NOAA Technical Memorandum NWS SR-114

AFOS DATA ANALYSIS PROGRAMS

Phillip D. Bothwell
WSFO Oklahoma City, Oklahoma

Scientific Services Division
Southern Region
Fort Worth, Texas
October, 1985

noaa NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION / National Weather Service

Editor's Note: FORTRAN source codes for these programs are available from NWS Southern Region, Scientific Services Division, Fort Worth, Texas.

AFOS DATA ANALYSIS PROGRAMS

Phillip D. Bothwell
National Weather Service Forecast Office
Oklahoma City, Oklahoma

OVERVIEW

These programs have been designed to maximize the information available from conventional surface and upper-air data (Bothwell et. al., 1985). The entire data analysis program series structure from data input through output is shown in Fig. 1. In this program series, you will be able to set up your own "local database" and a site-specific AFOS map background. The map background will be used to display the output from the programs (normally at a 1:1 zoom ratio on the AFOS GDM). You will be able to custom tailor the area you want to cover when you use the program BLDWXD. Figures 2 and 3 show how this was done at the Weather Service Forecast Office (WSFO) in Oklahoma City (OKC). Additional illustrations show how other maps can be constructed (see Figs. B1 and B2 in Appendix B).

Once a map and "local database" have been set up, the next program in the series, SAVOBS, addresses the problem of data management and quality control. All too often in a forecast environment, data from surface and upper-air stations can be missing or erroneous. This can cause problems for the meteorologist in a subjective analysis of the data. Even more serious problems can arise if the data is used in a computer generated analysis (including, but not limited to an objective analysis). Data is initially decoded by program SAODEC (Perrotti, 1984). Program SAVOBS checks the previously decoded data for errors and formats the data for display/editing on an AFOS ADM. Incorrect or missing data can be changed simply by editing one data file. In the case of hourly surface data files, once these files have been updated, the data can be quickly and easily replotted for the meteorologist (using program CHG and the AFOS macro REPLOT).

A trio of programs, MANDEC (Sunkel, 1981), MANDECF, and COMTP, decode, then format the mandatory level upper-air data for display/editing on an AFOS ADM, and finally compute mandatory level grid point temperatures. These grid point temperatures are used in the MESOS objective analysis to calculate stability indices.

Changes in surface temperature, dew point, wind direction and speed, and pressure (altimeter setting) are computed by program CHG. The changes can be plotted on any map background, including your locally generated map background by using the PMOD software (see Davis, 1983). Changes can cover any interval from one to twenty-four hours (provided that the data was first decoded (with SAODEC), then formatted (with SAVOBS)). As mentioned previously, program CHG is also used to replot an hourly surface data file once it has been updated on an AFOS ADM.

The objective analysis program (MESOS) employs both time and distance Gaussian (exponential) weighting of surface data. It uses the files generated by SAVOBS (up to three consecutive hours of data). Also, since surface data density varies across the United

States (and from day to night), MESOS features a variable distance filter weight that is specified by you. This weight depends on the data density over your area. The average station spacing over your area has been printed out for you in BLDWXD (Table 2). Refer to this when chosing a distance weight. Another unique feature of the program is that hourly stability indices are calculated at 500 mb and one other level above 500 mb (400, 300, 250, or 200 mb) using surface lifted parcel temperatures (see Hales and Doswell, 1982) and the upper-air grid point temperatures from COMTP.

Changes in the objectively analyzed altimeter, surface moisture convergence, and surface relative vorticity are computed by the program OACHG. The changes can cover from one to twenty-three hours. Twenty-four hour changes are not computed. MESOS must be run prior to OACHG for both hours that are input to OACHG.

INTRODUCTION TO BLDWXD

This program was developed to allow you, the user, to create a "site-specific" map and database (surface and upper-air) to be used in a detailed analysis of meteorological data over your particular area of interest and/or forecast responsibility. This program will BuiLD a WXDATA1.DT file that will control the operation of the programs SAVOBS, MANDECF, COMTP, CHG, and MESOS.

This program is designed to be run a limited number of times and only to initially set up your site-specific map. The AFOS preformat shown in Table 1 shows how a similar area was set up for the forecast office in Oklahoma City. Through the output graphics NMCGPHPØA (AFOS data base) and TEST (RDOS version of NMCGPHPØA), you will see the exact area you have selected or "windowed" on map background BØ2 (shown in Fig. 2). The map projection used is a polar sterographic map projection true at 60 degrees north latitude (see Inman, 1970, for more details).

The weighting scheme that is used in the objective analysis program (MESOS) is Gaussian (exponential) in both time and space (see Barnes 1973, Bothwell and Crawford, 1983, Bothwell et. al. 1985, Doswell 1977, Ruthi, 1978). Since surface data density varies over the United States, three distance weight tables corresponding to an average station spacing of 1) 100 km, 2) 125 km, or 3) 150 km are approximated by a series of discrete steps in BLDWXD and stored in the output file WXDATA1.DT. This allows for variable distance weighting according to the average station spacing over your area (printed out by BLDWXD, Table 2).

By executing the program BLDWXD, several important advantages are realized.

1. Programs SAVOBS, MANDECF, COMTP, CHG, and MESOS execute much faster since nearly all necessary input that involves any time consuming and/or repetitious calculations are done in advance and stored in WXDATA1.DT.

2. The geographical area that you, the user, "map out" is custom tailored to your area. Once you are satisfied with the placement of the grid, it remains fixed so that all users (especially forecasters on rotating shifts) will become more familiar with it. It is easy to plot surface data (with the help of PMOD software) on the map you create after running BLDWXD. Most data is easily displayed on a 1:1 zoom ratio on the GDM.

3. Because very few geographical areas are rectangular in nature, the grid and map may be rotated, expanded or contracted to fit whatever area needs to be covered.

METHODOLOGY AND SOFTWARE STRUCTURE

Data is first entered into a preformat (shown in Table 1) and then stored as the RDOS file NSTATIONS (see Fig. 4). First in the preformat is a list of stations for which surface data is to be saved. This can be for a maximum of 200 stations. Next in the preformat is a list of the 100 stations that are to be included in the objective analysis. The 100

stations must also be included in the previous list of 200. It is essentially, a subset of the first list. The reason for the first list is primarily to allow for more data than just that required for the objective analysis to be saved. The data must be entered alphabetically by node site and within the node (see example shown in Table 1.) Stations just outside the grid should also be included so that quantities near the edge of the grid will not be distorted.

The third list (not included in braces) is a list of upper air stations for the U.S., Canada and Mexico. The program BLDWXD determines which upper air stations are close enough to give a significant weight to a grid point (i.e. a distance weight greater than or equal to 0.1 in the upper-air objective analysis). These stations are then written to WXDATA1.DT for later use by the program COMTP (COMpute TemPeratures for upper-air data at the grid points).

CAUTIONS

Program failures will likely result from

1. An error in filling out the preformat
2. Extra spaces/missing spaces (or lines) in file NSTATIONS
3. Occasionally stations are used that are not in the master station directory (STDIR.MS). This could cause program failure or erroneous points to be plotted.

INTRODUCTION TO SAVOBS

This program was designed to allow a meteorologist in a forecast office the opportunity to correct erroneous and/or missing data in real-time and replot the data. All data is presented in one easy to read file which also has an accompanying descriptive error listing file. Through several years of experience at the WSFO in Oklahoma City, it became apparent that some method must be found to control the quality and quantity of the data that was going into the analysis programs. This program has met that need. It allows us to save data after a significant weather event for post-analysis. The hourly data files are relatively small despite the fact that they contain sea level pressure, temperature, dew point, wind direction and speed, wind gust, and altimeter setting for as many as 200 stations. During May and June, (1985), Oklahoma City WSFO routinely ran the program 24 hours a day and saved the data on floppy disk at the end of the day.

METHODOLOGY and SOFTWARE STRUCTURE

This program writes surface data (from SAODATA (see Perrotti, AFOS Surface Decoding, 1984)) to file SAxxZ.DT (where xx is the GMT hour). If the file SAxxZ.DT is found to already exist (24 hours old), this file is renamed SATMP.DT (TeMPorary), and the new data is stored in file SAxxZ.DT. A partial listing is shown in Table 4. An auxillary output file, SAVOBS.DT (see Table 5), contains a detailed listing of erroneous or missing data to aid in updating the file SAxxZ.DT. In order to display SAxxZ.DT or SAVOBS.DT type,

DSP:SAxxZ.DT (xx is the GMT hour); DSP:SAVOBS.DT .

To edit the file, SAxxZ.DT, type,

E:F/SAxxZ.DT (xx is the desired GMT hour) .

Then, in the header block (below the file name), type Y for overwrite and proceed to edit the file.

In order to run automatically (with no forecaster intervention), this program should be included at the end of any surface decoding/plotting AFOS macro.

A gross error check of the data is performed and bad data is flagged. Both sea level pressure and altimeter setting are checked (in addition to the gross error check) and flagged if they are outside three standard deviations either side of the mean. The checks may occasionally flag valid data from mountainous terrain where pressures are significantly different. If bad data is detected at a station, the altimeter is set to -99 as the flag (an erroneous sea level pressure, will be reported as -99). Also, if any (or all) of the following: temperature, dew point, wind direction, speed, and/or altimeter setting are missing, the altimeter is set to -99 as the flag. This is because these "base quantities" are required in the objective analysis (MESOS) for each station. The file, SAVOBS.DT, lists the stations with erroneous data and/or missing data and can be displayed on an ADM or adjacent GDM to aid in correcting the file SAxxZ.DT. The updated hourly surface file, SAxxZ.DT can be replotted after the data has been edited using program CHG and the AFOS macro REPLOT.

The files, SAxxZ.DT serve as input for programs CHG and MESOS. The files can be saved on floppy disk at the end of the day. At the Oklahoma City WSFO, we use a macro to save all of our data on a daily basis. The AFOS SAVDATA macro is included in Appendix D.

CAUTIONS

The program SAVOBS must be run after SAODEC and requires files SAODATA and SAOXXX. Occasionally, pressure data may be flagged as bad, even when it is actually correct. This most likely occurs in mountainous terrain.

INTRODUCTION, METHODOLOGY AND SOFTWARE STRUCTURE FOR PROGRAMS MANDEC, MANDECF, AND COMTP

These programs are discussed together since they are designed to run together. Program MANDEC (Sunkel, 1981) decodes mandatory level upper-air data. Program MANDECF is designed to take the output data MANDATA, from MANDEC and format the data for display and editing on an ADM. The output from MANDECF is MANDATAF.DT (see Table 6). In order to display MANDATAF.DT, type

DSP:MANDATAF.DT .

To edit the file, type

E:F/MANDATAF.DT .

Then, in the header block (below the file name), type Y for overwrite and then proceed to edit the file.

Program COMTP reads MANDATAF.DT and computes (via objective analysis) the temperatures at 500 mb and one level (user specified) from 400, 300, 250, or 200 mb for the grid points in the objective analysis MESOS. The upper-air objective analysis uses an upper-air distance weight table stored in WXDATA1.DT. These temperatures are combined with hourly surface data in MESOS to calculate hourly stability indices (see Hales and Doswell, 1982).

The file MANDATAF.DT has been formated so that when critical stations are missing, or the forecaster has reason to believe that temperatures aloft have changed significantly, the file may be updated. In this special case, only COMTP needs to be rerun. Otherwise, these three programs were designed to run only at the time of the upper-air soundings (every 12 hours). Thus, it is strongly recommended that these three programs be included at the end of your station's upper-air plotting macro. Once this is done, forecaster intervention is not required, and the data will be current. If your station plans to save data for post-analysis, the file, MANDATAF.DT, should be part of the data saved on floppy.

CAUTIONS

The programs must be run in the following order (every 12 hours):

1. MANDEC, 2. MANDECF, 3. COMTP.

If you are updating MANDATAF.DT, only COMTP needs to be executed. You may have to edit the file, MANDATAF.DT, to add Mexican and/or Canadian upper-air data.

INTRODUCTION, METHODOLOGY AND SOFTWARE STRUCTURE FOR PROGRAM CHG

This program is designed to compute changes in surface temperature, dew point, wind direction, speed, and pressure (altimeter setting) over any time interval from one to twenty-four hours. Altimeter setting was chosen to show pressure change due to the fact that nearly all stations report altimeter, whereas they do not necessarily report sea level pressure. The CHG program can also be used to replot data that has been updated in the hourly data file, SAxxZ.DT. Sea level pressure or altimeter setting can be specified to be plotted as the pressure group on the replotted map. Table 7 illustrates how this is accomplished.

Since the program is computing changes, two input hourly data files, SAXXZ.DT and SAYYZ.DT, are required. Two AFOS graphics make up the change chart graphics. The general description of the plotting models are shown in Figs. 5 and 6 and sample output is shown in Figs. 7 and 8. The two change charts may be overlayed if so desired. Changes will always be computed from the first hour specified to the second hour specified via switches in the command line (see Table 7). Data that is 24 hours old is renamed from SAxxZ.DT to file SATMP.DT (TeMPorary). To compute a twenty-four hour change chart at time XX, the program will use files SAXXZ.DT and SATMP. It assumes SATMP.DT is the same time as SAXXZ.DT, except twenty-four hours old.

On the first change chart graphic, the pressure change is the total altimeter change over the time period. It is represented by a 3 digit number. The leading digit shows whether pressure is falling (7), rising (2), or the same (4). The remaining two digits are the total altimeter change. Symbols depicting wind direction change (30 degrees or more) or speed change (5 knots or more) are shown on the first change chart (see Figs. 5 and 7). Temperature change and dew point change are plotted in the normal plotting location for temperature and dew point.

On the second change chart graphic, the pressure change represents the total change at a station minus the average change over all stations. This change can be specified in the command line by using a local switch or by allowing the program to calculate the change by leaving the switch off. Thus, if all stations were falling approximately 1 mb (-3 hundredths) from 16Z to 22Z (the semi-diurnal pressure change), this change would be subtracted out. It is used to highlight true pressure rise/fall centers from those that are masked by the daily rise and fall of pressure that occurs. The actual wind changes are shown on the second change chart. (see Figs. 6 and 8).

CHG does not complete the graphics, it only generates a plot file. The AFOS macro CHGMAC.MC illustrates how to complete the graphics using PMOD software (Tables 8 and 9).

CAUTIONS

Always make sure that both hours of surface data are present in the files SAxxZ.DT. A quick listing can be obtained at the ADM by typing

```
L:DPØ:/E SA-.DT
```

You should be aware that the change calculations do not check for the date, so if you are not careful, you could accidently calculate changes for periods greater than twenty-four hours and not realize it. Normally, this is not a problem, but if SAVOBS was not run for the times you are specifying, one or both of the input files could be from a different day than you were expecting. This is another reason for off-loading data at the end of the day (except for the hours you may want to retain for a twenty-four hour change chart).

INTRODUCTION TO PROGRAM MESOS

This is the objective analysis program. Up to 100 stations may be included in the analysis as well as data from one and two hours prior to the initial hour. The 100 stations were input from the second list of stations in the file NSTATIONS in program BLDWXD. As mentioned in the discussion of BLDWXD, stations just outside the grid should also be included (up to the 100 station maximum) to help lessen errors that would occur on the edge of the grid. This program was written to give increased stability to the derived fields, such as moisture convergence. Past experience had shown that if noise was allowed to contaminate the derived fields, little useful information would be derived from these fields. This program features variable distance weighting and also includes time weighting of observations. This has been shown to produce more consistent results. Also, if data is missing in critical locations, the time weighting will help lessen the impact of missing data. (See Bothwell, et. al., 1985). Refer to Appendix B for examples of the distance and time weighting.

Stations in elevated terrain can cause spurious warm/cold advection centers if temperature advection is calculated. Thus, in this program, temperature at each of the stations is reduced to a temperature at a fixed pressure level. Usually, this is a pressure near the center of the grid. The user may specify the pressure level, or let the program default to 1000 mb. This potential temperature field is used to calculate warm and/or cold advection, thus removing the problems caused by terrain.

Stability indices are calculated at 500 mb and one other level above this (400, 300, 250, or 200 mb) using surface lifted parcel temperatures and the upper-air temperatures computed by program COMTP. This method was illustrated by Hales and Doswell, 1982. The level above 500 mb is used since many times the maximum instability is not at 500 mb, but at a higher level. This in turn can lead to larger storm updrafts.

Another useful quantity is the surface wet-bulb potential temperature. This corresponds with the pseudo-adiabats on a sounding and when used in conjunction with soundings, can illustrate how much (or how little) positive/negative area there is.

Figures 9, 10, 11, 12, 13, 14, 15 and 16 illustrate the fields calculated by MESOS. Although changes in pressure (altimeter setting) are computed in OACHG, a pressure field was not selected to be plotted in this program. It was felt that the skilled analyst can still perform a superior analysis by hand. This program is used to calculate fields not easily computed by the meteorologist. These fields are as follows:

1. Stability (lifted) Index at 500 mb.
2. Stability (lifted) Index at 400, 300, 250, or 200 mb.
3. Surface Wet-Bulb Potential Temperature.
4. Potential Temperature (Temperature reduced to 1000 mb or user specified level).
5. Surface Moisture Convergence (Positive Numbers Represent Moisture Convergence).

6. Surface Wind Convergence (Positive Numbers Represent Convergence).
7. Surface Relative Vorticity.
8. Advection of Temperature on a Constant Pressure Surface.
9. Surface Mixing Ratio.

METHODOLOGY AND SOFTWARE STRUCTURE FOR MESOS

Missing or erroneous data in an objective analysis can seriously degrade the quality of the output. For this reason, the input data fields (both surface (SAxxZ.DT) and upper-air (MANDATAF.DT)) have been designed for ease of editing for those cases where it is necessary to correct and/or add data. The program includes wind gusts in the calculations. One half of the wind gust (if reported) is added to the sustained wind. It was felt that this would better help to approximate the wind in the boundary layer.

The program uses Gaussian (exponential) time and distance weighting to reduce the noise in the analysis and lessen the effect of missing data. The time weighting is fixed and will use data from the initial hour and one and two hours prior to the initial hour. These extra hours are not mandatory, but it is recommended that they be included. (See Appendix C) It should be remembered that the data must first be decoded (SAODEC) and formatted (SAVOBS).

The distance weighting that is used by the program depends on your data density. Since the density of surface data varies over the United States, three different distance weighting functions (filters) have been approximated by discrete steps in BLDWXD and been stored for use by MESOS in WXDATA1.DT. The first weighting function (also referred to as a weight table) corresponds to an average station spacing of 100 km, the second is for 125 km, and the third is for 150 km. The printout from BLDWXD (Table 2) lists the average station spacing for your grid and stations. You should use the distance weighting that corresponds to a spacing a little larger than your average station spacing. If for example, you have an average spacing of 98.75 km, you should use the weight table number one which corresponds to 100 km. This is done via the switches in the command line. The switches are covered in Table 7. Since some stations close at night and this effects the average distance between stations at night, you will sometimes have to switch to a weight table for a larger station spacing. (e.g., at WSFO OKC, we use weight table 2 during the day and weight table 3 at night.) (Again refer to Appendix C .)

The program MESOS does not generate the graphics. It produces what is called Internal Product Files. The PMOD program GENUTF generates the graphics. An AFOS macro, MESOSMAC will complete the graphics.

CAUTIONS

Make sure you are using a weight table that is supported by the data density over your area. Large "holes" where there are no stations can still make the results in those areas suspect. NO analysis can give perfect results. A little time invested to add important stations or correct erroneous data can return a high quality analysis.

It is advisable to use the PMOD software to plot your surface data on your locally generated map background so you can occasionally plot the data with the results of your objective analysis. This can give you a much better feel for what is occurring.

INTRODUCTION, METHODOLOGY AND SOFTWARE STRUCTURE FOR PROGRAM OACHG

This program computes the changes in altimeter, surface moisture convergence, and surface relative vorticity (see Figs. 17, 18, and 19) at the same grid points used in MESOS. It is often useful to look at the changes that are occurring over your area. These fields have been smoothed by the objective analysis (MESOS) and usually represent significant changes that may need additional monitoring. Changes can be computed from one to twenty-three hours. Twenty-four hour changes cannot be computed.

The changes are simply changes at the grid points in the objective analysis program MESOS. Whenever MESOS is run, altimeter setting, moisture convergence, and relative vorticity are written to a file SFCOUTxxZ.DT (xx is the GMT hour). OACHG reads two of these files as specified by switches in the AFOS command line and computes the changes. This altimeter change map which is contoured is not the same as those produced by the CHG program. CHG displays point changes, whereas OACHG represents a smoothed (via the objective analysis) change field. The magnitude of changes in altimeter should be less than those from CHG. Grid point changes represent changes occurring on the synoptic scale as opposed to changes in the station values which are point changes.

As in the case with MESOS, OACHG does not actually generate the AFOS graphic. It generates the Internal Produce Files (IPFs). GENUTF is the PMOD program that actually generates the AFOS graphic. An AFOS macro, OACHGMAC has been written to complete the graphics.

CAUTIONS

You should remember that MESOS must have been run for the hours specified in the command line switches. Twenty-four hour changes are not computed. It is possible to accidently compute changes for periods greater than twenty-four hours if old files are not removed from disk. However, the complete month, date, year and hour are specified on these plots.

REFERENCES

Barnes, S. L., 1973: Mesoscale objective map analysis using weighted time series observations. NOAA Tech. MEMO. ERL-NSSL-62, Norman, Okla., 60 pp.

Bothwell, P. D. and K. C. Crawford, 1983: The operational use of surface objective analysis in evaluating the potential for heavy convection. Preprints, 13th Conf. on Severe Local Storms (Tulsa, Okla.), AMS, Boston, Mass., 372-375.

Bothwell, P. D., R. A. Maddox, C. A. Doswell III, and K. C. Crawford, 1985: Operational methods for increasing the reliability of information derived from conventional surface and upper-air data. Preprints, 14th Conf. on Severe Local Storms (Indianapolis, Ind.), AMS, Boston, Mass.

Davis, R. A., 1983: PMOD plotting system for AFOS. NOAA AFOS Operations Division Computer Programs NWS AOD CP 83-1, National Weather Service, NOAA, U.S. Department of Commerce, 50 pp.

Doswell, C. A. III, 1977: Obtaining meteorologically significant surface divergence fields through the filtering property of objective analysis. Mon. Wea. Rev., 105, 885-892.

Hales, J. E. and C. A. Doswell III, 1982: High resolution diagnosis of instability using hourly surface lifted parcel temperatures. Preprints 12th Conf. on Severe Local Storms (San Antonio, Texas), AMS, Boston, Mass., 172-175.

Inman, R. L., 1970: Papers on operational objective analysis schemes at the National Severe Storms Forecast Center. NOAA Tech, Memo. ERL-NSSL-51, Norman, Okla., 91 pp.

Perrotti, H. P., 1984: AFOS surface decoding. NOAA Techniques Development Laboratory Computer Programs NWS TDL CP 84-2, National Weather Service, NOAA, U. S. Department of Commerce, 35 pp.

Ruthi, L. J., 1978: An evaluation of surface quantities in the short term prediction of the intensity of convective activity. M.S. Thesis, University of Oklahoma, OK. 90 pp.

Sunkel, W., 1981: MANDEC-Decoding mandatory upper-air observations. Central Region Programming Note No. 7, National Weather Service, NOAA, U. S. Department of Commerce, 19-30.

Program to BuiLD WXData1.dt

PART A: PROGRAM INFORMATION AND INSTALLATION PROCEDURE

PROGRAM NAME: BLDWXD AAL ID:
Revision No.: 01.00

PURPOSE: To read data from RDOS file NSTATIONS and create RDOS file WXDATA1.DT. This file, WXDATA1.DT, sets up a site specific (WSFO or WSO) mesoscale database used by SAVOBS, MANDECF, COMTP, CHG and MESOS (see Fig. 1).

PROGRAM INFORMATION:

Development Programmer:
Phillip D. Bothwell

Location:
WSFO, Oklahoma City, OK.
Phone: FTS 749-4155

Maintenance Programmer:
Phillip D. Bothwell

Location:
Same
Phone: Same

Language: Fortran IV/Rev 5.10 Type: Standard

Save file creation dates:BLDWXD.SV
Original Release/Rev 01.00 8/15/85

Running time: Five to Six minutes.

Disk space: Program files - 66 Blocks
Data files - 12 Blocks

PROGRAM REQUIREMENTS

Program files:

NAME	COMMENTS
BLDWXD.SV	

Data Files:

NAME	DP LOCATION	READ/WRITE	COMMENTS
STDIR.MS	DPØF	R	
WXDATA1.DT	DPØF	W	May be moved to DPØF and linked to DPØF from DPØ. (It cannot be displayed)
NSTATIONS	DPØ	R	Required only for BLDWXD program. It can be displayed on ADM. Type DSP:NSTATIONS
TEST	DPØ	W	Same as PØA. Requires map background BØ2. It may remain on disk (for reference) or it can be deleted. It can be displayed by typing DSP:TEST.

