CRH SSD
MARCH 1994

CENTRAL REGION TECHNICAL ATTACHMENT 94-07

RECENT TRENDS IN MISSING/DELAYED WEATHER OBSERVATIONS

Warren E. Sunkel
National Weather Service Central Region Headquarters
Systems Operations Division

1. Introduction

In 1988, the Systems Operations Division began an experiment to monitor missing and delayed weather observations. The purpose of the experiment was twofold--to increase the awareness of timely observations and to decrease the number of missing observations.

2. Data and Methodology

An AFOS applications program was developed to read the daily statistics message, cccSTASMC, from the National Weather Service Systems Operations Center. Radar observations (ROBs), rawinsonde observation mandatory levels (MANs), and surface aviation observations (SAOs) are monitored by the SOC and are tabulated in the statistics message (Figure 1). The local AFOS program archived counts for each station and produced monthly, quarterly, and annual summaries of missing/delayed observations. It included two special algorithms. The first counted missing observations for each node of the Central Region AFOS Regional Distribution Circuit. If more than 50 percent of the observations for a node were missing, a "node failure" was assumed, and individual stations were not charged with a missing observation. The second algorithm discounted missing observations for part-time stations during the hours they were closed. Data were analyzed for the five-year period 1989 to 1993. Rawinsonde observations showed nearly perfect results and were not considered in this study. For radar and surface observations, the data sample included 57 percent of the possible observations. The monthly distribution of the percentage of possible hours for which counts of missing observations were available is shown in Figure 2.

3. Results

The monthly percentages of missing radar and surface observations were computed using the relationship

$$T / n / h * 100$$

```
CRHSTASMC
TTAA00 KSMC 101130
ROB'S NOT RECEIVED BY H+36 AT THE SMCC FOR  9/ 5/90

TIME:0036  MFR
TIME:0136   RECEIVED ALL MONITORED PRODUCTS
TIME:0236   RECEIVED ALL MONITORED PRODUCTS
TIME:0336   PIT ZLC
TIME:0436  ZLC
TIME:0536  GLS
TIME:0836  AMA EYW MEM PIT
TIME:0936  EYW SEP SIL
TIME:1036   RECEIVED ALL MONITORED PRODUCTS
TIME:1136  AMA GRI MEM
TIME:1236  BNA GLS
TIME:1601  MORE THAN 12 ROB'S MISSING - PROBLEM ASSUMED AT THE SMCC
TIME:1604  MORE THAN 12 ROB'S MISSING - PROBLEM ASSUMED AT THE SMCC
TIME:1607  MORE THAN 12 ROB'S MISSING - PROBLEM ASSUMED AT THE SMCC
TIME:1636   RECEIVED ALL MONITORED PRODUCTS
TIME:1736   RECEIVED ALL MONITORED PRODUCTS
TIME:1936  FAR LIC ZLC
TIME:2136  CHS GLS HON LIC ZSE
TIME:2236  BRO GLS MSP ZLC
TIME:2336  DTW

MAN'S NOT RECEIVED BY 01Z OR 13Z AT THE SMCC FOR  9/ 5/90

TIME:0101  WEG
TIME:1301  WEG

SAO'S NOT RECEIVED BY H+56 AT THE SMCC FOR  9/ 5/90

TIME:0056  ELY MFD
TIME:0156  EKN MFD SHR
TIME:0256  BDR CAR EKN HTL LCH MFD SHR STC TYS WMC
TIME:0356  BDR CAR CHS EKN HTL MFD SHR STC WMC
TIME:0456  BDR CAR EKN GLD HTL MFD RST SHR STC WMC
TIME:0856  ATL BDR BPT CAR COU EKN HTL MCI MFD OKC SGF SHR STC WMC
TIME:0956  HTL JAX MFD SDF SHR STC TOP WMC
TIME:1056  PDX
TIME:1202  MFD SHR
TIME:1256  AVP LEX
TIME:1602  BIS FAR FSD HON ISN RAP
TIME:1605  BIS FAR FSD HON ISN MFD RAP SHR
TIME:1656  AEQ
TIME:1756  CAR FAT PDX
TIME:1856  IAD
TIME:1956  FAT GJT PDX
TIME:2156  BIS CPR CVG DDC FAR FSD HON ISN RAP SHR
TIME:2256  GGW LBB MFD STC
TIME:2356  BPT DLH GGW MFD SAT SLC
```

Figure 1. Statistics Message Indicating Radar (ROB), Rawinsonde Mandatory Level (MAN), and Surface Aviation Observations (SAO) that were missing.

