P1.7 FORECASTER USAGE PATTERNS OF AWIPS D2D AND GFESUITE DURING 2005

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1. INTRODUCTION

The AWIPS two-dimensional data display (D2D) and the Graphical Forecast Editor (GFESuite) are the primary forecasting systems that today's National Weather Service (NWS) forecasters use to display meteorological information and generate gridded forecast fields. In a study last year (Roberts, et. al., 2004), we showed that D2D and GFESuite product use had increased significantly over the past 6 years. In this study, we continue to evaluate how forecasters are using these systems tools and capabilities to observe the weather, and to generate and maintain their forecast fields.

This study presents results from the first continuous yearly collection of D2D usage logs at the National Weather Service Forecast Office (BOU) in Boulder, CO. The D2D usage logs record nearly every D2D action taken on the graphics workstation by the forecasters along with a time stamp and workstation identification (Roberts, et. al., 2004). Additionally, a weeklong sample of GFE usage logs was collected at the National Weather Service Forecast Office (TAE) in Tallahassee, FL during the Hurricane Dennis landfall. 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 (Roberts, et. al., 2004).

A summary of the usage logs analyses results including any common usage patterns that arose are presented here. Comparisons with previous studies are also presented.

2. D2D USAGE LOG COLLECTION

The AWIPS two-dimensional data display (D2D) is the primary display program for meteorological data on AWIPS (Roberts, et. al., 2004). In this study, D2D usage log results are compared with results from the 2004 warm season study (Roberts, et. al., 2004) and the 1993 cool season study (Roberts, et. al., 1993).

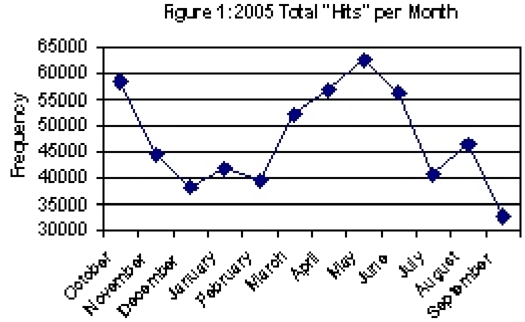
There are a total of five workstations at the BOU WFO with each being used to perform specific forecasting duties. These duties are reflected in each workstation's product use. During the collection period, one workstation was not available from mid-May to mid-July. The workstation outage is a contributing factor to an overall decrease in product use. Results of the yearly analyses from October 2004 to September 2005 are presented below.

2.1 BOU Office Summary

The BOU Office Summary refers to a combined total of product loads from each workstation. A total of 570,398 product loads or "hits" were recorded during the collection year.

Workstation bouL4 was not available from mid-May to mid-July during the collection period. The primary function of workstation bouL4 is for severe weather. Workstation bouL4 can be used in conjunction with workstation bouL3. Workstation bouL3 is the backup severe workstation. When one workstation is not available then the other workstation may be used in its place. A summary of each month's total product loads is illustrated in Figure 1.

Figure 1: 2005 Total "Hits" per Month



The 2004 warm season study reported 263,228 product loads during the four-month (May-August) period. This year's warm season (May-August) only reported 205,985 product loads. The resulting decrease in product loads can be explained using Figures 2, 3, 4, and 5.

Nearly every category's product use in 2004 exceeded that of 2005. The radar category, in particular, had 10,000 more products selected in the 2004 warm season than in 2005. The model category use also exceeded that of 2005. The other product categories' use remained about the same with slight fluctuations up and down throughout the warm season.