AFOS Products:

ID	ACTION	COMMENTS
NMCGPHPØA	Stored	This product is the same as file TEST, but will be deleted as new PØA (surface plots) maps are produced.

LOAD LINE

BLDWXD: RLDR BLDWXD BLK3 RDPRE PIXEL ZHDST UPRCK AG.LB BG.LB UTIL.LB FORT.LB AFOSE.LB

PROGRAM INSTALLATION*

1. Make sure STDIR.MS is on DPØ or linked to it.

2. Make sure keys, NMCGPHPØA and cccMCPNST exist, or add them to the wish list. (ccc is your Node).

3.** Move the file PREFORMAT from DP3 to DPØ.

4. Store it as cccMCPNST by typing:

   STORE:PREFORMAT cccMCPNST (ccc is your Node)

5.** Move BLDWXD.SV and BOXVIEW.SV from DP3 to DPØ. BLDWXD and BOXVIEW can be deleted when you are satisfied with the output and map produced in this section. If you decide later to rerun BLDWXD and create a new map, move the files from DP3 to DPØ temporarily.

6. PMOD.SV, GENUTF.SV and HCOPY.SV should already be on DPØ (or DPØF and linked to DPØ).

**These instructions/commands are included in the macro included on the floppy in DP3(MESOS-SETUP) and will be performed automatically once you direct to DP3 and execute the command (from the dasher)

MESOSSETUP .

*ALL REFERENCES TO DP3 REFER TO THE FLOPPY THAT ACCOMPANIED THIS INSTRUCTION PACKAGE.

PROGRAM TO BuiLD WXDatal.dt

PART B: PROGRAM EXECUTION AND ERROR CONDITIONS

PROGRAM NAME: BLDWXD AAL ID:
Revision No.: 01.00

PROGRAM EXECUTION

1. Complete the preformat cccMCPNST (for your area of interest) and store in the database as a temporary scratch file such as cccWRKxxx. Save this temporary file as RDOS file NSTATIONS by typing the following command at an ADM. (Table 1 shows sample preformat -the illustration is shown in Fig. 2)

   SAVE:cccWRKxxx NSTATIONS .

   The preformat contains sample data from WSFO OKC which must be deleted and/or overwritten. In order to become familiar with the program, you may want to use the OKC data in the preformat the very first time the program is executed.

2. From an ADM, enter the command

   RUN:BLDWXD (or just type BLDWXD at the dasher).

3. The message "BLDWXD COMPLETED: OUTPUT IN FILE NMCGPHPØA" alerts on the ADM when the program finishes. (If initiated at the dasher, you will not get this message). At this point, the file WXDATA1.DT has been completed and the map showing the grid and stations is on NMCGPHPØA (Fig. 2) (and the RDOS file TEST which can be displayed via DSP:TEST and overlaying map background BØ2).

   NOTE: Since you must use some of the information printed out by BLDWXD on the dasher, it is strongly recommended that you keep the printout for 1) use in the following step and 2) in case you need to rerun the program or change the initial conditions. (See Table 2)

   The next steps describe how to create the map background for your specific site.

4. This step must be executed at the dasher by typing

   BOXVIEW .

   Boxview will ask for the lower left latitude and longitude as well as the lower right latitude and longitude (see Table 3). The information you just input is on the dasher printout from Step 3 (see Table 2). After you input the lower left lat, lon, strike RETURN and it will ask for the lower right lat,

lon. After this, again strike RETURN and it will ask for the map selection. Enter 2 and strike RETURN. The program will finish by outputing files BOXVIEW.PF and BOXVIEW.CF to the disk. The files must be renamed according to the map background you want to use at your site.

5. Rename the files by typing at the dasher

```
RENAME BOXVIEW.PF NAXX.PF      (where XX is the
                                map background
                                number)      ,
RENAME BOXVIEW.CF NAXX.CF      .
```

6. Generate the map background by typing at the dasher

```
HCOPY BØ2 NAXX.CF    (XX is again the map background
                      number you want to use)      ,

GENUTF XPLOT BXX     (XX is map background number)   .
```

Figures 2 and 3 show the relation of the map that is "windowed" on NMCGPHPØA and the map that was created using the procedure described above. For additional information on HCOPY and GENUTF, see PMOD plotting system for AFOS, R. A. Davis, 1983.

ERROR MESSAGES

Error messages from BLDWXD will be typed at the dasher. They are as follows:

```
1    CHANNEL ERROR STDIR.MS
2    OPEN ERROR-STDIR.MS
3    READ ERROR-STDIR.MS
4    CLOSING ERROR-STDIR.MS   (Check STDIR.MS to make sure it
                               exists or is linked to DPØ).
5    OPEN ERROR-NSTATIONS
6    CLOSING ERROR-NSTATIONS  (Check to make sure file NSTATIONS is
                               on DPØ and is complete)
7    ERROR CREATING WXDATA1.DT
8    CHANNEL ERROR-WXDATA1.DT
9    OPEN ERROR-WXDATA1.DT
10   WRITING ERROR 1-WXDATA1.DT
11   WRITING ERROR 2-WXDATA1.DT
12   WRITING ERROR 3-WXDATA1.DT
13   WRITING ERROR 4-WXDATA1.DT
14   WRITE ERROR-WXDATA1.DT
15   WRITE ERROR (UPPER AIR)-WXDATA1.DT
16   CLOSING ERROR-WXDATA1.DT      (Check input from NSTATIONS and
                                    if necessary rerun BLDWXD)
```

If the proper files exist, there may be a system or disk problem if these errors occur.

Program to SAVe surface OBServations

Part A: PROGRAM INFORMATION AND INSTALLATION PROCEDURE

PROGRAM NAME: SAVOBS AAL ID:
Revision No: 01.00

PURPOSE: This program will perform an error check of previously decoded data (SAODATA) and format the data for display and/or editing on an AFOS ADM. This data can be replotted once it has been updated and the updated data set can be saved on floppy disk after a significant weather event. SAVOBS must be run before CHG or MESOS.

PROGRAM INFORMATION:

Development Programmer:
Phillip D. Bothwell

Location:
WSFO, Oklahoma City, OK.
Phone: FTS 749-4155

Maintenance Programmer:
Phillip D. Bothwell

Location:
Same
Phone: Same

Language: Fortan IV/Rev 5.10 Type: Standard

Save file creation dates: SAVOBS.SV
Original Release/Rev. 01.00 8/3/85

Running time: 25-30 seconds.

Disk space: Program Files - 43 Blocks
Data Files - 11 Blocks (each SAxxZ.DT file)
10 Blocks (SAVOBS.DT)

PROGRAM REQUIREMENTS

Program Files:

NAME	COMMENTS
SAVOBS.SV	

Data Files:

NAME	DP LOCATION	READ/WRITE	COMMENTS
SAxxZ.DT	DPØ	R/W	xx refers to the hour of the data (GMT hour). (e.g. SA18Z.DT is hourly surface data for 18Z.) Up to 24 files (each a maximum of 11 blocks) can accumulate in one day.
SATMP.DT	DPØ	W	Input for CHG and MESOS. 24 hour old data.
SAVOBS.DT	DPØ	W	Listing of erroneous data and missing data. Only one file. (SAxxZ.DT, SATMP.DT, and SAVOBS.DT may be displayed at an ADM/GDM by typing DSP:FILE NAME).

WXDATA1.DT	DPØF	R	(Cannot be displayed at ADM)
SAODATA	DPØ	R	Output from program SAODEC
SAOXXX	DPØ	R	Output from program SAODEC

AFOS Products: None

LOAD LINE

SAVOBS: RLDR SAVOBS BLK STDCK CKLST WRTDTA BG.LB UTIL.LB FORT.LB
AFOSE.LB

PROGRAM INSTALLATION*

1. Move the program SAVOBS.SV from DP3 to DPØF.

2. From DPØ, link SAVOBS.SV to DPØF.

These instructions/commands are included in the macro included on the floppy in DP3 (MESOS-SETUP) and will be performed automatically once you direct to DP3 and execute the command (from the dasher)

MESOSSETUP .

*ALL REFERENCES TO DP3 REFER TO THE FLOPPY THAT ACCOMPANIED THIS INSTRUCTION PACKAGE

Program to SAVe surface OBServations

PART B: PROGRAM EXECUTION AND ERROR CONDITIONS

PROGRAM NAME: SAVOBS AAL ID:
Revision No.: 01.00

PROGRAM EXECUTION

1. The program is executed simply by typing (at an ADM)

RUN:SAVOBS .

It is strongly recommended that this program be included as the last step in the local surface observation decoder/plotting AFOS macro. It does require SAODATA and SAOXXX, the output from SAODEC. Once it is included in the surface AFOS macro, the program will run automatically with no forecaster intervention (except to correct and/or add data).

When the program finishes the messages

SAVOBS COMPLETED:OUTPUT IN FILE SAxxZ.DT
JOB SAVOBS COMPLETED: PRODUCT SAVOBS.DT STORED

will alert your ADM. (xx will be the GMT hour.)

ERROR MESSAGES (DASHER MESSAGES)

1. CHANNEL ERROR-WXDATA1.DT
2. OPEN ERROR-WXDATA1.DT
3. READ ERROR-1-WXDATA1.DT
4. READ ERROR 2-WXDATA1.DT
5. CLOSING ERROR-WXDATA1.DT
6. CHANNEL ERROR-SAODATA
7. OPEN ERROR-SAODATA
8. ERROR CREATING SAVOBS.DT
9. OPEN ERROR FOR SAVOBS.DT
10. READ ERROR 1-SAODATA
11. READ ERROR 2-SAODATA
12. CLOSING ERROR-SAODATA
13. NO DATA TO CHECK-PROGRAM SAVOBS TERMINATED (problem with input data.)
14. CLOSING ERROR-SAVOBS.DT
15. OPEN ERROR (FOR READ)-SAXXZ.DT
16. OPEN ERROR (AFTER READ)-SAXXZ.DT
17. RENAMING ERROR-SATMP.DT
18. ERROR CREATING IFILE (IFILE is SAxxZ.DT where xx is the GMT hour)
19. OPEN ERROR (FOR WRITE)-SAXXZDT
20. CLOSING ERROR-SAXXZ.DT

#13 means that no data was found in the file to check, so check SAODATA. Other errors are standard AFOS error messages and may indicate possible system or disk problems IF WXDATA1.DT and SAODATA are on DPØ or linked to it.

To list all SAxxZ.DT files at the ADM type

L:DPØ:/E SA-.DT .

Program to take MANdatory DECoded upper level data and Format it

PART A: PROGRAM INFORMATION AND INSTALLATION PROCEDURE

PROGRAM NAME: MANDECF AAL ID:
Revision No.: 01.00

PURPOSE: This program is designed to take previously decoded upper-air data from mandatory levels (MANDATA) and format the data in a file so that it may be displayed and (if necessary) edited at an ADM.

PROGRAM INFORMATION:

Development Programmer:	Maintenance Programmer:
Phillip D. Bothwell	Phillip D. Bothwell
Location:	Location:
WSFO, Oklahoma City, OK	Same
Phone: FTS 749-4155	Phone: Same
Language: Fortran IV/Rev 5.10	Type: Standard

Save file creation dates: MANDECF.SV
Original Release/ Rev 01.00 9/5/85
Running time: Around 20 seconds.

Disk space: Program files - 29 Blocks
Data files - Approximately 30 Blocks

PROGRAM REQUIREMENTS

Program files:

NAME	COMMENTS
MANDEC.(SV and OL)	Data must first be decoded with this program. Program written by Warren Sunkel, WSFO, TOP. MUST be run first.
MANDECF.SV	

Data Files:

NAME	DP LOCATION	READ/WRITE	COMMENTS
MANDATA	DPØ	R	MANDECF.SV reads this file. (This file cannot be displayed)
MANDATAF.DT	DPØ	W	Formatted upper-air mandatory level data. (To display this file type DSP:MANDATAF.DT)
WXDATA1.DT	DPØF	R	(This file cannot be displayed)

AFOS Products: NONE

LOAD LINE
MANDECF: RLDR MANDECF RDWX2 BG.LB UTIL.LB FORT.LB AFOSE.LB

PROGRAM INSTALLATION*

1. Move the program MANDECF.SV AND MANDEC.(SV,OL) from DP3 to DPØF. (MANDEC.(SV,OL) may already be on disk)

2. From DPØ, link these programs to DPØF (if necessary).

These instructions/commands are included in the macro included on the floppy in DP3 (MESOS-SETUP) and will be performed automatically once you direct to DP3 and execute the command (from the dasher)

MESOSSETUP .

*ALL REFERENCES TO DP3 REFER TO THE FLOPPY THAT ACCOMPANIED THIS INSTRUCTION PACKAGE.

Program to take MANdatory DECoded upper-air data
and Format it

PART B: PROGRAM EXECUTION AND ERROR CONDITIONS

PROGRAM NAME: MANDECF

AAL ID:
Revision No.: 01.00

PROGRAM EXECUTION

1. To execute the program at the ADM type:

RUN:MANDEC
RUN:MANDECF

It is strongly recommended that these two commands be included at the end of the local station's upper-air plotting macro. This way, the programs will be executed after the upper-air data is in, and it will be done automatically with no forecaster intervention.

When the programs are finished, the messages

MANDEC COMPLETED: OUTPUT IN MANDATA
MANDECF COMPLETED: OUTPUT IN MANDATAF.DT

will alert at your console.

ERROR MESSAGES

1. CHANNEL ERROR-WXDATA1.DT
2. OPEN ERROR-WXDATA1.DT
3. READ ERROR-WXDATA1.DT
4. READ ERROR 2-WXDATA1.DT
5. CLOSING ERROR-WXDATA1.DT
6. ERROR CREATING MANDATAF.DT
7. OPEN ERROR-MANDATAF.DT
8. CHANNEL ERROR-MANDATA
9. OPEN ERROR-MANDATA
10. READ ERROR 1-MANDATA
11. READ ERROR 2-MANDATA
12. CLOSING ERROR-MANDATA
13. CLOSING ERROR-MANDATAF.DT

If you encounter any of these DASHER error messages, and WXDATA1.DT and MANDATA are on DPØ or linked to it, there may be a system or disk problem. (REMEMBER, MANDEC MUST BE RUN BEFORE MANDECF).

Program to COMpute upper-air TemPeratures at grid points

PART A: PROGRAM INFORMATION AND INSTALLATION PROCEDURE

PROGRAM NAME: COMTP

AAL ID:
Revision No.: 01.00

PURPOSE: This program will compute the grid point temperatures at 500 mb and one other user specified level (400, 300, 250, or 200 mb). The data is written to disk for later use by program MESOS.

PROGRAM INFORMATION:

Development Programmer:
Phillip D. Bothwell

Location:
WSFO, Oklahoma City, OK
Phone: FTS 749-4155

Maintenance Programmer:
Phillip D. Bothwell

Location:
Same
Phone: Same

Language: Fortran IV/Rev 5.10

Type: Standard

Save file creation dates: COMTP.SV
Original Release/Rev 01.00 8/18/85

Running time: Approximately 45 seconds.

Disk space: Program files - 30 Blocks
Data files - 4 Blocks

PROGRAM REQUIREMENTS

Program files:

NAME	COMMENTS
COMTP.SV	MANDEC and MANDECF must be run prior to running COMTP.

Data Files:

NAME	DP LOCATION	READ/WRITE	COMMENTS
MANDATAF.DT	DPØ	R	Input data. (To display this, type DSP:MANDATAF.DT)
UPROUT.DT	DPØ	W	Output data. (This file cannot be displayed)
WXDATA1.DT	DPØF	R	(This file cannot be displayed)

AFOS Products: NONE

LOAD LINE

COMTP: RLDR COMTP UPIN RDWXD UPRTP BG.LB UTIL.LB FORT.LB AFOSE.LB

PROGRAM INSTALLATION*

1. Move the program COMTP.SV from DP3 to DPØF.

2. From DPØ, link COMTP.SV to DPØF.

   These instructions/commands are included in the macro included on the floppy in DP3 (MESOS-SETUP) and will be performed automatically once you direct to DP3 and execute the command (from the dasher)

   MESOSSETUP .

*ALL REFERENCES TO DP3 REFER TO THE FLOPPY THAT ACCOMPANIED THIS INSTRUCTION PACKAGE

Program to COMpute upper-air TemPeratures
at grid points

PART B: PROGRAM EXECUTION AND ERROR CONDITIONS

PROGRAM NAME: COMTP

AAL ID:
Revision No.: 01.00

PROGRAM EXECUTION

1. To run the program (after MANDEC and MANDECF have run), type

RUN:COMTP xxx/P .

Switch P is optional. It allows the user the option of chosing at which level above 500 mb (400, 300, 250, or 200 mb) to compute stability indices. Default is 250 mb. To compute stability indices at 500 mb and 300 mb, type

RUN:COMTP 300/P .

When the program finishes the message

COMTP COMPLETED: OUTPUT IN FILE UPROUT.DT

will alert at your console.

ERROR MESSAGES

1. ERROR GETTING CHANNEL IC IN FCOM
2. ERROR GETTING CHANNEL KCHN
3. ERROR OPENING WXDATA1.DT
4. ERROR IN FIRST READ OF KCHN
5. ERROR IN LAST READ OF WXDATA1.DT
6. ERROR IN KLOSING WXDATA1.DT
7. ERROR OPENING MANDATAF.DT
8. ERROR CLOSING ICHN
9. ERROR CREATING UPROUT.DT
10. ERROR GETTING CHANNEL JCHN FOR UPROUT.DT
11. ERROR OPENING CHANNEL FOR UPROUT.DT
12. ERROR KLOSING JCHN
13. WEIGHT.LE.0...0A TERMINATED

The most likely source of errors is if WXDATA1.DT or MANDATAF.DT do not exist. (note that references to klosing refer to the routine KLOSE, and is in reference to closing a channel). If WXDATA1.DT and MANDATAF.DT are on DPØ or linked to it, there may be a system or disk problem. Error 13 indicates not enough data was available for the upper air objective analysis.

Program to compute and plot CHanGes in surface data

PART A: PROGRAM INFORMATION AND INSTALLATION PROCEDURE

PROGRAM NAME: CHG

AAL ID:
Revision No.: 01.00

PURPOSE: The program computes changes in temperature, dew point, wind direction, speed, and pressure (altimeter setting) for as many as 200 stations. Any time interval from one to twenty-four hours may be specified. The program creates a plot file which can be plotted using the PMOD software. CHG can also be used to replot surface data.

PROGRAM INFORMATION:

Development Programmer:
Phillip D. Bothwell

Maintenance Programmer:
Phillip D. Bothwell

Location:
WSFO, Oklahoma City, OK
Phone: FTS 749-4155

Location:
Same
Phone: Same

Language: Fortran IV/ Rev 5.10

Type: Standard

Save file creation dates: CHG.SV
Original Release/Rev 01.00 5/03/85

Running time: About 3 minutes (including graphic generation)
(Time depends on number of stations)

Disk space: Program files - 43 Blocks (excluding PMOD software)
Data files - 25 Blocks

PROGRAM REQUIREMENTS

Program files:

NAME	COMMENTS
CHG.SV	Changes stored in plot file.
CHGMAC.MC,REPLOT.MC	Macros to complete graphics
PMOD.SV, GENUTF.SV	PMOD software
CHG1.PM and CHG2.PM	Special PMOD plotting modules.

Data Files:

NAME	DP LOCATION	READ/WRITE	COMMENTS
SAxxZ.DT	DPØ	R	Two input files (SAxxZ.DT) are required. (To display those files, type DSP:SAxxZ.DT)
GP	DPØ	W	Plot file
WXDATA1.DT	DPØF	R	(This file cannot be displayed)

AFOS Products:

ID	ACTION	COMMENTS (See also Figs. 5 & 6)
NMCGPHSC1	STORED	This chart displays changes in temperature, dew point, wind direction (backing-solid station circle, veering-open station circle)* and speed (5 kt or greater increase - slanting line point to upper right corner, (plotted above station circle), 5 kt or greater decrease-slanting line pointing to lower right corner, less than 5 kt - horizontal line), and total altimeter changes (3 digits, leading digit 7-falling, 4-no change, 2-rising); second and third digit-total altimeter change (in hundredths inch). *Backing/veering must be 30 degrees or more to be displayed.
NMCGPHSC2	STORED	This chart displays wind direction/speed changes as in NMCGPHSC1. Also shows previous and current wind direction and speed. If there is significant wind speed change (5 kts or more) wind barb is magnitude of speed change to nearest 5 kts.** Pressure change is also shown. It is the total altimeter setting change at the station minus 1) the average of the change from all stations, or 2) a change input from the forecaster in the program command line. **The wind direction plotted is most current direction of the two hours.
NMCPLTSAO	STORED	Plot file.

LOAD LINE

CHG: RLDR CHG BLK2 RDCOM GETDTA MRGDTA PRCHG APCLB BG.LB UTIL.LB FORT.LB AFOSE.LB

PROGRAM INSTALLATION*

1. Move the program CHG.SV from DP3 to DPØF.
2. Move CHGMAC.MC, REPLOT.MC, CHG1.PM and CHG2.PM to DPØ.
3. From DPØ, link CHG.SV to DPØF.

These instructions/commands are included in the macro included on the floppy in DP3 (MESOS-SETUP) and will be performed automatically once you direct to DP3 and execute the command (from the dasher)

MESOSSETUP

*ALL REFERENCES TO DP3 REFER TO THE FLOPPY THAT ACCOMPANIED THIS INSTRUCTION PACKAGE.

Program to compute and plot CHanGes in surface data

PART B: PROGRAM EXECUTION AND ERROR CONDITIONS

PROGRAM NAME: CHG

AAL ID:
Revision No.: 01.00

PROGRAM EXECUTION

1. To execute the program at the ADM type

RUN:CHG xx/X yy/Y pp/P .

This command will cause the program to compute changes from hour (GMT) xx to hour (GMT) yy. This means that xx is the oldest (in time) and yy is the most current hour. The average pressure change (pp) in hundredths inch can be input via switch P (optional switch). This change is subtracted from each station total altimeter change and displayed on NMCGPHSC2. To run a change from 15 to 18Z, type

RUN:CHG 15/X 18/Y, (If pp omitted, program will calculated change.)

To compute 24 hour changes at 14Z, type

RUN:CHG 14/x 14/y Ø/p (Ø hundredths inch change input) .

The steps listed above will cause the program to create a plot file, much like a conventional surface plot file, however, it will NOT generate the graphic. The following MACRO listing will illustrate how to generate the graphics (NMCGPHSC1 and NMCGPHSC2).

CHGMAC.MC

```
PMOD GP/F NA.PF/T CHG1.PM/O
GENUTF XPLOT SC1

PMOD GP/F NA.PF/T CHG2.PM/O
GENUTF XPLOT SC2
```

(Note: NA.PF can be NAXX.PF, the file created after BLDWXD. SC1 and SC2 should then have map background BXX.)

NA.PF in the above instructions will cause the data to be plotted on map background (BØ2). CHG1.PM AND CHG2.PM are special plotting modules used to plot the specific changes already mentioned.

REPLOTTING SURFACE DATA FROM FILES SAxxZ.DT

If the parameter xx is input as 49, the data for the hour specified in yy will be replotted with sea level pressure. If xx is 99, the data will be replotted with altimeter setting. A macro similar to your surface macro must be used to generate the graphic. (See example REPLOT.MC below).

REPLOT.MC.

```
PMOD GP/F NA.PF/T SFC.PM/O
GENUTF XPLOT PØA
```

(Note: NA.PF can be NAXX.PF. PØA can be PXX. your local map)

When the CHG program finishes, the following Alert message will be displayed if a change chart plot file was produced,

CHG COMPLETED: OUTPUT IN FILE *APC = XXXX .

XXXX is the Average Pressure Change of all stations in hundredths of an inch. If CHG has been used only to create an hourly surface plot file, the message

CHG COMPLETED: OUTPUT IN FILE *APC = +0999 .

will appear.

