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A CASE FOR THE HUMAN ELEMENT - SUBJECTIVE ANALYSIS

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1. Introduction

The following example illustrates how one piece of corrupt data can change the character of a forecast. It also serves as an example of how important an examination, even briefly, of sounding data can be in making a forecast.

2. Weather Situation

On the morning of May 2, 1989, a closed low at 500 mb was centered over the Great Lakes region with northerly flow in the upper layers over the central United States. A short wave trough over the northwest United States was phasing with another low north of Hudson Bay. Height falls of 30 gpm were evident east of the short wave in central Montana and Wyoming (Fig. 1).

In the lower layers, a trough at 850 mb was moving into western Texas with a 35 knot low level jet advecting a +10°C isodrosotherm into northwestern Texas. In fact, +8°C dew points had already moved into western Nebraska (Fig. 2). Southerly flow could be expected to intensify over the region as the upper level short wave approached, increasing both the low level warm advection and (of most importance to the Northern Plains) low level moisture flux convergence. Showers and possibly thundershowers would have to be considered.

3. A Look at the North Platte Sounding

Although soundings in the Northern Plains were stable at this time, Table 1 shows some sounding indices for the North Platte (LBF) run at 12Z that look quite interesting. The forecasters interest in thundershowers must now include the possibility that deep convection, and possibly severe thunderstorms may occur in the region. In particular, a total totals index of 59 indicates severe potential. Unfortunately, several of the indices appear to be quite contradictory, especially the Lifted and Showalter indices. Also, the precipitable water is quite low, probably not enough to support convection.

Examining the North Platte sounding sheds suspicion on the data (Fig. 3). It appears from the dew point trace and the missing wind data from the surface to 700 mb that we should hold the 850 mb dew point data as suspect, and remove

it from our analysis. Surface dew points in the region were in the low to mid 20's ^{o}F (i.e., about $-5^{o}C$) hinting at a much drier flow than shown by the sounding. It is interesting how one piece of data at one level could show up in many different ways to corrupt the initial analysis.

Table 1
Severe Weather Indices from 12Z
May 2, 1989 North Platte Sounding

1.	Showalter	-5
2.	Lifted	+4
3.	K Index	29
4.	Total Totals	59
5.	Precip H20	.29
6.	Sweat	161

Here is a brief summary of the products affected by ONE bad piece of data at 850 mb.

1. 850 mb initial analysis
2. Total Totals index
3. Showalter index
4. K index
5. LFM initial analysis
6. Height errors in the sounding

The LFM model, since it considers only mandatory data, is most susceptible to this error. The model believed more moisture was present in the lower layers. Through the virtual temperature calculation, the hypsometric equation would give height values higher than they should be, resulting in geopotential height errors at and above 850 mb.

4. Final Comments

Observational errors have been a problem that meteorologists have had to deal with since the dawn of modern meteorology. The introduction of automated measuring equipment (such as ARTS system) and in the era of ASOS and NEXRAD, large amounts of data will be handled untouched by human hands. While automation may speed processing times and increase sampling frequency, if the data proves to be unreliable it will compound the forecasting problem. The human can only look at a limited amount of data in the time period needed to make a forecast, and the forecaster may not always be able to tell between what is real and what is contaminated by error. This case is just one example.

