P1.34

THE NWS SOUTHERN REGION GRID PREPARATION POLICY: MAKING A DIFFERENCE

G. Clay Anderson* and Jon W. Zeitler
NOAA/NWS Austin/San Antonio Weather Forecast Office, TX

1. INTRODUCTION

The National Weather Service (NWS) Southern Region implemented a policy in September, 2005 that prescribes a methodology for how forecasters should interact with the Graphical Forecast Editor (GFE) when producing routine forecasts. A similar policy, specified in a local forecast improvement project, was implemented several months earlier at the NWS Weather Forecast Office (WFO) Austin/San Antonio. The goals of both the project and the policy were to streamline the forecast process, improve WFO border consistency in the National Digital Forecast Database (NDFD) and improve forecast verification. This paper will focus mainly on the improvement in forecast verification.

2. BACKGROUND

The need to streamline the forecast process became obvious once the Point Forecast Matrix (PFM) "Stats On Demand" (MacAloney, 2004) verification data (Fig. 1) were made available in 2004, especially given the amount of time forecasters were spending performing forecast (grid) edits. Forecasters at WFO Austin/San Antonio were spending 3-4 hours editing grids each major model cycle (0000/1200 UTC). That was 6-8 hours a day for little to negative improvement over the Global Forecast System Model Output Statistics (GFSMOS), which are used as the benchmark for NWS forecast verification. Similar issues existed at all WFOs, as forecasters struggled to define their role in the digital forecast era of NWS forecast operations. The verification statistics shown in Figure 1 support the conclusions of Baars and Mass (2005) that "*...it is getting increasing difficult for human forecasters to improve upon MOS...*" and "*Humans cannot consistently beat MOS... and are only superior to MOS for short-term temperature forecasts...*" Furthermore, Mass (2003) adds "*...use of human beings to laboriously alter deterministic forecasts for a week into the future would be a serious mistake that would lessen forecaster's time for more productive work.*"

There are many reasons why forecasters were not improving on the GFSMOS in recent years. Maglaras (2004) cites the introduction of new technology and changes to procedures in forecast operations, but notes the most important reason was a flawed methodology, whereby forecasters used a previous gridded forecast as the starting point for a new forecast cycle, only making modifications when "significant" changes were deemed necessary. Others (C. Entremont and J. Gagan, personal communication) recognized flaws in this methodology by noting that forecast errors were carried from one cycle to the next, while GFSMOS errors generally become smaller with successive cycles. In addition, the transition to digital grid forecasting and a significant increase in the number of verification points likely had a negative impact on forecast performance. Regardless of those reasons, the staff at WFO Austin/San Antonio decided some action was necessary. We believed forecasters should consistently add value to the model guidance, or risk losing involvement in the forecast process.

At WFO Austin/San Antonio, we chose to see this as a wake-up call and a challenge to improve. The hypothesis was that forecasters *can* consistently show improvement over the GFSMOS, if only given a method for success. That method was developed over a period of two years and was inspired by the successes documented by Maglaras (2004) and the suggestions of Mass (2003). The answer was a simple policy specified in a local forecast improvement project at WFO Austin/San Antonio, which was implemented several months before the Southern Region policy was announced.

**Corresponding author address:*
G. Clay Anderson, National Weather Service, 2090 Airport Road, New Braunfels, TX 78130
e-mail: clay.anderson@noaa.gov

