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NGM BASED PROG SOUNDINGS: AN OPERATIONAL APPLICATION

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1. Introduction

Prognostic soundings based on grid point data from the NGM have demonstrated acceptable quality and detail to be of value to field forecasters. They also provide a unique view of the NGM. However, because of the limitations of AFOS communication this data is available at only a handful of sites. By combining several different AFOS data sources, it is possible to obtain an operationally useful prognostic sounding. An AFOS program[1] was developed to produce and display these soundings. Its output will be used to look at a fall precipitation event in North Dakota.

Twelve and 24-hour forecast soundings can be produced for any site in the NGM FOUS FRHTXX bulletins (NWS,1985). This product contains the boundary layer wind, low level temperatures (T1T3T5) and mean RH values (R1R2R3) from the NGM. The LFM MOS provides the surface temperature, dew point and wind. The FD2FAx and FD3FAx winds aloft products from the NGM provide additional temperature and wind data through 200 mb. Up to 12 levels of temperature and 11 levels of wind are available to plot the sounding (Table 1). For summer convective weather, the program produces prog values of the Showalter index, K-index and, optionally, a hodograph.

2. Operational Application

On October 22-23, 1991, a cold Canadian air mass was forecast to move across North Dakota while a strong vort max moved up in southwesterly flow aloft. This is a favorable precipitation pattern for North Dakota. The prog soundings were used to analyze two forecast problems on the 22nd.

At 1200Z on the 22nd, the air mass was unseasonably warm across North Dakota with an 850 mb temperature at Bismarck of

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[1] Details of program information, installation, and execution are contained in Central Region Program Note (CRPN) 71, August 1992.

>15°C. The observed and 12-hour forecast sounding (based on the 0000Z cycle) valid at 1200Z are shown in Figure 1. The prog sounding was a little cooler in the low levels and drier at high levels than the observed; but the inversion and lapse rates were depicted well. The question for the 10 a.m. forecast update was, what would afternoon temperatures be behind the Canadian cold front?

Figure 2 shows the 24-hour forecast sounding (based on the 0000Z cycle) and observed sounding for 0000Z on the 23rd. Although too dry, the prog sounding was quite accurate in depicting the depth and intensity of the frontal inversion. Extending the lowest layers of the prog sounding dry adiabatically to the surface indicated afternoon temperatures in the lower 50s. After a morning high of 61°F, temperatures fell into the upper 40s by late afternoon. MOS three-hourly temperature guidance indicated temperatures rising into the upper 50s during the afternoon. The prog sounding also depicted well the backing winds of the observed sounding.

The forecast problem for the 4 p.m. afternoon forecast was what precipitation type would occur overnight as the vort max moved across the state by 1200Z on the 23rd. The MOS FPC product, based on the 1200Z LFM, forecast liquid precipitation with temperatures above freezing. The 1200Z NGM forecast the thickness to be above 5460 meters, which would favor rain over snow. The NGM also forecast an 850 mb temperature of about -2°C, which by itself would not preclude the possibility of rain. Figure 3 shows the 24-hour forecast sounding (based on the 1200Z cycle) for 1200Z on the 23rd and the observed sounding. The forecast sounding was almost entirely below freezing, which indicated a forecast of snow. The precipitation began as snow, and seven inches of snow accumulated at Bismarck. The observed sounding was very similar to the prog sounding.

3. Summary

This brief example shows several potential uses of these prog soundings. The soundings provide useful operational forecast information and a unique view of the NGM output. The summertime soundings and prog hodographs have also proven operationally useful. These limited prog soundings serve to "whet the appetite" for the more detailed model soundings that will be available to all sites in the future.

4. References

National Weather Service, 1985: "FOUS Messages from the RAFS", *NWS Technical Procedures Bulletin No. 351*, NOAA, DOC, 7 pp.

