

# Development and Implementation of Dynamic Scripts to Support Local Model Verification at National Weather Service Weather Forecast Offices

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## BACKGROUND

- A number of local National Weather Service (NWS) forecast offices run a version of the Weather Research and Forecasting (WRF) numerical weather prediction (NWP) model called the Environmental Modeling System (EMS) at high resolution to complement global and larger-scale regional model guidance
- While forecasters may be able to eventually understand the biases in their model through daily use, effectively evaluating model performance requires a combination of quantitative metrics and case studies
- The Model Evaluation Tools (MET) software package was developed at National Center for Atmospheric Research (NCAR) Developmental Testbed Center (DTC) as a highly-configurable, state-of-the-art suite of verification tools for comparing gridded model output to point-based observations or gridded observations
- The DTC manages and distributes the MET code, but it is up to individual users to configure namelists and properly link model forecasts and verifying observations, which can take considerable time for those not familiar with how the software works
- The objective of this project is to develop and disseminate a set of dynamic scripts that enable researchers and operational weather forecasters to quickly evaluate their model output without needing detailed working knowledge of MET
- The MET Scripts make it possible to
  - process statistics for multiple forecasts initialized at the same date and time (e.g., a control and experiment, or model sensitivity studies), and
  - generate composite error statistics for a collection of simulations

## APPLICATIONS

- The SPoRT MET Scripts have been used by a number of collaborators to easily implement objective verification of operational local model runs; details of select projects are outlined below

### 1. CONVECTIVE INITIATION (SEE WAF/NWP 14.6)

- Collaboration with NWS Southern Region to investigate how well local models forecast convective initiation (CI)
- Improvements to CI found with inclusion of SPoRT higher-resolution land and water surface datasets, but model tended to be too dry
- Currently using MET Scripts to evaluate optimal physics configuration within WRF to simulate CI using new higher-resolution land and water surface datasets (see sample results in Fig. 2)
- Final results to provide guidance to local modelers in the SEUS