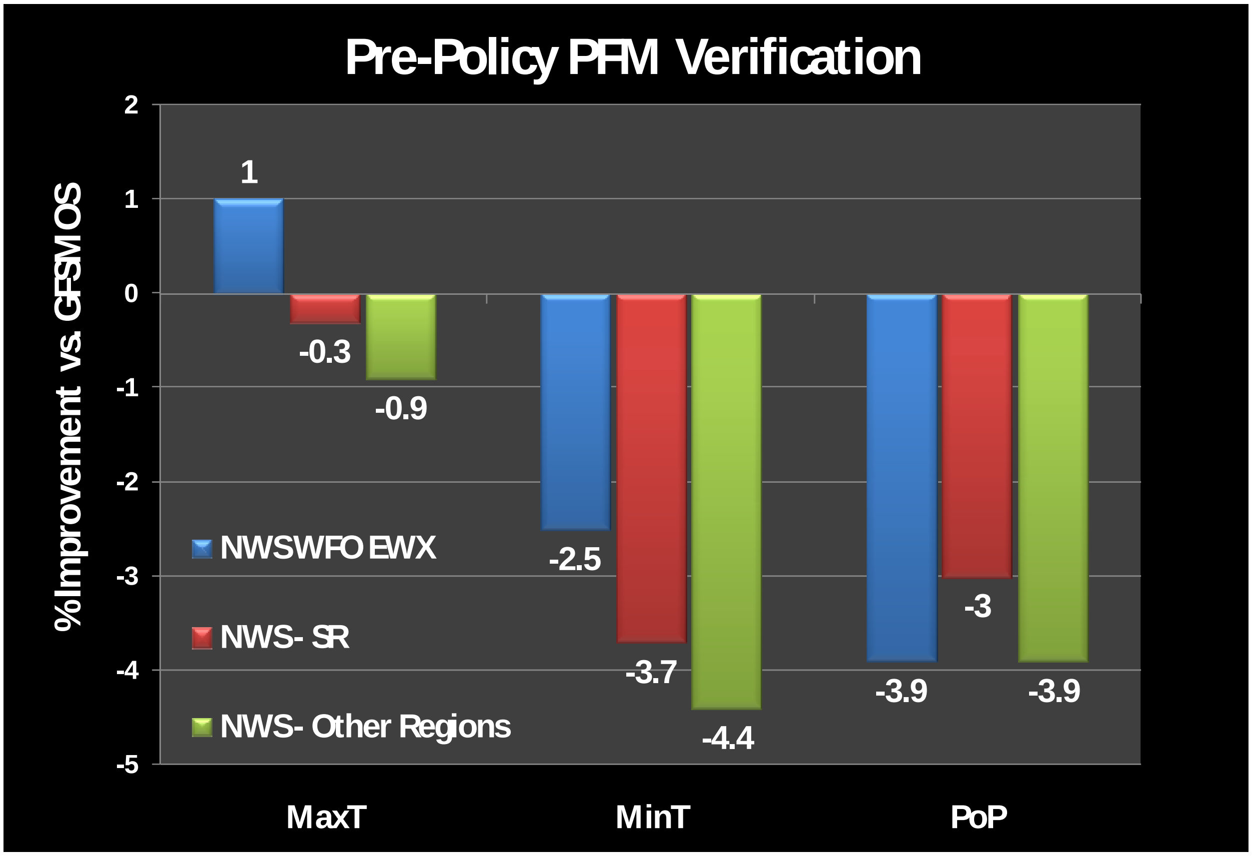

Fig. 1. Percentage improvement relative to GFSMOS in maximum temperature, minimum temperature and probability of precipitation forecasts for WFO Austin/San Antonio, NWS Southern Region. and other NWS Regions (combined), at all Point Forecast Matrix sites, all forecast periods, and all model cycles prior to implementation of the grid preparation policies.

3. DATA

The forecast verification data used in this paper also played a role in the policy formation and comes from the Performance Branch of the NWS Office of Climate, Water, and Weather Services Division. The Performance Branch maintains a Web site with verification for 879 paired Point Forecast Matrix/GFSMOS sites across the nation with statistics for maximum temperature (MaxT), minimum temperature (MinT) and probability of precipitation (PoP) for 14 forecast periods from each major model cycle (0000/1200 UTC).

The two data sets used for comparison in this study are labeled “Pre-Policy” and “Post-Policy”. The Pre-Policy data begin in January, 2004, when Point Forecast Matrix verification became available, and ends in August, 2005. The Pre-Policy period for WFO Austin/San Antonio is slightly offset from the Pre-Policy period for the Southern Region as a whole, because WFO Austin/San Antonio implemented its local grid preparation policy in June, 2005, three months prior to implementation of the Southern Region policy. The Post-Policy period beings in September 2005 and runs through April 2007. For the purpose of comparison, Point Forecast Matrix verification statistics were sampled for all other NWS Regions combined during the same Pre-Policy and Post-Policy periods as for the Southern Region.

WFO border consistency data are measured using the NDFD and were used in the policy-forming decision process. However, those statistics will not be addressed in this paper.