Table 1

DATA USED TO CONSTRUCT PROG SOUNDINGS

Level	Parameters	Source
Surface	T,D,W	LFM MOS
Boundary Layer	W	FRHTXX
.982 sigma	T,D	FRHTXX (T1,R1*)
.897 sigma	T,D	FRHTXX (T3,R2)
.785 sigma	T,D	FRHTXX (T5,R2)
3K Feet	W (low elev stns only)	FD2 OR FD3
6K FEET	T,W,D (most stns)	FD2 OR FD3,FRHTXX(R2)
9K FEET	T,W,D	FD2 OR FD3,FRHTXX(R2)
12K FEET	T,W,D	FD2 OR FD3,FRHTXX(R2)
18K FEET	T,W,D	FD2 OR FD3,FRHTXX(R2)
24K FEET	T,W,D	FD2 OR FD3,FRHTXX(R3)
30K FEET	T,W,D	FD2 OR FD3,FRHTXX(R3)
34K FEET	T,W,D	FD2 OR FD3,FRHTXX(R3)
39K FEET	T,W	FD2 OR FD3

* MEAN LAYER RH VALUES FROM THE FRH BULLETIN ARE APPLIED AT EACH LEVEL THAT FALLS WITHIN THE LAYER. IF THE RH IS <20, A DEW POINT DEPRESSION OF 30 IS USED. DEW POINT NOT PLOTTED IF TEMPERATURE IS COLDER THAN -40C.

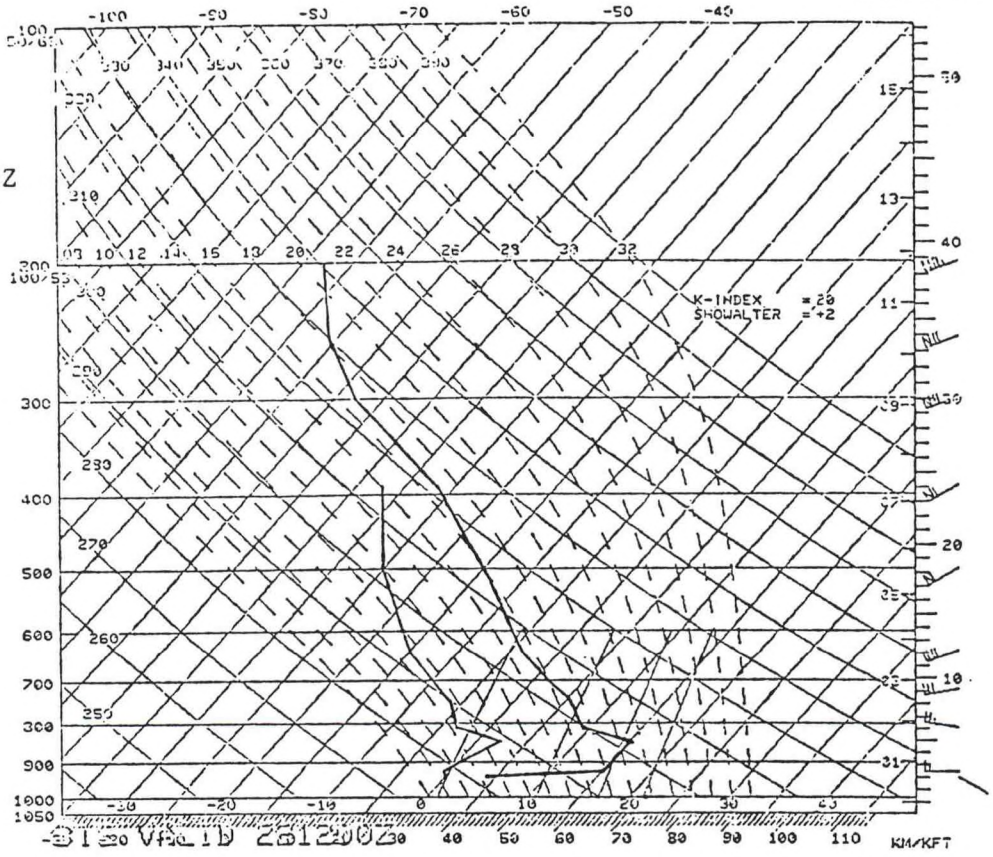

Figure 1a. 12-hour prog sounding valid 12Z October 22, 1991.

