U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL WEATHER SERVICE
OFFICE OF SYSTEMS DEVELOPMENT
TECHNIQUES DEVELOPMENT LABORATORY

TDL OFFICE NOTE 84-9

AN IN-HOUSE EVALUATION OF COMPUTER WORDED FORECASTS FOR ZONES

Jeff S. Waldstreicher and Robert J. Bermowitz

June 1984

AN IN-HOUSE EVALUATION OF COMPUTER WORDED FORECASTS FOR ZONES

Jeff S. Waldstreicher and Robert J. Bermowitz

1. INTRODUCTION

During the past few years, operational computer worded zone forecasts (OZF's) (Glahn, 1978; Bermowitz et al., 1980; National Weather Service, 1983a and 1983b) have undergone several field evaluations at Weather Service Forecast Offices (WSFO's). See Bermowitz and Miller (1984) for a report on one such evaluation. The results of these evaluations have indicated that the OZF's are generally useful in the preparation of the locally prepared zone product (ZFP). In fact, over the past year or so, there has been increased interest and use of the OZF's at many of the 21 WSFO's for which OZF's are available. Use has ranged from a guidance product (e.g., determining zone combinations, ordering of weather variables in the forecast, or as a first guess worded forecast) to occasionally, with forecaster editing, being used as the ZFP itself. However, the evaluations have also uncovered problems the OZF's have with regard to zone combinations and wording.

Two problems regarding zone combinations were uncovered by the forecasters during their evaluations. First, most forecasters felt that the computer worded forecast (CWF) program did not combine enough zones, thereby producing more total forecasts than the ZFP. Second, many forecasters felt that inappropriate zone combinations (e.g., coastal and inland zones) were occurring too often. With regard to wording, while most forecasters felt that overall wording was at an acceptable level, several had objections to specific phrases such as "mostly sunny with a slight chance of thunderstorms," "chilly," and "little change in temperature." Since these problems require the OZF to be edited on AFOS by the forecasters before they can be used as the official forecast, the useability of the OZF is reduced because of the limited word processing capabilities on AFOS. The greater the AFOS editing required, the less useable is the OZF.

To better understand the problems experienced by the forecasters when using the CWF and to determine how we could make the product more useable within the current AFOS environment, we decided to do our own evaluation. This paper describes the evaluation and the results we found.

2. EVALUATION

For the 2-month period from mid-January to mid-March 1984, we compared OZF's and ZFP's for WSFO's Fort Worth, Tex. (FTW) and Cleveland, Ohio (CLE). FTW and CLE were selected because both have shown an interest in using the OZF's in their daily operations and in working with us to improve the product. Initially, because of its proximity to us, Washington, D.C. and not CLE was selected as one of the test sites. However, it became obvious before too long that serious problems with some of the Virginia zone forecasts would preclude a meaningful evaluation there. Consequently, CLE was used as a replacement.

There were several things we wanted to examine in our comparison of the OZF's and ZFP's. First, we wanted to determine whether or not the OZF's at FTW and CLE contained more forecasts (fewer zone combinations) than the ZFP's. As noted earlier, this was one of the problems that surfaced as a result of previous field evaluations, although not necessarily at our two test sites.

To accomplish this task, we kept a running total of the number of OZF and ZFP combinations over the 2-month period. In a related effort, we also looked at the criteria used for each weather variable to determine whether or not they are so restrictive that too few OZF combinations result. To isolate which, if any, variables were at fault, we printed out the total number of times the criteria were exceeded for each variable for about 10 days during the test period for all 21 WSFO's for which OZF's are available.

Second, we wanted to look at the actual OZF combinations to see how closely they matched those of the ZFP's on a particular forecast cycle. Furthermore, we wanted to see how frequently, if at all, impossible combinations for the CWF program are used by the forecasters preparing their ZFP's. As mentioned earlier, these are important factors when considering the useability of the OZF, since a considerable amount of editing would be required if the combinations are not what the forecaster thinks they should be. To do this, we kept track of the actual number of matching OZF and ZFP combinations, as well as ZFP combinations that could not be duplicated by the OZF over the 2-month period.