The amount of time forecasters spent editing grids was collected using a worksheet that staff completed each operational shift at WFO Austin/San Antonio. Similar data were collected from other NWS forecasters informally via personal communication.

4. GRID PREPARATION POLICY

The forecast improvement project at WFO Austin/San Antonio, implemented in June 2005, specified a forecast methodology and a system of forecaster accountability. The crux of the methodology was to use the GFSMOS to populate the forecast grids twice daily (0000/1200 UTC cycles) and only deviate when another guidance source was deemed far superior, or when targets of opportunity were identified based on forecaster analysis and experience. In addition to populating the database with new guidance twice a day, forecasters were asked to complete a worksheet that included grid preparation time and departures from the GFSMOS based on locally defined thresholds, which were one half the NDFD collaboration thresholds. Small deviations from guidance were not documented. Forecasters also provided comments on the worksheet to alert following forecast shifts to model or MOS trends/biases. The worksheet was not intended to be burdensome, but rather promote decision-making accountability and aid forecast confidence. The Southern Region grid preparation policy, implemented in September 2005, specified a similar forecast methodology, but only required WFOs to populate the entire forecast database once a day using the 0000 UTC GFSMOS data. Only Days 1-3 were populated with 1200 UTC GFSMOS during the day shift. Forecasters were asked to "...look for *obvious* targets of opportunity to make significant adjustments..." The Southern Region policy indicated, among other things, that "Following this policy... ...should also result in better... ...verification scores."

5. RESULTS

The forecast improvement project at WFO Austin/San Antonio yielded positive results (Fig. 2). In addition to showing substantial improvement over the GFSMOS, grid preparation time was reduced from three or four hours to about two hours per major model cycle; a time savings of 30-50%.