Figure 2: 2005 Frequency by Product Category

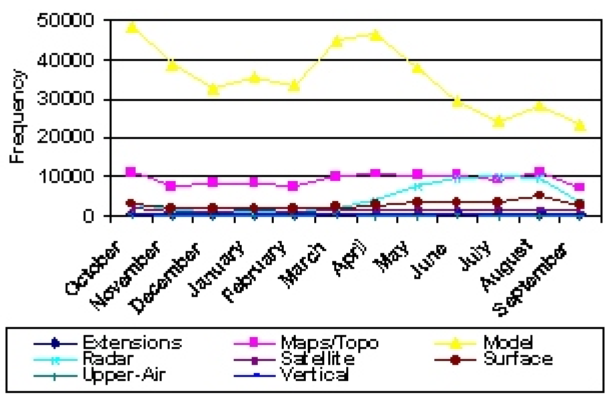
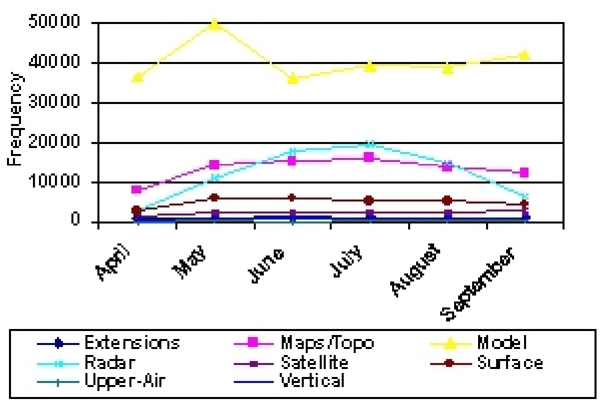


Figure 3: 2004 Warm Season - Frequency by Product Category



Figures 4 and 5 show the total number of winter and severe weather warnings for 2004 and 2005. When comparing the warnings for the two warm seasons, the number of warnings were similar; 307 warnings were issued in 2004 and 304 warnings were issued in 2005. However, the active warm season of 2004 was over a three-month period (June-August) with each month having more than 70 warnings compared to 2005, when only June had more than 70 warnings.

Figure 4: 2005 BOU Wx Warnings

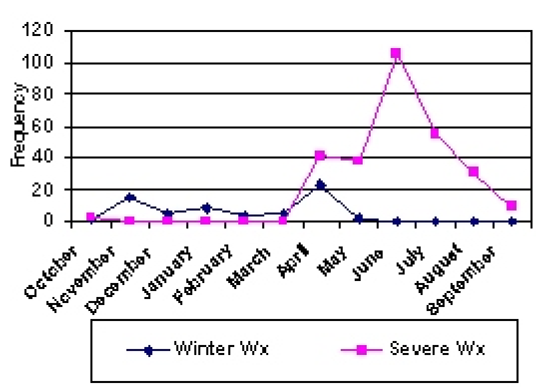
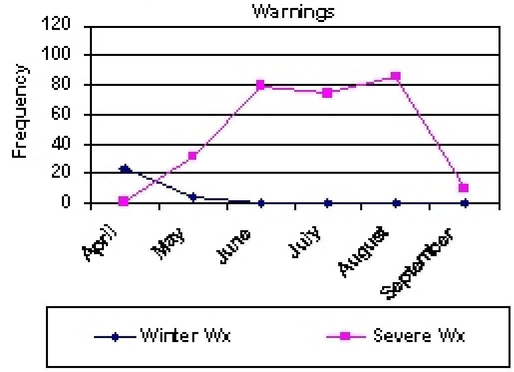


Figure 5: 2004 BOU Warm Season Wx Warnings



The resulting decrease appears to be due to the combination of a decrease in active weather and fewer workstations. These differences would account in less product use during the warm season in 2005 compared to 2004.

2.1.1 Most Commonly Used Products

Table 1 lists the top 25 most frequently used products from October 2004 to September 2005. A similar table was constructed in the 1993 cool season study (Roberts, et. al., 1993). A comparison of the most commonly used products from the 1993 study to this year's study follows Table 1.

Table 1: Most Requested D2D Products for 2005

Product	Frequency
METAR	9915
IR Satellite (C)	7549
ETA80 500MB Height (dam)	6033
ETA80 ETA Model MSLP (mb)	4857
GFS80 500MB Height (dam)	4767
GFS80 MSL Pressure (mb)	4664
GFS80 Precipitation (in)	4579
kftg 0.5 Reflectivity (dBZ)	4523
ETA80 700MB Height (dam)	4399

GFS80 700MB Height (dam)	4386
ETA80 500MB Vorticity (/1e5s)	3485
GFS80 500MB Vorticity (/1e5s)	3190
30 min Local Data Plot	2974
GFS80 1000MB-500MB Thickness (dam)	2970
GFS80 700MB Omega (-ubar/s)	2963
ETA80 1000MB-500MB Thicknes (dam)	2780
Nowrad Radar (dBZ)	2523
ETA80 700MB Omega (-ubar/s)	2521
gfsLR 500MB Height (dam)	2502
Interactive Points	2394
Visible Satellite	1861
ETA80 850MB-500MB Rel Humidity (%)	1674
GFS80 Layer Rel Humidity (%)	1620
Water Vapor Satellite	1440
kftg 0.5 Velocity (kts)	1292

The majority of the products listed here were also listed in the 2004 warm season study.

