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National Weather Digest

ANALYZING AIRWAYS OBSERVATIONS USING A TIME SHARING COMPUTER

bу

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1. INTRODUCTION

The weather forecaster's chief concern is the hour to hour, and sometimes minute to minute weather changes taking place in his forecast area. For the aviation forecaster, ceilings and visibilities are the prime concern since amendments must be issued when weather limits are exceeded. Similarly, the public service forecaster must monitor temperature, dew point, and winds as well as changes in cloudiness, and the onset and type of precipitation, etc. that affect the current forecast or that may require the issuance of special statements, advisories, bulletins, etc. The weather forecaster has a large span of data to survey; nevertheless he must constantly check for significant changes and assess their impact on the forecast product. This article describes a computer program that partly answers the problem of data analysis for the forecaster.

2. DISCUSSION

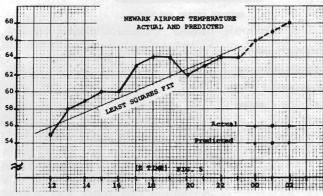
Figures 1 and 2 are computer formatted lists or files of the aviation observations taken at Newark Airport and at J. F. Kennedy Airport on May 31, 1974. The program to execute this was written in Fortran language on the Univac 1108 Time Sharing System. Two separate files were written by the program and then analyzed by the program (par-

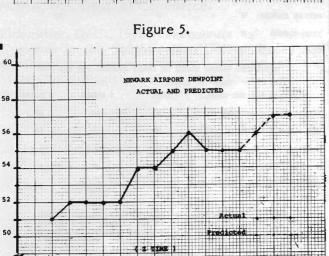
tial listing attached (see Appendix)). The data elements used by the program are shown in the column headings of Figures 1 and 2. Low Middle and High clouds are shown as condition codes (CND) where code 3 indicates scattered clouds, 6 broken and 8 overcast conditions. Heights (HT) are in hundreds of feet. Visibility, pressure, temperature, dew point and wind follow. (Pressure is in millibars with the first 2 digits omitted.)

The program reads the first file (Newark) and prints out the changes during the last 3, 6, and 12 hours. These are shown in Figures 3 and 4 under the Title PROGRAM OUTPUT. In this program, changes in cloud cover conditions are for a period of 3 hours only, but could be extended, if desired. On the top of Figure 3, opposite visibility, the changes for 3, 6, and 12 hours are shown. These values can be checked by referring to Figure 1. At 2000 GMT, visibility was 4.0, and 3 hours later at 2300 GMT it was 7.0 for a 3.0 mile increase. Checking the 12 hour change, it can be seen that at 1100 GMT visibility was 2.5 miles and 12 hours later it was 7.0 miles for an increase of 4.5 miles. Likewise the changes in pressure, temperature, and dew point are also determined and listed. The changes in sky condition and heights were calculated in a similar way. Thus, it can be seen that