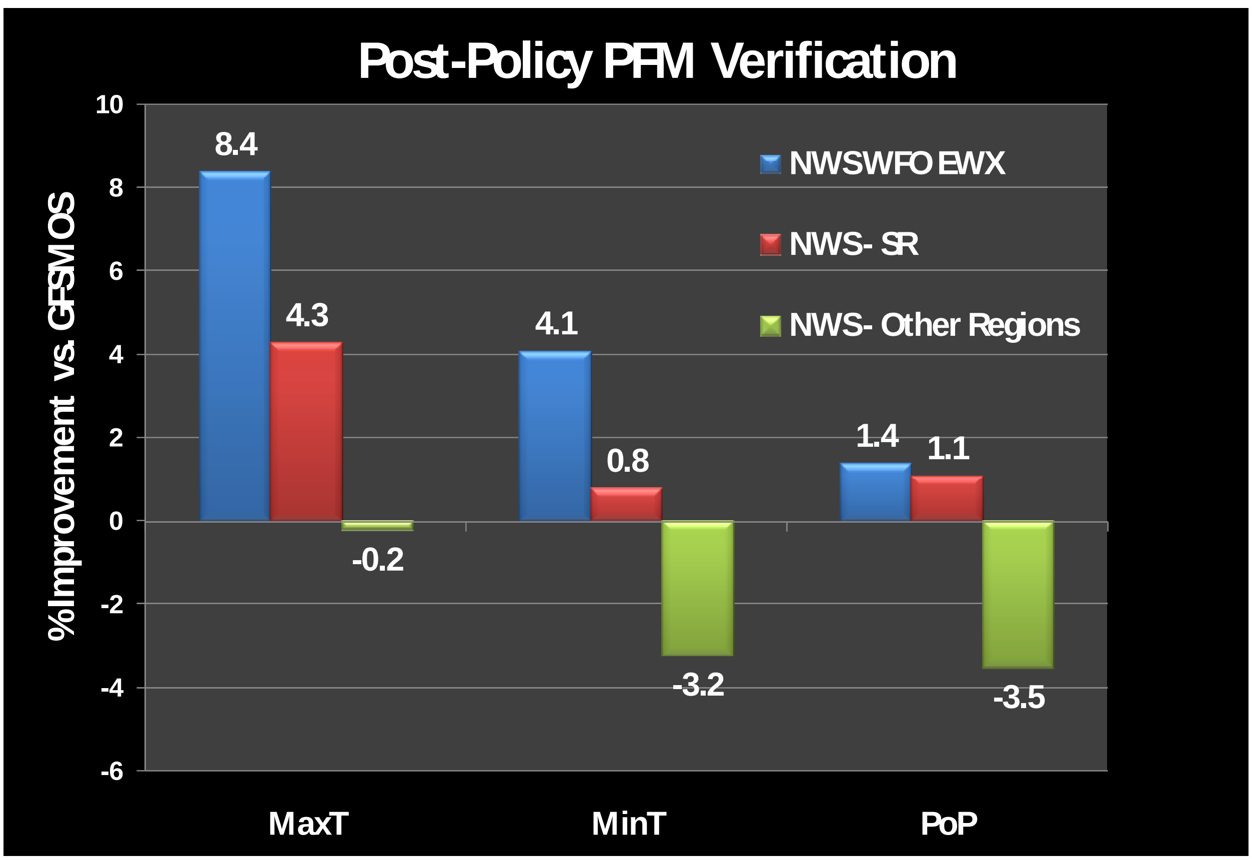

Fig. 2. Percentage improvement relative to GFSMOS in maximum temperature, minimum temperature and probability of precipitation for WFO Austin/San Antonio, NWS Southern Region. and all other NWS Regions (combined), at all Point Forecast Matrix sites, all forecast periods, and all model cycles after policy implementation to April, 2007.

Improvements relative to GFSMOS were noted at all Southern Region WFOs combined (Fig. 2) as compared to all other NWS Regions. To gain a better understanding of how much improvement has been realized, one should compare the Pre and Post-Policy periods (Fig. 3).

The data for the NWS Southern Region show significant improvement in MaxT, MinT and PoP forecast verification since policy implementation (Fig. 3). Other NWS Regions combined have shown only minor improvement during that period, possibly due to other regional policies or simply forecasters better adapting to their new role in the digital forecasting era.

6. CONCLUDING REMARKS

In an era of increasing numerical modeling skill and technological efficiencies it is difficult, but vitally important, for forecasters to add value to the available model guidance and resulting output statistics. Doing so efficiently demonstrates forecaster value in the human-machine mix, and allows more time for analysis/diagnosis and critical decision-making in the forecast process. The time saved from grid preparation can be used for enhanced support/services, outreach activities, professional development, and applied research. The positive results of the Southern Region Grid Preparation Policy on forecast verification show that the prescribed methodology works. Successes following this methodology have now been demonstrated on both a local WFO level and on a NWS Regional level. Judging from the verification results, we suggest that the Southern Region Preparation Policy should be considered for implementation by other NWS Regions or perhaps as a NWS-wide policy. In addition to improving product quality, efficiencies in forecast operations can be achieved as demonstrated at WFO Austin/San Antonio.

