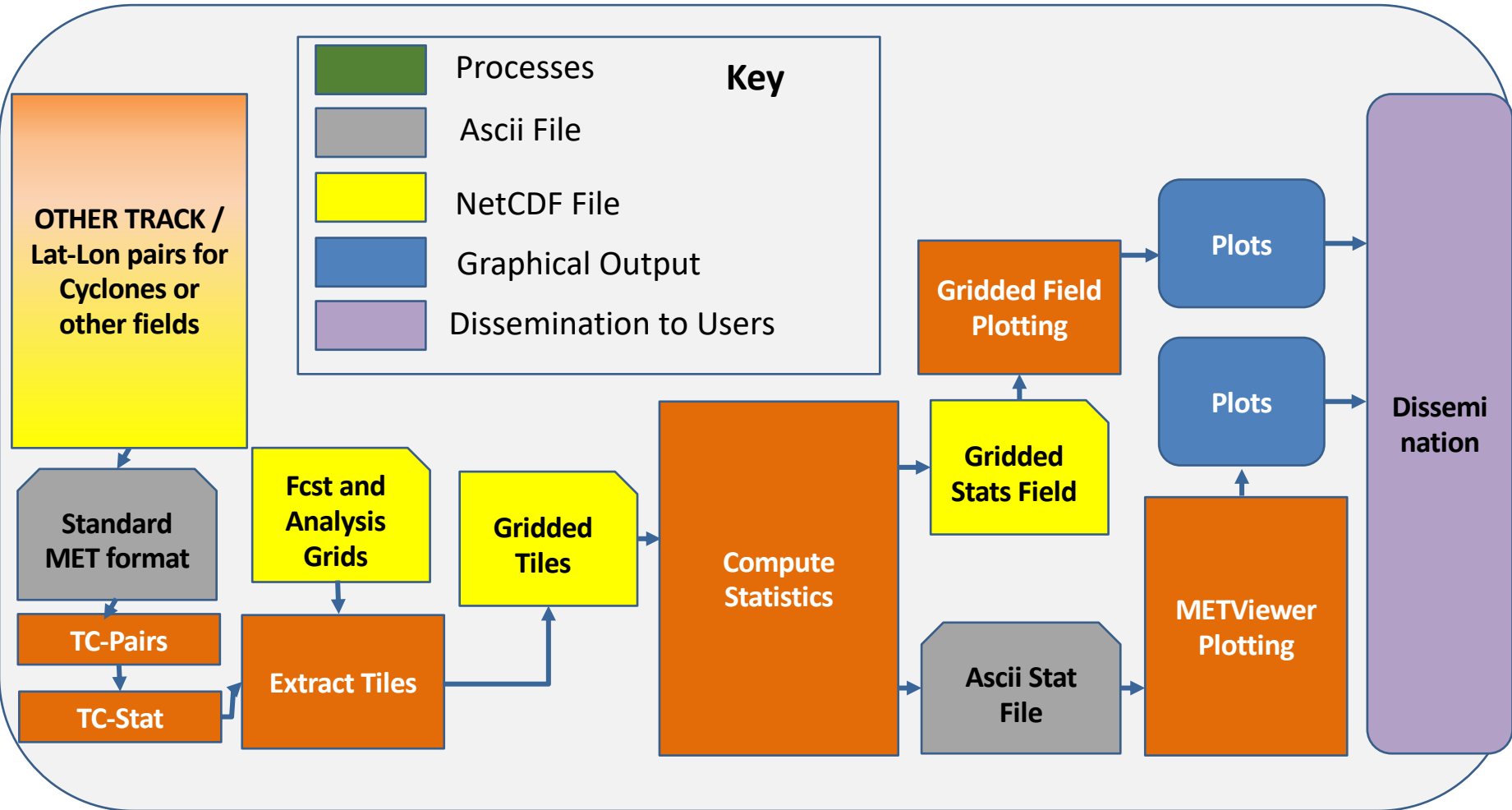
Released for testing on 2/6/17

- Uses TC-Pairs and TC-Stat to identify location of and extract tiles
- “Stack up” tiles by lead or init time to compute systematic errors about “feature” using Series-Analysis
- Plot results using Plot-Data-Plane (quick-look plotting)

Python Wrappers

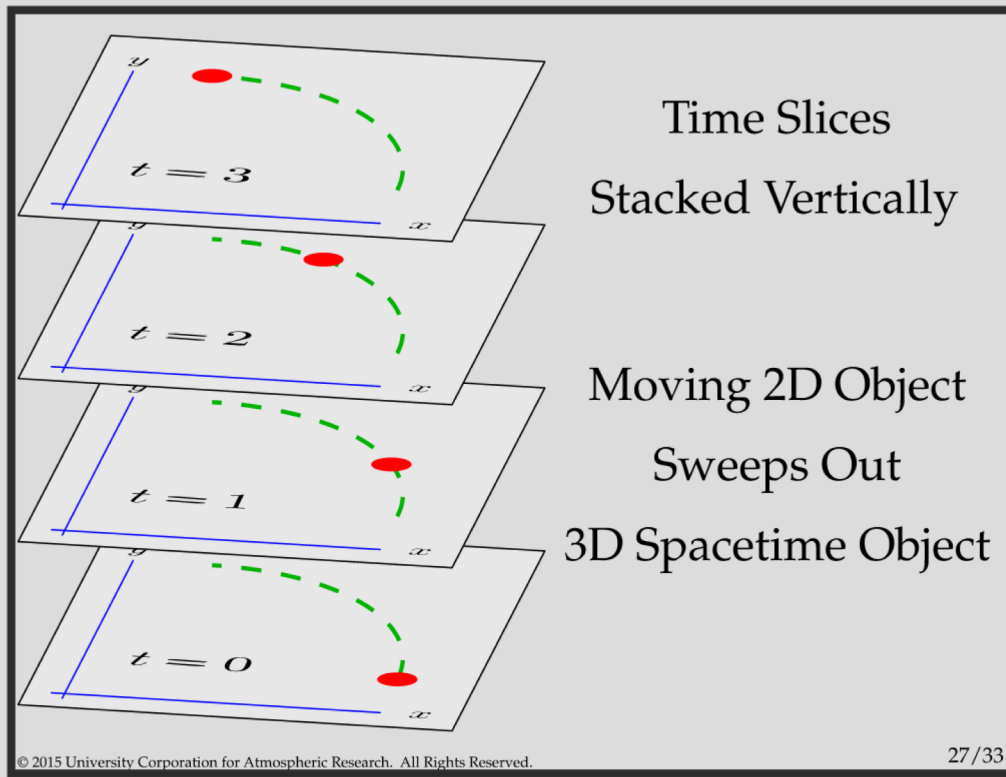


Cyclone Relative Evaluation System within Model Evaluation Tools (MET)+



Future Feature Relative Functionality

Use MODE Time-Domain for the track



Future Work: Transition to Feature Relative Evaluation System

Other Applications

- Tropical Cyclones
- Feature centric evaluations such as snowbands, extreme precipitation and turbulence
- Storm centric evaluation of MCSs, Convective Lines and other storms