ERROR MESSAGES (DASHER MESSAGES unless otherwise specified)

1. ERROR-FCOM (error reading command line-check input on command line)
2. OPEN ERROR-WXDATA1.DT
3. READ ERROR 1-WXDATA1.DT
4. READ ERROR 2-WXDATA1.DT
5. CLOSING ERROR-WXDATA1.DT (Check WXDATA1.DT)
6. ERROR CREATING SAOTEMP
7. CHANNEL ERROR-SAOTEMP
8. ERROR OPENING SAOTEMP
9. CHG ABORTED! ERROR CONDITION: MSG INPUT (ADM MESSAGE-check input)
10. MISSING INPUT DATA
11. OPEN ERROR-SAXXZ.DT
12. CHG ABORTED! ERROR CONDITION: CK INPUT (ADM MESSAGE-check data)
13. ERROR IN STATION INPUT
14. CLOSING ERROR-SAXXZ.DT
15. WRITE ERROR 1-SAOTEMP
16. WRITE ERROR 2-SAOTEMP
17. WRITE ERROR IN REPLOT OF DATA
18. WRITE ERROR (101400K)-SAOTEMP
19. CLOSING ERROR-SAOTEMP
20. RENAME ERROR-SAOTEMP-SAODATA
21. CHANNEL ERROR-SAOXXX
22. ERROR CREATING SAOXXX
23. OPEN ERROR-SAOXXX
24. CLOSING ERROR-SAOXXX
25. ERROR SWAPPING TO PLTGEN.SV VER. 4.30 (the change charts were designed to work with version 4.30, the output may be questionable with other versions)

Except for errors 9 and 12, there may be a system or disk problem if SAXXZ.DT files and WXDATA1.DT are OK.

MESOS - Program to objectively analyze surface data

PART A: PROGRAM INFORMATION AND INSTALLATION PROCEDURE

PROGRAM NAME: MESOS

AAL ID:
Revision No: 01.00

PURPOSE: Program objectively analyzes surface data using both time and distance Gaussian weighting schemes.

PROGRAM INFORMATION:

Development Programmer:
Phillip D. Bothwell

Location:
WSFO, Oklahoma City, OK
Phone: FTS 749-4155

Maintenance Programmer:
Phillip D. Bothwell

Location:
Same
Phone: Same

Language: Fortran IV/REV 5.10

Type: Standard

Save file creation dates: MESOS.SV
Original Release/Rev 01.00 8/31/85

Running time: Approximately 5 minutes

Disk Space: Program files - 71 Blocks
Data files - approximately 37 Blocks

PROGRAM REQUIREMENTS

Program files:

NAME	COMMENTS
MESOS.SV	Main program
GENUTF.SV	Generates graphics from Internal Product Files (IPF) created by MESOS.SV
MESOMAC.MC	Macro that generates ALL graphics from IPFs in MESOS.

Data Files:

NAME	DP LOCATION	READ/WRITE	COMMENTS
WXDATA1.DT	DPØF	R	(This file cannot be displayed)
SAxxZ.DT	DPØ	R	xx refers to GMT hour. Up to 3 hourly files may be used at one time. (To display this file, type DSP:SAxxZ.DT)
UPROUT.DT	DPØ	R	Upper-air data file containing grid point temperatures at two levels from 500 to 200 mb. (This file cannot be displayed)

Data Files (Continued):

NAME	DP LOCATION	READ/WRITE	COMMENTS
SFCOUTxxZ.DT	DPØ	W	Grid point output for use in program OACHG.SV. (This file cannot be displayed on an ADM.)

Internal Product Files (SLPLOT, SUPLOT, TWPLOT, THPLOT, MCPLOT, WCPLOT, RVPLOT, TAPLOT, and MRPLOT) are R/W on DPØ.

AFOS Products:

ID	ACTION	COMMENTS
NMCGPHSSL	STORED	Stability Index at 500 mb
NMCGPHSSU	"	Stability Index at user specified level (400, 300, 250, or 200 mb).
NMCGPHSTW	"	Surface Wet-Bulb Potential Temperature
NMCGPHSTH	"	Potential Temperature
NMCGPHSMC	"	Surface Moisture Convergence (+=moisture convergence)
NMCGPHSWC	"	Surface Wind Convergence (+=convergence)
NMCGPHSRV	"	Surface Relative Vorticity
NMCGPHSTA	"	Advection of Potential Temperature.
NMCGPHSMR	"	Surface Mixing Ratio.

LOAD LINE

```
MESOS: RLDR MESO BLK4 SETUP INPUT DAYTST ORDER FMIX WEIGHT SFCDER
       RDDSK OAOUT CALCON BG.LB UTIL.LB UGG.LB THERMO.LB FORT.LB
        AFOSE.LB
```

PROGRAM INSTALLATION*

1. Move the program MESOS.SV from DP3 to DPØF.
2. Move MESOSMAC.MC, STW.MC SSL.MC, SMC.MC SWC.MC, STH.MC, STA.MC, SMR.MC, SRV.MC to DPØ.
3. From DPØ, link MESOS.SV to DPØF.

These instructions/commands are included in the macro included on the floppy in DP3 (MESOS-SETUP) and will be performed automatically once you direct to DP3 and execute the command (from the dasher)

MESOSSETUP

*ALL REFERENCE TO DP3 REFER TO THE FLOPPY THAT ACCOMPANIES THIS INSTRUCTION PACKAGE.

MESOS - Program to objectively analyze surface data

PART B: PROGRAM EXECUTION AND ERROR CONDITIONS

PROGRAM NAME: MESOS AAL ID:
Revision No.: 01.00

PROGRAM EXECUTION

1. The program can run without any switches, but local switches add greatly enhanced capabilities to the program as follows.

   MESOS tt/T w/W pppp/P

   a. Switch T refers to the initial time of the observation. (e.g. tt is 17 for 17Z). By default, the program will use the current hour. The program also uses data from one and two hours previous to the initial hour in the Gaussian (exponential) time weighting. The only requirement is that the initial hour data be present. The program can run just on the initial hour, the initial hour and two hours prior, etc..

   b. Switch W refers to the distance weights used by the program. Default is weight table 2. (i.e. w not specified) (Recall now the printout from BLDWXD.SV, the program you used to build WXDATA1.DT see also TABLE 2). In the printout, the AVERAGE STATION SPACING IN KM was printed out. This is the average distance from each station to its nearest neighbor. In MESOS, there are 3 sets of distance weights or "weight tables". Weight table 1 corresponds to an average station spacing of 100 km. Weight table 2 is for an average station spacing of 125 km. Weight table 3 is for an average station spacing of 150 km. You should use a weight table that would be equal to or slightly larger than your average station spacing. (e.g. If the average station spacing according to BLDWXD was 115 km, then you should use weight table 2 (125 km)). This variable distance weighting was included in the program since data density varies from state to state (and from day to night).

   c. Switch P refers to the pressure level that stations temperatures are reduced to. Default pressure is 1000 mb. THETA (or potential temperature) is one of the output products displayed (NMCGPHSTH). You should use a pressure for a location near the center of the grid. In the case of Oklahoma City WSFO we have been using a value of 970 mb (i.e. ppp-970). With this switch, all temperatures are put on a nearly horizontal plane passing through the center of the grid. From this data, THETA advection (NMCGPHSTA) is calculated. This removes spurious warm/cold advection centers from elevated terrain sources that would contaminate the results.

EXAMPLE

WSFO XXX has data files SA18Z.DT, SA17Z.DT, and SA16Z.DT. The average station spacing was calculated at 96.75 km. Near the center of the grid, the station pressure (converted to mb) is approximately 980 mb. The command line would be typed as

RUN:MESOS 18/T 1/W 980/P .

(Remember, the program will use the data from 17 and 16Z, and generally produce a better analysis. However, only data from 18Z was necessary.)

At this point, it is important to note that no graphics have yet been generated. The Internal Produce Files (IPFs) are what is generated. To generate the graphics (NMCGPH...), a macro called MESOSMAC.MC has been set up. To run this, type

RUN:MESOSMAC .

MESOSMAC.MC is actually a set of macros, each of which can be run individually if you wish. It is composed of the following,

SSL.MC - NMCGPHSSL (STABILITY INDEX AT 500 mb)

SSU.MC - NMCGPHSSU (STABILITY INDEX AT 400, 300, 250, or 200 mb)

STW.MC - NMCGPHSTW (SURFACE WET-BULB POTENTIAL TEMPERATURE)

STH.MC - NMCGPHSTH (POTENTIAL TEMPERATURE, or TEMPERATURE REDUCED TO PRESSURE LEVEL P)

SMC.MC - NMCGPHSMC (SURFACE MOISTURE CONVERGENCE)

SWC.MC - NMCGPHSWC (SURFACE WIND CONVERGENCE)

SRV.MC - NMCGPHSRV (SURFACE RELATIVE VORTICITY)

STA.MC - NMCGPHSTA (ADVECTION OF TEMPERATURE ON A CONSTANT PRESSURE SURFACE)

SMR.MC - NMCGPHSMR (SURFACE MIXING RATIO)

To produce the graphic NMCGPHSMC, just type

RUN:SMC .

The individual macros will alert at the ADM when they are complete.

ERROR MESSAGES (All messages are dasher messages)

1. NO INITIAL HOUR FOUND..MESO ANALYSIS TERMINATED-This means that it could not find any surface data for the initial hour specified. Recheck the data to see if it is there by typing

   DSP:SAxxZ.DT . (xx is the GMT hour)

2. Errors will occur if SAVOBS (for the initial hour) or MANDEC, MANDECF, COMTP (every 12 hours) were not run.

Other errors (not listed here) would come from opening and closing files and in channel use. These errors (if they were to occur), would likely be from system or disk problems.

Program to compute Objective Analysis grid point CHanGes

PART A: PROGRAM INFORMATION AND INSTALLATION PROCEDURE

PROGRAM NAME: OACHG

AAL ID:
Revision No.: 01.00

PURPOSE: Program will compute changes in grid point values of altimeter setting, moisture convergence, and relative vorticity from one to twenty-three hours. Twenty-four hour grid point changes are not computed.

PROGRAM INFORMATION:

Development Programmer:
Phillip D. Bothwell

Location:
WSFO, Oklahoma City, OK
Phone: FTS 749-4155

Maintenance Programmer:
Phillip D. Bothwell

Location:
Same
Phone: Same

Language: Fortran IV/Rev 5.10

Type: Standard

Save file creation dates: OACHG.SV
Original Release/Rev 01.00 8/31/85

Running time: About 90 seconds.

Disk space: Program files - 46 Blocks
Data files - 5 Blocks

PROGRAM REQUIREMENTS

Program files:

NAME	COMMENTS
OACHG.SV	Requiries OACHGMAC.MC to produce AFOS graphics from Internal Product Files.
OACHGMAC.MC	
GENUTF.SV	

Data Files:

NAME	DP LOCATION	READ/WRITE	COMMENTS
SFCOUTxxZ.DT	DPØ	R	xx is the GMT hour. Requires two hours.
ACPLOT			
CCPLOT			
REPLOT	DPØ	R/W	Internal Product Files

AFOS Products:

ID	ACTION	COMMENTS
NMCGPHSAC	Stored	Grid point altimeter change
NMCGPHSCC	Stored	Grid point moist. convg. change
NMCGPHSRC	Stored	Grid point rel. vort. change

LOAD LINE

```
OACHG:  RLDR OACHG BLK4 TMCHG CHGOUT CALCON BG.LB UTIL.LB UGG.LB
        FORT.LB AFOSE.LB
```

PROGRAM INSTALLATION*

1. Move the program OACHG.SV from DP3 to DPØF.
2. Move the macros OACHGMAC.MC, SAC.MC, SCC.MC, SRC.MC from DP3 to DPØ.
3. From DPØ, link SAVOBS.SV to DPØF.

These instructions/commands are included in the macro included on the floppy in DP3 (MESOS-SETUP) and will be performed automatically once you direct to DP3 and execute the command (from the dasher)

MESOSSETUP .

*ALL REFERENCES TO DP3 REFER TO THE FLOPPY THAT ACCOMPANIED THIS INSTRUCTION PACKAGE.

Program to compute Objective Analysis grid point CHanGes

PART B: PROGRAM EXECUTION AND ERROR CONDITIONS

PROGRAM NAME: OACHG

AAL ID:
Revision No.: 01.00

PROGRAM EXECUTION

1. This program requires switches X and Y and is executed by typing,

```
RUN:OACHG xx/X yy/Y
RUN:OACHGMAC     .
```

xx refers to the oldest hour and yy refers to the most recent hour. The changes are computed from time xx to time yy. To run the program to compute changes from 15 to 18Z, type

```
RUN:OACHG 15/X 18/Y
RUN:OACHGMAC     .
```

(Note that MESOS must have been run for these two times, and there is the additional stipulation that the weights (the distance weighting in MESOS) MUST be the same both times it was run. Otherwise, the program will abort.)

OACHGMAC (a macro) will plot the AFOS graphics from Internal Product Files. It is

```
RUN:SAC.MC - Generates NMCGPHSAC  (altimeter change at grid points)
RUN:SCC.MC - Generates NMCGPHSCC  (moist. convg. change at grid points)
RUN:SRC.MC - Generates NMCGPHSRC  (sfc rel. vort. change at grid
                                   points)     .
```

The individual macros will alert at the ADM when they are complete.

ERROR MESSAGES (DASHER MESSAGES)

1. COM LINE ERR - Program could not read command line.
2. CHANNEL ERROR-SFCOUTXXZ.DT
3. OPEN ERROR-SFCOUTXXZ.DT
4. CHANNEL ERROR-SFCOUTYYZ.DT
5. OPEN ERROR-SFCOUTYYZ.DT
6. READ ERROR-SFCOUTYYZ.DT
7. READ ERROR 1
8. READ ERROR 2
9. READ ERROR 3 (ERRORS 1-9 may mean a system or disk problem)
10. WEIGHTS UNEQUAL - The weights from the two times are not the same. Thus, the program will not attempt to compute any changes.
11. NO DATA FOUND - Program could not find the input data. You should check the data. A listing of the files can be obtained by typing

```
L:DPØ:/E SFCOUT-Z.DT     .
```

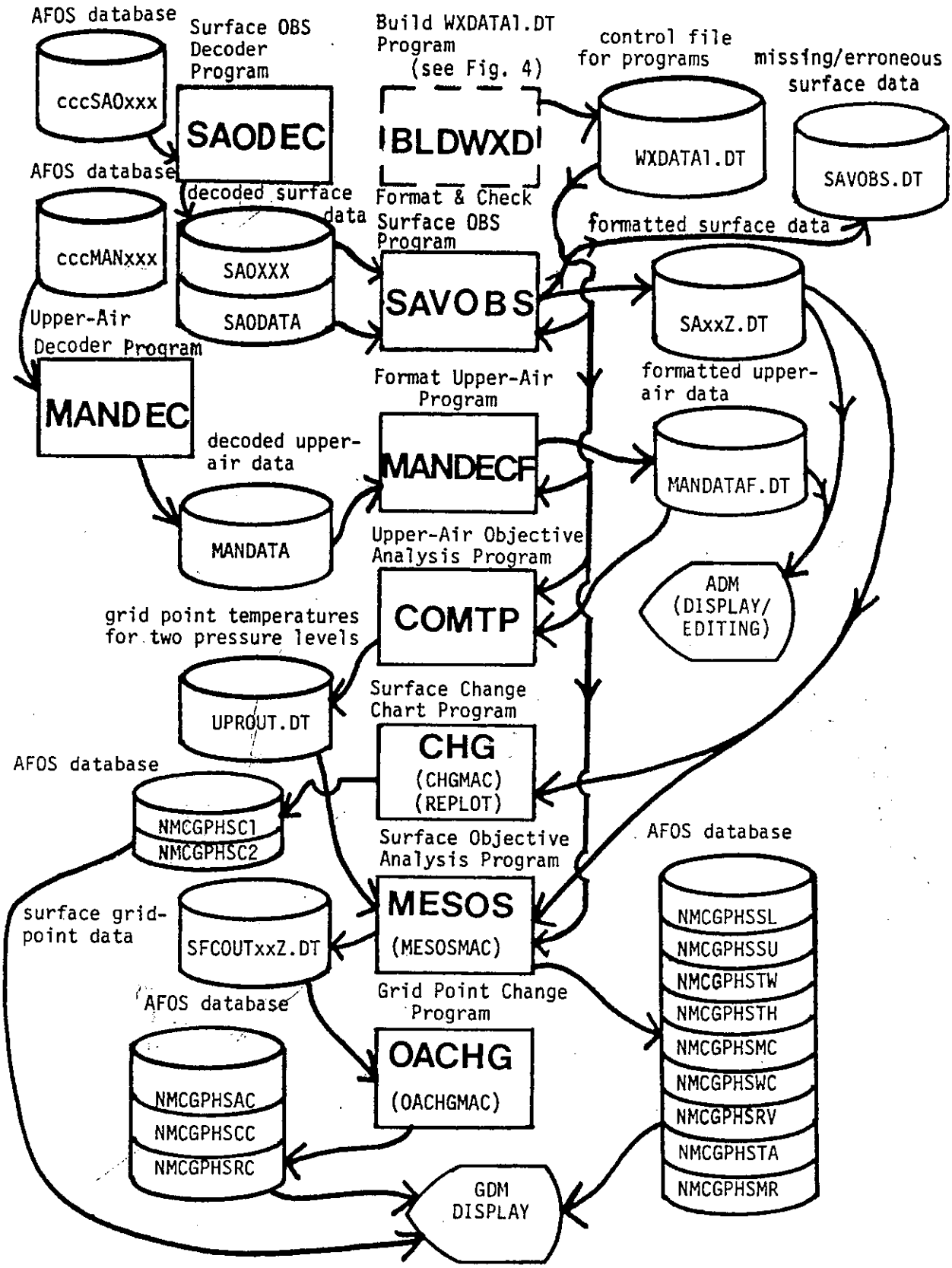


Figure 1 Data flow and program relationships. Rectangles are programs and cylinders are data files. Labels for programs and data files are immediately above or just next to the symbols. Program BLDWXD is illustrated in Fig. 4. AFOS macros are in parenthesis.

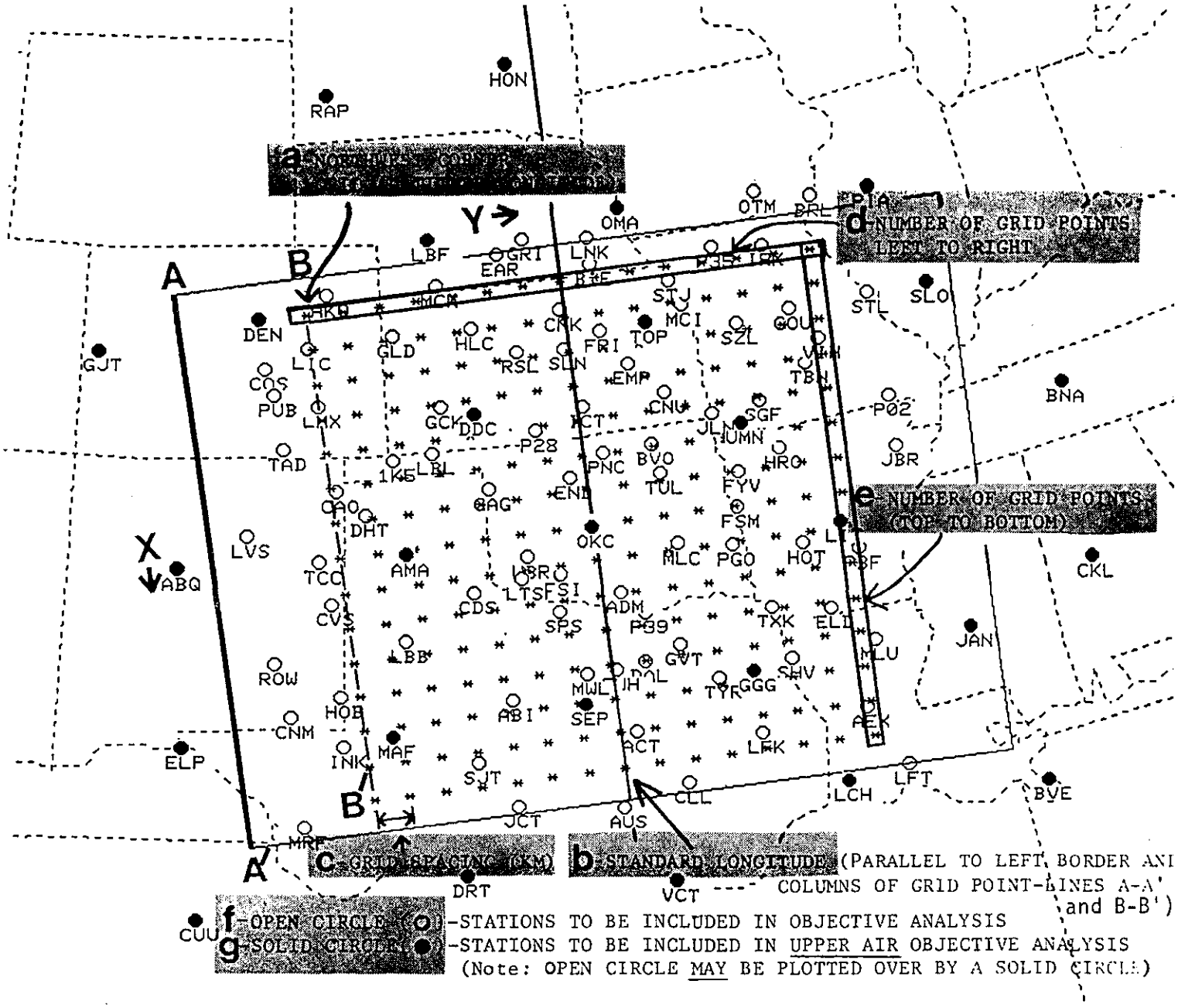


Figure 2 NMCGPHPØA (output from program BLDWXD). Reference also Table 1 (AFOS preformat). This illustrates the input that must be supplied by the user in the AFOS preformat. Note that it usually takes several attempts of running BLDWXD to achieve the desired results. This product is produced so you can see the results of your input. Also, a map will be produced identical to the area enclosed (or "windowed") by the solid rectangle in this figure. (see also Fig. 3)

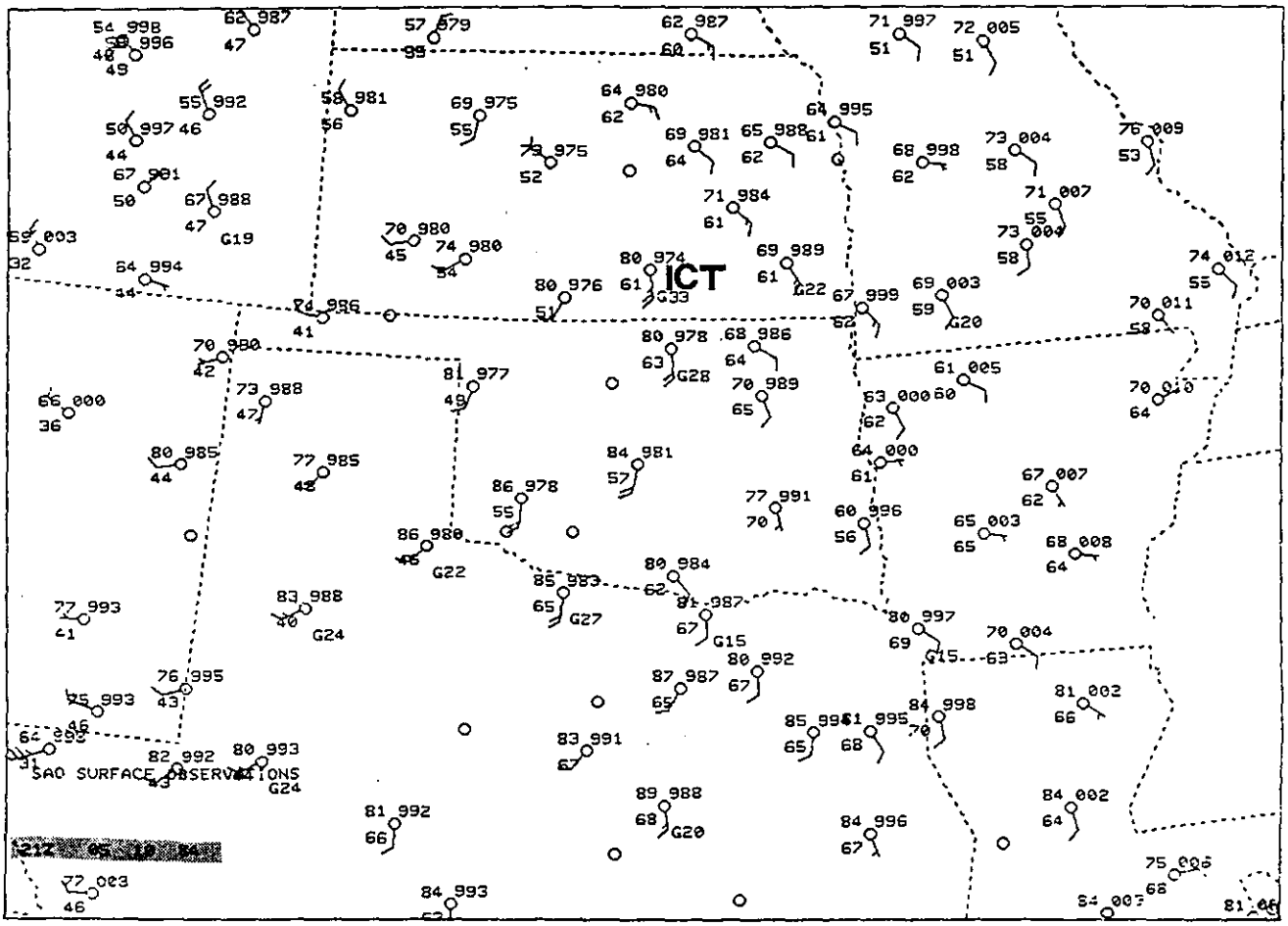


Figure 3 The map produced from BOXVIEW.SV and PMOD software. It is identical to the "windowed" area on Fig. 2. Surface data is plotted on this map (temperature, dew point, wind direction and speed, and altimeter setting). The data is from a severe weather event in Kansas on Oct. 5, 1984. (see also Figs. 7-19). The severe weather was north and northeast of Wichita, Kansas (station ICT).