| TIME | LO | | IARK AI | IRPORT | OBSER HIG | | ns m | Y 31 | 1974 | | | | PROGRAM OUTPUT- NEWARK AIRPORT |
|---|--|---|--|--|--|--|--|--|--|--|---|---|---|
| | cro | | | DODS | | uds • | | | | | | | CHANGES DURING THE LAST |
| 2. | CENTO | HT O | CINID | H T O | CINID | HT O | VSBY | PRES 129 | TMP 63 | DP 52 | WIND | VEL | 3 HÓURS 6 HOURS 12 HOURS |
| 1 | 0 | 0 | 0 | 0 | ٥ | ٥ | 6.0 | 135 | | | 150 | 5 | VISIBILITY (MILES) +3.0 +3.0 +4.5 |
| 2 | 0 | 0 | 0 | ٥ | 0 | 0 | 6.0 | 142 | 61 | | 150 | 7 | PRESSURE (MILLIBARS) -2.1 -2.1 -3.1 |
| 3 | 0 | 0 | 0 | 0 | 0 | 0 | | | 60 | 53 | 150 | 8 | TEMPERATURE (DEGREES) +2 +1 +8 |
| 4 | ٥ | ٥ | 0 | ٥ | 0 | 0 | 6.0 | 149 | 60 | 53 | 150 | 4 | DEW POINT (DEGREES) -1 +1 +3 |
| 5 | 0 | 0 | ٥ | ٥ | 0 | 0 | 6.0 | 152 | 60 | 53 | 160 | 5 | |
| 6 | 8 | 9 | ٥ | 0 | 0 | 0 | 5.0 | 152 | 59 | 53 | 110 | 3 | CHANGES DURING THE LAST 3 HOURS |
| 2 | 8 | 9 | 0 | 0 | 0 | 8 | 4.0 | 159 | 59 | 53 | 80 | 6 | # SKY CONDITIONS CHANGED CLOUD HEIGHTS FROM 3 HRS AGO TO PRESENT (IN HUNDREDS OF FEET) |
| 8 | 8 | 6 | 0 | 0 | ٥ | | 5.0 | 159 | 59 | 53 | 150 | 6 | LOW CLOUDS 8 3 -3 |
| 9 | 8 | 6 | ٥ | 0 | 0 | 0 | 4.0 | 173 173 | 58 | 53 52 | 120 | 6 | MIDDLE CLOUDS 0 8 +60 |
| 10 | 8 | 5 | ٥ | ٥ | 0 | 0 | 2.5 | 180 | 52 56 | 52 | 126 | 6 B | HIGH CLOUDS & 0 0 |
| 11 | 8 | 5 | 0 | ٥ | 0 | 0 | 2.5 | 190 | 56 | 52 | 130 | 7 | nun Clows 9 |
| 12 | 8 | 6 | 0 | 0 | 0 | 0 | | | | | | | PREDICTED VALUES BASED ON LEAST SQUARES FIT FOR THE |
| 13 | 8 | 7 | 0 | 0 | 0 | 0 | 3.0 | 193 | 55 | 51 | 120 | 9 | NEXT 3 HOURS |
| 14 | 8 | 11 | 0 | 0 | 0 | ٥ | 2.5 | 190 | 58 59 | 52 52 | 136 | 8 | FORECAST FOR THE NEXT HOUR 2 HOURS 3 HOURS |
| 15 | 8 | 12 | 0 | 0 | 0 | 0 | 3.0 | 190 | 60 | 52 | 110 | 8 | TEMPERATURE (DEGREES) 66 67 68 |
| 16 | 8 | 12 | 0 | ٥ | 0 | 0 | 3.0 | 190 | 60 | | 110 | 8 | DEW POINT (DEGREES) 56 57 57 |
| 17 | 8 | 12 | 0 | 0 | D | D | 4.0 | 180 | 63 | 54 | 110 | 8 | VISIBILITY (MILES) 5.9 6.1 6.4 |
| 18 | 8 | 13 | ٥ | 0 | 0 | 0 | 4.0 | 176 | 64 | 54 | 120 | 9 | WIND VELOCITY (KNOTS) 9 9 9 |
| 19 | 8 | 9 | ٥ | 0 | ٥ | 0 | 4.0 | 176. | 64 | 55 | 140 | 9 | SURFACE PRESSURE (MILLIBARS) 16.3 16.0 15.8 |
| 20 | 8 | 13 | 0 | 0 | 0 | 0 | 4.0 | | | 56 | | 7 | |
| 21 | В | 8 | 0 | 0 | 0 | 0 | 4.0 | 180 169 | 62 63 | 55 | 140 | 8 | #NOTE: SKY CONDITION 3 = SCATTERED CLOUDS 1-5 TENTES 6 = BROKEN CLOUDS 6-9 TENTES |
| 22 | 8 | 6 | 0 | 0 | 0 | 0 | 6.0 | 166 | 64 | \$5 | 140 | 8 | " 8 = OVERCAST CLOUDS 10 TENTHS |
| 23 | 3 | 10 | 8 | 60 | 0 | 0 | 7.0 | 159 | 64 | 55 | 130 | 9 | Figure 3. |
| | | | | | Figu | re i | _ | | | | | | |
| | | | | | | | <u>. </u> | | | | | | <u> </u> |
| TIME | 1.0 | | | MEDY A | IRPOR | r OBS | | oms ma | Y 31 1 | 974 | | | <u>`</u> |
| TIME | | M DODS | CLOU | MEDY A | IRPOR HIGH CLOU | r obsi | BRVATI | | 3,762-5 | | WTMD 1 | TRI. | PROGRAM OUTPUT- JF REMHEDY AIRPORT |
| | | W | MIDI | MEDY A | IRPOR | r OBS | | ONS MA | Y 31 1 | 974 DP 54 | WIND 1 | ÆL B | CHANGES DURING THE LAST |
| z | CITO | W DUDS ET | CIAD | MEDY A DLE UDS HT | IRPOR HIGH CLOUC CMD | r obsi | WSBY | PRES | TMP | DP | | | CHANGES DURING THE LAST 3 HOURS 6 HOURS 12 HOURS |
| Z 0 | CITO CITO | M DUDS ET 9 | CHD CHD 6 | MEDY A DIE UDS HT 15 | LIRPORT HIGH CLOUC CMD 8 | F OBS | VSBY 9.0 | PRES 132 | TMP 58 | DP 54 | 130 | 8 | CHANGES DURING THE LAST 3 HOURS 6 HOURS 12 HOURS VISIBILITY (MILES) +8.0 +3.0 +4.5 |
| z 0 | CIA CMD 3 | W CODS ETT 9 | CLOU CMD 6 | MEDY A DIE UDS HT 15 | LIRPORT ELIGE CLOUE CEED 8 | F OBSI | VSBY 9.0 | PRES 132 139 | TMP 58 57 | DP 54 53 | 130 120 | 8 7 | CHANGES DURING THE LAST 3 HOURS 6 HOURS 12 HOURS VISIBILITY (MILES) +8.0 +3.0 +4.5 PRESSURE (MILLIBARS)-1.3 -1.3 -2.0 |
| 2 0 1 2 | CIA CMID 3 6 3 | DUDS ET 9 15 | MIDI CLOT CMD 6 6 | MEDY R | LIRPORT HIGH CLOUD CEND 8 | F CBSi 106 HT 40 39 | VSBY 9.0 4.0 | PRES 132 139 146 149 | TMP 58 57 | DP 54 53 | 130 120 120 190 | 9 7 5 | CHANGES DURING THE LAST 3 HOURS 6 HOURS 12 HOURS VISIBILITY (MILES) +8.0 +3.0 +4.5 PRESSURE (MILLIBARS)-1.3 -1.3 -2.0 TEMPERATURE (DEGREES) - 3 -3 +6 |