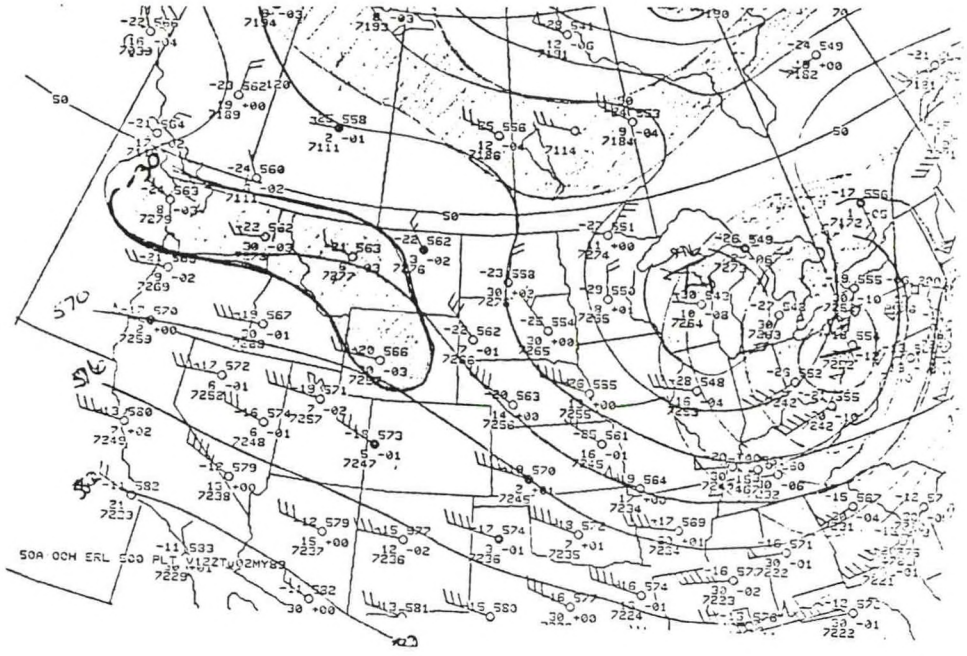

Fig. 1

500 MB ANALYSIS 12Z 2 MAY 1889

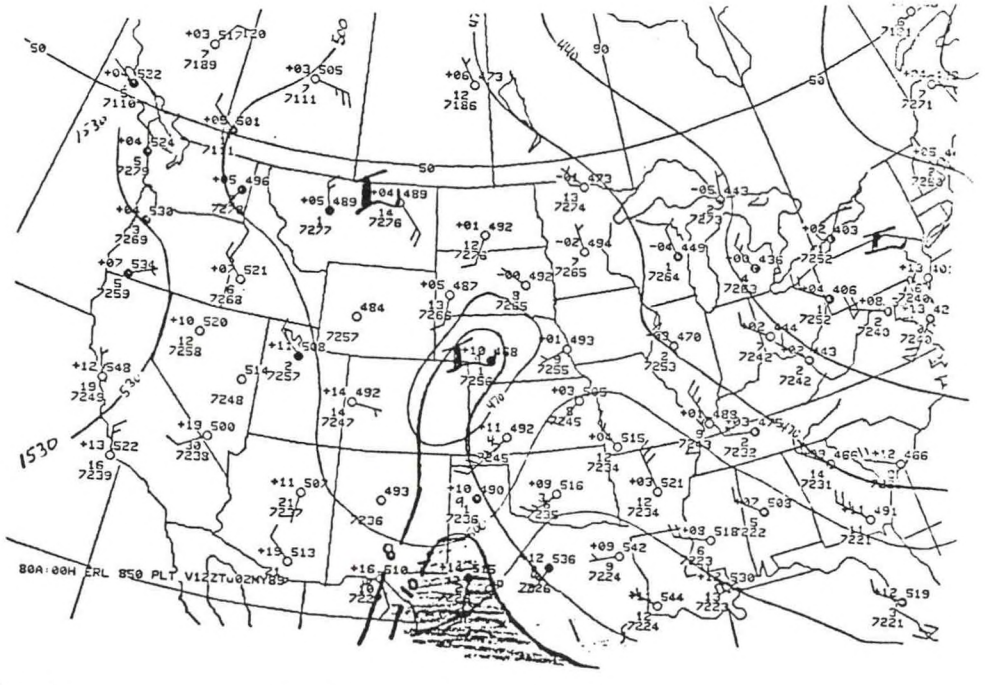

Fig. 2