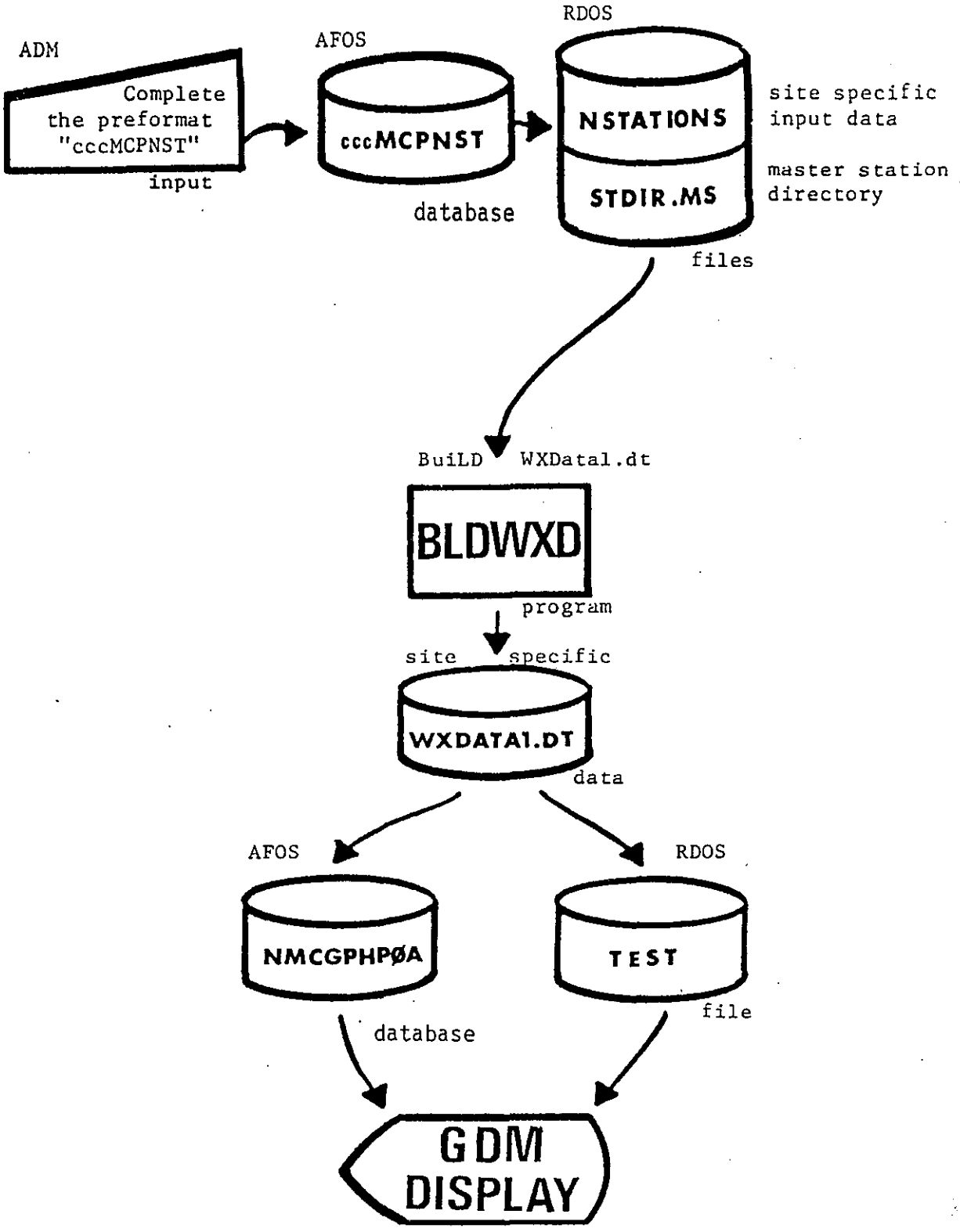
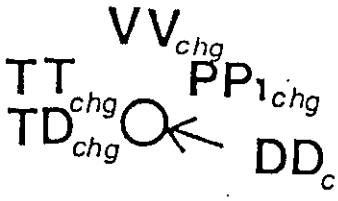


Figure 4 Data flow and program relationship for program BLDWXD.



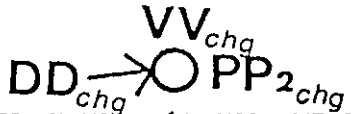
TT_{chg}-TEMPERATURE CHANGE; TD_{chg}-DEW POINT CHANGE

$PP1_{chg}$-ALTIMETER CHANGE (app); a=4 (NO CHANGE), a=2 (RISING), a=7 (FALLING)
pp-MAGNITUDE OF ALTIMETER CHANGE (HUNDREDTHS INCH). IF CHANGE GREATER THAN 100 (*i.e.* 1 inch), add 1 to "a".

DD^{*}_{chg}-DIRECTION CHANGE-SOLID (●)-BACKING WIND, OPEN (O)-VEERING WIND, (⊗)-NO SIGNIFICANT CHANGE OR CHANGE EQUAL TO 180 DEGREES.

VV^{*}_{chg}-SPEED CHANGE- (—)-NO SIGNIFICANT CHANGE, (／)-SPEED INCREASE, (＼)-SPEED DECREASE

*NOTE:DIRECTION CHANGE MUST BE AT LEAST 30 DEGREES AND SPEED CHANGE AT LEAST 5 KNOTS.



$PP2_{chg}$-ALTIMETER CHANGE (CHANGE MINUS (1). SEMI-DIURNAL CHANGE OR (2). AVERAGE OF CHANGES FROM ALL STATIONS)

DD_{chg} and VV_{chg} ARE SAME AS BEFORE. VEERING OR BACKING AND THE MAGNITUDE OF SPEED CHANGES ARE PLOTTED

Figure 5 (Top) Illustration of station model plot for Change Chart 1 (NMCGPHSC1)

Figure 6 (Bottom) Illustration of station model plot for Change Chart 2 (NMCGPHSC2)

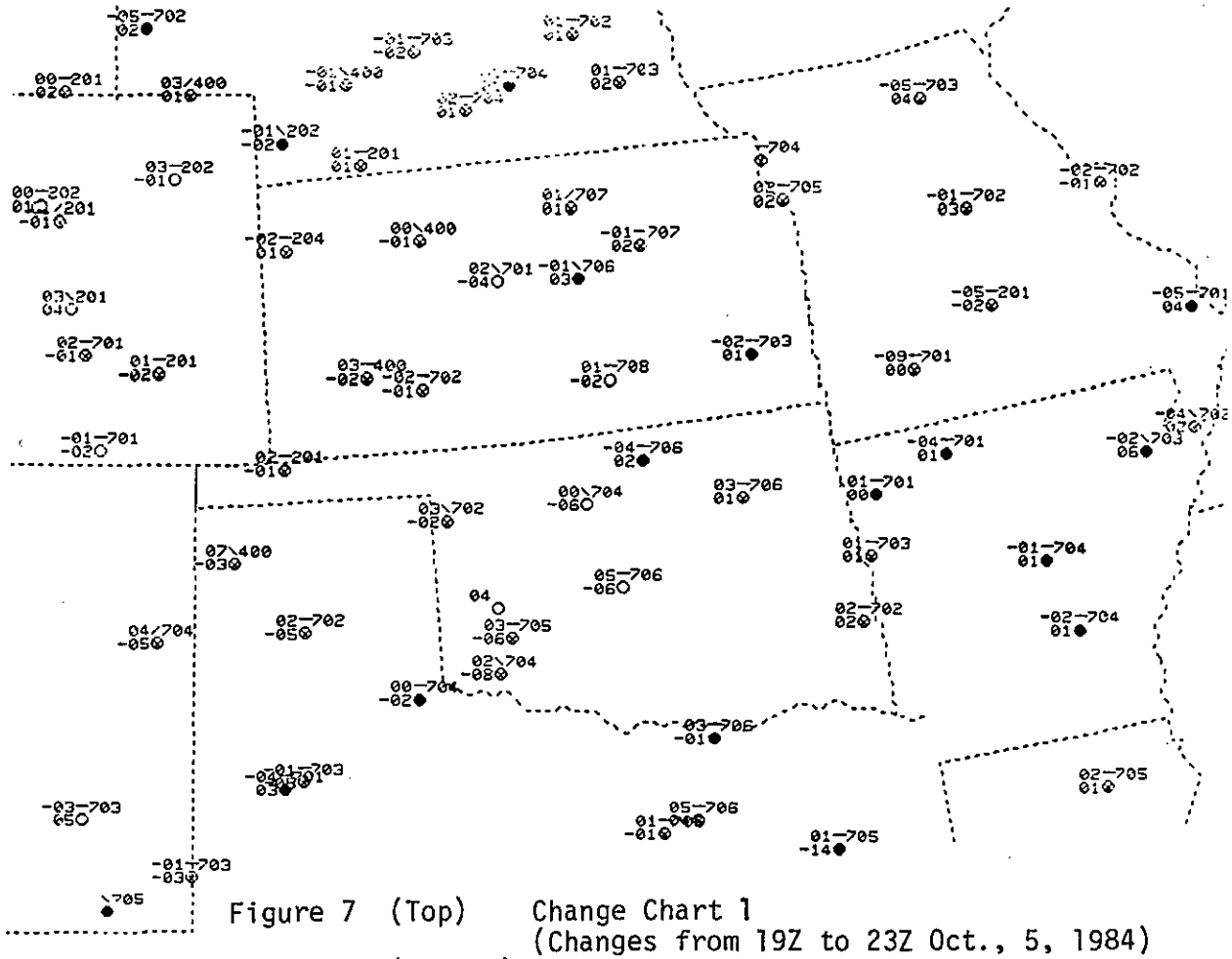
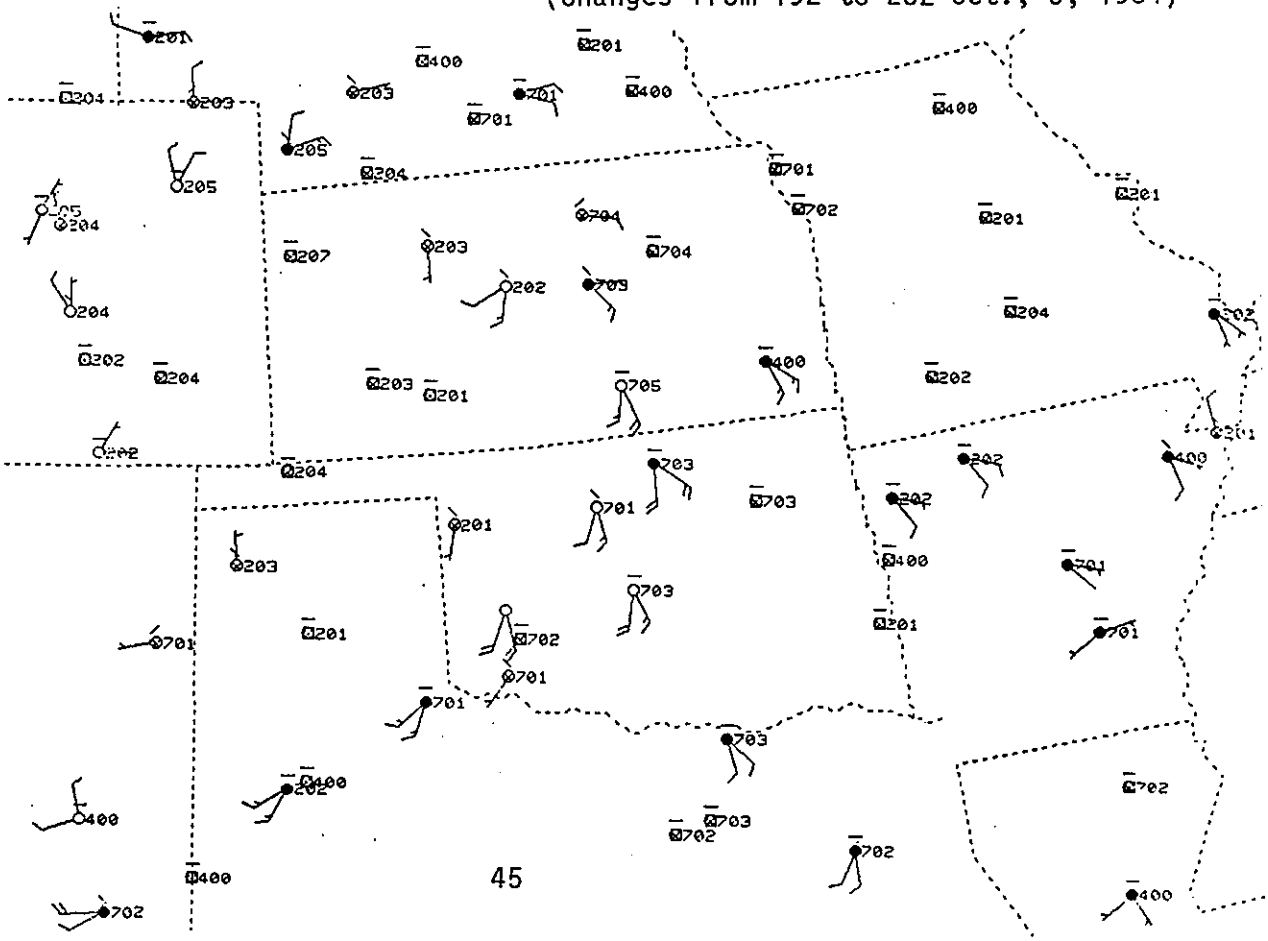


Figure 7 (Top) Change Chart 1
(Changes from 19Z to 23Z Oct., 5, 1984)

Figure 8 (Bottom) Change Chart 2
(Changes from 19Z to 23Z Oct., 5, 1984)



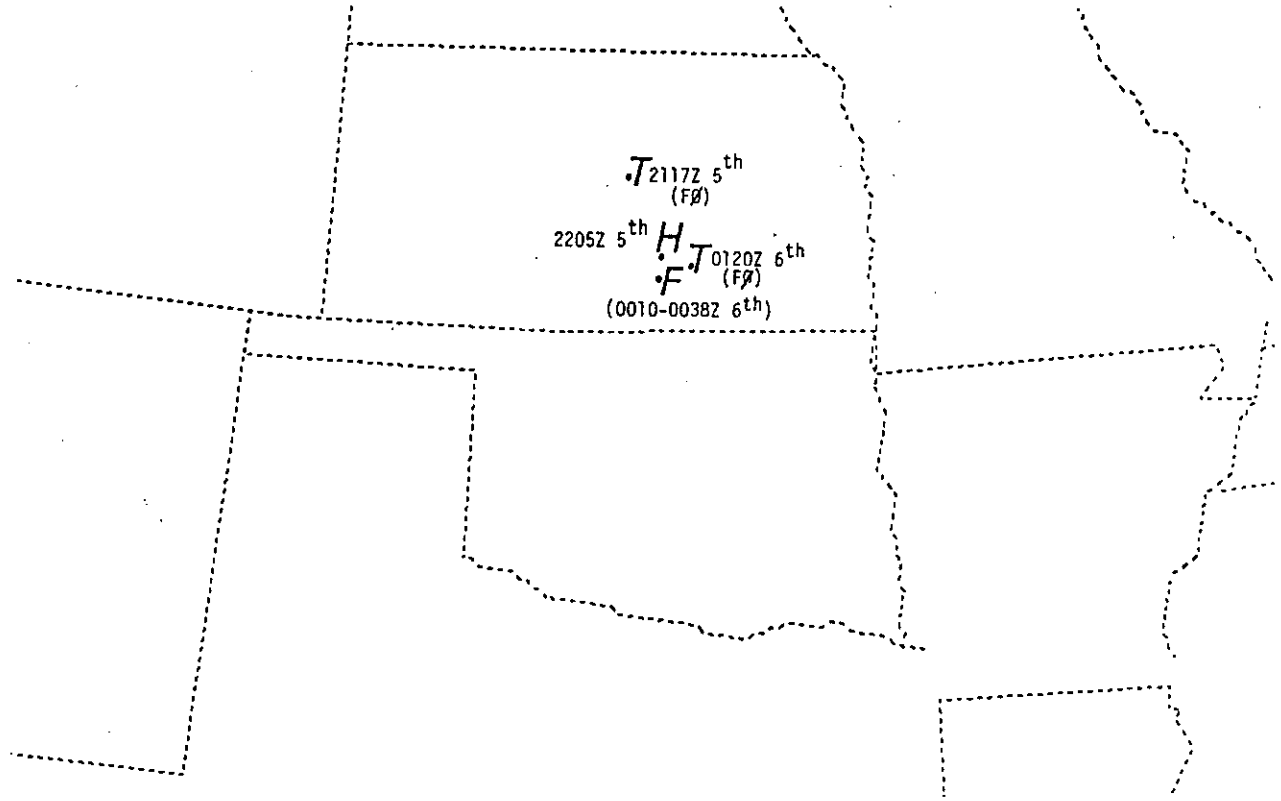
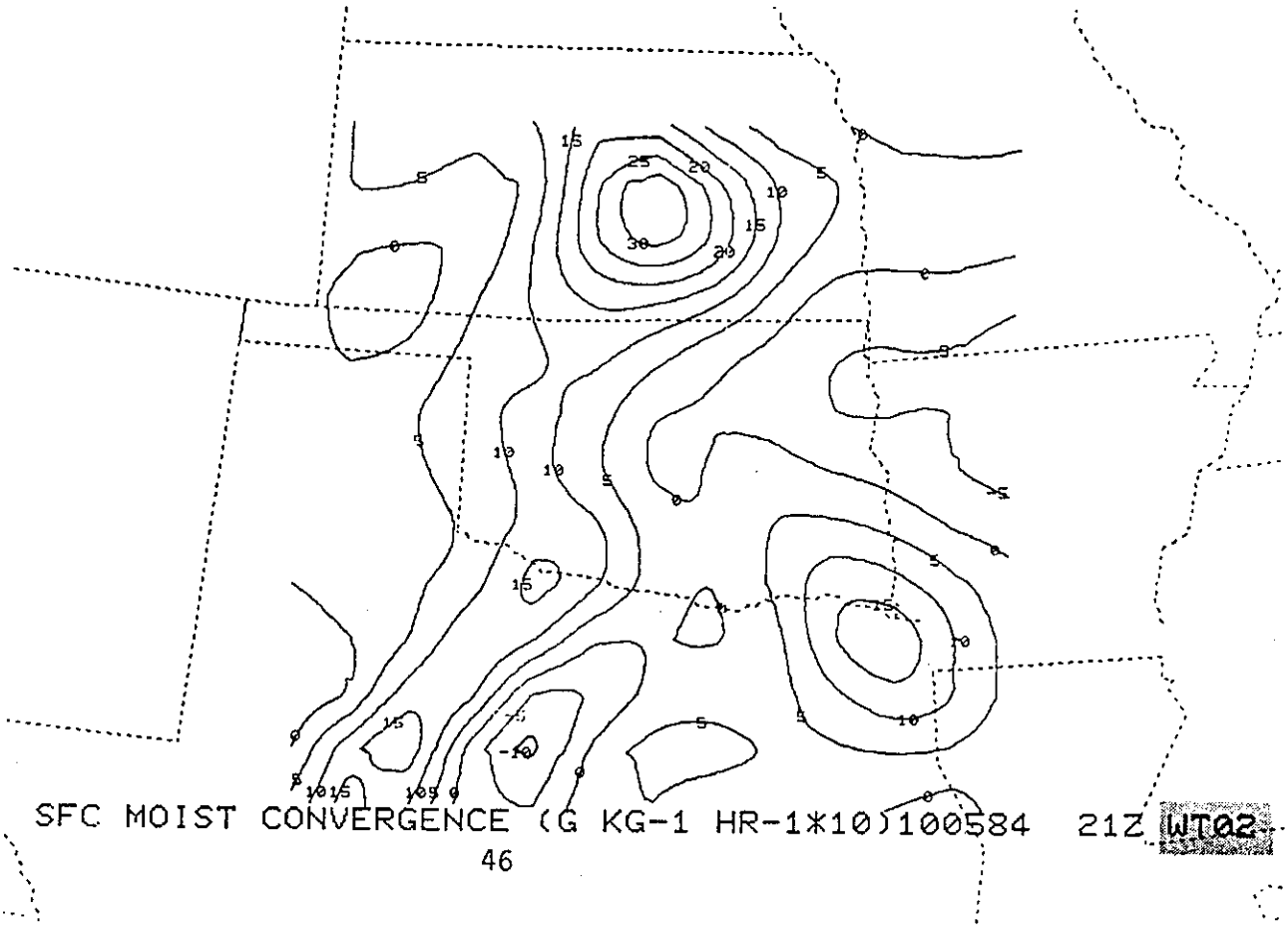


Figure 9a (Top) Severe weather reports from afternoon and evening of Oct. 5, 1984 (reported in STORM DATA). Times are in GMT (CST + 6 = GMT). T-Tornado, H-Hail, F-Funnels.

Figure 9b (Bottom) Moisture convergence from program MESOS at 21Z. Shaded area (WTØ2) refers to weight table 2 that was used in the objective analysis. Positive numbers represent moisture convergence.



