

# 8.11 EXAMPLES OF GRAPHICAL FORECAST EDITOR USE IN OPERATIONS DURING 2003

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## 1. INTRODUCTION

In the last few years, the Graphical Forecast Editor and supporting software (called the GFESuite or GFE) has become the primary tool that operational forecasters at the National Weather Service (NWS) offices use to create and edit their gridded forecast fields (LeFebvre et al., 2003). The GFESuite provides a wide range of tools and capabilities for this purpose, but it has been left up to the NWS regions, individual forecast offices, and ultimately individual forecasters to decide what approach to take to generate and maintain these forecast fields. Along with maintaining an internally consistent gridded forecast database, forecasters must also consider the gridded forecasts generated by surrounding offices in order to maintain a level of spatial and temporal consistency over the large national domain (Glahn and Ruth, 2003).

Over the past several years, the FSL Evaluation Team has evaluated most aspects of the NWS modernization and new operational components including AWIPS (e.g. Kucera and Roberts, 1995). We have developed several evaluation metrics which have been successfully used to evaluate these changes (Lusk, et al., 1999) and help direct future development activities.

The goal of this study is to determine how the GFE is currently used operationally at NWS offices. Specific objectives are: what GFE components are being used, when is the GFE used, how are the grids initialized and modified, how does the GFE fit into the NWS operational framework, and what is the impact of the GFE on the forecast process?

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Operational GFE computer logs have been the primary source of information for this study, along with interviews and observations conducted at some of the NWS offices. A survey has also been developed, but has not been administered at the offices. The GFE logs record status information, which tools and capabilities are used, and a time stamp indicating exactly when tools are used or when specific actions are performed. Week-long log "snapshots" were collected in 2003 from 5 randomly-selected forecast offices at varied geographical locations and during a variety of weather conditions. These snapshots were examined in order to see the range and frequency of GFE use by a number of forecasters with a variety of forecast responsibilities. A summary of these results are presented here, as well as common patterns of use based on these snapshots.

Offices noted that Interactive Forecast Preparation (IFP) capabilities are rapidly evolving, as well as the requirements for generating specific weather elements. It is important to keep this in mind when reviewing the results for this study. However, these results will establish a baseline for determining how GFE use evolves in the future.

## 2. GFE COMPONENT USE

The GFE user interface is divided into functional groups similar to many interactive computer applications. The menu bar contains a large variety of operations from pull-down menus. The tool bar contains animation controls, drawing, editing, and configuration tools. There is also a specialized interface for managing and creating forecast grids, as well as smart tool capabilities and context-sensitive mouse button options. Each of these functional areas is discussed below.

### 2.1 Grid Manager

The Grid Manager interface provides both inventory information, display controls, and whole-

grid editing capabilities (Wier, et al., 1998). It allows users to select specific forecast grids or groups of grids, as well as generate new grids.

The grid manager had about 1200 - 3200 log entries on average per day. The large number of grid manager entries is consistent with the large number of grids available (on the order of 1000) in the forecast database at any one time, indicating that each forecast grid is likely to be accessed at least once daily.

## 2.2 Main-Menu Actions

Populate/Copy and Interpolate were the most frequently used options from main menu for all of the sites. These commands account for 40%-60% of the main menu actions. As the name implies, Populate/Copy is used to populate forecast weather element grids with data derived from numerical models, or to copy grids from one time period to another. Interpolate fills in time periods between previously generated grid times.

Grids were published to the official database twice or more each day at each site. The GFE was also started and stopped several times per day. Some of the functions used in the IFP process are not part of the GFE, so the GFE is typically turned off when it is not in use, and other programs (including D2D) are used on those machines.

Several procedures are also accessed through the main menu. Procedures allow users to run a list of commands, including Smart Tools, with one button click. Procedures typically generate new forecast elements and grids from previously generated forecast elements. Table 1 lists some of the commonly-used Procedures. The names indicate how the Procedures are used.

As the names indicate, Procedure calls are used in a variety of ways. Some Procedures derive new fields from existing fields (e.g., DirunalTfromMinMaxT) fill in grids between existing grids (e.g., Fill\_In\_Gaps), some are specific to forecast duty areas (e.g., FireOutLook\_Machine), and some are seasonal (e.g., WindChill).

