

5.3 GFE METHODOLOGY AND EXTENDED CAPABILITIES

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1. Introduction

The National Weather Service Graphical Forecast Editor (GFE) in AWIPS provides a bridge between data models and forecast products. It furnishes the capability for meteorologists to edit grid-based data, produce a wide variety of graphical forecasts, and then output grid-based text products. As part of the Rapid Prototyping Project, the Tampa Bay Area NWS Office has participated in development of the GFE with NOAA Forecast Systems Laboratories. The system is enhanced by flexible Python scripting permitting extensive localization.

Using the GFE, forecasters must perform substantial grid manipulation, in one to twelve hour increments, to provide meaningful and accurate public, marine, and fire weather forecasts out as far as seven days. Methodology is very important to provide forecasters a clear, concise routine with sound scientific basis for producing products. In this paper, we describe such a methodology showing the flow from initialization of model data to production of graphical, text, and html forecast products. The model data access and scripting capability of the GFE permits implementation of simple models to produce new fields or enhance existing ones. Much of the basic grid editing is accomplished by using GFE Smart Tools that utilize key forecast fields to derive other fields. For example, from the weather field, it is possible to derive estimates of sky cover, QPF, PoP, and Lightning Activity Level (LAL).

The software's scripting and grid manipulation capability extends beyond input and manipulation of model data by providing methods to derive new forecast parameters. For example, a wind regime-based lightning climatology (Lericos, 2000) is introduced into the GFE as a grid that forecasters may use as a basis for forecasting weather related fields.

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2. Methodology.

The GFE forecast process is straightforward and proceeds as follows:

- A. Choose and load forecast models into the GFE.
- B. Where needed, graphically adjust the four key fields. (Wx, Wind, T, Td)
- C. Interpolate grids with time gaps.
- D. Run Smart Tools to modify and provide consistency to all other forecast fields.
- E. Save and publish the forecast.
- F. Make the Graphics, text, and html files.
- G. Transmit the data to AWIPS and to the web page.

Depending on local configuration and which models are input, grids may encompass a 1, 3, 6, or 12 hour time frame. Public forecasts extend to seven days and comprise six separate forecast elements leading to the possibility of nearly 300 grids. Consider the other forecasts the typical coastal Weather Forecast Office produces, and the number swells to over 400 grids! With a potentially overwhelming number of grids for forecasts that extend to five or seven days, the GFE software developers built scripting capability into the software. These Python scripts can streamline processes that may require many mouse clicks to accomplish otherwise. Python scripts used in GFE fall into several categories: 1) Smart tools, 2) Procedures, and 3) Text formatters. Smart Tools are used for manipulating grids through simple relationships, or formulas, based on a variety of either existing forecast grids or model data. Procedures provide a method for running multiple smart tools for specified periods of time. Text formatters put the gridded data into text products. Important to this process is conversion grids to six hour time spans where possible. This limits the number of grids to be resolved.

This methodology describes a process using procedures to: 1) load new model data, 2) create new grids, 3) edit four key fields (weather, wind, temperature, dewpoint), 4) Initiate procedures that call Smart Tools.

3. Smart Tools

Smart Tools limit the number of grids potentially edited. In addition to faster editing, another benefit of using Smart Tools is to provide forecast consistency. For example, when weather based Smart Tools are used, areal extent and characteristics of weather areas match PoP, Sky, QPF. This consistency works into other grids, such as consistency of T and Td grids corresponding to RH. The smart tools produce a good first guess but may not produce favorable results for all situations. Therefore, some editing of derived fields may be required. Table 1 shows public, marine, and fire weather forecast fields derived from the four key fields using Smart tools.

Table 1. Forecast Elements derived from the four key fields using Smart Tools		
Weather	Wind	Temperature/ Dewpoint
PoP	Trans Wind	Max T
QPF	Wave Height	Min T
Sky	Dispersion	RH
LAL		Max RH
Ceiling		MinRH
		Wind Chill
		Heat Index
		Mix Hgt

4. Procedures

Procedures are used in this methodology to: 1) load new model data, 2) create new grids, 3) edit four key fields (weather, wind, temperature, dewpoint), 4) Initiate procedures that call SmartTools. Built into the Procedures are graphical point and click interfaces such as radio buttons, check boxes, entry boxes, and scales (slider bars). These widgets easily provide flexibility for forecasters to select the appropriate tools. Several Procedures are used in this methodology. The first Procedure typically used in the forecast process loads model data and makes new grids for a specified time frame, for fields not directly available from the models. Once a time frame is specified using scale widget, the forecaster selects a model of choice. If the forecaster selects the full time range available (0 to 240 hours), then the MRF model is loaded to

240 hours, the AVN to 120 hours, and a shorter term model loaded to its duration. Most often though, the forecaster simply makes minor adjustments to the existing database. Typically, the only times all grids are replaced with new model data are in dynamically changing situations. Next the forecaster edits the four key fields and then runs a Procedure to collectively or individually interpolate those key fields. The forecaster then uses another Procedure to collectively or individually run Smart Tools. Procedures may also be run from the command line using a cron or timer routine. This may insure certain fields are automatically loaded at prescribed times.

5. Text Formatters

A series of Python scripts provides capability for extracting data from the model grids. Performing vector or scalar analyses, scripts extract data in from the grids. Maxima, minima, averages, and other methods may be used to gather the grid data for a specific edit area. Next, the data are either put into tables or phrase products. Since html files are comprised of text, elaborate and dynamic web pages may be produced.

6. Conclusions and Future Work

The methodology described in this paper provides the forecaster tools to simplify the arduous task of preparing many forecast grids. The routine continues to evolve as GFE capabilities evolve. The recently developed Smart Initialization provides a flexible way to extract fields from the models. In the future, other fields such as climatologies will be used, where suitable, to represent particular forecast situations. One such particular climatology is a wind regime based, hourly lightning climatology data that often represents the Florida Summer thunderstorm cycle better than forecast model grids. Other future products include Hazardous Weather Outlooks, and development of smart tools for severe weather prediction fields and improved fire weather indices are already underway. GFE tools permit science to rule and guessing to wane. This is hands-on forecasting!

7. References

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