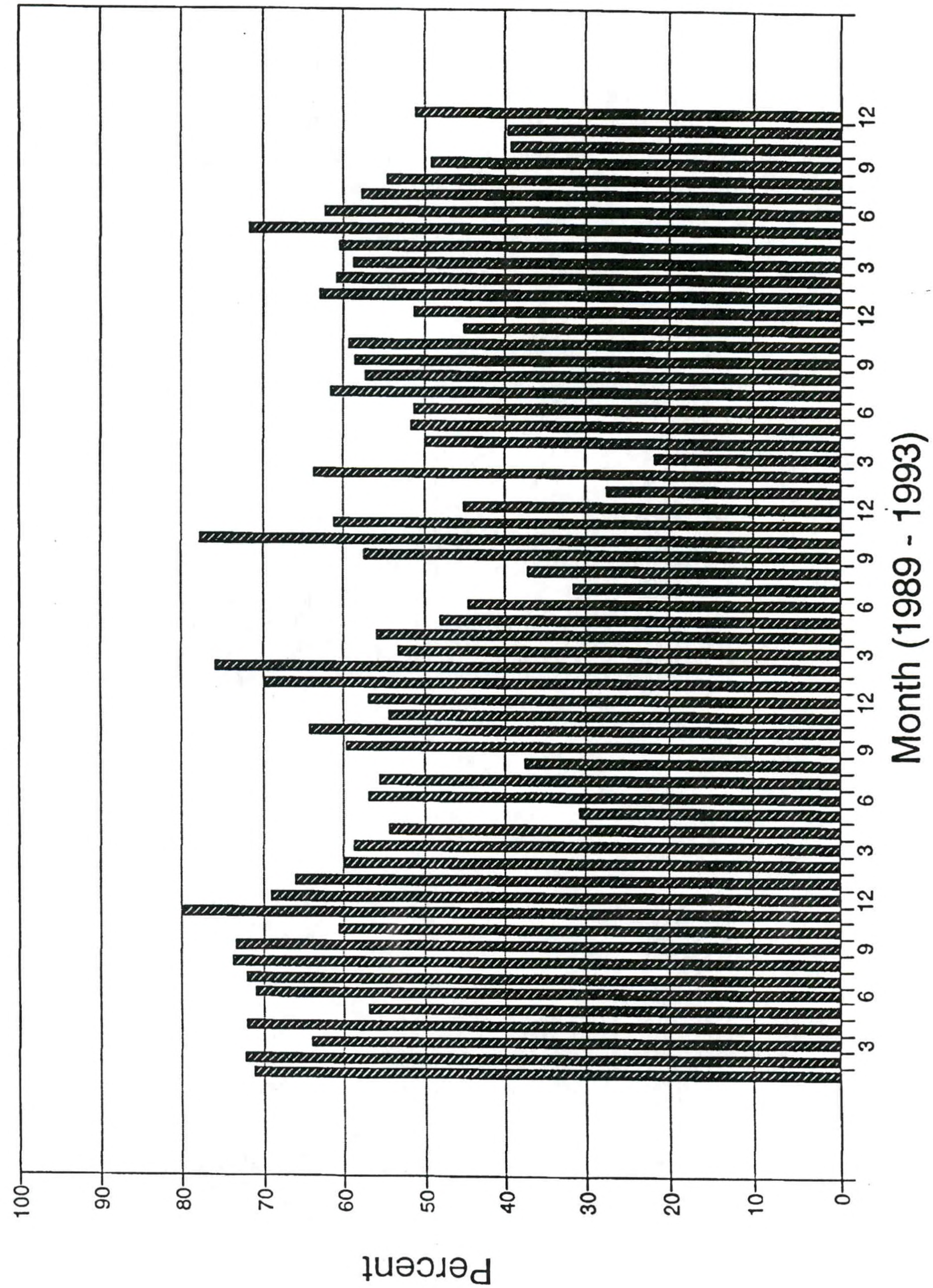

Figure 2. Percentage of Hours for which Counts of Missing Observations were Available.

where T was the total number of missing observations for the region, n was the number of stations, and h was the number of hours monitored.