| 2 0 1 2 | CIA CMD 3 6 3 | OUDS ETT 9 15 3 | CLOT CHD 6 6 6 | MEDY A DIE UDS HT 15 25 26 28 | EIGE CLOUE CEDD 8 8 8 | 7 OBS | VSBY 9.0 4.0 4.0 5.0 | PRES 132 139 146 149 | TMP 58 57 57 | DP 54 53 53 53 | 130 120 120 190 | 7 5 4 | CHANGES DURING THE LAST 3 HOURS 6 HOURS 12 HOURS VISIBILITY (MILES) +8.0 +3.0 +4.5 PRESSURE (MILLIBARS)-1.3 -1.3 -2.0 |
| 2 0 1 2 3 | 6 3 6 | 0005 ETF 9 1.5 3 | MIDICALON CARD 6 6 6 6 | MEDY A DIZ JDS HT 15 25 26 28 | AIRPORT | F CBSI 1066 HT 40 39 44 50 | VSBY 9.0 4.0 4.0 5.0 | PRES 132 139 146 149 156 | TMP 58 57 57 57 55 | DP 54 53 53 53 | 130 120 120 190 100 | 7 5 4 | CHANGES DURING THE LAST 3 HOURS 6 HOURS 12 HOURS VISIBILITY (MILES) +0.0 +3.0 +4.5 PRESSURE (MILLIBARS)-1.3 -1.3 -2.0 TEMPERATURE (DEGREES) - 3 -3 +6 DEW POINT (DEGREES) -1 -1 +4 |
| 2 0 1 2 3 4 | CMO 3 6 3 2 0 | W DODS ETT 9 .15 .3 .2 .0 .8 | CHD 6 6 6 6 0 0 | MEDY A DIE UDS HT 15 25 26 28 0 | AIRPORT | 7 CBSI 1 CBS HTT 40 39 44 50 | VSBY 9.0 4.0 4.0 5.0 4.0 | PRES 132 139 146 149 156 159 | TMP 58 57 57 57 55 56 | DP 54 53 53 53 53 | 130 120 120 190 100 | P 7 5 4 4 5 5 | CHANGES DURING THE LAST 3 HOURS 6 HOURS 12 HOURS VISIBILITY (MILES) +0.0 +3.0 +4.5 PRESSURE (MILLIBARS)-1.3 -1.3 -2.0 TEMPERATURE (DEGREES) - 3 -3 +6 DEW POINT (DEGREES) -1 -1 +4 CHANGES DURING THE LAST 3 HOURS |
| 2 0 1 2 3 4 5 | CMD 3 6 3 2 0 6 6 6 | W DODS ETT 9 1.5 3 2 0 8 8 | ELOTO CENTO 6 6 6 0 0 | MEDY A DIA LOS HT 15 26 28 0 0 | EIGE CLOUE CEND 8 8 8 8 | T OBSI | 9.0 4.0 4.0 5.0 4.0 | PRES 132 139 146 149 156 159 159 163 | TMP 58 57 57 57 55 56 55 | DP 54 53 53 53 53 53 53 | 130 120 120 190 100 110 | 9 7 5 4 4 5 | CHANGES DURING THE LAST 3 HOURS 6 HOURS 12 HOURS VISIBILITY (MILES) +0.0 +3.0 +4.5 PRESSURE (MILLIBARS)-1.3 -1.3 -2.0 TEMPERATURE (DEGREES) - 3 -3 +6 DEW POINT (DEGREES) -1 -1 +4 |
| 2 0 1 2 3 4 5 | 6 3 6 3 2 0 6 8 | W PODOS ETT 9 1.5 3 2 0 8 8 3 | CLOT CENTO 6 6 6 6 0 0 0 0 0 0 0 | MEDY A DIE DIE LOS HT 15 26 26 0 0 0 | HIGH CLOUE CEID 8 8 8 8 8 | T CBSi | VSBY 9.0 4.0 4.0 5.0 4.0 5.0 1.0 3.0 | PRES 132 139 146 149 156 159 163 168 168 | 58 57 57 55 56 55 54 | DP 54 53 53 53 53 53 52 52 | 130 120 120 190 100 110 100 | B 7 5 4 4 5 5 7 | CHANGES DURING THE LAST 3 HOURS 6 HOURS 12 HOURS VISIBILITY (MILES) +8.0 +3.0 +4.5 PRESSURE (MILLIBARS)-1.3 -1.3 -2.0 TEMPERATURE (DEGREES) - 3 -3 +6 DEW POINT (DEGREES) -1 -1 +4 CHANGES DURING THE LAST 3 HOURS # SRY CONDITIONS CHANGED CLOUD HEIGHTS |
| 2 0 1 2 3 4 5 6 7 | CHO 3 6 3 2 0 6 8 | W (ODS) ET 9 1.5 3 2 0 8 8 3 4 | CHO CHO 6 | MEDY A DIZ UDS HTT 15 26 28 0 0 0 | IRPORE CLOVE CLOVE S 8 8 8 8 0 0 0 0 0 0 0 0 0 | F CDS: | VSBY 9.0 4.0 4.0 5.0 4.0 5.0 1.0 | PRES 132 139 146 149 156 159 163 168 168 | 58 57 57 55 56 55 54 54 | DP 54 53 53 53 53 52 52 52 52 51 | 130 120 120 190 100 110 100 90 85 86 | 9 7 5 4 4 5 7 | CHANGES DURING THE LAST 3 HOURS 6 HOURS 12 HOURS VISIBILITY (MILES) +0.0 +3.0 +4.5 PRESSURE (MILLIBARS)-1.3 -1.3 -2.0 TEMPERATURE (DEGREES) - 3 -3 +6 DEW POINT (DEGREES) - 1 -1 +4 CHANGES DURING THE LAST 3 HOURS # SRY CONDITIONS CHANGED CLOUD HEIGHTS FROM 3 HRS AGO TO PRESENT (IN HUNDREDS OF PRET) |
| 2 0 1 2 3 4 5 6 7 8 | CMD 3 6 3 2 0 6 8 8 8 8 | W DDOS ETT 9 1.5 3 2 0 8 8 3 4 4 | ELICATOR CARDO 6 6 6 6 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | MEDY A DIE DIE DIE DIE DIE DIE DIE DI | S S S S S S S S S S S S S S S S S S S | T OBSILES ETT 40 39 44 50 0 0 0 0 0 0 0 | VSBY 9.0 4.0 4.0 5.0 4.0 5.0 1.0 3.0 | PRES 132 139 146 149 156 159 163 168 168 185 | TMP 58 57 57 57 55 56 55 54 54 54 54 | DP 54 53 53 53 53 52 52 52 52 51 | 130 120 120 190 100 110 100 90 85 86 | 9 7 5 4 4 5 7 8 | CHANGES DURING THE LAST 3 HOURS 6 HOURS 12 HOURS VISIBILITY (MILES) +8.0 +3.0 +4.5 PRESSURE (MILLIBARS)-1.3 -1.3 -2.0 TEMPERATURE (DEGREES) - 3 -3 +6 DEW POINT (DEGREES) - 1 -1 +4 CHANGES DURING THE LAST 3 HOURS # SKY CONDITIONS CHANGED CLOUD HEIGHTS (IN HUNDREDS OF FRET) LOW CLOUDS 3 8 +26 |