850 MB ANALYSIS 12Z 2 MAY 1989

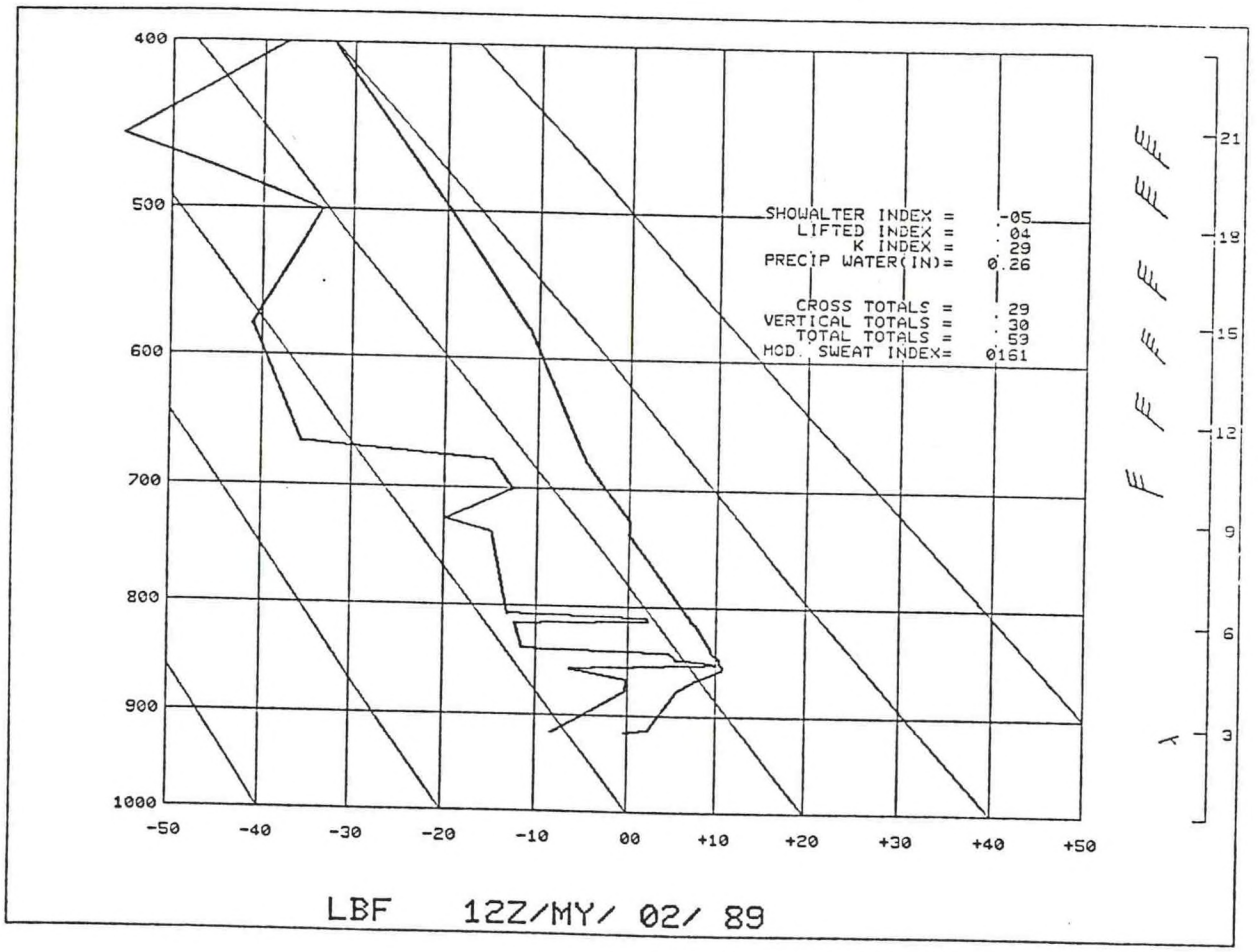

Fig. 3

12Z, May 2, 1989 rawinsonde plot for North Platte, Nebraska.