The monthly distribution of percentage of missing observations is shown for radar observations (Figure 3) and surface observations (Figure 4). Values for radar observations ranged from a high of 4.94 in March 1989 to a low of 0.56 in February 1993. Values for surface observations ranged from a high of 2.02 in January 1989 to a low of 0.45 in May 1993. The downward trend of the monthly values is shown by fitting the data to an exponential curve (Figures 5 and 6).

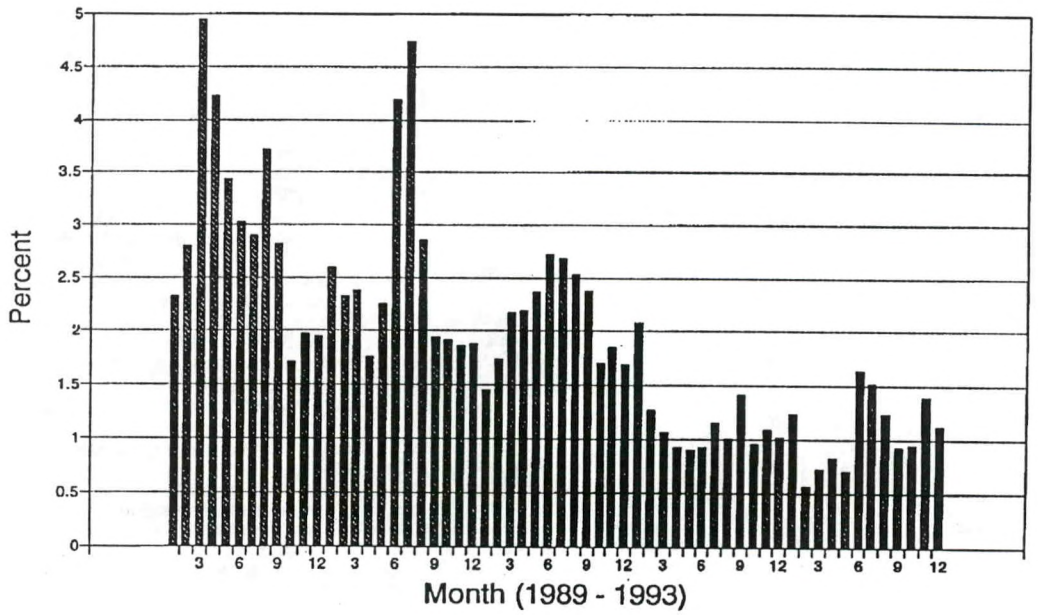

Figure 3. Percentage of Missing ROBs; Raw Data.

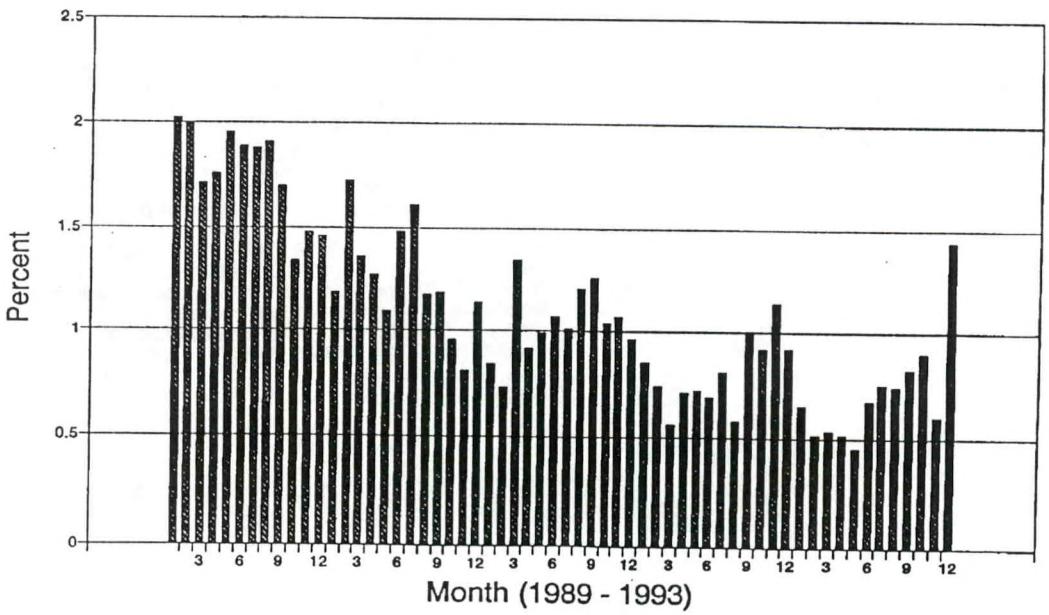

Figure 4. Percentage of Missing SAOs; Raw Data.