| 2 0 1 2 3 4 5 6 7 8 9 | CHO 3 6 3 2 0 6 8 8 8 | W NODS ETT 9 1.5 3 2 0 6 8 3 4 4 5 5 | MIDICALOR CLASS 6 6 6 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | MREDY A DILE NO. 10 DILE NO. 1 | EXERPORE ELIGIBE CLOUR CENT S 8 8 8 8 9 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | F CBS: FT 40 39 44 50 0 0 0 0 0 0 0 0 0 0 | 9.0 4.0 4.0 5.0 4.0 5.0 3.0 3.0 | PRES 132 139 146 149 156 159 163 168 168 185 190 | TMP 58 57 57 55 56 55 54 54 54 53 | DP 54 53 53 53 53 52 52 52 52 51 51 | 130 120 120 190 100 110 100 90 85 86 | 9 7 5 4 4 5 7 8 9 | CHANGES DURING THE LAST 3 HOURS 6 HOURS 12 HOURS VISIBILITY (MILES) +8.0 +3.0 +4.5 PRESSURE (MILLIBARS)-1.3 -1.3 -2.0 TEMPERATURE (DEGREES) - 3 -3 +6 DEW POINT (DEGREES) -1 -1 +4 CHANGES DURING THE LAST 3 HOURS * SRY CONDITIONS CHANGED CLOUD HEIGHTS (IN HUNDREDS OF FEET) LOW CLOUDS 3 8 +26 MIDDLE CLOUDS 6 0 -15 HIGH CLOUDS 8 0 -35 |
| 2 0 1 2 3 4 5 6 7 8 9 10 11 12 | CIMD 3 6 3 2 0 6 6 8 8 8 8 8 8 8 8 8 8 8 8 | M NDDS ETT 9 1.5 3 2 G 8 8 3 4 4 5 6 6 6 9 9 | MIDION CLICATE CLICATE CONTROL | DIEDY NO. 15. 15. 15. 15. 15. 15. 15. 15. 15. 15 | LIRPORT HIGH CLOUD CENT 8 8 8 8 8 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | CBS: 1 CB | VSEY 9.0 4.0 4.0 5.0 5.0 1.0 3.0 3.0 3.0 3.0 3.0 3.0 | PRES 132 139 146 149 156 159 163 168 168 199 193 190 | TMP 58 57 57 57 55 56 55 54 54 55 55 55 55 55 55 55 55 55 55 | DP 54 53 53 53 53 52 52 52 51 51 51 | 130 120 120 190 100 110 100 90 85 86 90 120 120 | B 7 5 4 4 4 5 5 5 7 8 8 9 9 8 9 8 | CHANGES DURING THE LAST 3 HOURS 6 HOURS 12 HOURS VISIBILITY (MILES) +8.0 +3.0 +4.5 PRESSURE (MILLIBARS)-1.3 -1.3 -2.0 TEMPERATURE (DEGREES) - 3 -3 +6 DEW POINT (DEGREES) -1 -1 +4 CHANGES DURING THE LAST 3 HOURS # SRY CONDITIONS CHANGED CLOUD HEIGHTS (IN HUNDREDS OF FEET) LOW CLOUDS 3 8 +26 MIDDLE CLOUDS 6 0 -15 |
| 2 0 1 2 3 4 5 6 7 8 9 10 11 | CIMD 3 6 3 2 0 6 6 8 8 8 8 8 8 8 8 8 | M NODOS 2 1.5 3 4 4 4 5 6 6 6 8 8 | MIDIO CLIOTO CLIOTO GO | DIEDY NOTE: 1012 NOTE: 15 15 15 15 15 15 15 15 15 15 15 15 15 | LIRPORT HIGH CLOUD CRID 8 8 8 8 9 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | F CBS: | VSBY 9.0 4.0 4.0 5.0 4.0 5.0 1.0 3.0 3.0 2.5 | PRES 132 139 146 149 156 159 163 168 168 199 193 190 | TMP 58 57 57 57 55 56 55 54 54 53 54 55 | DP 54 53 53 53 53 52 52 52 51 51 51 | 130 120 120 190 100 110 100 90 85 86 90 120 120 | B 7 5 4 4 4 5 5 5 7 8 8 9 8 9 9 | CHANGES DURING THE LAST 3 HOURS 6 HOURS 12 HOURS VISIBILITY (MILES) +0.0 +3.0 +4.5 PRESSURE (MILLIBARS)-1,3 -1.3 -2.0 TEMPERATURE (DEGREES) - 3 -3 +6 DEW POINT (DEGREES) - 1 -1 +4 CHANGES DURING THE LAST 3 HOURS # SRY CONDITIONS CHANGED CLOUD HEIGHTS FROM 3 HRS AGO TO PRESENT (IN HUNDREDS OF FRET) LOW CLOUDS 3 8 +26 MIDDLE CLOUDS 6 0 -15 HIGH CLOUDS 8 0 -35 |
| 2 0 1 2 3 4 5 6 7 8 9 10 11 12 | CIMD 3 6 3 2 0 6 6 8 8 8 8 8 8 8 8 8 8 8 8 | M NDDS ETT 9 1.5 3 2 G 8 8 3 4 4 5 6 6 6 9 9 | MIDION CLICATE CLICATE CONTROL | DIEDY NO. 15. 15. 15. 15. 15. 15. 15. 15. 15. 15 | LIRPORT HIGH CLOUD CENT 8 8 8 8 8 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | CBS: 1 CB | VSBY 9.0 4.0 4.0 5.0 4.0 5.0 3.0 3.0 3.0 3.0 3.0 3.0 3.0 | PRES 132 139 146 149 156 159 163 168 185 190 193 190 186 190 | TMP 58 57 57 57 55 56 55 54 54 55 55 55 55 55 55 55 55 55 55 | DP 54 53 53 53 53 52 52 52 51 51 51 | 130 120 120 190 100 110 100 90 85 86 90 120 120 120 120 | B 7 5 4 4 4 5 5 5 7 8 8 9 9 8 9 8 | CHANGES DURING THE LAST 3 HOURS 6 HOURS 12 HOURS VISIBILITY (MILES) +8.0 +3.0 +4.5 PRESSURE (MILLIBARS)-1.3 -1.3 -2.0 TEMPERATURE (DEGREES) - 3 -3 +6 DEW POINT (DEGREES) - 1 -1 +4 CHANGES DURING THE LAST 3 HOURS # SRY CONDITIONS CHANGED CLOUD HEIGHTS (IN HUNDREDS OF FEET) LOW CLOUDS 3 8 +26 MIDDLE CLOUDS 6 0 -15 HIGH CLOUDS 8 0 -35 PREDICTED VALUES BASED ON LEAST SQUARES FIT FOR THE NEXT 3 HOURS |
| 2 0 1 2 3 4 5 6 7 8 9 10 11 12 13 | CMD 3 6 3 2 0 6 6 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 | M NODOS 2 1.5 3 4 4 4 5 6 6 6 8 8 | MIDIO CLIOTO CHED 6 6 6 6 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | DIE DY DIE DE | HIGHORY HIGH CLOUD STATE OF THE | F CBSi | VSEY 9.0 4.0 4.0 5.0 4.0 5.0 3.0 3.0 3.0 3.0 3.0 3.0 3.0 3.0 | PRES 132 139 146 149 156 159 163 168 185 190 193 186 190 190 186 | 58 57 57 55 56 55 54 55 55 56 57 | DP 54 53 53 53 53 52 52 52 51 51 51 52 | 130 120 120 190 100 110 100 90 85 86 90 120 120 120 100 | B 7 5 4 4 5 5 5 7 8 8 9 9 8 8 0 0 | CHANGES DURING THE LAST 3 HOURS 6 HOURS 12 HOURS VISIBILITY (MILES) +0.0 +3.0 +4.5 PRESSURE (MILLIBARS)-1.3 -1.3 -2.0 TEMPERATURE (DEGREES) - 3 -3 +6 DEW POINT (DEGREES) - 1 -1 +4 CHANGES DURING THE LAST 3 HOURS # SKY CONDITIONS CHANGED CLOUD HEIGHTS FROM 3 HRS AGO TO PRESENT (IN HUNDREDS OF FRET) LOW CLOUDS 3 8 +226 MIDDLE CLOUDS 6 0 -15 HIGH CLOUDS 8 0 -35 PREDICTED VALUES BASED ON LEAST SQUARES FIT FOR THE NEXT 3 HOURS FORECAST FOR THE NEXT HOUR 2 HOURS 3 HOURS |