## 2.3 Tool Bar Actions

The GFE Tool Bar has operators that control the GFE screen layout, animation controls, edit tools, and edit area controls. For this evaluation, I will be focusing the edit tools and the edit area

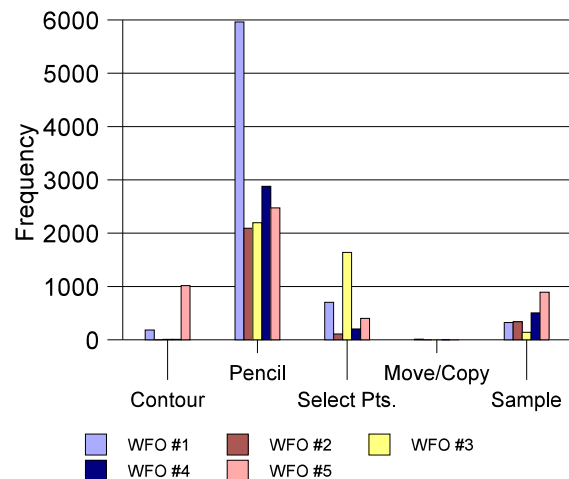
controls.

**TABLE 1.**  
**Names of frequently used Procedures.**

DirunalTfromMinMaxT  
 FireWeather  
 QPF\_and\_PoP-6hr\_12hr  
 Discrepancy\_Value\_Grid  
 ISC\_Discrepancies  
 MarineData  
 FinalPrep\_FireSeason\_Procedure  
 PoP\_Machine  
 Obs\_Loader  
 FireOutLook\_Machine  
 Grid\_Completeness  
 WindChill  
 Copy\_Windspeed\_to\_Gust  
 Add\_Day\_7  
 Fill\_In\_Gaps

There are five different edit tools available on the GFE tool bar. The Contour Tool allows users to draw, modify, add, and delete contours with the spatial editor. The Pencil Tool allows users to modify grid values by drawing virtual contours. The Move/Copy Tool allows users to move defined areas within a grid from one location to another. The Sample Tool allows for

**Figure 1. Edit Tool Use**



alphanumeric displays of data on the gridded fields. Figure 1 shows the accumulated weekly frequency of use of all five tools from each of the WFOs. The Pencil Tool is the most frequently used edit tool at all three sites. It is used in a variety of ways depending on the context of the editor. For example, it is used to define areas which get an assigned value, or the defined areas can be smoothed using a smart tool in order to blend better with surrounding values. This latter technique is used around WFO boundaries in Intersite Coordination (ISC) mode when discrepancies exist. The Select Points and Sample Tools are the second and third most frequently used Edit Tools, respectively. The Contour and Move/Copy tools were less frequently used.

Toggle ISC Mode was another tool bar action that was frequently used by all of the sites. ISC mode allowed users to view ISC grids from surrounding offices and their own grids at the same time. Intersite coordination is a key component for generating the National Digital Forecast Database (NDFD) and this feature helps assure that discontinuities between sites are easily identified and addressed before grids are published.

## 2.4 Smart Tool Use

The Smart Tool framework allows users to write object-oriented programming code that performs numerical functions on grids (LeFebvre, et al., 2002). Once Smart Tools are written, they can be selected from the GFE menu to perform actions on selected grids or selected parts of grids. A large variety of Smart Tools have been written by developers and forecasters, and shared among offices. Smart Tool repositories have also been set up to collect and manage the ever-increasing number of Smart Tools.

Four tools account for about 90% of the Smart Tool use at all of the sites. These tools are "Smooth", "Adjust Value Up", "Adjust Value Down", and "Assign Value". As the names imply, these are fairly primitive actions that adjust or set grid values.

A large variety of other Smart Tools are used routinely, but less frequently at the sites. Most of these Smart Tools are more sophisticated and are applied to entire grids, or are used to generate new grids. Thus, these other Smart Tools may only need to be utilized once per forecast cycle to

accomplish a significant amount of work. Table 2 lists some of the other more frequently used Smart Tools. Like Procedures, the Smart Tool names give a good indication of how they are used. Interestingly, the sites that used more Smart Tools used the basic editing tools (e.g. pencil tool) less.