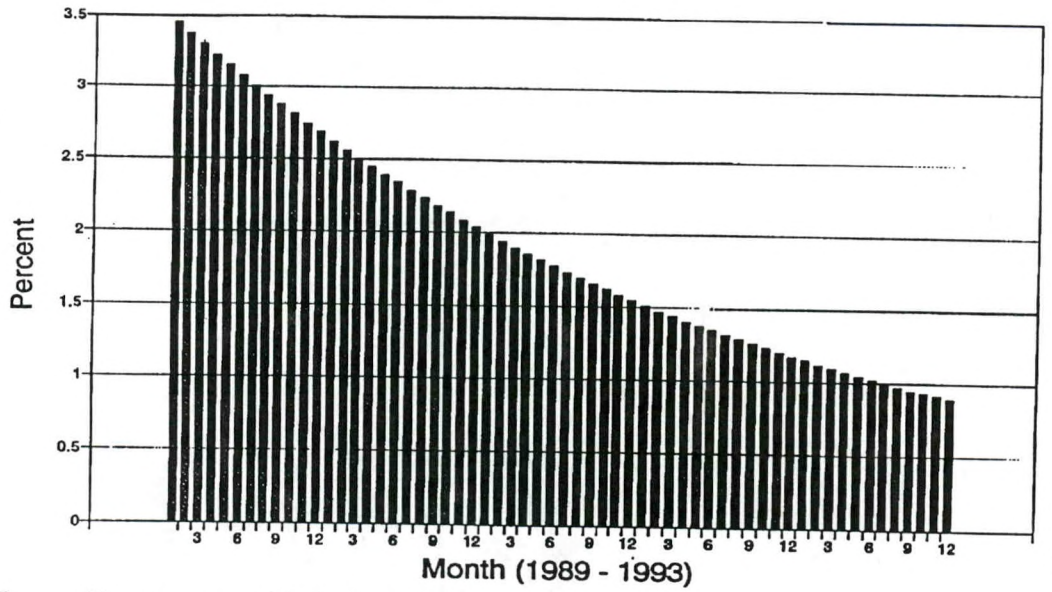

Figure 5. Percentage of Missing ROBs; Exponential Fit.