| 2 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 | CMD 3 6 3 2 0 6 6 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 | M NODS ETT 9 1.5 3 2 0 8 8 3 4 4 5 6 6 8 8 11 | MIDION CLICATE | DIEDY NOTE: 15 15 15 15 15 15 15 15 15 15 15 15 15 | INTERPORT | FFT CBSI | VSBY 9.0 4.0 4.0 5.0 4.0 5.0 3.0 3.0 3.0 3.0 3.0 3.0 3.0 | PRES 132 139 146 149 156 159 163 168 185 190 193 186 190 190 186 | TMP 58 57 57 57 55 56 54 54 55 56 57 60 | DP 54 53 53 53 53 52 52 52 51 51 51 52 53 | 130 120 120 120 190 100 110 100 90 85 86 90 120 120 120 100 | B 7 5 5 4 4 4 5 5 5 7 8 8 8 9 8 8 9 8 8 0 6 6 | CHANGES DURING THE LAST 3 HOURS 6 HOURS 12 HOURS VISIBILITY (MILES) +0.0 +3.0 +4.5 PRESSURE (MILLIBARS)-1.3 -1.3 -2.0 TEMPERATURE (DEGREES) - 3 -3 +6 DEW POINT (DEGREES) - 1 -1 +4 CHANGES DURING THE LAST 3 HOURS # SRY CONDITIONS CHANGED CLOUD HEIGHTS FROM 3 HRE AGO TO PRESENT (IN HUNDREDS OF FRET) LOW CLOUDS 3 8 +226 MIDDLE CLOUDS 6 0 -15 HIGH CLOUDS 8 0 -35 PREDICTED VALUES BASED ON LEAST SQUARES FIT FOR THE NEXT 3 HOURS FORECAST FOR THE NEXT HOUR 2 HOURS 3 HOURS TEMPERATURE (DEGREES) 65 65 66 |
| 2 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 | CIMD 3 6 3 2 0 6 6 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 | M NDDS ETT 9 15 3 2 0 8 8 3 4 4 5 6 6 8 8 8 11 0 | MIDIO CLIOTO CLI | DIEDY NO. 15. 15. 15. 15. 15. 15. 15. 15. 15. 15 | NIRPORT HIGH CLOUD CENT S 8 8 8 8 8 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | F CBS: | VSBY 9.0 4.0 4.0 5.0 4.0 5.0 3.0 3.0 3.0 3.0 3.0 3.0 4.0 5.0 | PRES 132 139 146 149 156 159 163 168 185 190 180 190 180 190 183 183 | TMP 58 57 57 57 55 56 55 54 54 55 56 57 60 60 60 | DP 54 53 53 53 53 52 52 52 51 51 51 52 53 54 | 130 120 120 190 100 110 100 90 85 86 90 120 120 120 120 100 100 100 | B 7 5 5 4 4 4 5 5 5 7 8 8 8 9 8 8 00 8 6 6 | CHANGES DURING THE LAST 3 HOURS 6 HOURS 12 HOURS VISIBILITY (MILES) +8.0 +3.0 +4.5 PRESSURE (MILLIBARS)-1.3 -1.3 -2.0 TEMPERATURE (DEGREES) - 3 -3 +6 DEW POINT (DEGREES) - 1 -1 +4 CHANGES DURING THE LAST 3 HOURS # SRY CONDITIONS CHANGED CLOUD HEIGHTS (IN HUNDREDS OF FEET) LOW CLOUDS 3 8 +26 MIDDLE CLOUDS 6 0 -15 HIGH CLOUDS 8 0 -35 PREDICTED VALUES BASED ON LEAST SQUARES FIT FOR THE NEXT 3 HOURS FORECAST FOR THE NEXT HOUR 2 HOURS 3 HOURS TEMPERATURE (DEGREES) 65 65 66 DEWPOINT (DEGREES) 58 58 59 |
| 2 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 | CMD 3 6 3 2 0 6 6 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 | MODOS ETT 9 15 3 2 0 8 8 3 4 4 5 6 8 11 0 15 | MIDIO CLIOTO CLIOTO G | DIEDY NOTE: 15 125 26 28 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | INTERPORT ENTERPORT ENTERP | FT OBSI | VSBY 9.0 4.0 4.0 5.0 4.0 5.0 3.0 3.0 3.0 3.0 3.0 4.0 5.0 5.0 5.0 6.0 | PRES 132 139 146 149 156 159 163 168 195 190 190 186 190 183 183 183 | TMP 58 57 57 57 55 56 55 54 54 55 56 57 60 60 63 67 63 | DP 54 53 53 53 552 52 51 51 51 52 53 54 56 57 56 | 130 120 120 190 100 110 100 90 85 86 90 120 120 120 120 120 120 100 130 1 | B 7 5 5 4 4 4 5 5 5 7 8 8 8 9 8 8 1.0 6 8 16 1.0 9 9 1.0 | CHANGES DURING THE LAST 3 HOURS 6 HOURS 12 HOURS VISIBILITY (MILES) +0.0 +3.0 +4.5 PRESSURE (MILLIBARS)-1.3 -1.3 -2.0 TEMPERATURE (DEGREES) - 3 -3 +6 DEW POINT (DEGREES) -1 -1 +4 CHANGES DURING THE LAST 3 HOURS # SKY CONDITIONS CHANGED CLOUD HEIGHTS (IN HUNDREDS OF FRET) LON CLOUDS 3 8 +226 MIDDLE CLOUDS 6 0 -15 HIGH CLOUDS 8 0 -35 PREDICTED VALUES BASED ON LEAST SQUARES FIT FOR THE NEXT 3 HOURS FORECAST FOR THE NEXT HOUR 2 HOURS 3 HOURS TEMPERATURE (DEGREES) 65 65 66 DEMPOINT (DEGREES) 58 58 59 VISIBILITY (MILES) 7.3 7.7 8.1 |