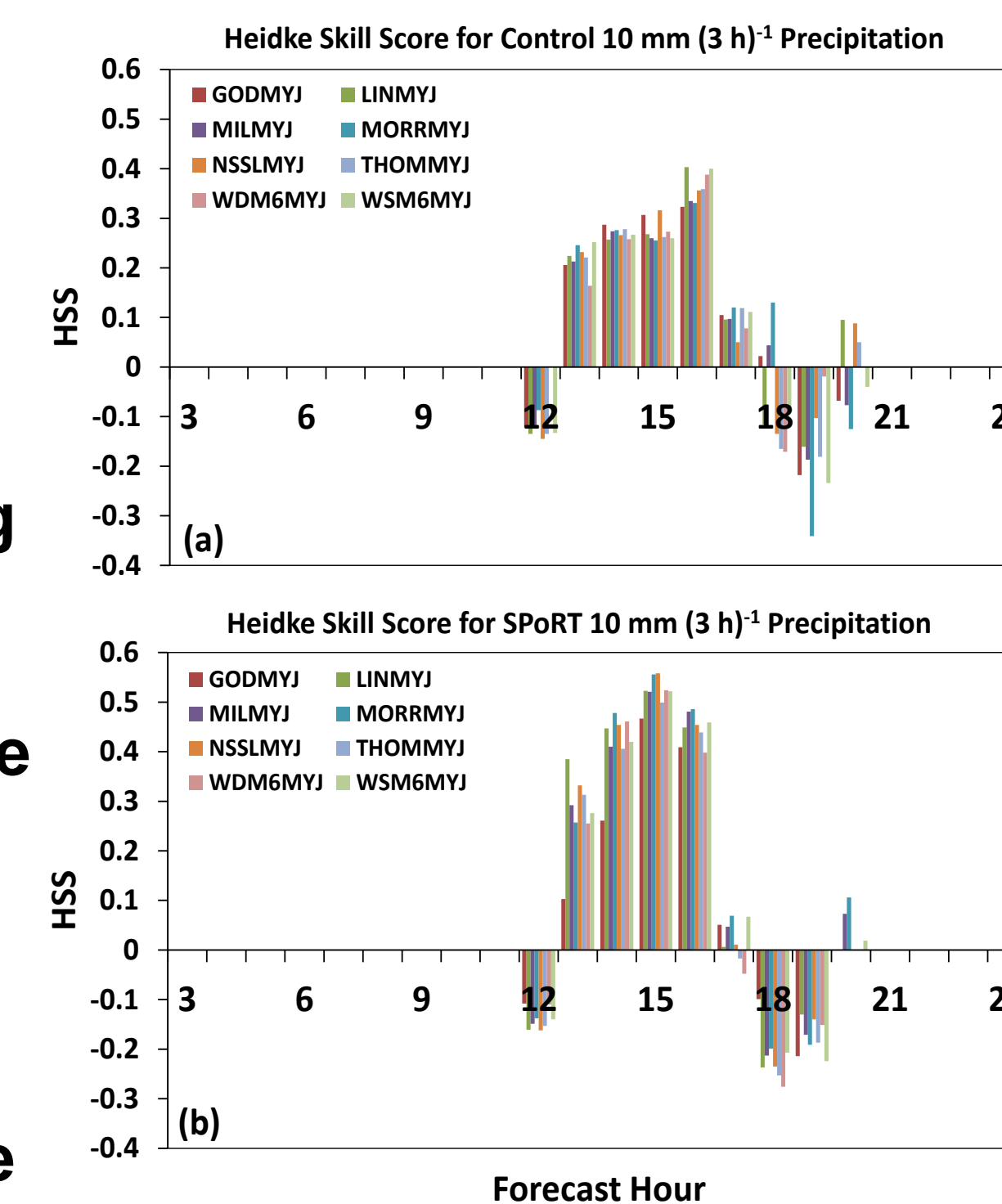


Figure 2. Heidke Skill Score (HSS) for 3-h precipitation at 10-mm thresholds for a set of EMS forecasts using (a) standard initialization fields, and (b) high-resolution SPoRT data.

### 2. LAKE EFFECT SNOW

- NWS Eastern Region runs an operational local model ensemble to forecast the onset, dissipation, and inland extent of lake-effect snow
- Some members of their ensemble use SPoRT high-resolution (2-km) lake-surface temperature (LST) instead of the legacy RTG LST (1/12-deg)
- SPoRT-MET scripts are being used to evaluate the results of individual ensemble members