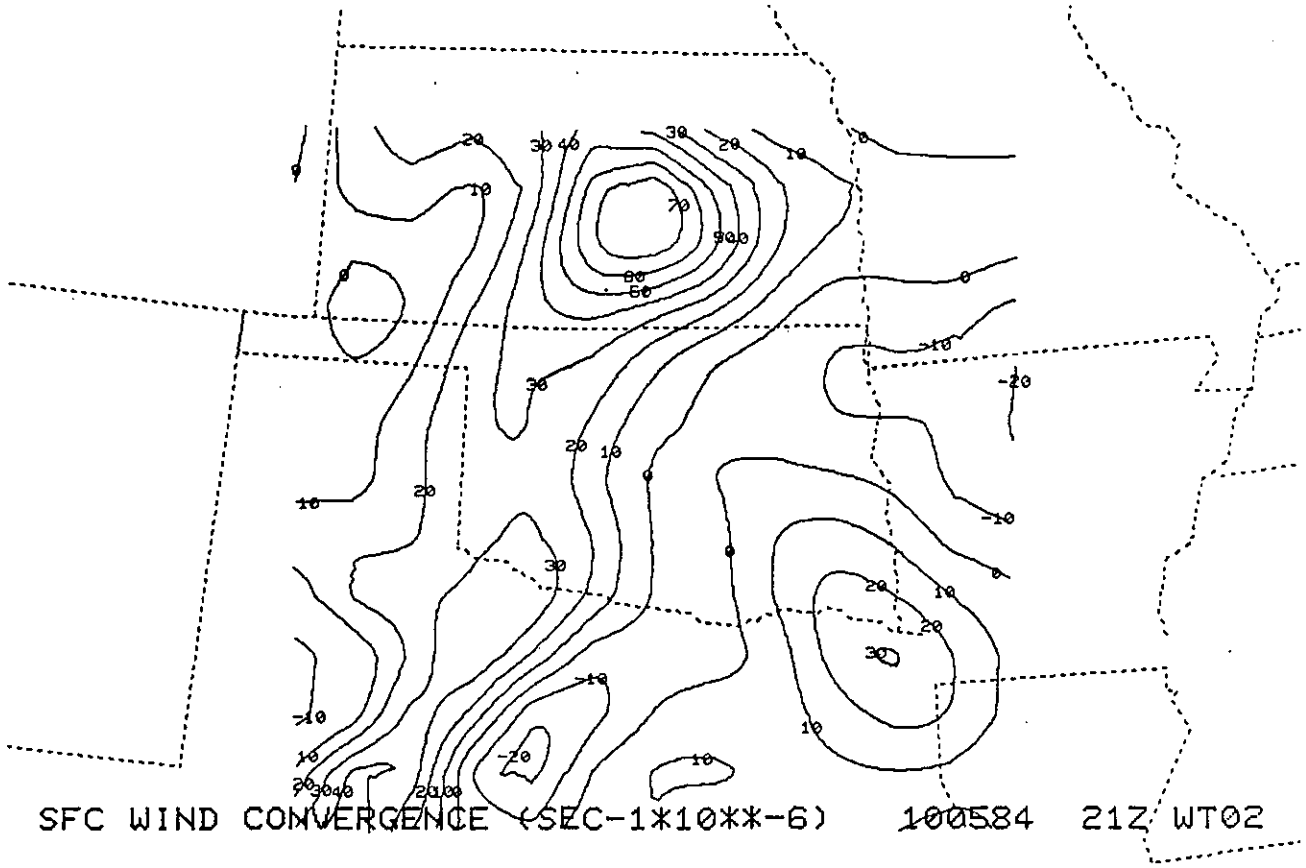
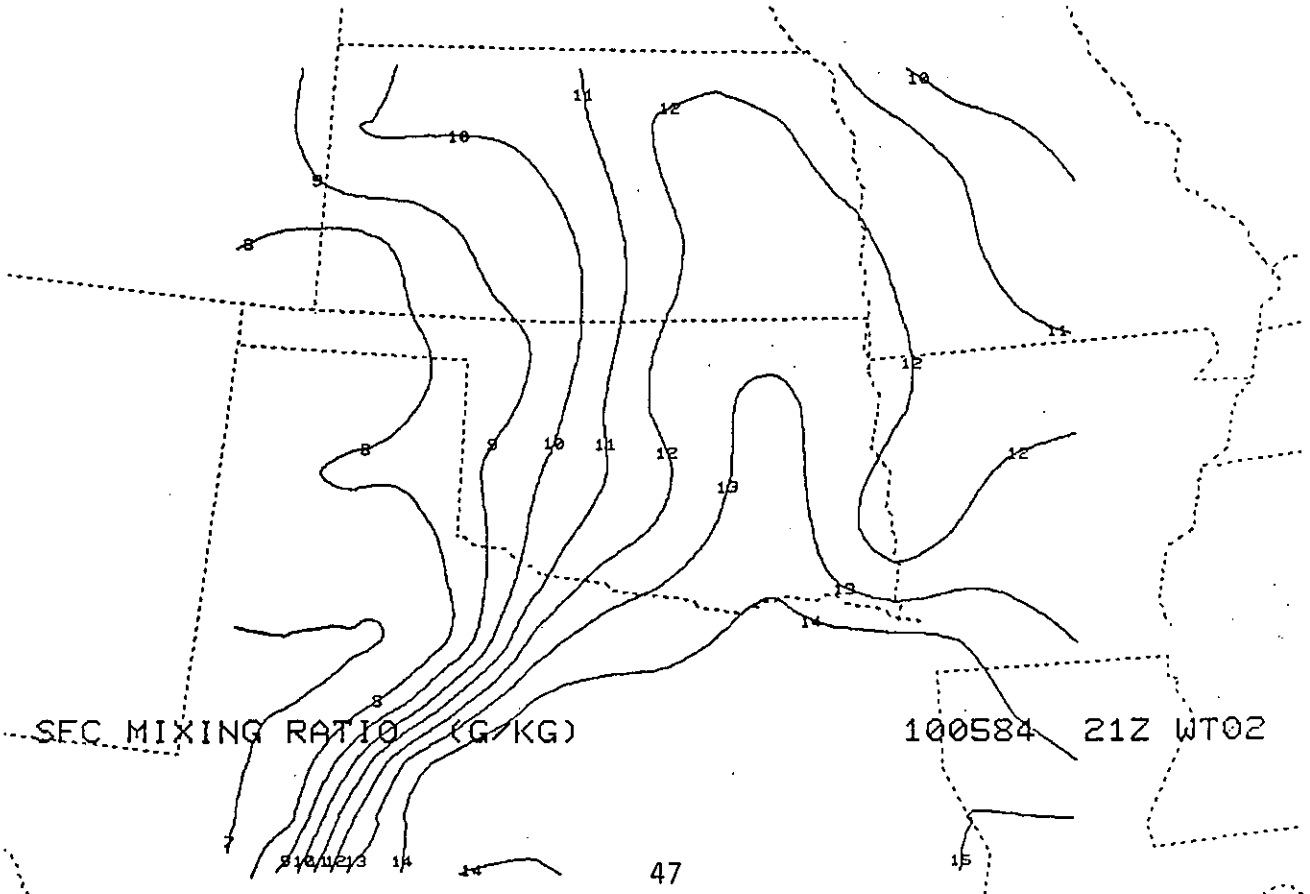


Figure 10 (Top) Surface wind convergence from MESOS at 21Z. Positive numbers represent wind convergence.

Figure 11 (Bottom) Surface mixing ratio from MESOS at 21Z.



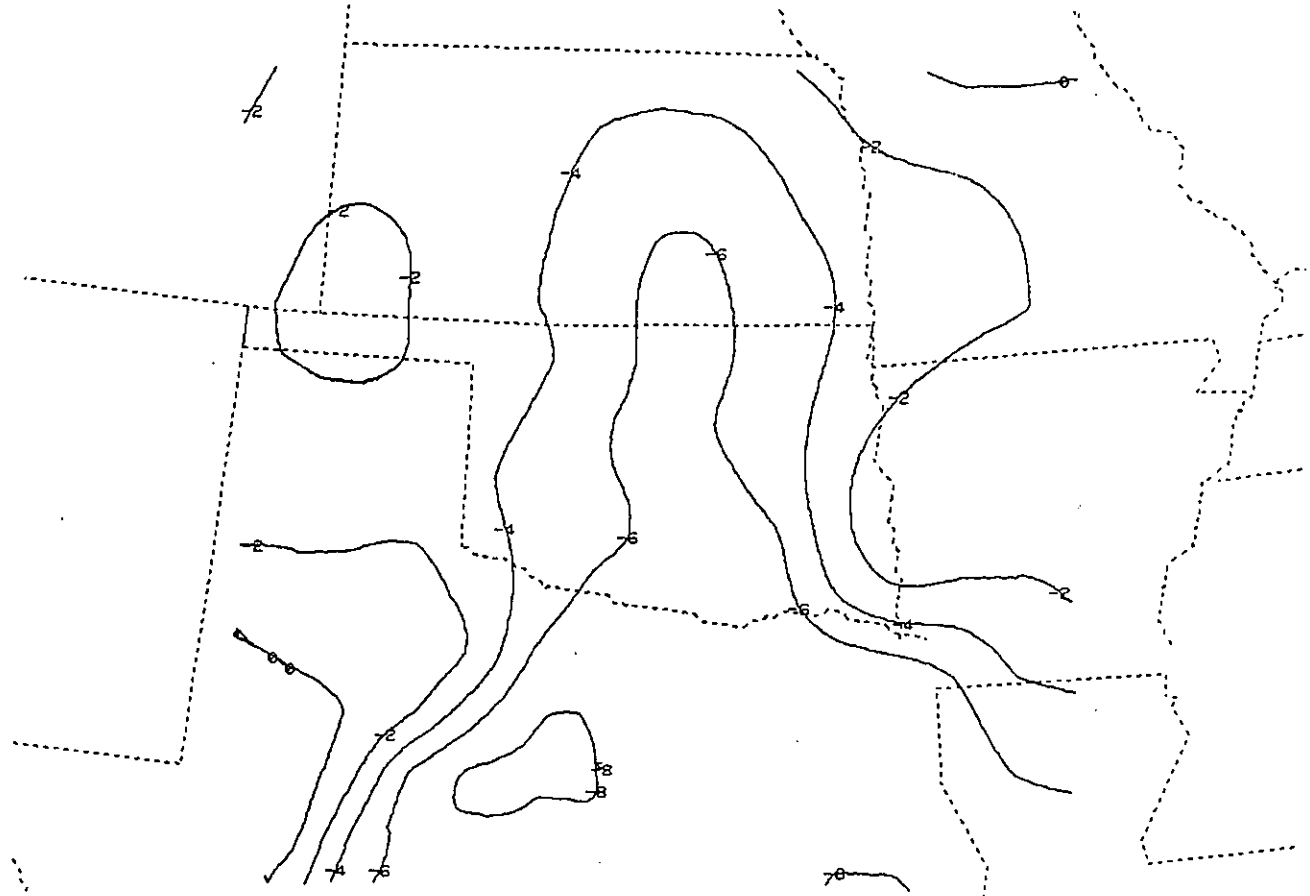
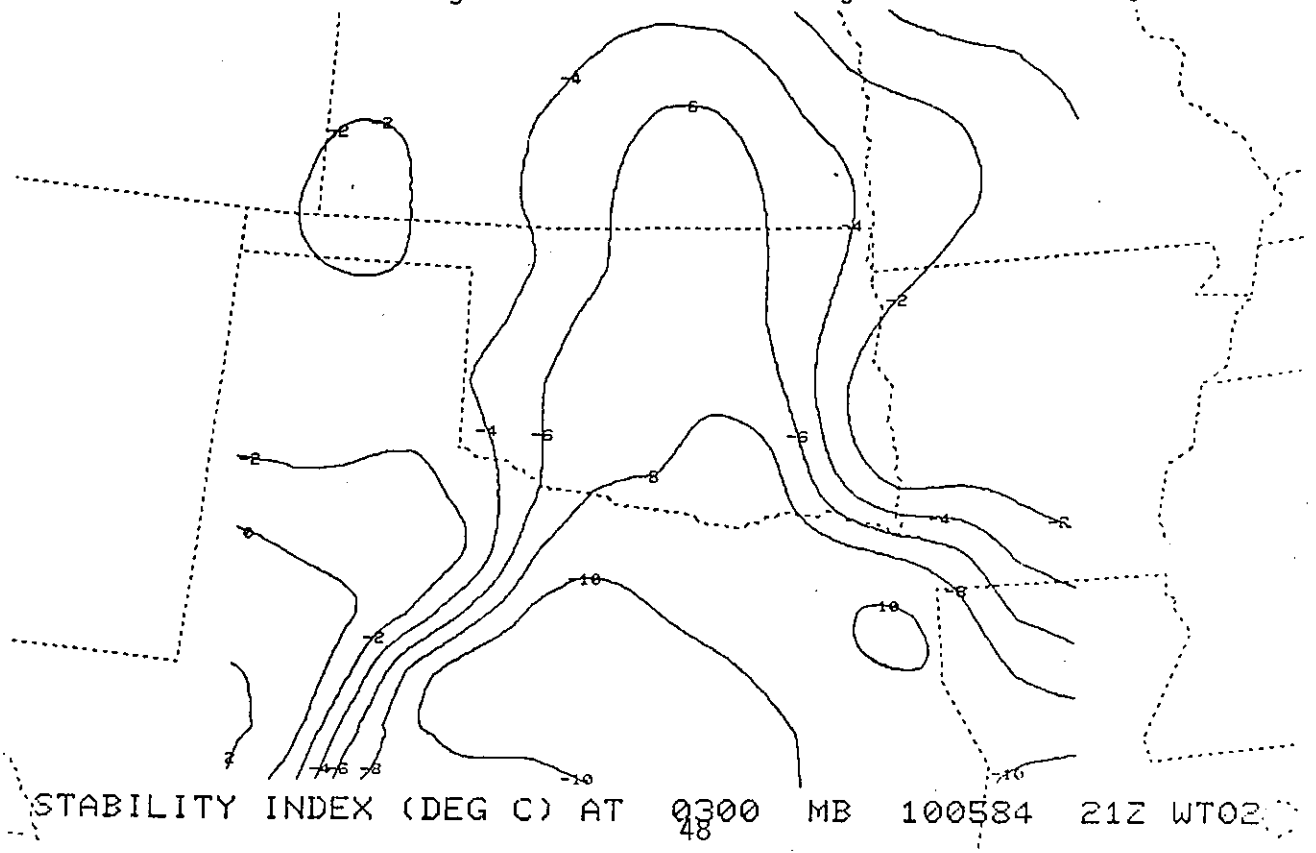


Figure 12a (Top) Stability index at 500 mb using objectively analyzed mandatory level upper-air temperatures (from 12Z) and hourly (21Z) surface lifted parcel temperatures (MESOS).

Figure 12b (Bottom) Same as 12a except at 300 mb (from MESOS). Larger negative numbers indicate greater instability.



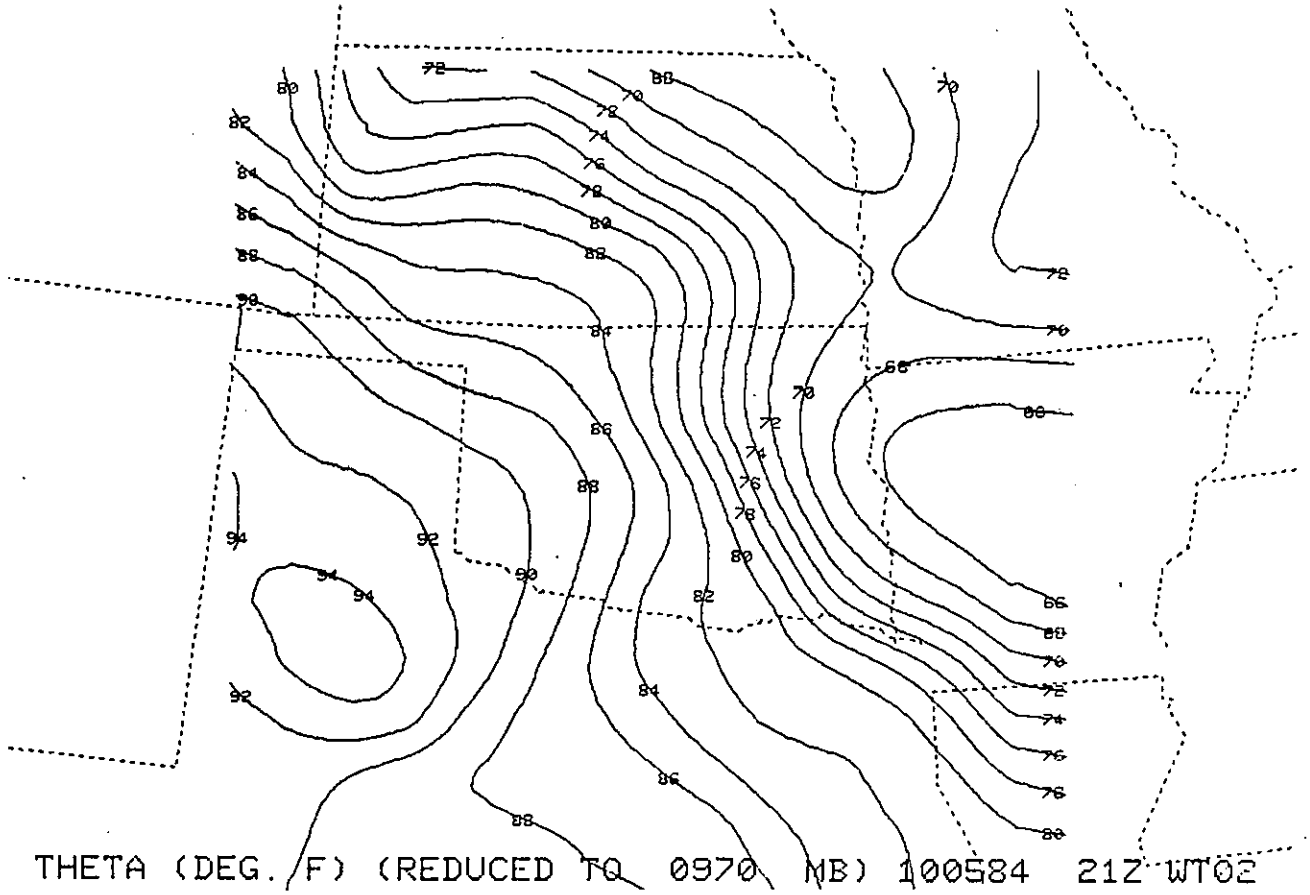
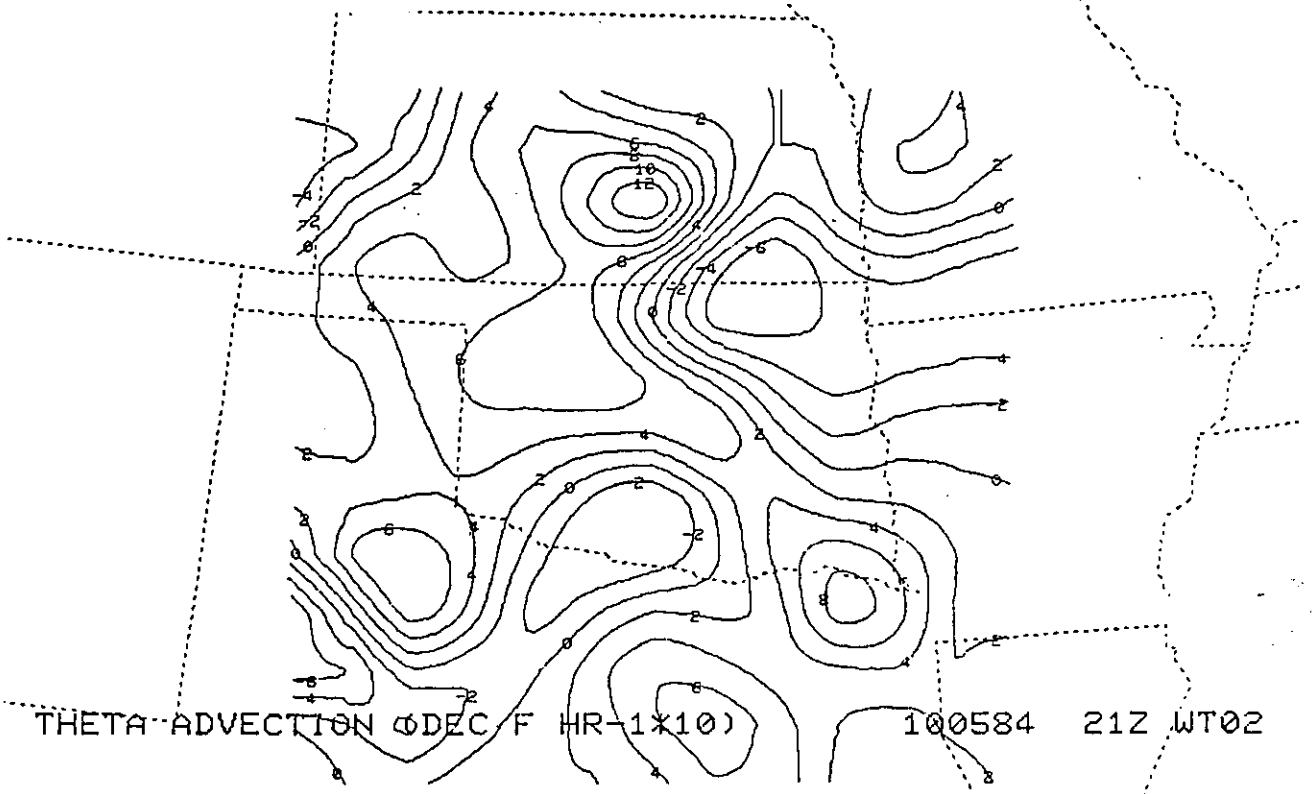


Figure 13 (Top) Station temperatures reduced to 970 mb (the pressure near Oklahoma City) and then objectively analyzed (MESOS).

Figure 14 (Bottom) Advection of potential temperature field described in Fig. 13 by the horizontal wind (from MESOS). Plus 10 contour indicates 1.0 degrees F per hour (warm advection).



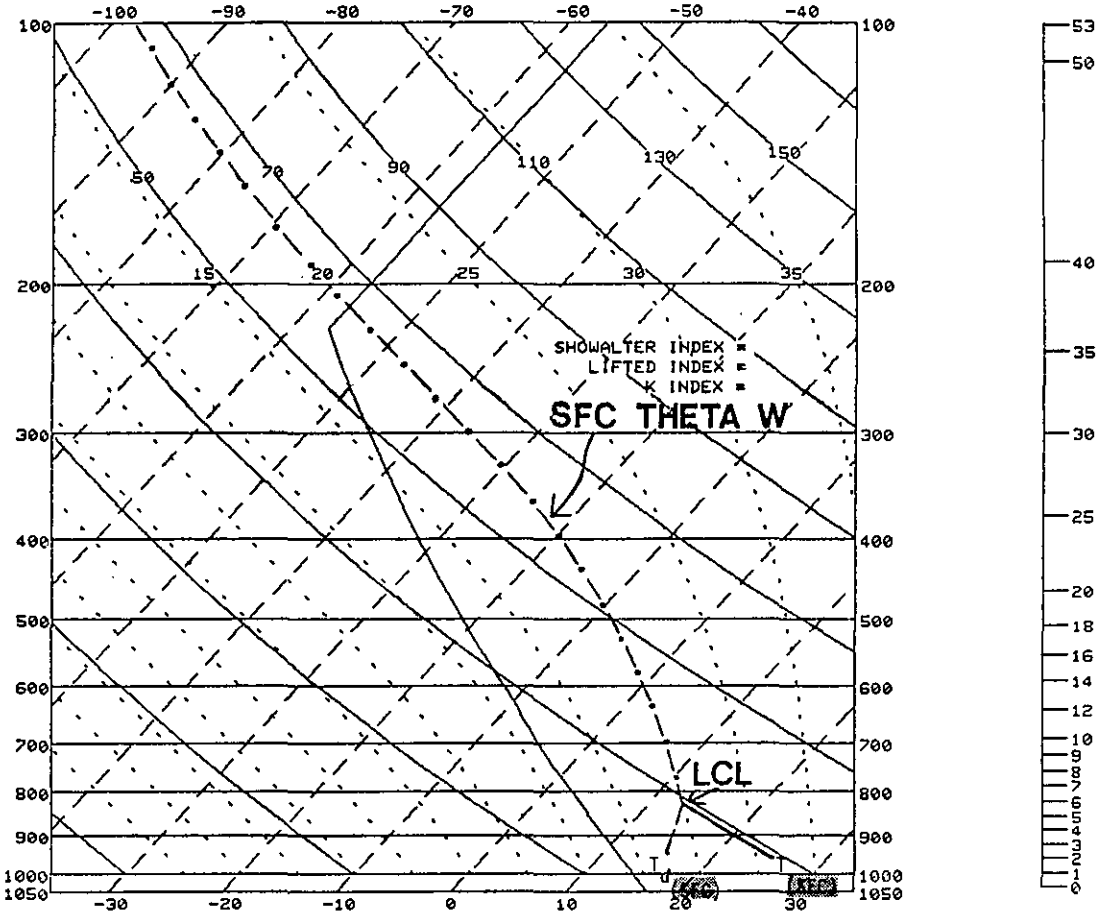
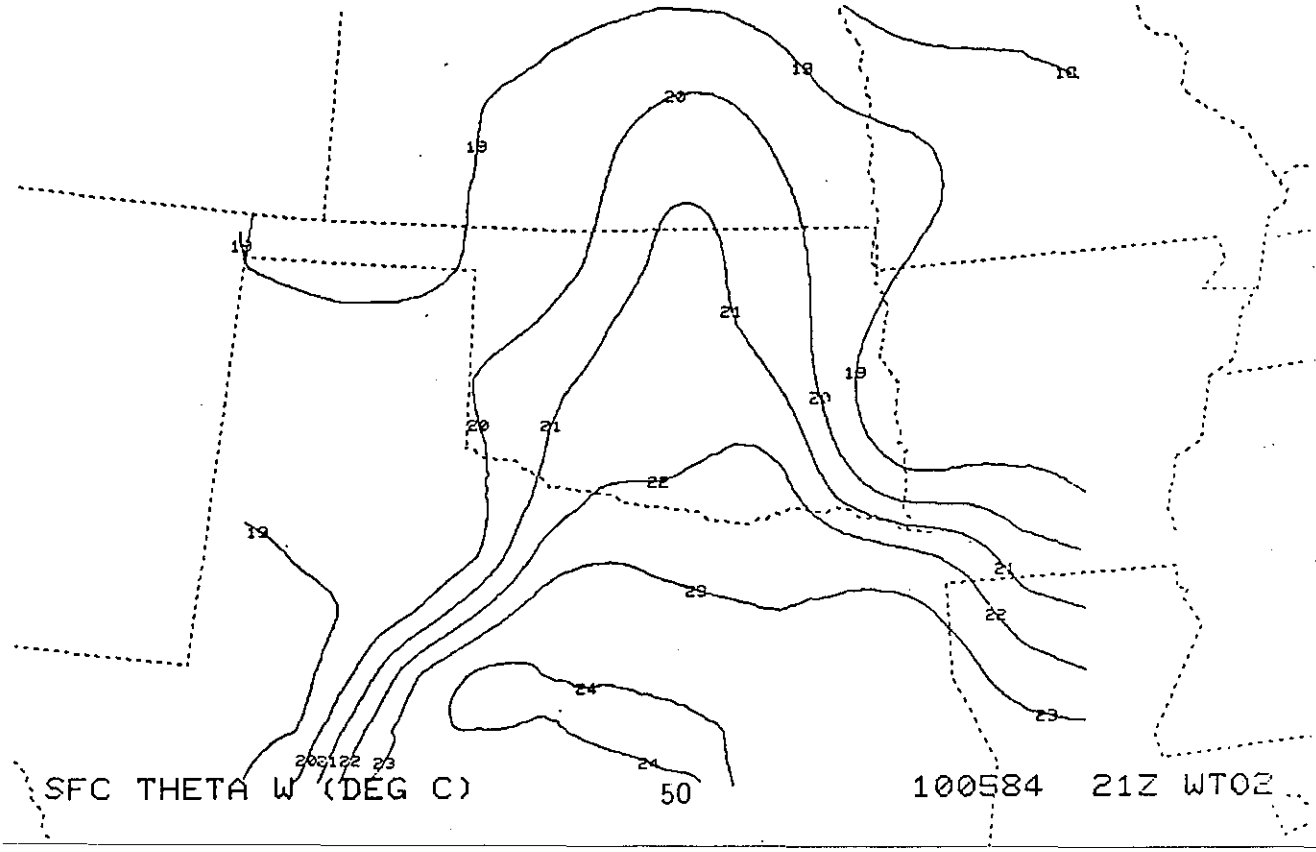


Figure 15a (Top) Example of Sfc Theta W (The wet-bulb potential temperature) - computed from Temperature (T_{sfc}) and Dew point ($T_{d_{sfc}}$) at Wichita at 21Z.