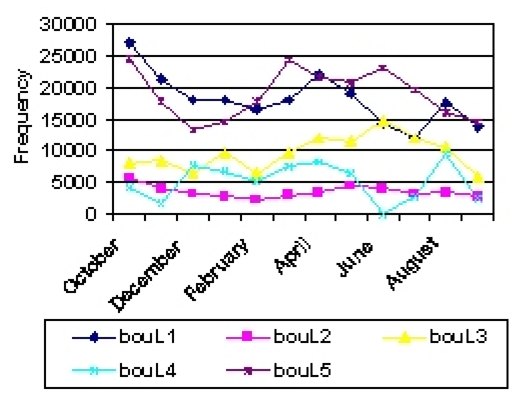
The 1993 cool season study (Roberts, et. al., 1993) evaluated the D2D product use at the Denver WFO from November 1992 to February 1993. Many of the same products that were loaded at the BOU WFO this year were also loaded in the 1993 cool season. Some common products include IR Satellite, GFS (referred to as AVN in 1993), Water Vapor Satellite, Visible Satellite, and Radar (reflectivity, velocity).

Another item to note is the use of Interactive Points. Interactive Points is a tool that forecasters use to create model cross-sections, soundings, and time-height plots through the volume browser on AWIPS by moving a labeled point to the desired location on the map background.

2.2 BOU Workstation Summary

There are a total of five workstations at BOU. Figure 6 illustrates the frequency by workstation use from October 2004 to September 2005 for each individual workstation. Each workstation is used for specific forecasting duties. A description of each workstation follows.

Figure 6: 2005 Frequency by Workstation



The HMT workstation is bouL2. The Hydro-Meteorological Technicians primarily use this workstation. This workstation is accessed approximately 20 hours per day during both the cool and warm seasons. Workstation bouL2 is mainly used for monitoring and supporting forecast operations. According to Figure 6, workstation bouL2's frequency of use remains relatively constant. There is a slight decrease in use during the cool season and a slight increase in use during the warm season, especially during hard rain events. The majority of the products used were from the model category.

The severe weather workstations are bouL3 and bouL4. These two workstations are used interchangeably. During the collection period, bouL4 was not available from mid-May to mid-July. As a result, bouL3's use increased. According to Figure 6, the severe weather workstations' use decreased during the cool season and rapidly increased during the warm season. There was however a period from December to February, during the cool season, where winter weather warnings were issued and the severe weather workstations' use had increased. The model category products were accessed the most during the period, however during the warm season; the radar category products were the most frequently accessed.

The most frequently accessed workstations at BOU were bouL1 and bouL5. During the period, products on bouL1 and bouL5 were accessed more than 24,000 times in one month. The long-term workstation, bouL1, was accessed the most during the cool season, whereas bouL5, the short-term workstation, was accessed the most during the warm season. The long-term forecaster has 18 hours of coverage per day during the cool season and 9 hours of coverage per day during the warm season, which would explain the increased use of workstation bouL1 during the cool season. The short-term forecaster has 24 hours of coverage per day during both cool and warm seasons. When there is inactive weather, the use rapidly decreases and increases again when there is weather activity present. This would explain the increased use of workstation bouL5 during the warm season.

2.2.1 Most Commonly Used Products for the Long-Term Workstation, bouL1

Table 2 lists the top 25 most frequently used products from October 2004 to September 2005 for the long-term workstation.

Table 2: Most Requested D2D Products for the Long-Term Workstation during 2005

Product	Frequency
ETA80 500MB Height (dam)	3007
GFS80 500MB Height (dam)	2711
METAR	2662
ETA80 ETA Model MSLP (mb)	2368
GFS80 MSL Pressure (mb)	2321
GFS80 Precipitation (in)	2096
gfsLR 500MB Height (dam)	1905
GFS80 700MB Height (dam)	1877
ETA80 700MB Height (dam)	1744
ETA80 500MB Vorticity (/1e5s)	1504
IR Satellite (C)	1440
GFS80 500MB Vorticity (/1e5s)	1315
gfsLR MSL Pressure (mb)	1262
ETA80 1000MB-500MB Thickness (dam)	1175
GFS80 1000MB-500MB Thickness (dam)	1170
gfsLR 500MB Vorticity (/1e5s)	1138
gfsLR Precipitation (in)	1138
ETA80 850MB-500MB Rel Humidity (%)	1114
GFS90 500MB Height (dam)	948
GFS80 700MB Omega (-ubar/s)	810
ETA80 700MB Omega (-ubar/s)	769
Interactive Points	664
ETA80 700MB Temperature ©)	587
kftg 0.5 Reflectivity (dBZ)	572
ETA80 850MB Wind (kts)	550