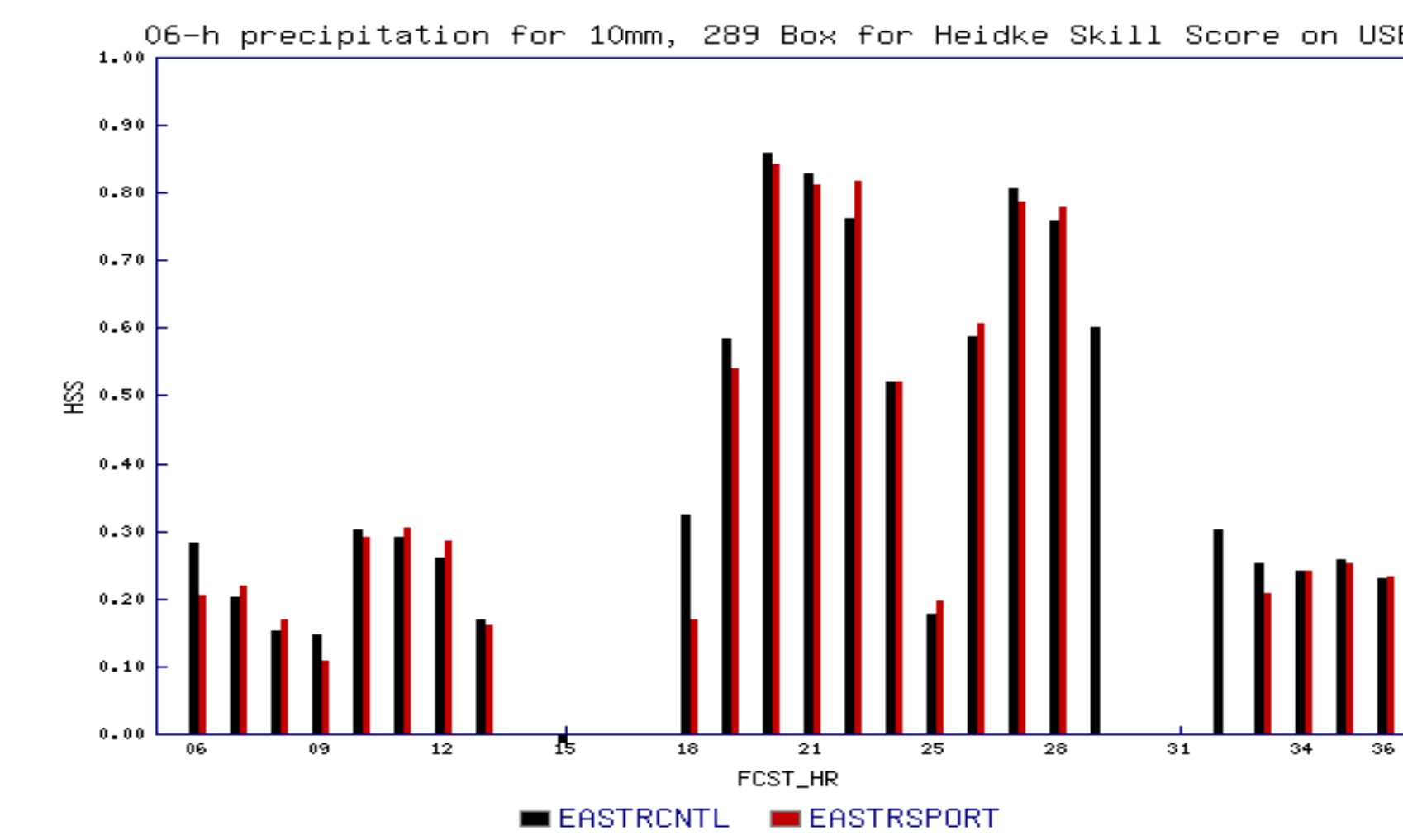


Figure 3. Sample output from Perl graphing module showing 6-hr accumulated precipitation HSS for two individual ensemble members: one using standard initialization (EASTRCNTL; black) and one using SPoRT initialization (EASTRSPORT; red)

### 3. MESOAMERICA/KENYA (SEE WAF/NWP J9.4)

- Collaboration with NASA/SERVIR to enhance modeling capabilities at international hubs
- EMS for Mesoamerica is being run in the cloud; EMS for Kenya being run locally at SPoRT
- SPoRT is running MET in near real-time (constrained by observation data latency) to verify the operational model output and post statistics figures on website for evaluation
- Plan to transition scripts to both hubs