Figure 15b (Bottom) Objectively analyzed field of wet-bulb potential temperature from MESOS at 21Z.



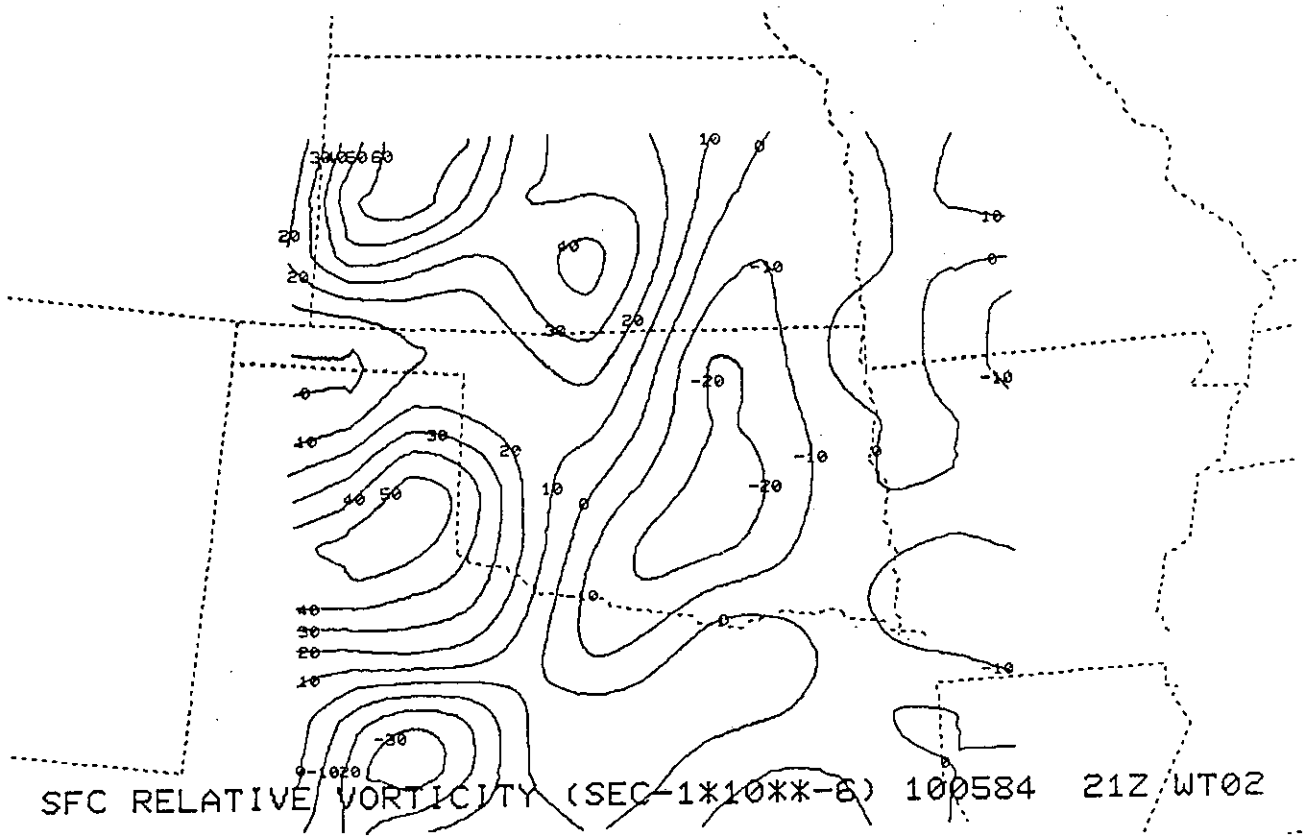
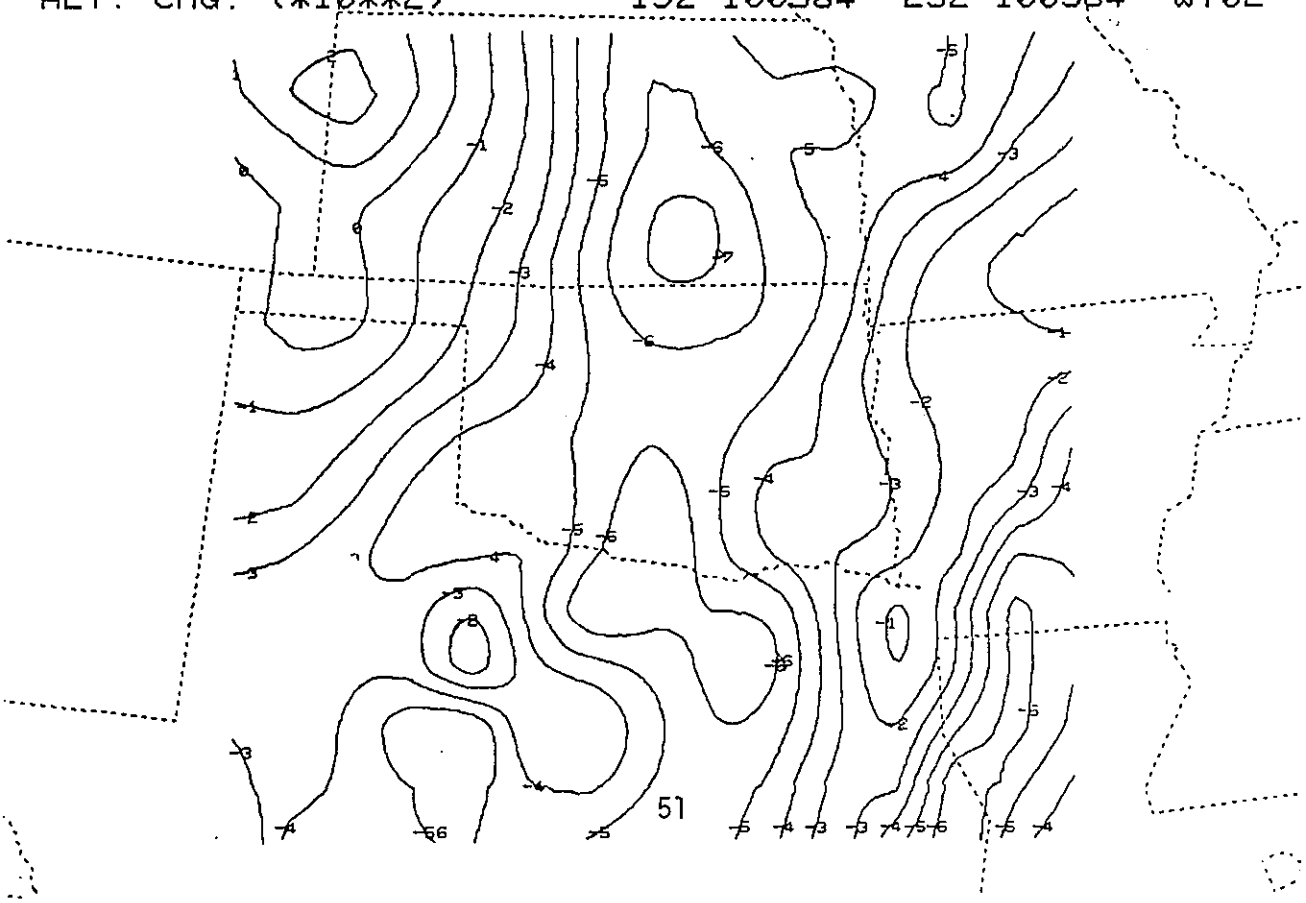


Figure 16 (Top) Surface relative vorticity as computed from MESOS.

Figure 17 (Bottom) Altimeter setting changes at grid points. Minus 7 is altimeter change of 7 hundredths of an inch. Time interval is 19Z to 23Z.



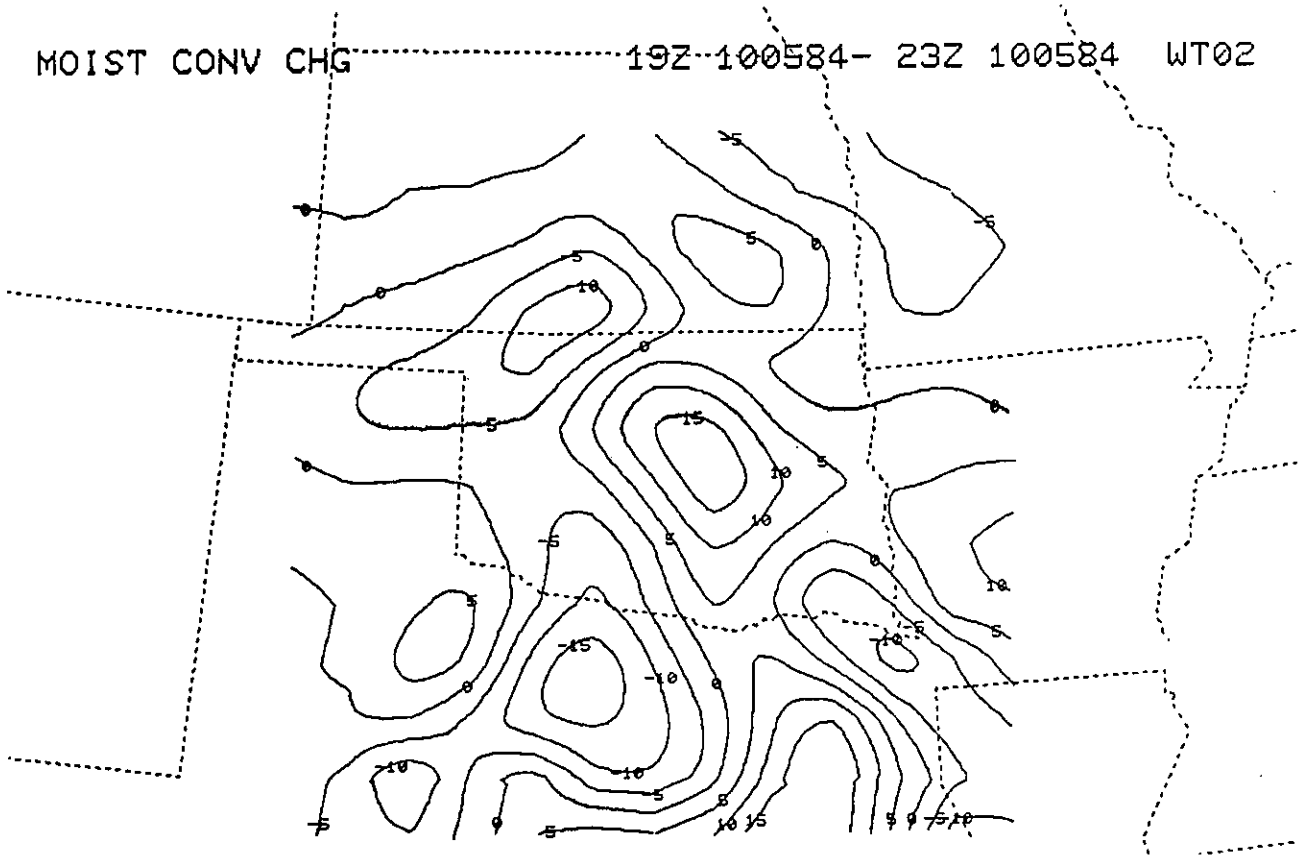
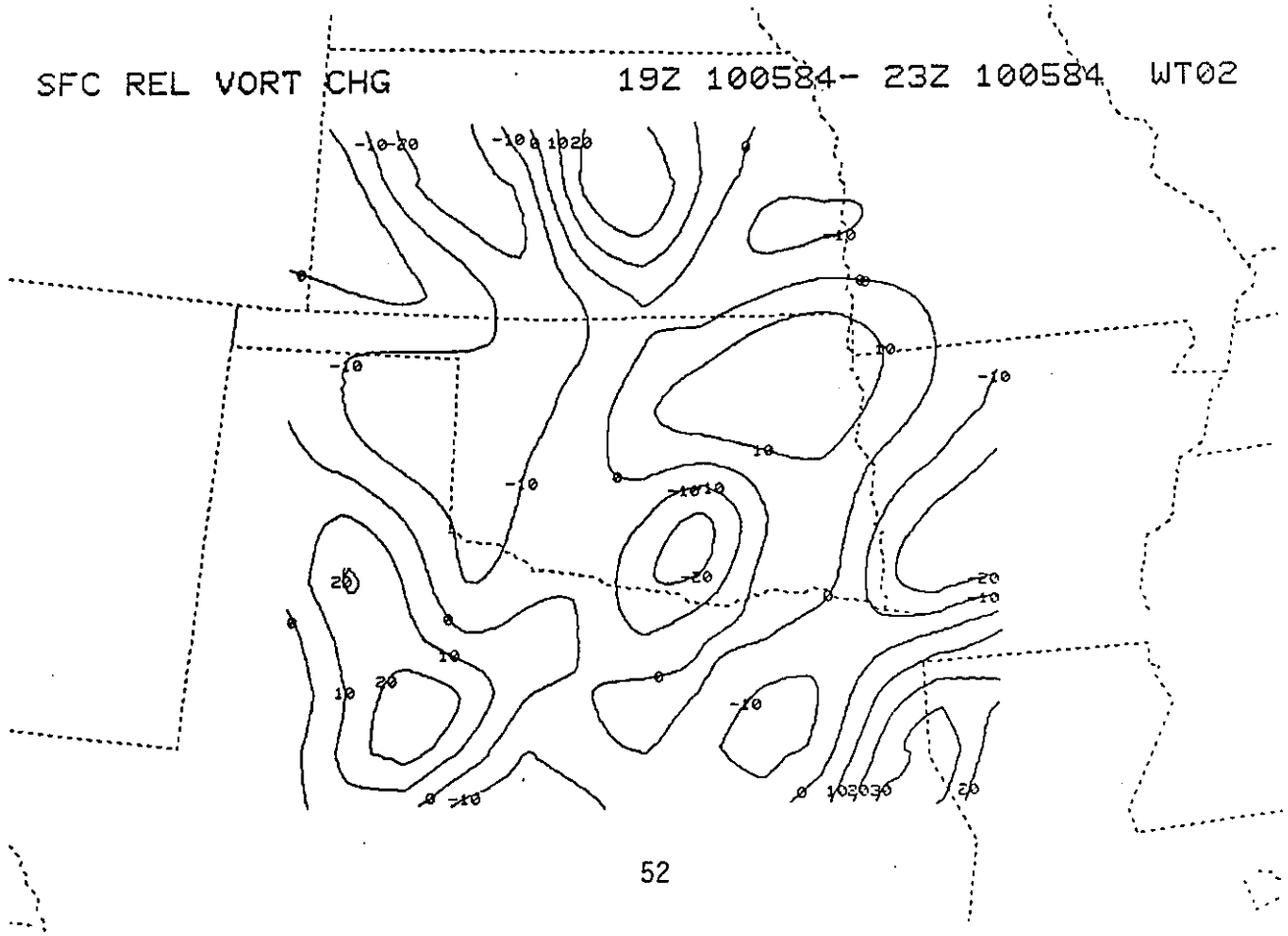


Figure 18 (Top) Grid point moisture convergence change from 19Z to 23Z.

Figure 19 (Bottom) Grid point relative vorticity change from 19Z to 23Z. (Grid points are same points as in MESOS)



```
TTAA00 KOKC 240304
     .....CHANGE ONLY THE DATA WITHIN BRACES "[ ]". USE THIS PREFORMAT
1.  TO SAVE DATA FOR POST ANALYSIS.....(USE PREFORMAT THIS PAGE)
2.  TO SAVE FOR USE WITH CHANGE CHARTS.....(USE PREFORMAT THIS PAGE)
3.  TO SAVE DATA FOR OBJECTIVE ANALYSIS PROGRAM.....(USE PREFORMAT NEXT PAGE).

ENTER STATIONS ALPHABETICALLY BY NODE (AND WITHIN NODE).
EXAMPLE:  ABQ CAO HOB ROW COS DEN TAD.
   ENTER 19 STATIONS PER LINE WITH 10 STATIONS ON THE LAST LINE (MAX 200)
[200] STATIONS TO BE READ IN FOLLOWING LIST.  02  MAP BACKGROUND
[ABQ CAO CNM CVS DMN FMN GUP HMN HOB LVS ROW RUI SAF TCC TCS BIS DIK FAR ISN ]1
[COD CPR CYS LAR LND RKS RWL SHR WRL AKO ALS ASE COS DEN DRO EGE GJT GUC LHX ]2
[LIC PUB TAD 30I 3SE ALO BRL CID DBQ DSM FOD MCW OTM SUX 9V9 ABR ATY BKX FSD ]3
[HON MHE PHP PIR RAP REJ YKN ABI ACT DAL DFW DYS F39 FTW FWH GGG GRK GVT LFK ]4
[MWL SEP SPS TPL TYR AMA CDS DHT ELP GDP INK LBB MAF MRF REE SJT BYH ELD FSM ]5
[FYV HOT HRO JBR LIT LRF PBF TXK AEX BTR BVE ESF LCH LFT MLU MSY POE SHV ADM ]6
[BVO CSM END FSI GAG HBR LTS MLC OKC PGO PNC TIK TUL WDG AIA ANW BBW BFF BIE ]7
[CDR EAR GRI HSI LBF LNK MCK MHN OFF OFK OLU OMA SNY VTN ALI AUS BPT BRO CLL ]8
[COT CRP DLF DRT GLS HDO HOU IAH JCT LRD MFE NIR PSX SAT VCT CGI COU IRK JEF ]9
[JLN MCI MKC P02 P35 SGF STJ STL SZL TBN VIH 1K5 CNK CNU DDC EMP FOE FRI GCK ]0
[GLD HLC IAB ICT LBL MHK P28 RSL SLN TOP ]11  OBJECTIVE ANALYSIS DATA FOLLOWS
a[39.8] NW CORNER GRID LATITUDE. [103.7] NW CORNER GRID LONGITUDE.[ ]
b[ 97.6] STANDARD LONGITUDE.          c[ 85.0] GRID SPACING IN KM.
d[15] # OF GRID POINTS LEFT TO RIGHT e[15] # OF GRID POINTS TOP TO BOTTOM

f ENTER THE STATIONS (MAX OF 100) THAT ARE TO BE INCLUDED IN OA
 [100] STATIONS IN FOLLOWING LIST FOR OA.
 [CAO CNM CVS HOB LVS ROW TCC AKO COS DEN] 1
 [LHX LIC PUB TAD BRL OTM ABI ACT DAL F39] 2
 [FWH GGG GVT LFK MWL SEP SPS TYR AMA CDS] 3
 [DHT INK LBB MAF MRF SJT ELD FSM FYV HOT] 4
 [HRO JBR LIT PBF TXK AEX LCH LFT MLU SHV] 5
 [ADM BVO END FSI GAG HBR LTS MLC OKC PGO] 6
 [PNC TUL BIE EAR GRI LBF LNK MCK OMA AUS] 7
 [CLL DRT JCT COU IRK JLN MCI P02 P35 SGF] 8
 [STJ STL SZL TBN VIH 1K5 CNK CNU DDC EMP] 9
 [FRI GCK GLD HLC ICT LBL P28 RSL SLN TOP] 10

g  90 UPPER AIR STA. (US, CANADIAN AND MEXICAN) ..DO NOT CHANGE THIS DATA..
 ABQ ACY AHN ALB AMA AQQ AYS BIS BNA BOI BRO BUF BVE CAR CHH CKL CHS DAY DEN
 DDC DRA DRT ELP ELY EYW FHU FNT GEG GGG GGW GJT GRB GSO GTF HAT HON HTS IAD
 INL INW JAN LBF LCH LIT LND MAF MFR MIA MYF OAK OKC OMA PBI PIA PIT PWM RAP
 SAN SEP SLE SLC SLO SSM STC TBW TOP TUS UIL UMN VBG VCT VPS WAL WMC WNI WTL
 WVK YMO YQD YSM YXD YXS YYE YYQ YZT YZV CUU GYM MID MTY
                PUT CURSOR AT RIGHT AND STRIKE ENTER....                [ ]
```

Table 1 AFOS preformat (cccMCPNST). Sample data included in preformat must be deleted and/or overwritten with new data to build the "site-specific" database. For items a-g see also Fig. 2.

```
DATA INPUT...AS READ FROM ROOS FILE..NSTATIONS
200                                                    2
ABQ CAO CNM CVS DMN FMN GUP HMN HOB LVS ROW RUI SAF TCC TCS BIS DIK FAR ISN
COD CPR CYS LAR LND RKS RWL SHR WRL AKO ALS ASE COS DEN DRO EGE GJT GUC LHX
LIC PUB TAD 3OI 3SE ALO BRL CID DBQ DSM FOD MCW OTM SUX 9V9 ABR ATY BIL FSE
HON MHE PHP PIR RAP REJ YKN ABI ACT DAL DFW DYS F39 FTW FWH GGG GRK GVT LFK
MWL SEP SPS TPL TYR AMA CDS DHT ELP GDP INK LBB MAF MRF REE SJT BYH ELO FSM
FYV HOT HRO JBR LIT LRF PBF TXK AEX BTR BVE ESF LCH LFT MLU MSY POE SHV ADM
BVO CSM END FSI GAG HBR LTS MLC OKC PGO PNC TIK TUL WDG AIA ANW BFW BFF BIE
CDR EAR GRI HSI LBF LNK MCK MHN OFF OFK OLU OMA SNY VTN ALI AUS BFT BRO CLL
COT CRP DLF DRT GLS HDO HOU IAH JCT LRD MFE NIR PSX SAT VCT CGI COU IRK JEF
JLN MCI MKC P02 P35 SGF STJ STL S2L TBN VIH 1K5 CNK CNU DDC EMP FOE FRI GCK
GLD HLC IAB ICT LBL MHK P28 RSL SLN TOP
39.8                                  103.7
 97.6                                          85.0
15                                       15
100
CAO CNM CVS HOB LVS ROW TCC AKO COS DEN
LHX LIC PUB TAD BRL OTM ABI ACT DAL F39
FWH GGG GVT LFK MWL SEP SPS TYR AMA CDS
DHT INK LBB MAF MRF SJT ELO FSM FYV HOT
HRO JBR LIT PBF TXK AEX LCH LFT MLU SHV
ADM BVO END FSI GAG HBR LTS MLC OKC PGO
PNC TUL BIE EAR GRI LBF LNK MCK OMA AUS
CLL DRT JCT COU IRK JLN MCI P02 P35 SGF
STJ STL S2L TBN VIH 1K5 CNK CNU DDC EMP
FRI GCK GLD HLC ICT LBL P28 RSL SLN TOP
 90
ABQ ACY AHN ALB AMA AOO AYS BIS BNA BOI BRO BUF BVE CAR CHH CKL CHS DAY DEN
DDC DRA DRT ELP ELY EYW FHU FNT GEG GGG GGW GJT GRB GSO GTF HAT HON HTS IAD
INL INW JAN LBF LCH LIT LND MAF MFR MIA MYF OAK OKC OMA PBI PIH PIT PWM RAP
SAN SEP SLE SLC SLO SSM STC TBW TOP TUS UIL UMN VBG VCT VPS WAL WMC WNI WTL
WYA YMO YOO YSM YXD YXS YYE YYQ YZT YZV COU GYM MID MTY
FOR BOXVIEW--LOWER LEFT LAT.=    29.9414 LONG.=   105.1471      <- Refer to Program BOXVIEW
LOWER RIGHT LAT.=    29.9546 LONG.=    88.0002

MINIMUM STATION SPACING IN KM=   52.02

MAXIMUM STATION SPACING IN KM=  216.30

AVERAGE STATION SPACING IN KM=  110.22 <- REFER TO PROGRAM MESOS
TERRAIN HEIGHT (M)-FROM STATION DATA AND USING WT 3
 1563 1396 1123  900  759  647  534  440  377  328  292  278  276  272  255
 1564 1413 1146  908  745  624  505  422  366  321  293  283  282  284  273
 1523 1367 1088  895  758  624  495  413  358  324  301  294  299  305  295
 1464 1282 1034  877  773  637  491  402  353  321  307  313  327  329  310
 1430 1242 1040  891  772  626  475  383  331  300  301  324  350  350  307
 1392 1238 1082  907  746  579  442  360  305  274  289  325  359  347  275
 1344 1237 1091  882  667  523  423  351  299  270  295  327  337  305  204
 1286 1191 1042  794  575  467  408  357  308  297  329  349  313  227  147
 1239 1136  967  710  519  434  383  333  298  305  374  375  283  179  115
 1163 1076  911  679  503  406  348  296  261  267  322  314  220  139   95
 1075 1029  909  688  495  379  310  257  222  210  218  193  145  106   75
 1004  960  854  660  503  385  303  246  206  180  159  134  108   79   58
  949  893  763  609  519  409  314  247  200  166  139  119   96   67   42
  932  848  691  585  531  431  307  233  181  148  126  109   84   51   31
  991  768  600  553  524  439  282  195  154  128  110   93   73   32   20

UPPER AIR STATIONS INCLUDED IN YOUR ANALYSIS
ABQ AHN BNA BVE CKL DEN DDC DRT ELP GGG GJT HON JAN LBF LCH LIT MAF OKC OMA PIA
RAP SEP SLO TOP UMN VCT COU
R
```