**TABLE 2.**  
**Names of other frequently used Smart Tools.**

Td\_SmartTool  
 PoP\_from\_Wx  
 Wx\_from\_PoP  
 MinT\_SmartTool  
 MaxT\_SmartTool  
 WindChillTool  
 LimitQPF\_to\_PoP15  
 SnowFromQPF  
 DiurnalTfromMSAST  
 WindGustSmartTool  
 Vsby\_from\_WxType  
 ModelBlend\_SmartTool  
 Taper\_AtIcCoastalWaters  
 WaterSfcTempsMaxT  
 Point\_Serp\_Tool  
 HgrElev\_TaperUp  
 MatchMOS  
 Haines\_SmartTool

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## 2.5 Mouse Button 3 Popup Menus

Mouse Button 3 allows users to make context-sensitive popup menu selections without having to select options from the main menu or the tool bar. Button 3 options are used most frequently with the Grid Manager to copy, paste, split, and delete grids, as well as other functions. Button 3 Popups are also frequently used with simple editing tools such as the pencil, sample, select points, and contour. At some sites Smart Tools are launched from these Button 3/Edit Tool Popups. Color bar options are also frequently selected from Button 3 Popups.

### 3. HOURLY USE OF GFE CAPABILITIES

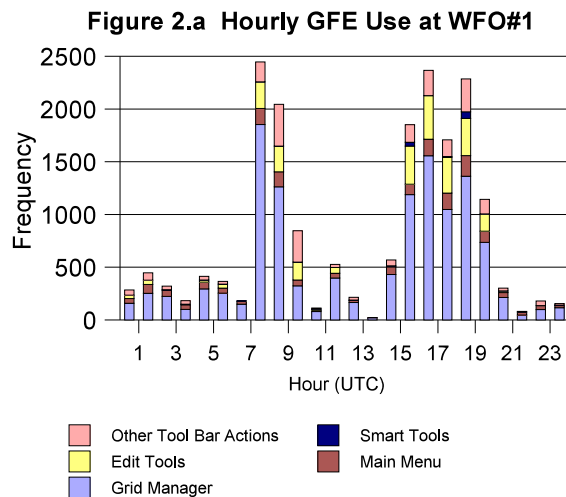
Another objective of this evaluation was to determine when GFE components were used during operational shifts. In order to understand when the GFE is used during operational shifts, I first interviewed IFP focal points at different WFOs to determine which forecast staff members used the GFE, grid elements for which they were responsible, and when grid elements were generated. The logs were examined to see how they related to those responsibilities.

#### 3.1 Division of Gridded Forecast Responsibilities

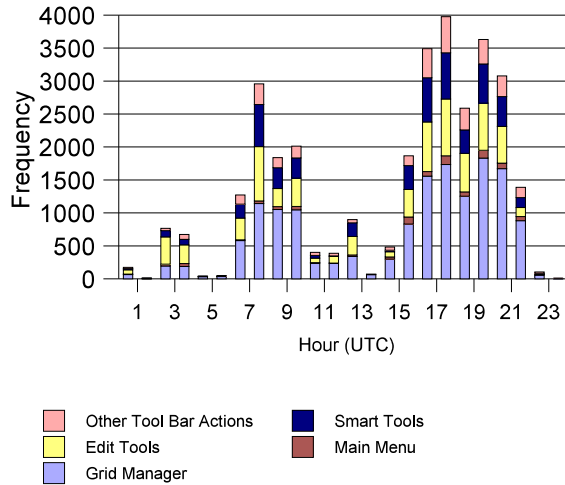
The division of duties for generating and editing gridded weather elements varied from site to site. At some sites, the grids were divided temporally with one forecaster responsible for short-term (day 1) grids and another forecaster responsible for the long term (days 2-7) grids. At other offices, responsibilities were divided by weather elements. For example, one forecaster would be responsible for marine related grid elements (e.g. winds/gusts, visibility, wave height, etc.) and another for fire weather related grids (e.g. humidity, mixing depth, Haines index, etc.). Traditional public, aviation, marine and fire weather duties were also assigned to specific forecasters. Since most of the routine text products are initially generated from the forecast grids, the deadlines for publishing text products dictated when GFE work was performed, as described in the next section.