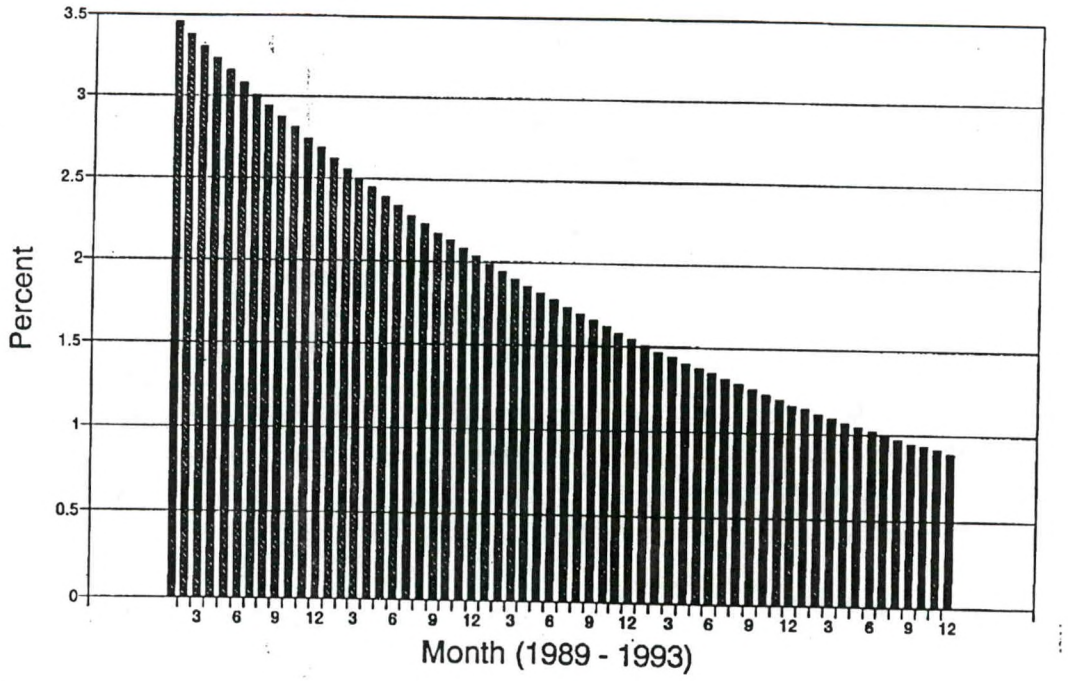

Figure 6. Percentage of Missing SAOs; Exponential Fit.

Ten of the 62 surface reporting stations were replaced with automated observing systems (ASOS) in September 1992. The time windows for the taking of automated observations are different from those for the manual observations, and the automated sites occasionally showed large numbers of missing observations. Thus, the raw data for missing SAOs contain some contamination for the last 15 months of the study.

The seasonal distribution of missing observations is shown in Figure 7. The number of missing radar observations showed a slight peak in the summer months and a slight dip in the winter. The number of missing surface observations was nearly constant throughout the year.

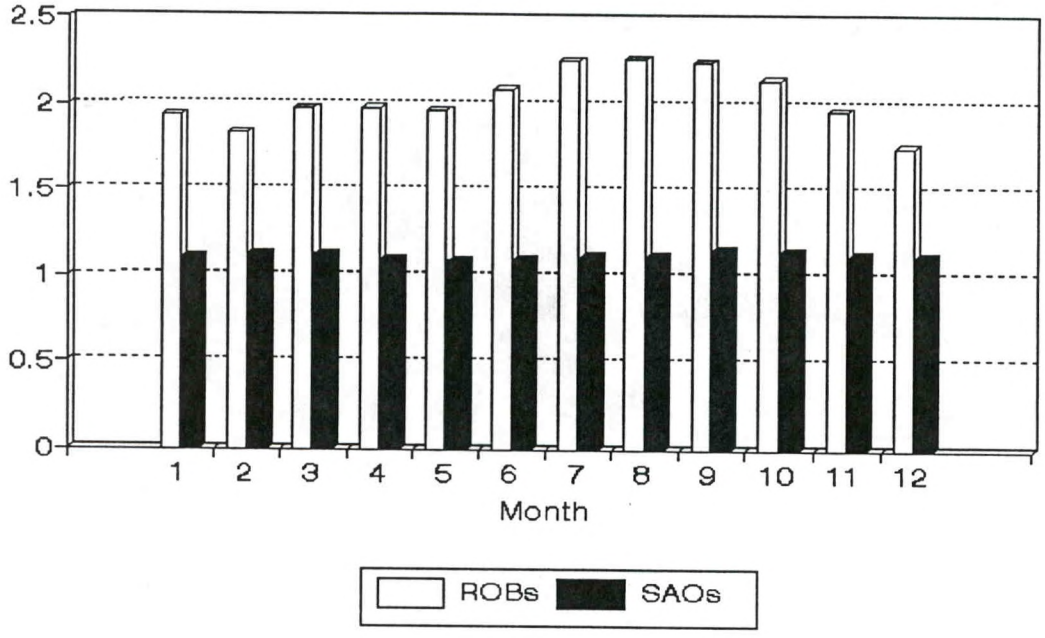

Figure 7. Seasonal Percentage of Missing Observations.

4. Conclusions

The experiment was successful in its two purposes. Awareness of timely observations was increased by sending monthly and quarterly reports of missing/delayed observations to the Central Region Area Managers. Data collected during the five-year period showed that the number of missing observations for both radar and surface decreased.

Even with the advent of automated observations, monitoring of missing observations will still be necessary to detect equipment failures and communications problems. The threshold time for determining a late observation will need to be adjusted to the time window of the automated observing systems.

5. Acknowledgement

Tom Schwein, Chief of the Systems Operations Division, devised this experiment and handled much of the communications with field stations related to the increased awareness of timely observations. He deserves much of the credit for the decrease in missing observations.