Note that for the long-term workstation nearly all of the top products used were model products. The most accessed product during the period was the ETA80 500MB Height (dam) with more than 3000 product loads.

Another item to note is the use of Interactive Points. Interactive Points is a tool that forecasters use to create model cross-sections, soundings, and time-height plots through the volume browser on AWIPS by moving a labeled point to a desired location on the map background.

2.2.2 Most Commonly Used Products for the Short-Term Workstation, bouL5

Table 3 lists the top 25 most frequently used products from October 2004 to September 2005 for the short-term workstation.

Table 3: Most Requested D2D Products for the Short-Term Workstation during 2005

Product	Frequency
METAR	4833
IR Satellite (C)	3435

30 min Local Data Plot	2122
ETA80 500MB Height (dam)	2096
Kftg 0.5 Reflectivity (dBZ)	1875
Interactive Points	1827
ETA80 ETA Model MSLP (mb)	1742
ETA80 700MB Height (dam)	1611
ETA80 500MB Vorticity (/1e5s)	1469
15 Minute Lightning Plot	1446
ETA40 700MB Height (dam)	1237
GFS80 500MB Height (dam)	1226
Water Vapor Satellite	1167
Kftg 0.5 Velocity (kts)	1154
ETA20 Precipitation (in)	998
GFS80 Precipitation (in)	843
ETA20 ETA Model MSLP (mb)	796
GFS80 MSL Pressure (mb)	790
11u-3.9u Satellite (counts)	701
15 min Local Data Plot	701
1 Hour Lightning Plot	696
ETA40 500MB Height (dam)	656
ETA20 Surface Wind (kts)	627
GFS80 700MB Height (dam)	622
KDNR Skewt	590

Note that for the short-term workstation a variety of different products were used. Compared to the long-term forecaster, the short-term forecaster focuses more on observational-type products, for example, satellite products, models that reflect current surface conditions, radar products, and surface products. The most accessed product during the period was the METAR, with more than 4800 product loads.

3. GFESUITE USAGE LOG COLLECTION

The Graphical Forecast Editor (GFESuite) is the primary program used by the forecasters to create and edit their gridded forecast fields. A weeklong collection of usage logs was collected at the National Weather Service (TAE) in Tallahassee, FL during the Hurricane Dennis landfall. Results of the weekly analyses from July 2005 are presented and compared to last year's GFESuite analysis results (Roberts, et al., 2004).

3.1 Hurricane Dennis

On July 10, 2005 at 2:25 PM CDT, Hurricane Dennis made landfall on Santa Rosa Island between Navarre Beach and Pensacola Beach, Florida. The intensity of Dennis was 100 to 105 knots (115 to 120 mph), which is a category three on the Saffir-Simpson hurricane scale. The following figures illustrate the intensity of landfall.