Table 2 Output from program BLDWXD (dasher printout). Refer also to Table 3.

```
BOXVIEW
TO WINDOW A MAP FROM THE N. HEMISPHERE (B01) MAP ENTER
ANY EASTERN HEMISPHERE COORDINATES AS - NBR.
IE. IF YOU WANT A MAP OF SPAIN AND ITALY...
ENTER 30.0,20.0      AS YOUR LOWER LEFT
AND   30.0,-30.0     AS YOUR LOWER RIGHT
THIS WILL ALSO ROTATE THE MAP ACCORDINGLY...
COORDINATES BETWEEN 0.0 AND 180.0 WEST ARE POSITIVE #'S
ENTER LOWER LEFT LAT,LON  ? 29.9414,105.1471
ENTER LOWER RIGHT LAT,LON ? 29.9353,90.0002
ENTER MAP SELECTION (1=B101 2=N AMR) ? 2
R
```

Table 3 Output from program BOXVIEW (dasher printout). Refer also to Table 2.

```
                          9 20 85     0Z    32 OF 200 MISSING
ABQ 169 56 51 20 4 -9   17=CAO -99 75 46 2116 -9   4=CNM -99-99-99 -9-9 -9 -99
CVS 130 73 63 17 7 -9    7=DMN -99-99-99 -9-9 -9 -99=FMN -99-99-99 -9-9 -9 -99
GUP -99-99-99 -9-9 -9 -99=HMN -99-99-99 -9-9 -9 -99=HOB -99 73 64 1611 -9   9
LVS 152 59 48 22 9 15   21=ROW 110 77 63 1515 24   2=RUI -99 66 54 22 6 -9  18
SAF -99 64 47 19 6 -9   19=TCC -99 73 56 1711 -9   5=TCS -99 61 52 32 7 -9  10
BIS 178 44 42 3015 20    2=DIK 219 37 35 3119 -9  12=FAR 111 50 47 32 8 -9 984
ISN 224 39 36 3011 -9   14=COD -99 44 34 12 7 -9  16=CPR 203 49 36 2811 -9  18
CYS 133 63 34 3520 -9   10=LAR 130 55 28 2615 22  15=LND 196 49 40  9 7 -9  17
RKS 196 50 31 2910 -9   22=RWL 179 49 33 2417 -9  19=SHR 235 48 39 36 7 -9  20
WRL 228 50 40 11 7 -9   20=AKO  98 76 48  515 -9 997=ALS 161 62 34 2410 -9  21
ASE -99 59 30 35 9 -9   20=COS  93 74 32 1815 -9   2=DEN  84 76 33 3513 -9 999
DRO -99-99-99 -9-9 -9 -99=EGE 144 65 31 2310 -9  17=GJT 155 65 40 3211 -9  12
GUC -99-99-99 -9-9 -9 -99=LHX  74 84 35 2712 -9 -99=LIC  97 78 26 2311 -9 999
PUB  85 81 36 2810 -9 995=TAD 105 76 33 2613 -9   5=3OI 148 83 64 1911 -9   0
3SE 100 81 68 2112 -9 985=ALO 139 84 62 1915 20 995=BRL -99 80 62 1810 -9   8
CID 151 83 63 1712 -9    0=DBQ -99-99-99 -9-9 -9 -99=DSM 129 85 65 1817 -9 995
FOD -99 84 65 1814 -9 986=MCW 113 83 64 1817 -9 989=OTM 159 84 62 1714 -9   2
SUX 100 81 69 19 9 -9 985=9V9 -99 54 47 3215 -9 997=ABR 142 50 47 3010 -9 994
ATY 118 51 48 2919 -9 991=BKX -99 57 56 2710 -9 998=FSD 120 62 56 3013 -9 990
HON 129 54 49 3217 -9 992=MHE -99 56-99 3114 -9 -99=PHP -99-99-99 -9-9 -9 -99
PIR 180 51 45 3015 23    6=RAP 211 47 36 3425 -9  14=REJ -99 41 34 3315 -9  19
YKN -99 64 61 30 6 10 990=ABI 140 84 64 1314 -9   2=ACT 157 87 65 1212 -9   2
DAL -99-99-99 -9-9 -9 -99=DFW 161 88 62 1511 -9   3=DYS 139 86 66 1310 -9   2
F39 -99 86 57 14 8 -9    5=FTW -99 88 64 13 8 -9   5=FWH 162 85 62 18 5 -9   3
GGG -99-99-99 -9-9 -9 -99=GRK 165 89 62 13 8 -9   6=GVT -99-99-99 -9-9 -9 -99
LFK 177 83 58  9 5 -9    6=MWL -99-99-99 -9-9 -9 -99=SEP -99 84 62 16 8 -9   4
SPS 149 84 64 1510 -9    1=TPL -99 87 68 1412 -9   1=TYR -99 88 57 12 7 -9   5
AMA 134 72 61 1912 -9    5=CDS 144 82 61 19 8 -9   2=DHT -99 78 55 1815 20   3
ELP  94 82 57 14 5 -9 999=GDP -99 69 63  521 -9   5=INK -99-99-99 -9-9 -9 -99
LBB 143 76 64 1611 -9    8=MAF 142 73 67  7 5 -9   7=MRF -99 73 62 14 7 -9  16
REE 147 72 62 1711 -9   10=SJT 142 84 65 1610 -9   3=BYH 207 78 61 11 2 -9  15
ELD -99 81 62 13 5 -9   12=FSM 181 85 59 19 6 -9   8=FYV 190 78 62 14 5 -9  12
HOT -99 83 61  0 0 -9   10=HRO -99 77 58 13 6 -9  16=JBR 209 79 59 10 4 -9  15
LIT 200 80 62  9 4 -9   12=LRF 202 80 65  0 0 -9  13=PBF -99 81 61  7 5 -9  13
TXK -99 83 61 13 9 -9   10=AEX 192 83 62  4 1 -9  10=BTR 193 81 61  7 6 -9  10
BVE 191 79 64  913 -9   10=ESF 192 80 68  4 4 -9  10=LCH 183 82 67  7 5 -9   7
LFT 186 79 62 12 5 -9    8=MLU 195 79 66 13 4 -9  11=MSY 192 79 57 10 9 -9  10
POE 188 84 62  0 0 -9   10=SHV 187 84 60 1010 -9   9=ADM -99-99-99 -9-9 -9 -99
BVO -99-99-99 -9-9 -9 -99=CSM -99-99-99 -9-9 -9 -99=END 142 85 66 1812 17   0
FSI 150 84 70 1712 18    2=GAG -99 78 66 1910 -9 999=HBR -99-99-99 -9-9 -9 -99
LTS 137 85 68 1610 -9 999=MLC 168 83 66 17 4 -9   6=OKC 156 83 63 1511 -9   4
PGO -99 71 56 15 4 -9   18=PNC 139 86 67 1715 -9 998=TIK 163 82 67 1810 -9   5
TUL 165 86 61 1612 -9    4=WDG -99 84 68 1715 -9 999=AIA -99-99-99 -9-9 -9 -99
.
.
.
```

Table 4 Partial listing of file SAØØZ.DT (surface data from 00Z on 9/20/85). 32 of 200 stations have been flagged as having bad data or missing data. Stations are three per line and the order is left to right and then down to the next line. Data for each station is structured the same as a normal observation (e.g., for ABQ sea level pressure is 1016.9, temperature is 56, dew point is 51, wind direction 200 degrees at 4 knots, no wind gust, and altimeter is 30.17). Missing sea level pressure, temperature, dew point, and altimeter is -99. Missing wind direction, speed, (or no wind gust) is coded as -9. Remember altimeter is used to "flag" bad data and will be coded as -99 if there is bad and/or missing data (excluding sea level pressure which may or may/not be reported).

```
                SAO CHECK LIST FOR FILE   SA00Z.DT
CHECK FOLLOWING STATION FOR ERROR IN DATA
HMN  PP= -99 TT= -99 TD= -99 DD=  -9 VV=  -9 GG=  -9 AL= -99
CHECK FOLLOWING STATION FOR ERROR IN DATA
LHX  PP=  74 TT=  84 TD=  35 DD=  27 VV=  12 GG=  -9 AL= -99
CHECK FOLLOWING STATION FOR ERROR IN DATA
MHE  PP= -99 TT=  56 TD= -99 DD=  31 VV=  14 GG=  -9 AL= 990
CHECK FOLLOWING STATION FOR ERROR IN DATA
COT  PP= -99 TT= -99 TD= -99 DD=  -9 VV=  -9 GG=  -9 AL= -99
STATION CNM  MISSING
STATION DMN  MISSING
STATION FMN  MISSING
STATION GUP  MISSING
STATION HMN  MISSING
STATION DRO  MISSING
STATION GUC  MISSING
STATION DBQ  MISSING
STATION PHP  MISSING
STATION DAL  MISSING
STATION GGG  MISSING
STATION GVT  MISSING
STATION MWL  MISSING
STATION INK  MISSING
STATION ADM  MISSING
STATION BVO  MISSING
STATION CSM  MISSING
STATION HBR  MISSING
STATION AIA  MISSING
STATION BBW  MISSING
STATION CDR  MISSING
STATION MHN  MISSING
STATION SNY  MISSING
STATION COT  MISSING
STATION DLF  MISSING
STATION DRT  MISSING
STATION PSX  MISSING
STATION STJ  MISSING
STATION LBL  MISSING
STATION RSL  MISSING
END
```

Table 5 File SAVOBS.DT. This file contains a list of missing and/or erroneous data.

37 UPPER AIR STATIONS FOR 9 20 85 AT 0Z

STA	PPP	HHH	TT	TDP	DD	VV	PPP	HHH	TT	TDP	DD	VV	PPP	HHH	TT	TDP	DD	VV
ABQ	850	508	-99	-99	-99	-99	700	131	5	1	335	21	500	579	-14	0	-99	-99
	400	747	-21	2	-99	-99	300	954	-36	6	-99	-99	250	78	-44	-99	-99	-99
	200	225	-53	-99	215	94	150	407	-62	-99	220	48	100	653	-69	-99	220	31
AMA	850	512	19	4	200	20	700	157	9	9	240	20	500	586	-6	14	230	35
	400	758	-16	6	215	47	300	968	-32	4	215	55	250	94	-43	-99	210	54
	200	241	-54	-99	215	60	150	420	-67	-99	235	53	100	660	-72	-99	225	23
BNA	850	593	14	7	130	7	700	219	10	30	175	6	500	594	-7	30	225	5
	400	764	-17	30	80	24	300	974	-33	15	40	26	250	99	-43	-99	30	33
	200	246	-54	-99	40	36	150	426	-64	-99	360	16	100	668	-73	-99	15	6
BVE	850	571	16	13	60	20	700	192	6	21	80	13	500	590	-8	19	65	23
	400	759	-18	16	50	37	300	968	-32	14	45	49	250	94	-41	-99	40	46
	200	242	-52	-99	35	46	150	422	-64	-99	30	32	100	665	-72	-99	65	19
CKL	850	589	14	7	65	10	700	214	10	30	110	11	500	592	-8	30	85	20
	400	763	-18	30	75	27	300	972	-33	30	50	41	250	98	-42	-99	45	48
	200	246	-53	-99	45	40	150	427	-65	-99	50	27	100	669	-71	-99	55	12
DEN	850	446	-99	-99	-99	-99	700	103	10	14	75	8	500	579	-10	30	250	33
	400	746	-24	14	220	45	300	952	-36	6	220	87	250	77	-43	-99	210	97
	200	224	-52	-99	215	93	150	406	-62	-99	225	81	100	660	-61	-99	265	15
DDC	850	507	17	1	205	35	700	155	10	9	220	29	500	587	-7	10	230	33
	400	757	-18	1	220	53	300	967	-33	3	210	61	250	93	-42	-99	210	63
	200	240	-54	-99	215	68	150	420	-65	-99	230	54	100	661	-68	-99	220	23
DRT	850	547	20	3	135	22	700	189	9	1	170	4	500	591	-5	14	190	17
	400	763	-15	16	225	21	300	974	-31	11	210	7	250	101	-42	-99	190	2
	200	248	-53	-99	285	8	150	428	-66	-99	330	8	100	667	-74	-99	140	9
ELP	850	505	24	13	155	19	700	162	9	4	210	16	500	586	-7	16	240	36
	400	757	-18	16	220	48	300	966	-32	13	215	75	250	92	-42	-99	220	69
	200	239	-52	-99	220	70	150	420	-66	-99	220	70	100	661	-72	-99	230	29

Table 6 Partial listing of file MANDATAF.DT. In the header line, PPP refers to mandatory pressure level (e.g., 850 is 850 mb), HHH is height of pressure level (same as in original mandatory message), TT is temperature at pressure level in degrees C, TDP is the dew point depression in degrees C. DD and VV are the wind direction in degrees and wind speed in knots respectively.

PROGRAM	DEFAULT	LOCAL SWITCH	DEFINITION
BLDWXD		NONE	
SAVOBS		NONE	
MANDEC		NONE	
MANDECF		NONE	
COMTP	250 mb	ppp/P	Temperatures are computed for the grid points in MESOS at 500 mb and one other level specified by ppp. ppp can be 400, 300, 250, or 200 mb.
CHG		xx/X yy/Y	xx and yy specify the time in GMT. The oldest hour is xx (SAxxZ.DT). The most current hour is yy (SAyyZ.DT). (e.g., To compute a change from 15Z to 18Z, xx is 15 and yy is 18). xx=yy for 24 hour change. To replot data using CHG, set xx to 49 and yy to the desired hour to be replotted (SAyyZ.DT). This will plot the data with sea level pressure. To plot the same data only with altimeter setting, specify xx as 99. Do not use switch P with the replot feature. (e.g., To replot 20Z data with altimeter setting, xx is 99 and yy is 20).
	CHG computes pp	pp/P	The average pressure change in hundredths inch is pp. This is used in the second change chart graphic. It is normally the semi-diurnal pressure change. (e.g., A 1 mb fall (-3 hundredths) from 16Z to 22Z would be input as -3/P)
MESOS	Current clock hour (GMT)	tt/T	The GMT hour. (e.g., tt is 18 for 18Z.) The program requires data from SA18Z.DT. Data files SA17Z.DT and SA16Z.DT are optional files that will be used if available.
	Weight Table 2	w/W	This determines which of the distance filter weight tables will be used. WEIGHT TABLE — AVERAGE STATION SPACING (from BLDWXD) 1 — 100 km 2 — 125 km 3 — 150 km
	1000 mb	ppp/P	This is the pressure level (mb) that the station temperatures are reduced to. It is normally a pressure near the center of the analysis grid. (e.g., WSFO OKC uses 970 mb.)
OACHG		xx/X yy/Y	This is identical to the CHG program, except the input files (output from MESOS) are SFCOUTxxZ.DT. Change is from xx to yy. Changes from one to twenty-three hours can be computed.

Table 7 Listing of programs, local switches required and definitions of switches.

PROGRAM	PLOTTING MACRO (If required)	GRAPHICS	(NUMBER OF GRAPHICS AND COMMENTS)
BLDWXD		NMCGPHPØA	(Also, RDOS file, TEST) (2)
SAVOBS		NONE	
MANDEC		NONE	
MANDECF		NONE	
COMTP		NONE	
CHG	CHGMAC	NMCGPHSC1 and NMCGPHSC2	(2) Change Charts 1 and 2
	REPLOT	NMCGPHPØA	(1) Replotted surface data
MESOS	MESOSMAC	NMCGPHSSL	- Stability Index at 500 mb
		NMCGPHSSU	- Stability Index above 500 mb
		NMCGPHSTW	- Surface Wet-Bulb Potential Temp.
		NMCGPHSTH	- Potential Temperature
		NMCGPHSMC	- Surface Moisture Convergence
		NMCGPHSWC	- Surface Wind Convergence
		NMCGPHSRV	- Surface Relative Vorticity
		NMCGPHSTA	- Advection of Potential Temp.
		NMCGPHSMR	- Surface Mixing Ratio
			(9)
OACHG	OACHGMAC	NMCGPHSAC	- Altimeter Change at Grid Points.
		NMCGPHSCC	- Moisture Convergence Change " " "
		NMCGPHSRC	- Relative Vorticity Change " " "
			(3)

Table 8 (Top) Listing of programs, AFOS macros, and description of graphics produced by AFOS macros.

Table 9 (Bottom) Sample Program Sequence.

Program SAVOBS should be at the end of any surface decoding/plotting AFOS macro. Programs MANDEC, MANDECF, and COMTP should be at the end of your station's upper-air plotting AFOS macro. (This is so the programs run automatically at the correct times.)

Assume that data has been decoded from 16Z through 21Z and you want to compute changes from 18Z to 21Z as well as look at the current 21Z data. Type

```
RUN:MESOS 21/T 2/W 970/P
RUN:MESOSMAC
RUN:CHG 18/X 21/Y -2/P
RUN:CHGMAC
RUN:OACHG 18/X 21/Y
RUN:OACHGMAC
```

At WSFO OKC, we have written several AFOS macros that will do the above commands simply by typing one command (e.g. RUN:MESOS18Z). When all programs are executed at once (and you have approximately 200 stations), the complete program set will take approximately 10 to 12 minutes to execute. The fewer the stations, the less time it will take to execute. When the AFOS system is busy, and/or other programs need to run, it is often best to run the programs in groups (i.e. run MESOS and MESOSMAC, then run CHG and CHGMAC, and finally OACHG and OACHGMAC)

APPENDIX A

COMPLETE LOADING INSTRUCTIONS FOR DATA ANALYSIS PROGRAMS

1. Insert MESOS-SETUP floppy in DP3.

2. Direct to DP3 and type

   MESOSSETUP .

   This moves all files to their proper locations and establishes all the proper links. (See Table A1, the MESOSSETUP AFOS macro.)

   If programs MANDEC.(SV.,OL.) and BOXVIEW.SV were already on disk, dasher messages will be printed out as the macro attempts to move these programs to disk and/or link the MANDEC.SV and .OL files to DPØF. These messages should state the file already exists. This does not indicate a problem.

   PMOD.SV...GENUTF.SV...HCOPY.SV... and NA.PF (PMOD software will be required and should be on disk.

3. Make sure STDIR.MS is on DPØ or linked to it. Make sure the AFOS key NMCGPHPØA exists. cccMCPNST should be added to the database or wish list. Your Node is ccc.

4. Store the file PREFORMAT (already on DPØ) as cccMCPNST.

   STORE:PREFORMAT cccMCPNST .

   Once this step is complete, you may delete the file PREFORMAT from DPØ.

5. Complete the preformat cccMCPNST and store in the database as a temporary scratch file such as cccWRKxxx. (See the examples of how to fill out the preformat in Table 1 and Fig. 2). Save this temporary product as file NSTATIONS by typing

   SAVE:cccWRKxxx NSTATIONS .

   The preformat contains sample data from WSFO OKC which must be deleted and/or overwritten. In order to become familiar with the program, you may want to use the OKC data in the preformat the very first time you execute the program BLDWXD.

6. Type

   RUN:BLDWXD .

7. Once you are satisfied with the placement of your grid and stations (in NMCGPHPØA), proceed to Step 8, otherwise return to Step 5 (or save time by editing the file NSTATIONS). The file NSTATIONS is an RDOS file. The very first time you edit it, there may be extra characters at the end which make it too large to edit. So, the very first time type

   DSP:NSTATIONS . Then type E:F/ .

The header block will ask for the file name. Fill in the name NSTATIONS and then type Y for yes to overwrite the data. After the first editing, you can simply type

E:F/NSTATIONS .

8. You must create a new map background that matches the area that was "windowed" on the output (NMCGPHPØA) in program BLDWXD. At the dasher type

BOXVIEW .

Refer to Tables 2 and 3 for examples of how to answer the questions from BOXVIEW that will be typed on the dasher. (Also refer to BLDWXD PART B.) The output from BOXVIEW will be BOXVIEW.PF and BOXVIEW.CF.

9. In this step, a local map background number must be selected. (At WSFO Oklahoma City, this was map background B18). Having selected an appropriate number, type (at the dasher)

RENAME BOXVIEW.PF NAXX.PF (XX is your map background number)

RENAME BOXVIEW.CF NAXX.CF .

10. To generate the actual map background, at the dasher type

HCOPY BØ2 NAXX.CF (XX is your map background number)

GENUTF XPLOT BXX .

Figures 2 and 3 show the relation of the map that is "windowed" on map background BØ2 and the map that was created using the procedure just described.

11. Once you are completely done with the above steps, you may delete BLDWXD and BOXVIEW from your disk (DPØ). If you need to rerun the above steps to create another map background, direct to the MESOS-SETUP floppy (DP3) and type

MOVE/V DPØ BLDWXD.SV BOXVIEW.SV .

12. Add program SAVOBS to the end of your station's surface decoding and/or plotting macro(s) so that the data will be generated automatically and at the appropriate time.

13. Add the programs MANDEC, MANDECF, and COMTP to the end of your station's upper-air plotting macro(s) so that the data will be generated automatically and at the appropriate time.

14. The following keys should be added to your database. You will need to PILEDIT them in, or temporarily add them to the wish list.

    1. NMCGPHSC1 - Surface Change Chart 1

    2. NMCGPHSC2 - Surface Change Chart 2

    3. NMCGPHSSL - Stability Index at 500 mb

    4. NMCGPHSSU - Stability Index above 500 mb (400, 300, 250, or 200 mb)

    5. NMCGPHSTW - Surface Wet-Bulb Potential Temperature

    6. NMCGPHSTH - Temperature Reduced to 1000 mb or User Specified Pressure Level

    7. NMCGPHSMC - Surface Moisture Convergence

    8. NMCGPHSWC - Surface Wind Convergence

    9. NMCGPHSRV - Surface Relative Vorticity

    10. NMCGPHSTA - Advection of Temperature on a Constant Pressure Surface

    11. NMCGPHSMR - Surface Mixing Ratio

    12. NMCGPHSAC - Grid Point Altimeter Change

    13. NMCGPHSCC - Grid Point Moisture Convergence Change

    14. NMCGPHSRC - Grid Point Relative Vorticity Change

    15. NMCGPHBXX - XX is the map background number you select. NMCGPHBXX may already exist if you have chosen one you had not been using.