#### 3.2 Hourly GFE Statistics

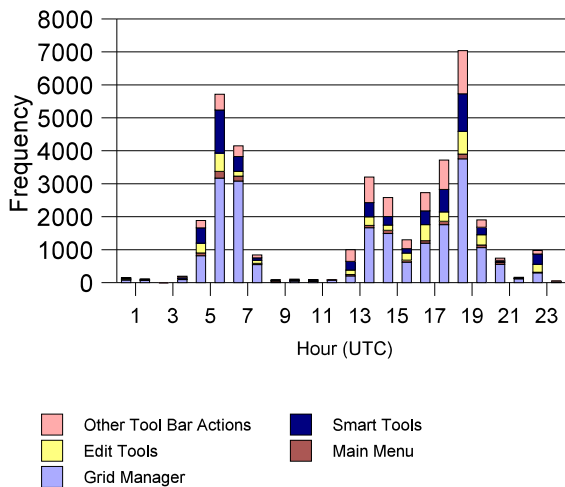
Hourly statistics of GFE use were generated for



**Figure 2.b Hourly GFE Use at WFO#2**



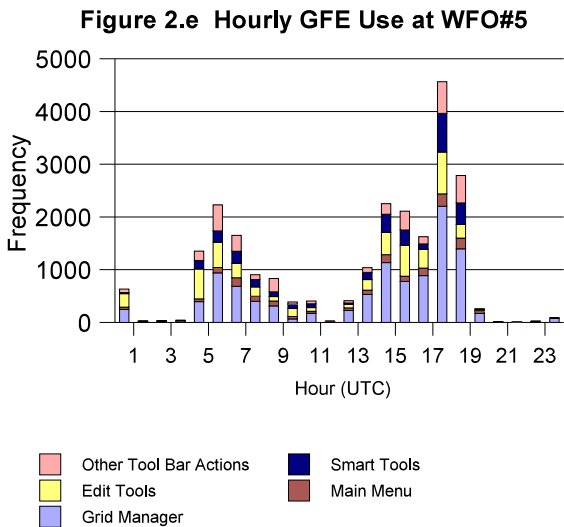
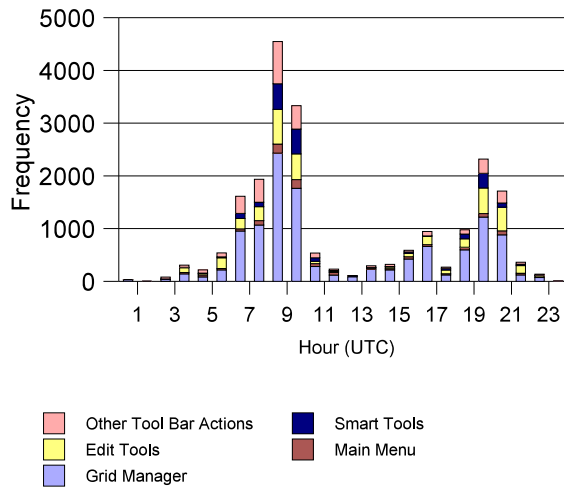
**Figure 2.c Hourly GFE Use at WFO#3**



each of the sites for the week-long collection periods. The log entries were divided into categories as previously discussed. Figures 2.a - 2.e show the hourly statistics from each site.

Hourly use from all five sites indicate the GFE is primarily used during the day shift (~14UTC - 22UTC) and mid shift (~6UTC - 14UTC). These peak use periods also come before the issuance of the zone packages at ~4AM local time and ~4pm local time (~9-11UTC and ~21-23UTC, depending on the time zone). This use pattern agrees well with the comments from the offices that GFE Text Formatters (Hansen, et al. 2003) are used to generate the initial zone packages as well as other products.