Figure 7: Hurricane Dennis - Before Making Landfall

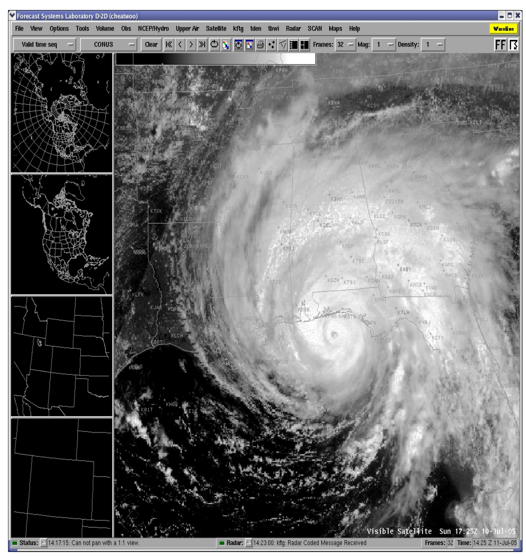
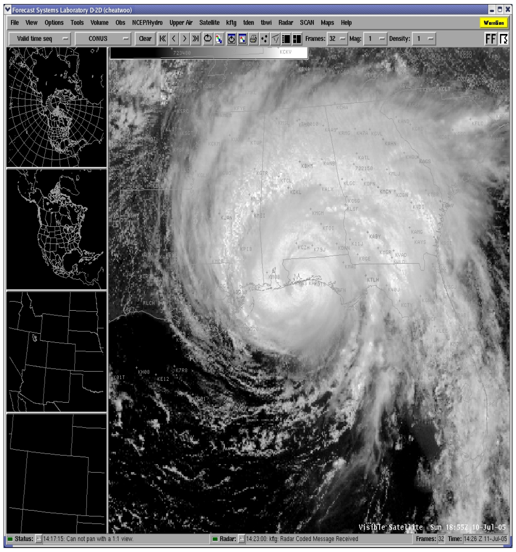
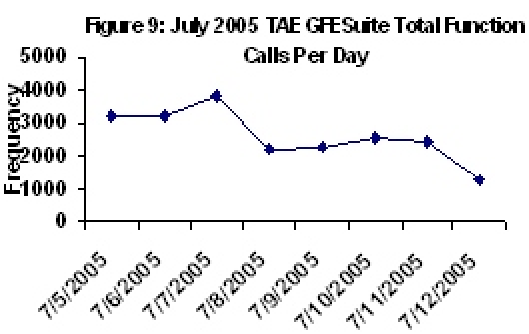


Figure 8: Hurricane Dennis Landfall on July 10, 2005



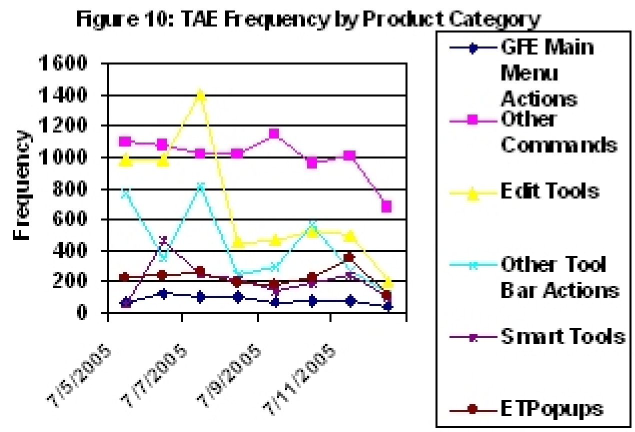
3.2 TAE GFESuite Summary

During the Hurricane Dennis landfall a total of 21,134 function calls were recorded during the weeklong collection period from July 5, 2005 to July 12, 2005. Figure 9 illustrates the daily use cumulative.



The peak use, with greater than 3500 function calls, occurred on July 7, 2005, two days before the Hurricane Dennis landfall. The peak use reflects the end of a three-day forecasting period. During this three-day forecasting period, the hurricane track is identified and forecasted using GFE tools. After July 7th, there is a decrease in GFE use due to less editing of the grids (the forecasters felt confident with their forecasts) and had less time for gridded forecast preparation.

The frequency of use by function category is shown in Figure 10. The Edit Tools category was the most frequently accessed category in one day, greater than 1400 function calls. This peak is illustrated in the graph above. The forecasters were vigorously editing



the grids right before the end of the three-day forecast on July 7th. The Pencil Tool was the most accessed tool in the Edit category. The Pencil Tool allows users to modify the grid values by drawing virtual contours (Roberts, et. al., 2004). The Other Commands category was the overall most accessed category during the week with over 600 function calls made per day. The Other Commands category primarily consists of GFESuite program software scripts that run automatically when a function is called or accessed. 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 (Roberts, et. al., 2004). The names of some of the most frequently used Smart Tools and their frequencies, for this study, are listed in Table 4.