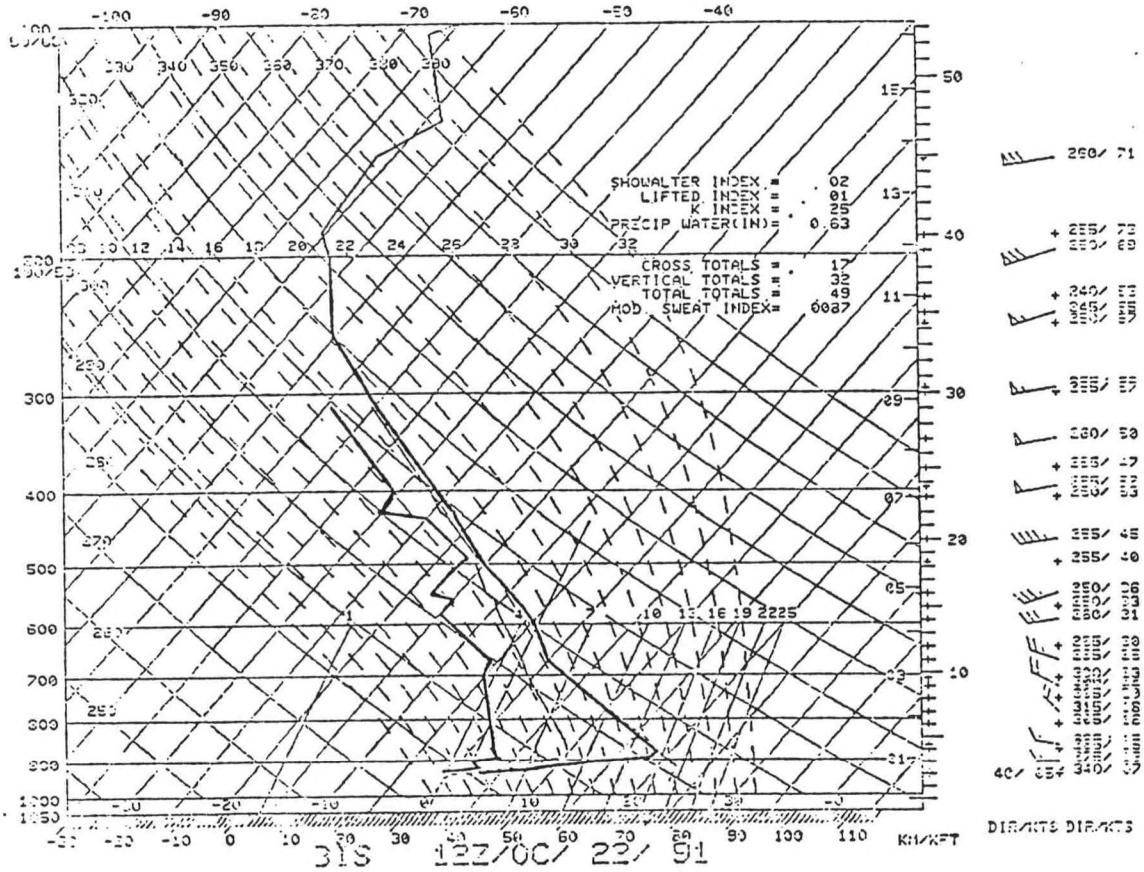

Figure 1b. Observed sounding valid 12Z October 22, 1991.