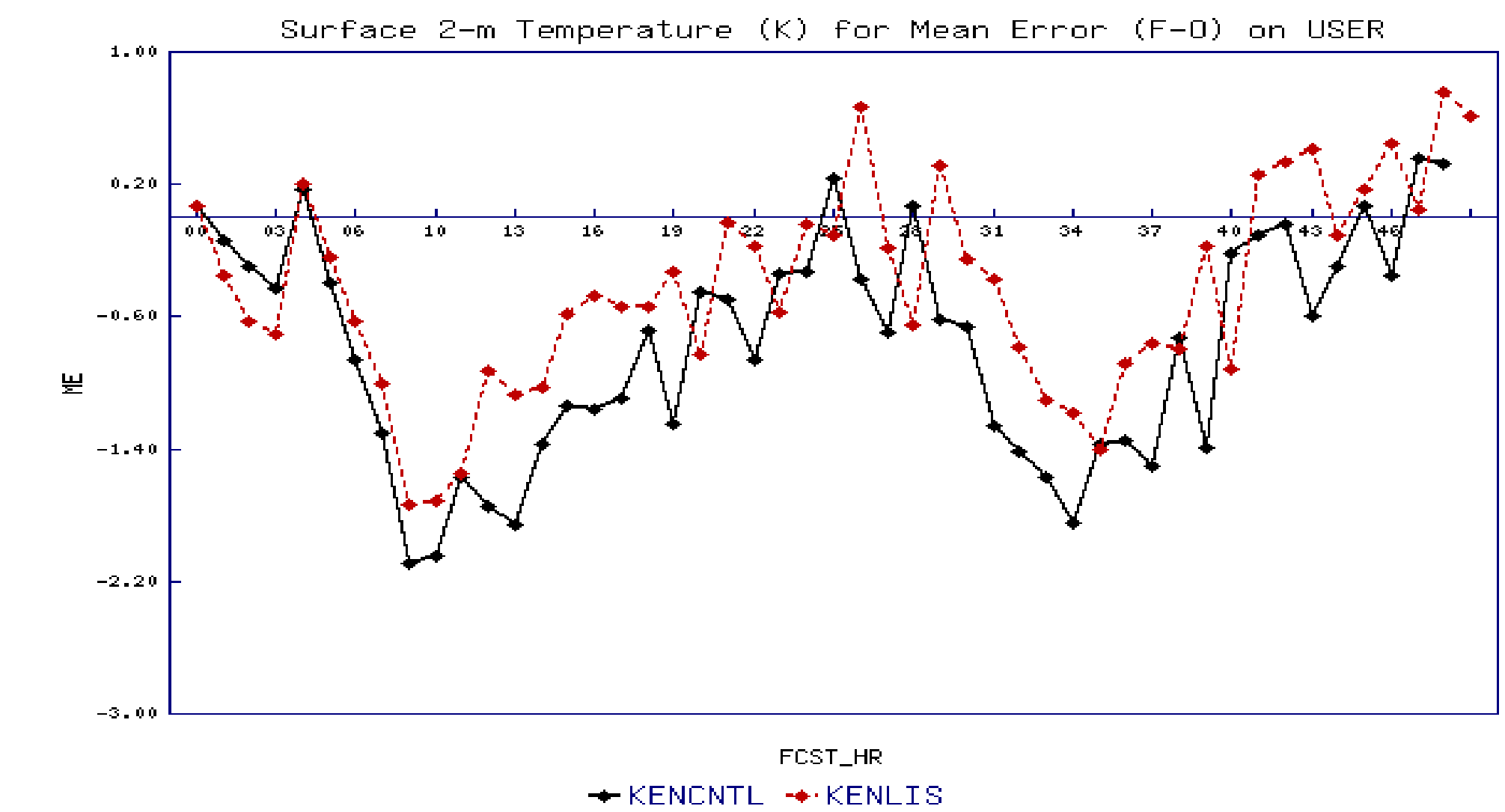


Figure 4. Sample output from Perl graphing module showing 2-m temperature mean error (i.e., bias) for a control (KENCNTL; black) and experiment (KENLIS; red) over an East-Africa domain

## CODE INFRASTRUCTURE

- Open source scripts written in Perl with included modules to run various components of MET (see red stars in Fig. 1) that wrap around the individual MET executables allowing for “set it and forget it” statistics processing
- Current version of SPoRT MET Scripts (v4.1.2) is compatible with latest version of MET (v4.1; including bug fixes)
- Unique features:
  - Single configuration file for all MET programs
  - Automatically downloads and configures MADIS observations
  - Sums Stage IV precipitation for any accumulation interval
  - Generates hourly quick-look plots for all statistics