Third, we looked at the OZF and ZFP wording and their differences. The purpose here was to determine the impact that required changes made to the OZF phrases would have on the utility of the OZF's. We did this by noting the phrase differences, including additions and deletions, and subjectively assessing their impact. For example, a difference in max/min temperature is minor and should detract little from the utility of the OZF. However, adding phrases such as "chance of thunderstorms in the afternoon" to a number of OZF combinations on the same forecast cycle should have a greater effect on utility.

It should be remembered that in our evaluation, the ZFP's are not necessarily independent of the OZF's, since on any given cycle the OZF's may or may not have been used by the forecaster in preparing the ZFP's. Note, however, that prior to March 1, 1984, forecasters did not have 1200 GMT OZF's as guidance, since this product was not operational for this cycle. (In our comparison, we used 1200 GMT OZF's generated from experimental runs prior to March 1.) We should also point out that lost data, especially due to its unavailability on weekends, considerably reduced the number of cases during the 2-month test period.

3. RESULTS AND CONCLUSIONS

Table 1 contains the results of the comparisons of OZF and ZFP zone combinations for FTW and CLE. At FTW, there was a total of 23 more OZF forecasts than ZFP forecasts (seven more at 0000 and 16 more at 1200 GMT) or only about one more OZF combination for every three cases. At CLE there were a total of 12 fewer OZF than ZFP combinations for the two cycle times. Even if attention is focused on the 1200 GMT cycle for the period before March 1 when OZF's were not operationally available and therefore did not influence the forecasters in preparing their ZFP's, there was only about one more OZF combination per case at FTW and slightly fewer OZF combinations at CLE. It appears, therefore, that at FTW and CLE the CWF program is producing about the same number of zone combinations as produced locally.

Looking at identical zone combinations in Table 1, the CWF program matched somewhat over one third of the zone combinations produced by the forecasters

at both sites for the 0000 GMT cycle. This is not particularly good and implies that a considerable amount of editing would be required if the forecasters wanted to use the OZF's. There are a few reasons for the low number of identical matches of the OZF and ZFP combinations: incorrect MOS forecasts, errors in the stations used to interpolate MOS forecasts to zone centers, problems with the criteria used to determine whether or not zones combine, and errors in the lists of each WSFO's preferred combinations. Of course, it's possible that the forecasters are making mistakes in combining zones, too. Of interest are the results at 1200 GMT. At both sites, there was a sharp increase in the number of identical combinations after March 1 when the 1200 GMT OZF's became available. This indicates that the forecasters used the 1200 GMT OZF's to determine the combinations for their ZFP's. At 0000 GMT, an increase (not shown in Table 1) was also noticed in the number of identical combinations after March 1 at FTW, but this was only about half as much as at 1200 GMT. At CLE, no increase was noticed for the 0000 GMT cycle. It's possible that the forecasters make more use of the 1200 GMT OZF's than the 0000 GMT product because of increased workload during the daylight hours.

The results for zone combinations produced by the forecasters that are impossible for the CWF program to match are encouraging, especially at FTW. There, not only were less than 7 percent of the forecaster's zone combinations impossible for the CWF to duplicate for 0000 GMT, but every zone combination issued by FTW forecasters for the 1200 GMT cycle after March 1 was possible for the CWF to generate. While the percentage of impossible combinations for CLE was also reasonably low, they were not as good as those at FTW. Based on these results and those for identical zone combinations, it appears that at least some improvement can be made in the OZF combinations, especially at CLE. We have had some recent discussions with personnel at CLE about the useability of their OZF's, and we will be revising the stations used to interpolate MOS forecasts to zone centers and the list of preferred zone combinations.

In our evaluation of the criteria used to determine whether or not zones combine, we found that the criteria themselves appear satisfactory. However, a few problems were uncovered. Ceiling and visibility, which do not appear in a public weather forecast, were inadvertently being evaluated in the combining process, and 3-hourly dewpoints, which rarely enter into a public weather forecast, were unduly influencing the combining process. In both cases, zones that should have combined were prevented from doing so. This may have been a contributing factor in the low number of identical matches of OZF and ZFP combinations. After making the appropriate changes, the average number of OZF zones that combined increased by 10 percent for a sample of 14 test cases (both 0000 and 1200 GMT) when compared to the operational program.