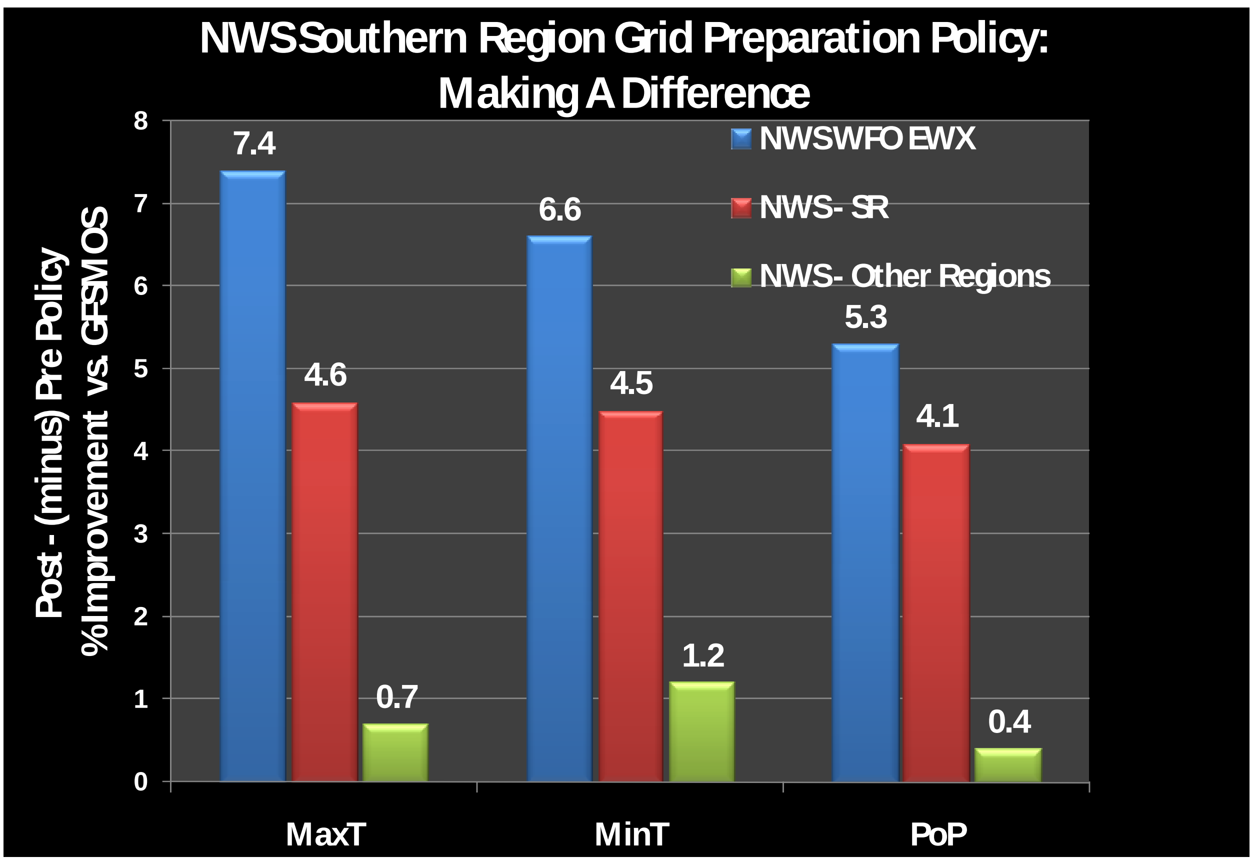

Fig. 3. Percentage improvement relative to GFSMOS in maximum temperature, minimum temperature and probability of precipitation between Pre- and Post-Policy periods for WFO Austin/San Antonio, NWS Southern Region. and other NWS Regions (combined), at all Point Forecast Matrix sites, all forecast periods, and all model cycles.

Further improvements can be achieved through meaningful, forecaster-specific verification, coupled with policy to improve consistently poor forecast decision-making. Local studies need to be conducted to evaluate GFSMOS performance in recent years and determine when it performs poorly so forecasters can easily identify and capitalize on "targets of opportunity." Adhering to this seemingly strict methodology has proven less than easy due to a variety of human factors, including less than one hundred percent policy compliance by forecasters as determined through informal surveys of Southern Region WFOs. One can imagine that further improvement may also be realized through additional policy buy-in.

7. ACKNOWLEDGEMENTS

We thank forecasters at WFO Austin/San Antonio and across the NWS Southern Region for following the Grid Preparation Policy and adeptly adjusting to never-ending changes to forecast operations. We also thank NWS Southern Region Headquarters staff for moving quickly during the summer of 2005 to formulate the policy, based on input provided by WFO Austin/San Antonio and other Southern Region forecasters. We thank Joe Arellano, Jr., Meteorologist-in-Charge at WFO Austin/San Antonio, for his encouragement and unfailing support of improvement to forecast operations and services. Bernard N. Meisner, SRH Science and Technology Services, provided a thorough and helpful review. Kurt Vanspeybroeck, Lead Forecaster at the NWS Spaceflight Meteorology Group, played a key role in development of the methodology behind the Grid Preparation Policy.

8. REFERENCES

Baars, J. A. and C. F. Mass, 2005: Performance of National Weather Service forecasts compared to operational, consensus, and weighted Model Output Statistics. *Wea. Forecasting*, **20**, 1034-1047.

MacAloney, B., 2004: PFM Based Stats on Demand. *NWS Performance Branch Performance Management Website*. [Available online at: https://verification.nws.noaa.gov/]

Maglaras, G. J., 2004: Improving temperature verification results within the IFPS/GFE framework. Eastern Region Technical Attachment No. 2004-01, 10 pp. [Available online at: http://www.erh.noaa.gov/er/hq/ssd/erps/ta/ta2004-01.pdf]

Mass, C. F., 2003: IFPS and the future of the National Weather Service. *Wea. Forecasting*, **18,** 75-79.