| 2 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 | CIMD 3 6 3 2 0 6 6 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 | MODOS ETT 9 15 3 2 0 8 8 3 4 4 5 6 8 11 0 15 15 | MIDIO | DIEDY NO. 1012 NO. 10 | INTERPORT ENTERPORT ENTERP | FT OBSI | VSBY 9.0 4.0 4.0 5.0 4.0 5.0 3.0 3.0 3.0 3.0 3.0 4.0 5.0 5.0 5.0 5.0 5.0 5.0 6.0 6.0 6.0 | PRES 132 139 146 149 156 159 163 168 195 190 190 183 183 183 183 | TMP 58 57 57 55 56 55 54 54 55 56 57 60 60 63 67 | DP 54 53 53 53 552 52 51 51 51 52 53 54 56 57 | 130 120 120 190 100 110 100 90 85 86 90 120 120 120 120 100 100 130 1130 | B 7 5 5 4 4 4 5 5 5 7 8 8 8 9 8 8 0 0 8 8 8 0 0 9 9 | CHANGES DURING THE LAST 3 HOURS 6 HOURS 12 HOURS VISIBILITY (MILES) +0.0 +3.0 +4.5 PRESSURE (MILLIBARS)-1.3 -1.3 -2.0 TEMPERATURE (DEGREES) - 3 -3 +6 DEW POINT (DEGREES) -1 -1 +4 CHANGES DURING THE LAST 3 HOURS # SKY CONDITIONS CHANGED CLOUD HEIGHTS FROM 3 HRB AGO TO PRESENT (IN HUNDREDS OF FRET) LOW CLOUDS 3 8 +26 MIDDLE CLOUDS 6 0 -15 HIGH CLOUDS 8 0 -35 PREDICTED VALUES BASED ON LEAST SQUARES FIT FOR THE MEXT 3 HOURS FORECAST FOR THE NEXT HOUR 2 HOURS 3 HOURS TEMPERATURE (DEGREES) 65 65 66 DEWPOINT (DEGREES) 58 58 59 VISIBILITY (MILES) 7.3 7.7 8.1 MIND VELOCITY (KNOTS) 9 9 9 SURFACE PRESSURE (MILLIBARS) 17.2 17.0 16.9 **NOTE: SKY CONDITION 3 = SCATTERED CLOUDS 1-5 TENTHS |
| 2 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 | CMD 3 6 3 2 0 6 6 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 | MODOS ETT 9 15 3 2 0 8 8 3 4 4 5 6 8 11 0 15 | MIDIO | DIEDY NOTE: 15 15 15 15 15 15 15 15 15 15 15 15 15 | INTERPORT ENTERPORT ENTERP | FOR OBSIDE SECTION OF THE SECTION OF | VSBY 9.0 4.0 4.0 5.0 4.0 5.0 3.0 3.0 3.0 3.0 3.0 4.0 5.0 5.0 7.0 | PRES 132 139 146 149 156 159 163 168 195 190 190 183 183 183 183 | TMP 58 57 57 57 55 56 55 54 54 55 56 57 60 60 63 67 63 63 63 | DP 54 53 53 53 53 52 52 52 51 51 51 52 53 54 56 56 56 56 | 130 120 120 120 190 100 110 100 90 85 86 90 120 120 120 120 120 100 130 130 1120 | B 7 5 5 4 4 4 5 5 5 7 8 8 8 9 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 | CHANGES DURING THE LAST 3 HOURS 6 HOURS 12 HOURS VISIBILITY (MILES) +0.0 +3.0 +4.5 PRESSURE (MILLIBARS)-1.3 -1.3 -2.0 TEMPERATURE (DEGREES) - 3 -3 +6 DEW POINT (DEGREES) -1 -1 +4 CHANGES DURING THE LAST 3 HOURS # SKY CONDITIONS CHANGED CLOUD HEIGHTS FROM 3 HRB AGO TO PRESENT (IN HUNDREDS OF FRET) LOW CLOUDS 3 8 +26 MIDDLE CLOUDS 6 0 -15 HIGH CLOUDS 8 0 -35 PREDICTED VALUES BASED ON LEAST SQUARES FIT FOR THE MEXT 3 HOURS FORECAST FOR THE NEXT HOUR 2 HOURS 3 HOURS TEMPERATURE (DEGREES) 65 65 66 DEWPOINT (DEGREES) 58 58 59 VISIBILITY (MILES) 7.3 7.7 8.1 MIND VELOCITY (KNOTS) 9 9 9 SURFACE PRESSURE (MILLIBARS) 17.2 17.0 16.9 **NOTE: SKY CONDITION 3 = SCATTERED CLOUDS 1-5 TENTHS |
| 2 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 | CMD 3 6 3 2 0 6 6 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 | MODOS ETT 9 15 3 2 0 8 8 3 4 4 5 6 6 8 8 11 0 15 15 | MIDIO CILOTO CILOTO 6 6 6 6 6 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | DIEDY NOTE: 15 15 15 15 15 15 15 15 15 15 15 15 15 | INTERPORT ENTERPORT ENTERP | FT OBSI | VSBY 9.0 4.0 4.0 5.0 5.0 1.0 3.0 3.0 3.0 3.0 3.0 3.0 5.0 5.0 7.0 7.0 | PRES 132 139 146 149 156 159 163 168 185 190 190 186 190 183 183 183 176 | TMP 58 57 57 57 55 56 55 54 54 55 56 57 60 60 63 67 63 63 62 | DP 54 53 53 53 53 52 52 52 51 51 51 52 53 54 56 56 56 56 | 130 120 120 120 100 110 100 90 85 86 90 120 120 120 120 100 130 130 1100 | B 7 5 5 4 4 4 5 5 5 7 8 8 8 9 8 8 1.0 6 8 8 1.0 9 9 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 | CHANGES DURING THE LAST 3 HOURS 6 HOURS 12 HOURS VISIBILITY (MILES) +8.0 +3.0 +4.5 PRESSURE (MILLIBARS)-1,3 -1.3 -2.0 TEMPERATURE (DEGREES) - 3 -3 +6 DEW POINT (DEGREES) - 1 -1 +4 CHANGES DURING THE LAST 3 HOURS # SKY CONDITIONS CHANGED CLOUD HEIGHTS FROM 3 HEM AGO TO PRESENT (IN HUNDREDS OF FRET) LOW CLOUDS 3 8 +26 MIDDLE CLOUDS 6 0 -15 HIGH CLOUDS 8 0 -35 PREDICTED VALUES BASED ON LEAST SQUARES FIT FOR THE NEXT 3 HOURS FORECAST FOR THE NEXT HOUR 2 HOURS 3 HOURS TEMPERATURE (DEGREES) 65 65 66 DEWPOINT (DEGREES) 58 58 59 VISIBILITY (MILES) 7.3 7.7 8.1 WIND VELOCITY (NOTS) 9 9 9 SURFACE PRESSURE (MILLIBARS) 17.2 17.0 16.9 #NOTE: SKY CONDITION 3 = SCATTERED CLOUDS 1-5 TENTHS #NOTE: SKY CONDITION 3 = SCATTERED CLOUDS 6-9 " |