In our comparison of OZF and ZFP wording, we found that if it is necessary for the forecaster to add relatively long phrases to a number of zone forecasts, a considerable amount of time would be involved--especially when editing on AFOS--which would reduce OZF useability. This is demonstrated at FTW where the phrase "wind advisories will be necessary on area lakes" is required for strong winds but is not available in the OZF. This is not an infrequent occurrence. Also, first period weather, such as morning fog, that is not mentioned in the OZF but is occurring at the time the ZFP's are prepared and requires addition to the forecast is another example that would significantly reduce the useability of the OZF.

4. SUMMARY

In an effort to better understand the problems experienced by forecasters using the OZF, we performed an evaluation of its useability by comparing OZF and ZFP zone combinations and wording.

We found, as in other evaluations, that the OZF's are a useable product. However, problems with zone combinations and wording exist. These problems are exacerbated by the inability to do any meaningful editing on AFOS. NWS plans call for the installation of IBM compatible microcomputers with sophisticated word processing capabilities which will enable the forecasters to make greater use of the OZF's.

To provide a zone CWF of maximum quality and useability, improvements in zone combinations, stations used for interpolation, and wording still need to be made. Improvements to zone combinations can be achieved by working with forecasters from each WSFO on the selection of stations to use to interpolate MOS forecasts to zone centers and on their preferred zone combinations. Some of the problems with wording can be corrected by changing the values of the station specific control constants. This, too, is best done by working closely with the forecasters.

5. ACKNOWLEDGMENTS

We would like to thank Ward R. Seguin and Robert L. Miller for their helpful suggestions during the course of this work. Our appreciation also goes to Alice T. Baker for typing the paper.

6. REFERENCES

Bermowitz, R. J., and R. L. Miller, 1984: A field evaluation and some recent changes in the computer worded forecast. Preprints Tenth Conference on Weather Forecasting and Analysis, Clearwater Beach, Amer. Meteor. Soc., 92-97.

_____, M. M. Heffernan, and H. R. Glahn, 1980: Computer worded forecasts: An update. Preprints Eight Conference on Weather Forecasting and Analysis, Denver, Amer. Meteor. Soc., 453-456.

Glahn, H. R. 1978: Computer worded public forecasts. NOAA Technical Memorandum NWS TDL-67, National Oceanic and Atmospheric Administration, U.S. Department of Commerce, 24 pp.

National Weather Service, 1983a: Computer worded forecasts. NWS Technical Procedures Bulletin No. 336, National Oceanic and Atmospheric Administration, U.S. Department of Commerce, 17 pp.

_____, 1983b: Computer worded forecasts (appendix). NWS Technical Procedures Bulletin No. 337, National Oceanic and Atmospheric Administration, U.S. Department of Commerce, 8 pp.

Table 1. Results of the zone combination comparison between computer worded zone forecasts (OZF's) and locally prepared zone forecasts (ZFP's) for WSFO's Fort Worth, Tex. and Cleveland, Ohio.

Site	Cycle*	Number of Cases	Total ZFP Forecasts	Total OZF Forecasts	Identical Zone Combinations Per Forecast (%)	ZFP Zone Combinations Impossible for the OZF (%)
FTW	0000 GMT	40	236	243	40.2	6.8
	1200 GMT (Before 3/1)	12	67	77	32.8	9.0
	1200 GMT (After 3/1)	10	60	66	63.3	0.0
CLE	0000 GMT	22	128	114	33.6	18.0
	1200 GMT (Before 3/1)	8	43	38	37.2	14.0
	1200 GMT (After 3/1)	6	33	40	54.5	15.2

*The 1200 GMT OZF became available to the forecasters on March 1, 1984. Comparisons for the 1200 GMT cycle before that date were made between the ZFP and experimental runs made at TDL.