Table 4: Frequency by Smart Tool

Smart Tool	Frequency
AdjustValue_Down	474
Smooth	455
AdjustValue_Up	423
Smooth_5X	92
Assign_Value	75
AdjustUp_wTaper	36
Wind_dir_back	29
AdjustDown_wTaper	18
Wind_dir_veer	10
get_Max6hrGrid	5
SummerSky	4

TAE_Wx_from_PoP	4
Eta12_MixHgt_Day	3
Eta12_MixHgt_Night	3
TAE_TransWind_fm_Wind	3
Model_Blend	2
PoP12hr_fm_PoP6	2
QPF_SmartTool	2
TAE_Ceiling_input	2
TAE_MixHgt_fm_Model	2
TAE_QPF_consistency_fm_PoP	2
TAE_QPF_from_Wx_PoP	2
Copy_from_Model	1
Eta12_Ceiling	1
JAX_MixHgt	1
serp	1

Note that AdjustValue_Down, Smooth, and AdjustValue_Up were used greater than 400 times.

The following tables, Table 5 and Table 6, represent the frequency by Main Menu Action. The names of the commands and procedures indicate how they are used. Table 5 refers to the commands accessed directly from the GFESuite main menu. Some of the most frequently accessed commands include Populate/Copy, Interpolate, and Publish. These commands were accessed more than 78 times during the period. 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 (Roberts, et. al., 2004). Publish is used to publish the generated grids to the official database for user access. Table 6 refers to the procedures, generated by the forecasters, accessed from the GFESuite 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 (Roberts, et. al., 2004).

Table 5: Frequency by Main Menu Action

Main Menu Action	Frequency
Populate->Copy	83
Grids->Interpolate...	81
Products->Publish	78
GFE->Weather	56
Products->Formatter	41
GFE->Exit	39
Shutting	37
Consistency->Send	24
Edit->Revert	21
Edit	18
Edit->Undo	15
Products->Scripts...	10
Maps->Samples->Load ...	5
GFE->Define	2
Maps->Samples->Show	2
Grids->Split	1
Last	1
Maps->Samples->Create	1

Table 6: Frequency by Main Menu Action Procedure

Main Menu Action Procedure	Frequency
D__Run_SmartTools	27
TCMWindTool	27
E__Fire_Wx_Tools_step1	18
E__Fire_Wx_Tools_step2	16
C__DiurnalTemp	14

A__Obs_Load	8
Extended_Step2	8
Extended_Step1	7
PlotSPCWatches	7
ShortTerm_Step1	7
ShortTerm_Step2	5
PlotLocalHazards	4
A__Obs_Load_and_Merge	2
CheckTandTd	1
GenerateCyclone	1
ViewWCL	1

Some of the most frequently used procedures include Run_SmartTools, TCMWindTool, Fire_Wx_Tools, and DiurnalTemp. These tools were accessed more than 14 times during the period. The TCMWindTool is a procedure that is used during hurricane or tropical storm weather events. The National Weather Service (TAE) in Tallahassee, FL is required to use the TCMWindTool when wind radii effects any part of the county warning area and every time they issue an update to the forecast. The forecasters initiated the TCMWindTool on July 6, 2005 and continued using it until July 10, 2005, the day Hurricane Dennis made landfall.

In a similar study conducted last year, we evaluated the GFESuite usage logs at the National Weather Service Forecast Offices in Boise, ID (BOI), Pueblo, CO (PUB), and Denver, CO (BOU). This is the first year to conduct a tropical GFESuite usage log analysis. In comparison with BOI, PUB, and BOU, the GFESuite usage log analysis at TAE is similar. Nearly all of the same tools are used at TAE as of the other NWS Offices, however during hurricane and tropical storm weather scenario TAE focuses on using hurricane specific tools.

4. CONCLUSION

This 2005 evaluation of AWIPS D2D and the GFESuite has shown that expanding the sources for data collection and analysis has opened a new perspective of how these systems tools and capabilities are used by the National Weather Service forecasters. From this study, we learn that forecasters are still taking advantage of the higher resolution models, radar products, and other fields that are provided. They are also still taking advantage of the increased number of forecast grids generated by the offices, the increased forecast grid resolution, and the forecasters continued development of better smart tools to generate and adjust weather elements.

For future studies, we will continue to track the evolution of D2D and GFESuite use in operations and feed this information into the AWIPS development process. We will also continue to evaluate the natural variability in the weather from one year to the next as we continue to collect and analyze yearly usage log data.

5. ACKNOWLEDGEMENTS

The authors gratefully acknowledge the feedback provided by the IFP focal points and other NWS staff, in particular Jeff Fournier, Tallahassee, FL, Dr. Eric Thaler, Boulder, CO, Robert Glancy, Boulder, CO, and David Barjenbruch, Boulder, CO. The authors thank Mark Matthewson from the GFE staff for providing log collection support.

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