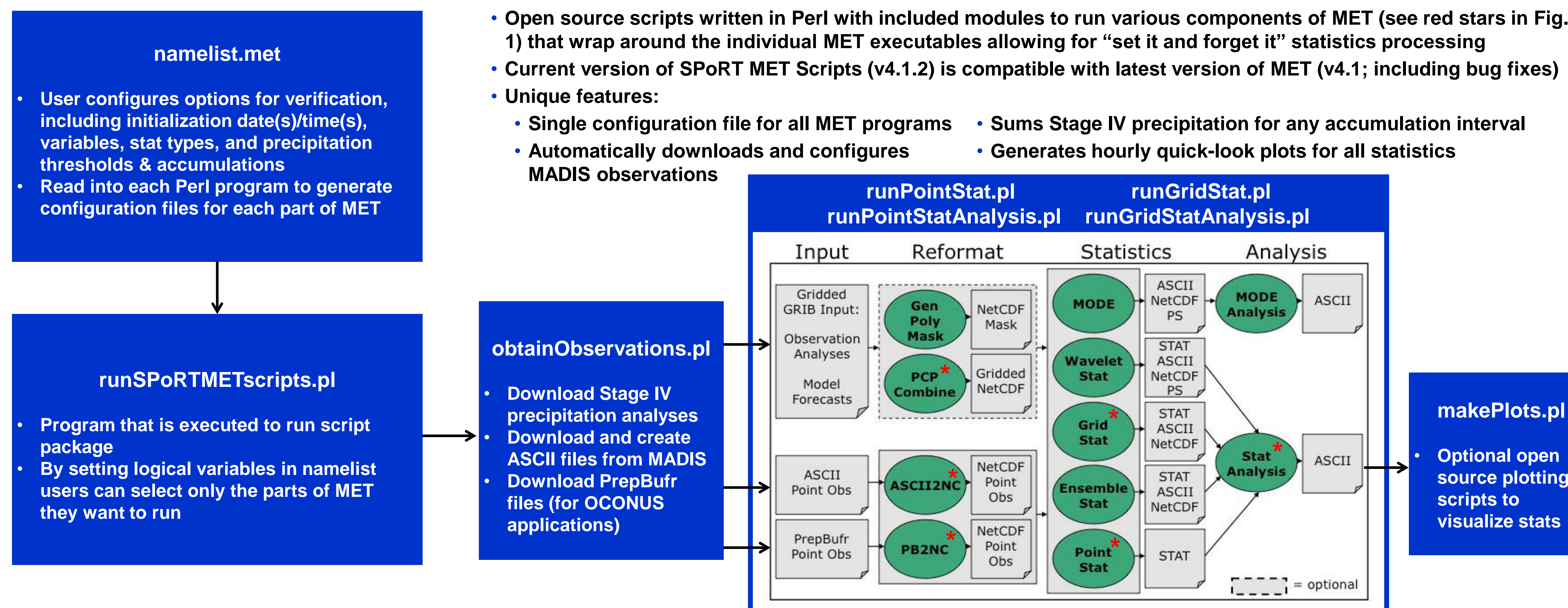
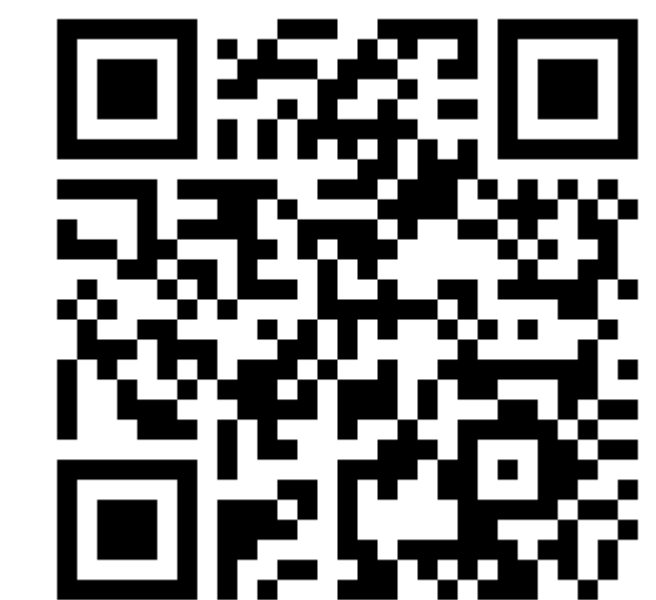


Figure 1. Schematic of SPoRT MET Scripts with blue boxes indicating additional capabilities provided by the scripts. Center figure is schematic of MET (red stars indicate current functionality of scripts) from the MET User's Guide.

## HOW DO I GET THE SCRIPTS?

- <ftp://geo.nsstc.nasa.gov/SPoRT/modeling/metScripts> or scan the QR code below
- User must first download and compile MET source code from DTC (<http://www.dtcenter.org>)
- If you plan to use the scripts for your research please acknowledge NASA SPoRT as the script developers
- Contact Brad Zavodsky at [brad.zavodsky@nasa.gov](mailto:brad.zavodsky@nasa.gov) for more information or if you have questions about the scripts and/or their use



## FUTURE DEVELOPMENTS

- Update the scripts as new versions of MET are released
- Add capabilities to perform object-based verification (MODE) for precipitation and other gridded fields
- Integrate MET Scripts into EMS and output to AWIPS II
- Add verification of NASA satellite datasets