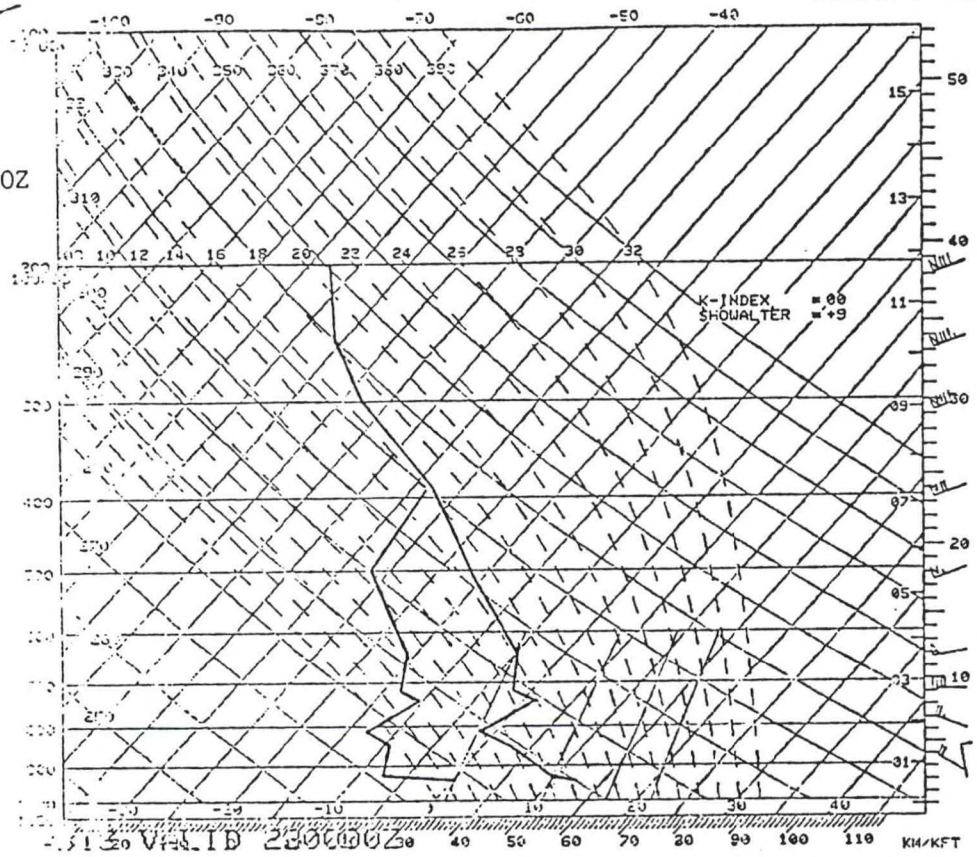

Figure 2a. 24-hour prog sounding valid 00Z October 23, 1991.