Figure 2.





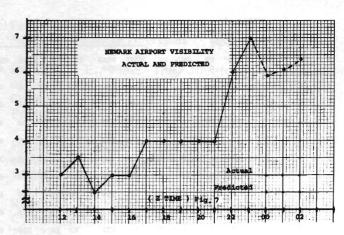
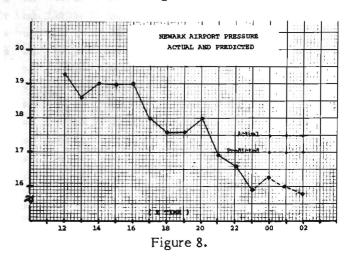


Figure 7.



the program can be designed to check for significant changes for any number of data elements over specific time periods and subsequently these can be highlighted to the forecaster.

Figure 6.

3. THE FORECAST

If the forecaster is presented with data information like this for his forecast area, he should have an excellent understanding of the direction of trends up to the present, and be in a good position to make his forecast for the next period. To aid in this aspect, the program has a subroutine that uses the current data file, such as that shown in Figures 1 and 2, to develop a least squares fit and trend line. Based on the previous trend calculated by the subroutine a forecast for each element is made for the next 3 hours. (A longer period could have been developed but with diminished accuracy.) On the bottom of Figures 3 and 4, under the sub-heading PREDICTED VALUES BASED ON LEAST SQUARES FIT FOR THE NEXT 3 HOURS ... The predicted values for temperature, dew point, visibility, wind velocity and surface pressure are listed. These are shown on the graphs (Figures 5, 6, 7, 8). The solid line is the actual data and the dotted values for the 0000, 0100 and 0200 GMT times are the predicted values. Also on Figure 5 only the calculated LEAST SQUARES FIT line is shown to illustrate how closely the predicted values follow the trend line. The predicted values may be slightly off due to the fact that the program printed them as integer values and not decimal values.

After the Newark data file has been processed the program recycles and analyzes the J. F. Kennedy file and as many more files that may be available.