**Figure 2.d Hourly GFE Use at WFO#4**



**4. CONCLUSION**

This analysis of the GFE has given us an initial objective evaluation of how GFE components are being used operationally at NWS Forecast Offices. These results indicate that a wide range of GFE capabilities are being used, including both basic editing tools as well as sophisticated Smart Tools which many of the WFOs have developed and shared with other sites.

Frequent use of basic editing tools, such as the Pencil Tool, suggest that many users spend a considerable amount of time manually editing grids, or sub-grid areas. Observations of GFE use and interviews have substantiated this fact. This should not be surprising considering gridded forecast production is a new and rapidly-evolving capability at WFOs.

Smart Tool use also indicates a wide range utilization. Frequent use of the Smooth Tool, along with ISC mode, suggest users try to resolve differences along WFO boundaries before grids are published. Conversely, sophisticated Smart Tools are used to derive and generate entire suites of forecast elements from existing grids, saving a substantial amount of time.

Analysis of hourly GFE use indicates two periods of high use which are tied to the issuance times of the zone packages. This use pattern resembles patterns observed with the AWIPS-like text workstation used at the Denver Weather Service Forecast Office (Lusk, 1993). Comments from the forecasters interviewed indicated they typically look at the AWIPS D2D displays to formulate their forecast, then use the GFE to generate their forecast grids - much like they used to use the graphic screens then the text editor on AWIPS. Future evaluations of AWIPS use along with GFE use will help substantiate this finding.

Finally, it is important to remind readers that IFP capabilities, and the GFE in particular, are still new and rapidly-evolving capabilities in NWS Forecast Offices. Additionally, NWS products and services are also evolving. Clearly, the gridded forecast database is a very rich source of information that will eventually be exploited in many new and different ways. Thus, the way the GFE is used in the future will likely change based on these factors. It will be important to track these changes in order to help understand how this tool can best be used and to help direct future development activities.

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## 6. REFERENCES

- Glahn, H.R. and D.P. Ruth, 2003: The New Digital Forecast Database of the Nation Weather Service. *Bull. Amer. Meteor. Soc.*, **84**, 187-201.
- Hansen, T., T. Dankers, and C. Paxton, 2003: Text formatting with the Graphical Forecast Editor. *19th Int. Conf. on Interactive Information Processing Systems (IIPS) for Meteorology, Oceanography, and Hydrology*, Long Beach, CA, Amer. Meteor. Soc., CD-ROM, P1.11.
- Kucera, P.C. and W.F. Roberts, 1995: Warm Season Product Usage Patterns from the DARE Workstations at the Denver and Norman WSFOs. *Preprints, 14<sup>th</sup> Cnf. on Weather Analysis and Forecasting*, 15-20 Jan 1995, Dallas, TX, Amer. Meteor. Soc., 101-107.
- LeFebvre, T., M. Romberg, T. Hansen, 2002: Initializing gridded fields from numerical models.. *Interactive Symp. on the Advanced Weather Interactive Processing System (AWIPS)*, Orlando, FL, Amer. Meteor. Soc., 41-45.
- LeFebvre, T.J, M. Mathewson, T. Hansen, 2003: The Rapid Prototype Project. *CD-ROM, 19th Int. Conf. on Interactive Information Processing Systems (IIPS) for Meteorology, Oceanography, and Hydrology*, Long Beach, CA, Amer. Meteor. Soc., 12.4.
- Lusk, C.M., 1993: DARE-II Workstation Use at the Denver Weather Service Forecast Office. NOAA Technical Memorandum ERL FSL-8, Forecast Systems Laboratory, Boulder, CO, 42 pp.
- Lusk, C.M., P. Kucera, W. Roberts, and L. Johnson, 1999: The Process and Methods Use to Evaluate Prototype Operational Hydrometeorological Workstations, *Bull. Amer. Meteor. Soc.*, **80**, 57-65.
- Wier, S., M. Mathewson, and T.J. LeFebvre, 1998: Grid editing for the Interactive Forecast Preparation System. *14th Int. Conf. on Interactive Information and Processing Systems for Meteorology, Oceanography, and Hydrology*, Phoenix, AZ, Amer. Meteor. Soc., 469-473.