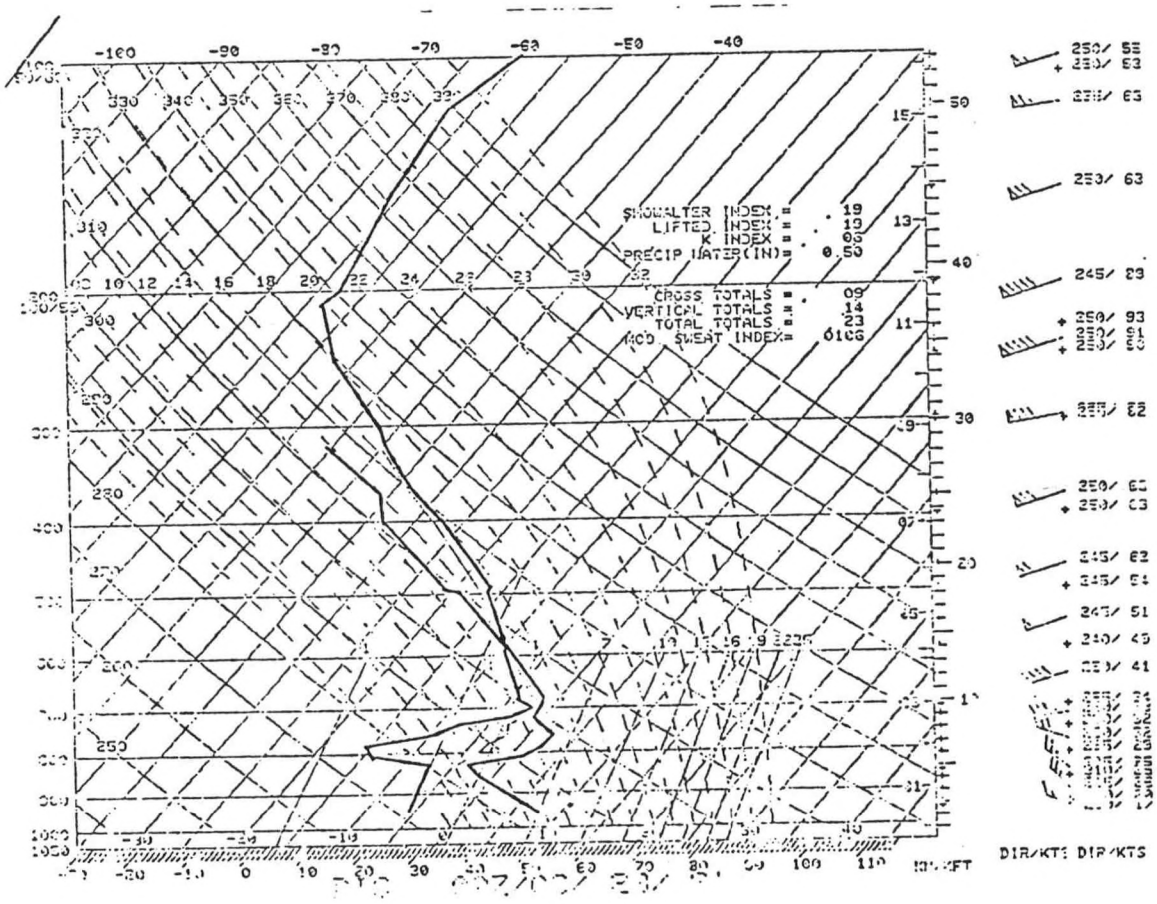

Figure 2b. Observed sounding valid 00Z October 23, 1991.

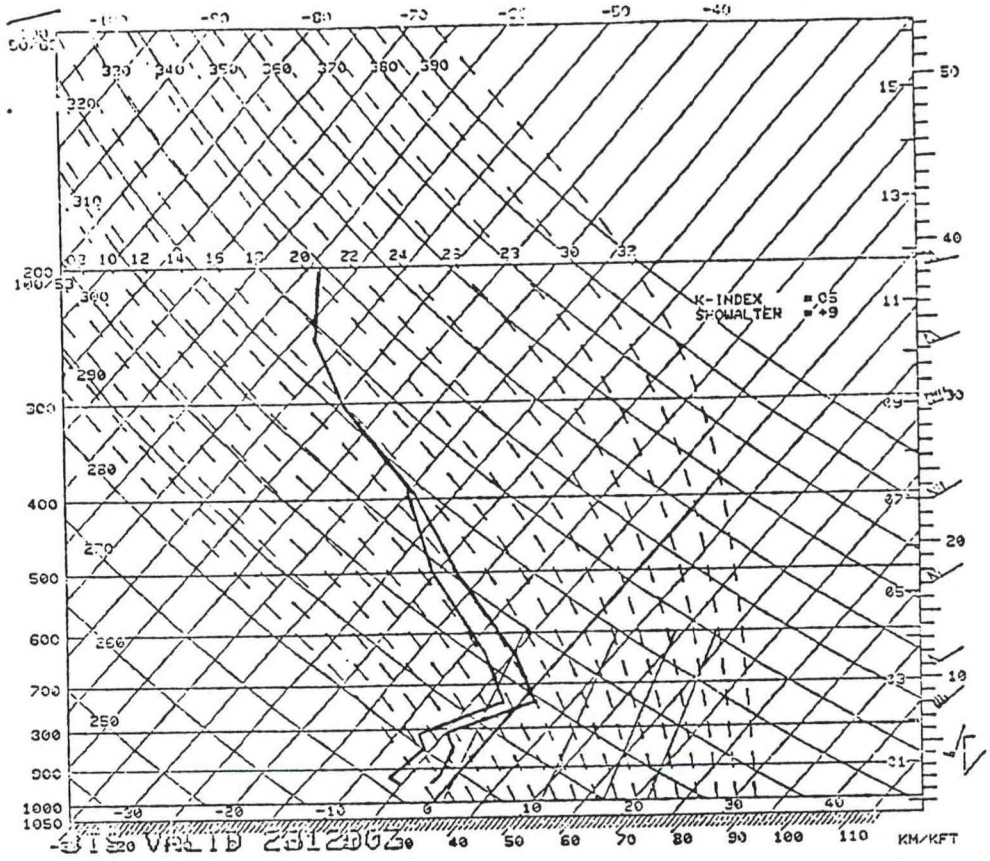

Figure 3a. 24-hour prog sounding valid 12Z October 23, 1991.