4. FUTURE APPLICATIONS

With the arrival of the AFOS System there will probably be available to users large amounts of data stored on disc or magnetic tapes or on punch cards. Programs similar to this one could process this data and this will afford an opportunity to those who wish to, to make a contribution to the science of meteorology.

```
APPENDIX
   JSWEW !
$55555 KYU - URMC 1108 OPERATING SYSTEM
                                                      VEh. 31-244-4#18 (hSI)*
67UN WJB4,0-6239-028,BLAKE-W,5,10
DATE: 091974
                      TIME: 110637
                                                 PARTIAL LISTING OF
GEDG PHOGHAM. OSS
EDG 2.2P 19 SEP 74 11:06:58(0)
                                                 SOURCE PROGRAM
EDIT
C
       THE FOLLOWING REVISIONS WERE MADE BY TED SAM 9/17/74
PEDG ?
@EOF
END EDG. LINES FILED: 174
EDG 2.2P 13 SEP 74 11:08:42(0)
EDIT
P 180
C *** THE FOLLOWING REVISIONS WERE NADE BY TED SAM 9/17/74
C *** ALL LINES THAT WERE CHANGED ARE PRECEDED BY COMMENTS & STARS COUNCY Z (30)
       DIMENSION J1 (27), J2(27), J3(27), J4(27), J5(27), J6(27), J7(27),
C *** THE DIMENSION FOR V(24) REMOVED, SINCE NOT USED C *** LIMENSIONS WERE CHANGED TO 27
      lue(27), Lu(27), 010(27), 011(27), 012(27), 013(27)
DlmEx510N SIN(1)
       DIRERGION V2(27), V3(27), V4(27), V6(27), V7(27)
       FORMAT(1X,AS,SIS,414,3(1X,11,1X,13))
FORMAT(1X,AS,715,2X,F5.2,515,/)
FORMAT(1X,72H STN Z CND HI C
                                                   CND
                                                                                     PR
8
                                                           HT
                                                                 CND HI VSBY
      IIMP DP WIND )
FG.WHT(IX, IAS, 8(2X, I3), IX, IF3.1,5(IX, I3))
6
                                     LOW CLOUDS MIL CLOUD HI CLOUD
        Funhat (1X, 43H
                                                                               )
            FORMAT (20X, 38HS16NIFICANT CHANGES
10
                                                        DURING
                                                                    LAST
       FURMAT (2X,//)
ló
       FORMAT(30X,7H3 HOURS,2X,7H6 HOURS,2X,8H12 HOURS,//)
FORMAT(1X,20HVISIBILITY MILES ,5X,3(5X,F5.2),/)
15
11
       FORMAT CIX, LOHPRESSURE MBS
                                                 ,5X,3(5X,15),/)
12
       FORMATCIX, CONTEMPERATURE DEGS
13
                                                 ,5X,3(5X,15),/)
        FORMATCIX, 20HDEW POINT DEGS
14
                                                  ,5X,3(5X,15))
        FORMAT(IX,24HNO CHANGE CLEAR TO CLEAR,/)
FORMAT(IX,24HCLEAR TO SCATTERED ,/)
FORMAT(IX,24HCLEAR TO BHOKEN ,5X
30
31
32
                                                       ,5X,F5.2,/)
       FORMAT(1X,24HCLEAR TO OVERCAST ,/)
FORMAT(1X,49H ANALYSIS OF JFK AIRPORT OBSERVATIONS MAY 31 1974,//
THE RIGHT PARENTHESIS PUT ON A CONTINUATION
C ***
     1)
35
        FGRMAT(IX, 4CH.... WINDS AND CLOUD CHANGES LAST 3 HOURS,/)
        FORMAT(IX,23H AVG WIND DIR DEG ,5X,F5.2,/)
FORMAT(IX,23H AVG WIND VEL MPH ,5X,F5.2,/)
FORMAT(IX,23HCHANGE IN SKY CONDITIONS,5X,10HCHANGE IN )
36
37
38
                                                      ,5X,10HHEIGHT
        FURRATCIX, 25H LAST 3 HOURS
35
                                                      ,1X,3(5X,15),/)
,1X,3(5X,15),/)
       FURMAT (IX, 24HLC# CLCUDS
40
       FULLATCIX, 24HMIDDLE CLOUDS
41
42
       FULLET CIX, 24HHIGH CLCUBS .
                                                      ,1X,3(5X,15),/)
       FULLWAT (35%, 4HF. CM, 5%, 2HTC, 5%, 6HHEIGHT, //)
43
44
        FURNAT (2X,/)
                                ESTIMATES DASED ON LEAST SQUAKES FIT')
46
         FUNDAT (
      FULLAT (8X,6HHOUR ,5X,6HTENP ,5X,6HDEW PI,5X,6HVSBY ,5X, 10hand Fr,5X,6HPRESS ,//)
45
         FURNAT CIX, ZUHTEMPERATURE
47
                                                    ,5X,3(5X,F5.0),/)
                                                    ,5X,3(5X,F5.0),/),5X,3(5X,F5.1),/)
         FORMATCIX, SCHOEW POINT
45
         FURNAT (IX, ZUHVISIBILITY
43
                                                   ,5X,3(5X,F5.0),/)
,5X,3(5X,F5.0),/)
50
         FURTHER CIX, 20HWIND VELOCITY
         FURMAT (IX, ZUHSUMFACE PRESSUME
51
                     FORECAST FOR NEXT ...
                                                          HOUR
                                                                         2 HOURS
22
         FUNDAT (
      13Xv2 .)
          FCAMAT (
53
                            SIGNIFICANT CHANGES LAST HOUR, 2HOURS, 3HOURS')
        NK=24
        k3=kK-3
        16=kl-6
        M12=1.N-12
        1.15=1.11+3
       DO 100 J=1,4N
       DO 400 K=1,2
C *** END =111 CLAUSE USED TO HANDLE END-OF-INPUT CONDITION
       KEAD(10,5,END=111)STN,J1(J),J2(J),J3(J),J4(J),J5(J),J6(J),J7(J)
      (1)311, (1)211, (1)111, (1)011, (1)61, (1)81,1
111
        10.*(L)4(J)*.01
        V6(J)=J6(J)
        V6(J)=V6(J)+.5
        V7(J)=J7(J)
        V3(2)=J3(J)
        V2(J)=J2(J)
```