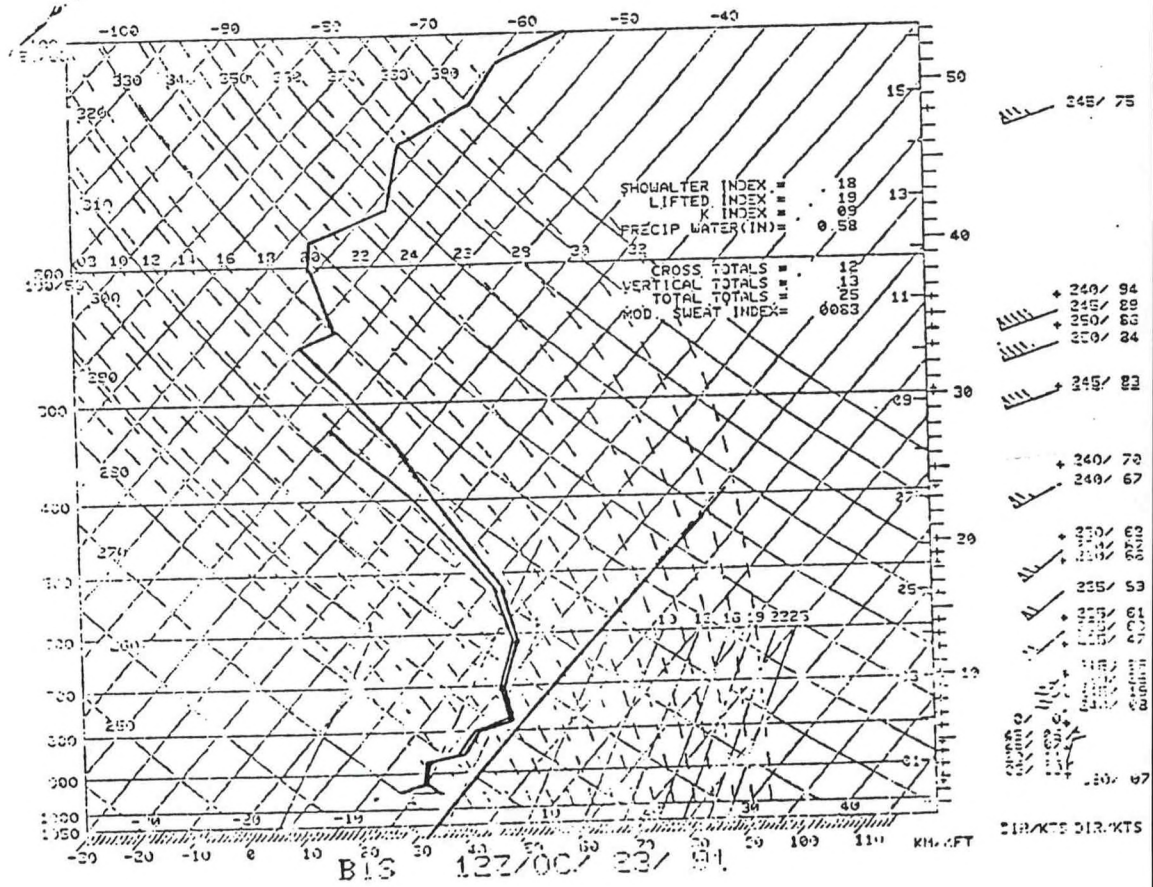

Figure 3b. Observed sounding valid 12Z October 23, 1991.