    16. NMCGPHPXX - Surface data plot.

    17. cccMCPNST - Preformat

    Map background BXX (your local use map background that was created after BLDWXD) should be assigned to Keys 2 - 14. It is recommended that map background BXX be used with Keys 1 and 2, however, the AFOS macro supplied to you to plot the data (CHGMAC) currently is set up for map BØ2. To use BXX with Keys 1 and 2, you will have to change the NA.PF in CHGMAC.MC to NAXX.PF. Also change the output graphic PØA in REPLOT.MC to PXX and change NA.PF to NAXX.PF if you want to replot the data on map background BXX.

15. Now you should be ready to run programs CHG, MESOS, and OACHG. Tables 7, 8 and 9 contain the instructions for program execution and graphic generation.

16. The following files are created by the Data Analysis Programs

Files on DPØF

1.	WXDATA1.DT	You should CHATR this file to make it permanent.

Files on DPØ

1.	SAxxZ.DT	Decoded surface data in formatted form. xx is the GMT hour (up to 24 of these files can be on disk)
2.	SATMP.DT	Previously file SAxxZ.DT, but twenty-four old (for change chart).
3.	SFCOUTxxZ.DT	Output from MESOS, used in calculating grid point changes. Up to 24 of these files could accumulate on disk.
4.	UPROUT.DT	Upper-air grid point temperatures used in calculating stability indices.
5.	MANDATA	Decoded mandatory level upper-air data.
6.	MANDATAF.DT	Formatted upper-air data.
7.	GP	AFOS plot file.
8.	SLPLOT SUPLOT TWPLOT THPLOT MCPLOT WCPLOT TAPLOT RVPLOT MRPLOT ACPLOT CCPLOT RCPLOT	Internal Product Files used in graphic generation by PMOD software.

Only files SAxxZ.DT, SATMP.DT, MANDATAF.DT, and GP can be displayed on an ADM/GDM by typing DSP:File Name.

17. Main programs excluding MANDEC.(SV,OL) require around 260 blocks. BLDWXD and BOXVIEW can remain on floppy disk. Data could accumulate to a maximum of 400 blocks IF the programs were run every hour. A more reasonable data block usage is around 200 blocks maximum on a busy day.

18. To save data after a significant weather event, a SAVDATA macro should save at least files SAxxZ.DT and MANDATAF.DT on floppy. An example of this is shown in Appendix D, Table D1. If you are not saving data, delete SAxxZ.DT, MANDATA, MANDATAF.DT, and SFCOUTxxZ.DT in a clean macro.

```
MESSAGE  **** BEGINNING MESOS-SETUP PROCEDURE...MOVING DATA FROM DP3
MOVE/A/V DP0 STW.MC
MOVE/A/V DP0 SSL.MC
MOVE/A/V DP0 SSU.MC
MOVE/A/V DP0 SMC.MC
MOVE/A/V DP0 SWC.MC
MOVE/A/V DP0 STH.MC
MOVE/A/V DP0 STA.MC
MOVE/A/V DP0 SMR.MC
MOVE/A/V DP0 SRV.MC
MOVE/A/V DP0 SAC.MC
MOVE/A/V DP0 SCC.MC
MOVE/A/V DP0 SRC.MC
MOVE/A/V DP0 MESOSMAC.MC
MOVE/A/V DP0 OACHGMAC.MC
MOVE/A/V DP0 CHGMAC.MC
MOVE/A/V DP0 REPLOT.MC
MOVE/A/V DP0 BLDWXD.SV
MOVE/A/V DP0F SAVOBS.SV
MOVE/A/V DP0F CHG.SV
MOVE/A/R/V DP0 BOXVIEW.SV
MOVE/A/R/V DP0F MANDEC.OL
MOVE/A/R/V DP0F MANDEC.SV
MOVE/A/V DP0F MANDECF.SV
MOVE/A/V DP0F COMTP.SV
MOVE/A/V DP0F MESOS.SV
MOVE/A/V DP0F OACHG.SV
MOVE/A/V DP0 CHG1.PM
MOVE/A/V DP0 CHG2.PM
MESSAGE                          ********
MESSAGE  **** NOW ESTABLISHING PROPER LINKS FOR PROGRAMS ON DP0 ****
MESSAGE                          ********
DIR DP0
LINK WXDATA1.DT DP0F:WXDATA1.DT
LINK SAVOBS.SV DP0F:SAVOBS.SV
LINK CHG.SV DP0F:CHG.SV
LINK MANDEC.OL DP0F:MANDEC.OL
LINK MANDEC.SV DP0F:MANDEC.SV
LINK MANDECF.SV DP0F:MANDECF.SV
LINK COMTP.SV DP0F:COMTP.SV
LINK MESOS.SV DP0F:MESOS.SV
LINK OACHG.SV DP0F:OACHG.SV
RELEASE DP3
MESSAGE **** IF PROGRAMS MANDEC.(SV,OL) AND BOXVIEW.SV WERE ALREADY
MESSAGE      ON DISK..DASHER MESSAGES WILL BE PRINTED OUT AS THE MACRO
MESSAGE      ATTEMPTS TO MOVE THESE PROGRAMS TO DISK OR LINK THE MANDEC
MESSAGE      .SV AND .OL FILES TO DP0F. THESE MESSAGES SHOULD STATE
MESSAGE      THE FILE ALREADY EXISTS. THIS DOES NOT INDICATE A PROBLEM.
MESSAGE      PMOD.SV...GENUTF.SV...HCOPY.SV...AND NA.PF THE PMOD
MESSAGE      SOFTWARE WILL BE REQUIRED AND SHOULD BE ON DISK.    ****
MESSAGE **** YOU SHOULD NOW BE READY TO CREATE YOU LOCAL MAP BACKGROUND
MESSAGE      AND LOCAL DATA BASE WITH PROGRAM BLDWXD.
MESSAGE **** AFTER YOU HAVE CREATED YOUR LOCAL MAP BACKGROUND BXX AND
MESSAGE      WXDATA1.DT..YOU SHOULD BE READY TO RUN PROGRAMS CHG..MESOS
MESSAGE      ..AND OACHG. YOU MAY WANT TO ESTABLISH A MACRO TO DISPLAY
MESSAGE      THE GRAPHIC OUTPUT OF THE PROGRAMS
MESSAGE                          ****************
MESSAGE ***  JOB COMPLETE. REMOVE FLOPPY FROM DP3.
```

Table A1 Listing of the AFOS MESOS-SETUP macro. The macro moves files to proper locations and establishes needed links.

APPENDIX B SETTING UP THE OBJECTIVE ANALYSIS GRID AND MAP BACKGROUND

The following tables and accompanying figures illustrate how data can be set up to create different grids and maps for different parts of the country.

```
OKCWRKOKC          ETTAA00 KOKC 181921
      .....CHANGE ONLY THE DATA WITHIN BRACES " ". USE THIS PREFORMAT
1.  TO SAVE DATA FOR POST ANALYSIS.....(USE PREFORMAT THIS PAGE)
2.  TO SAVE FOR USE WITH CHANGE CHARTS.....(USE PREFORMAT THIS PAGE)
3.  TO SAVE DATA FOR OBJECTIVE ANALYSIS PROGRAM.....(USE PREFORMAT NEXT PAGE).

ENTER STATIONS ALPHABETICALLY BY NODE (AND WITHIN NODE).
EXAMPLE:  ABQ CAO HOB ROW SOS DEN TAD.
   ENTER 19 STATIONS PER LINE WITH 10 STATIONS ON THE LAST LINE (MAX 200)
 060  STATIONS TO BE READ IN FOLLOWING LIST.  02  MAP BACKGROUND
 ALB BGM BTV MPV MSS POU UCA BDL BDR BOS ORH PVD BUF ELM ROC SYR CAK CLE CMH  1
 MFD YNG ZZV BKW CRW EKN HTS MGW PKB EWR JFK LGA ACY AVP CXY MDT PHL PNE RDG  2
 BFD ERI JST PIT FAY GSO HAT HKY ILM RDU BWI CHO DAN DCA HGR IAD ILG ORF PHF  3
 RIC ROA SBY                                                                  4
                                                                              5
                                                                              6
                                                                              7
                                                                              8
                                                                              9
                                                                              0
                                        11
 44.5  NW CORNER GRID LATITUDE.   76.7  NW CORNER GRID LONGITUDE.
 105.0  STANDARD LONGITUDE.              75.0  GRID SPACING IN KM.
 10  # OF GRID POINTS LEFT TO RIGHT.  15  # OF GRID POINTS TOP TO BOTTOM

ENTER THE STATIONS (MAX OF 100) THAT ARE TO BE INCLUDED IN OA
  60  STATIONS IN FOLLOWING LIST FOR OA.
 ALB BGM BTV MPV MSS POU UCA BDL BDR BOS  1
 ORH PVD BUF ELM ROC SYR CAK CLE CMH MFD  2
 YNG ZZV BKW CRW EKN HTS MGW PKB EWR JFK  3
 LGA ACY AVP CXY MDT PHL PNE RDG BFD ERI  4
 JST PIT FAY GSO HAT HKY ILM RDU BWI CHO  5
 DAN DCA HGR IAD ILG ORF PHF RIC ROA SBY  6
                                          7
                                          8
                                          9
                                          10

  90 UPPER AIR STA. (US, CANADIAN AND MEXICAN) ..DO NOT CHANGE THIS DATA..
 ABQ ACY AHN ALB AMA AQQ AYS BIS BNA BOI BRO BUF BVE CAR CHH CKL CHS DAY DEN
 DDC DRA DRT ELP ELY EYW FHU FNT GEG GGG GGW GJT GRB GSO GTF HAT HON HTS IAD
 INL INW JAN LBF LCH LIT LND MAF MFR MIA MYF OAK OKC OMA PBI PIA PIT PWM RAP
 SAN SEP SLE SLC SLO SSM STC TBW TOP TUS UIL UMN VEG VCT VPS WAL WMC WNI WTL
 WVK YMO YQD YSM YXD YXS YYE YYQ YZT YZV CUU GYM MID MTY
                PUT CURSOR AT RIGHT AND STRIKE ENTER....
```

Table B1 Data input required to produce map B1a using BLDWXD.

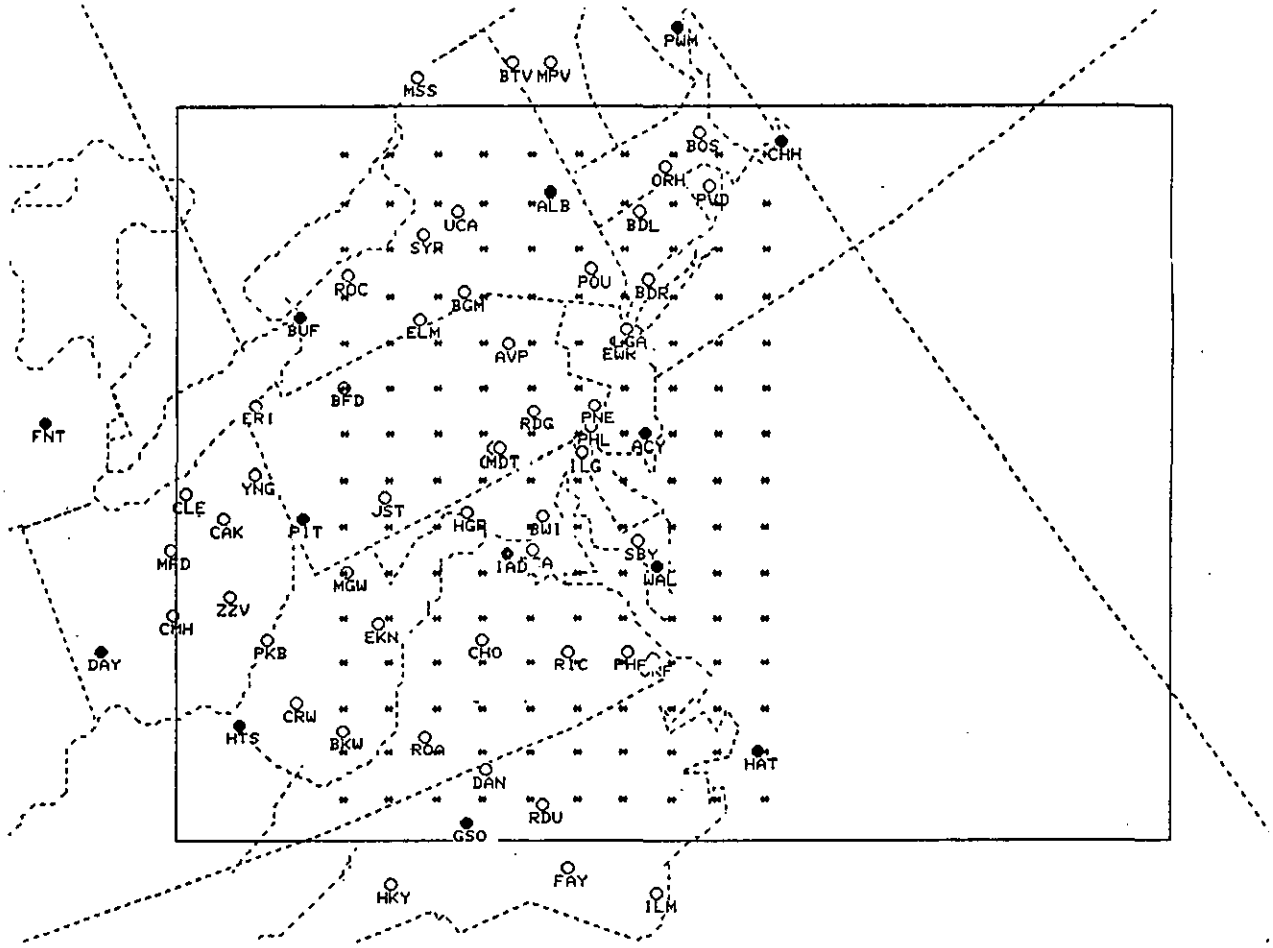
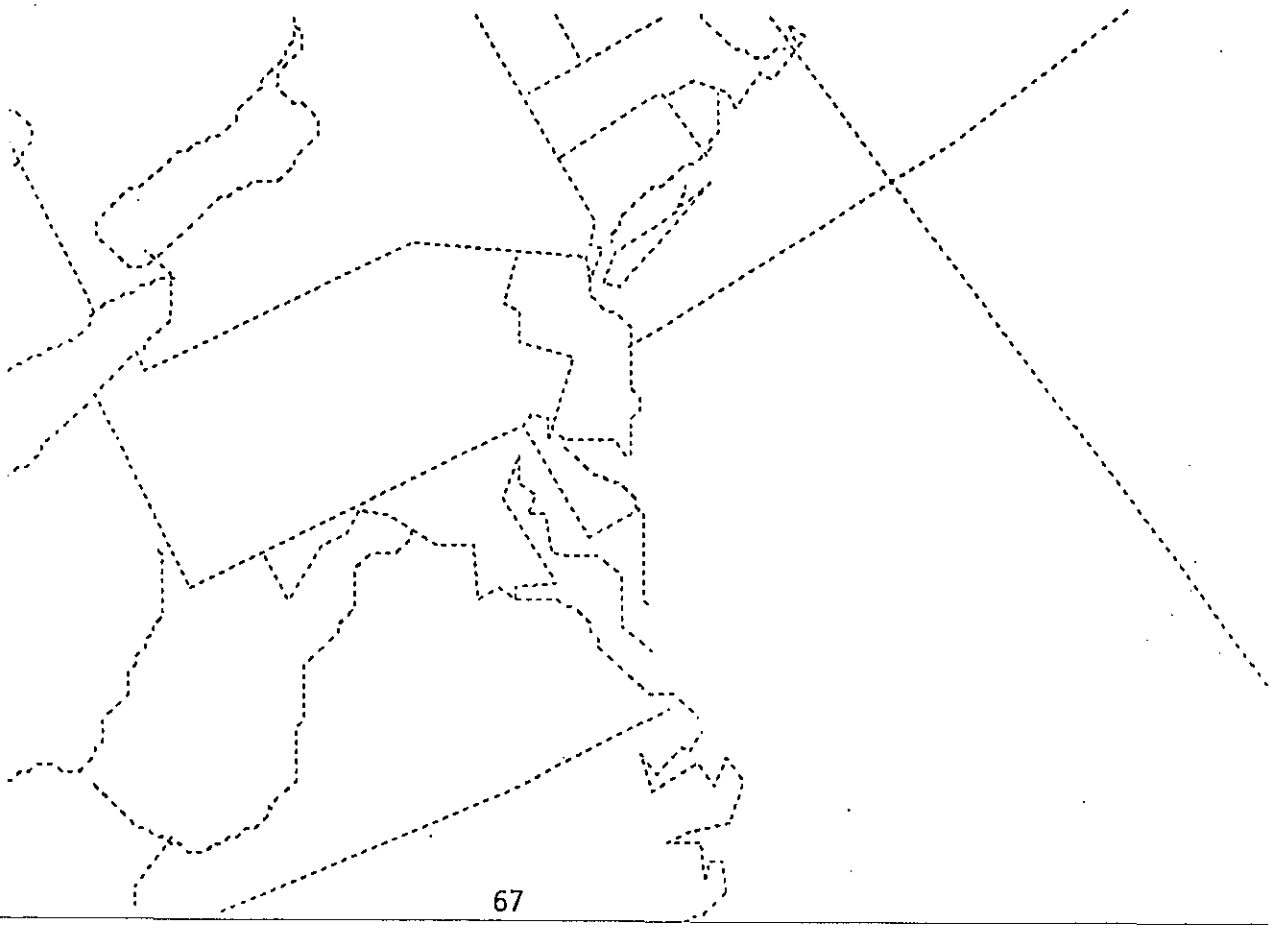


Figure B1a (Top) Objective analysis grid and stations for Northeastern United States.

Figure B1b (Bottom) Map produced from program BOXVIEW, HCOPY, and GENUTF. This map is the portion of the map above (B1a) that is enclosed in the rectangle.



```
OKCWRKOKC          ETTAA00 KOKC 162224
      .....CHANGE ONLY THE DATA WITHIN BRACES *  *. USE THIS PREFORMAT
1.  TO SAVE DATA FOR POST ANALYSIS.....(USE PREFORMAT THIS PAGE)
2.  TO SAVE FOR USE WITH CHANGE CHARTS.....(USE PREFORMAT THIS PAGE)
3.  TO SAVE DATA FOR OBJECTIVE ANALYSIS PROGRAM.....(USE PREFORMAT NEXT PAGE).

ENTER STATIONS ALPHABETICALLY BY NODE (AND WITHIN NODE).
EXAMPLE:  ABQ CAO HOB ROW COS DEN TAD.
   ENTER 19 STATIONS PER LINE WITH 10 STATIONS ON THE LAST LINE (MAX 200)
  41  STATIONS TO BE READ IN FOLLOWING LIST.  02  MAP BACKGROUND
 ABY AGS AHN ATL AYS CSG MCN SAV SSI VLD ANB AQQ BHM CKL DHN HSV MGM MOB MSL  1
 PAM PFN PNS TCL VPS CAE CHS CRE FLO GSP AGR COF DAB EYW FMY GNV JAX MCO MIA  2
 ORL PBI TLH                                                                  3
                                                                              4
                                                                              5
                                                                              6
                                                                              7
                                                                              8
                                                                              9
                                                                              0
                                          11  OBJECTIVE ANALYSIS DATA FOLLOWS
 31.0  NW CORNER GRID LATITUDE.    85.0  NW CORNER GRID LONGITUDE.
  55.0  STANDARD LONGITUDE.              75.0  GRID SPACING IN KM.
  6  * OF GRID POINTS LEFT TO RIGHT.  15  * OF GRID POINTS TOP TO BOTTOM

ENTER THE STATIONS (MAX OF 100) THAT ARE TO BE INCLUDED IN OA
  41  STATIONS IN FOLLOWING LIST FOR OA.
 ABY AGS AHN ATL AYS CSG MCN SAV SSI VLD  1
 ANB AQQ BHM CKL DHN HSV MGM MOB MSL PAM  2
 PFN PNS TCL VPS CAE CHS CRE FLO GSP AGR  3
 COF DAB EYW FMY GNV JAX MCO MIA ORL PBI  4
 TLH                                      5
                                          6
                                          7
                                          8
                                          9
                                          10

  90 UPPER AIR STA. (US, CANADIAN AND MEXICAN) ..DO NOT CHANGE THIS DATA..
 ABQ ACY AHN ALB AMA AQQ AYS BIS BNA BOI BRO BUF BVE CAR CHH CKL CHS DAY DEN
 DDC DRA DRT ELP ELY EYW FHU FNT GEG GGG GGW GJT GRB GSO GTF HAT HON HTS IAD
 INL INW JAN LBF LCH LIT LND MAF MFR MIA MYF OAK OKC OMA PBI PIA PIT PWM RAP
 SAN SEP SLE SLC SLO SSM STC TBW TOP TUS UIL UMN VBG VCT VPS WAL WMC WNI WTL
 WVK YMO YQD YSM YXD YXS YYE YYQ YZT YZV CUU GYM MID MTY
               PUT CURSOR AT RIGHT AND STRIKE ENTER....
```

Table B2 Data input required to produce map B2a using BLDWXD

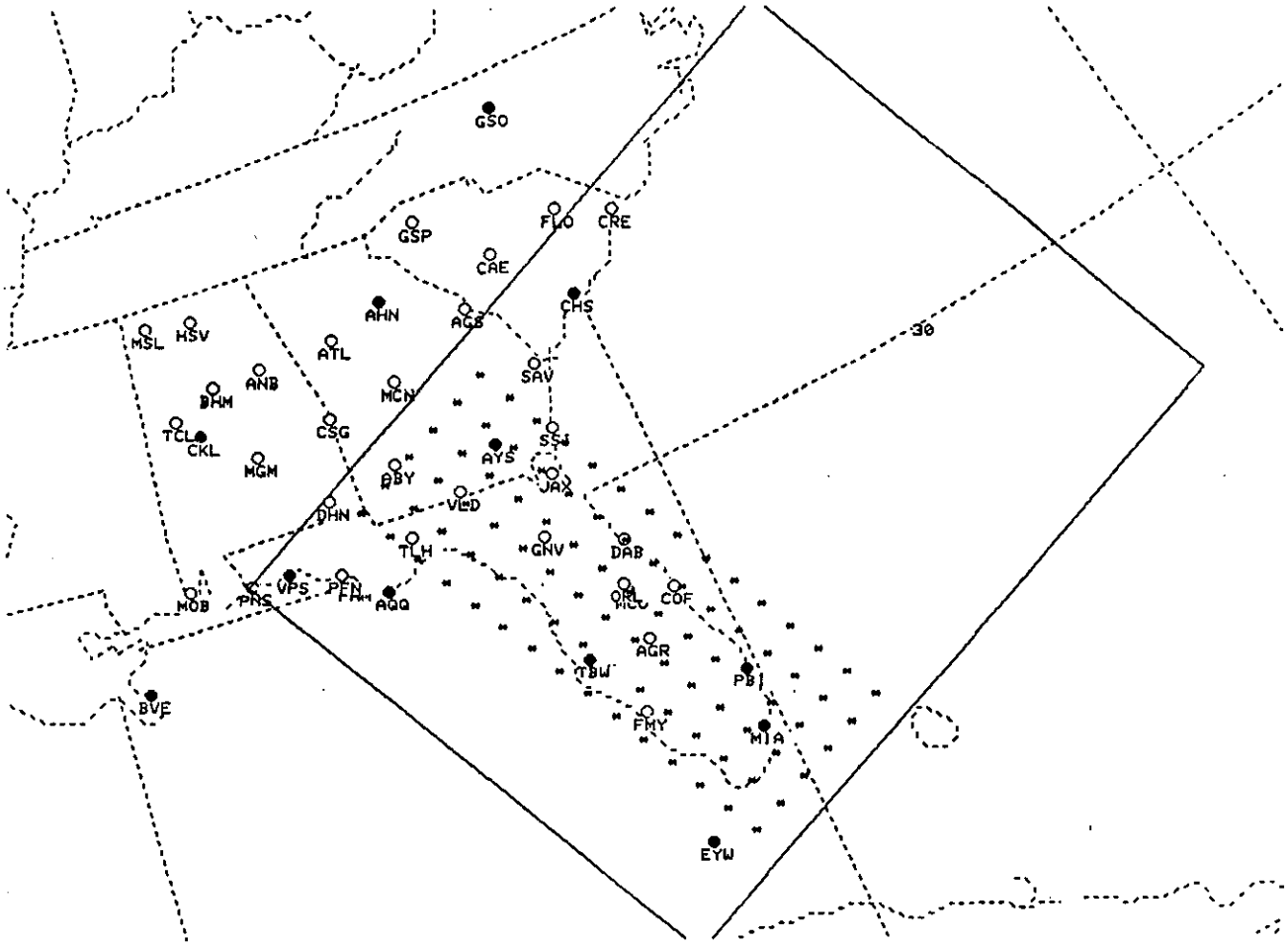


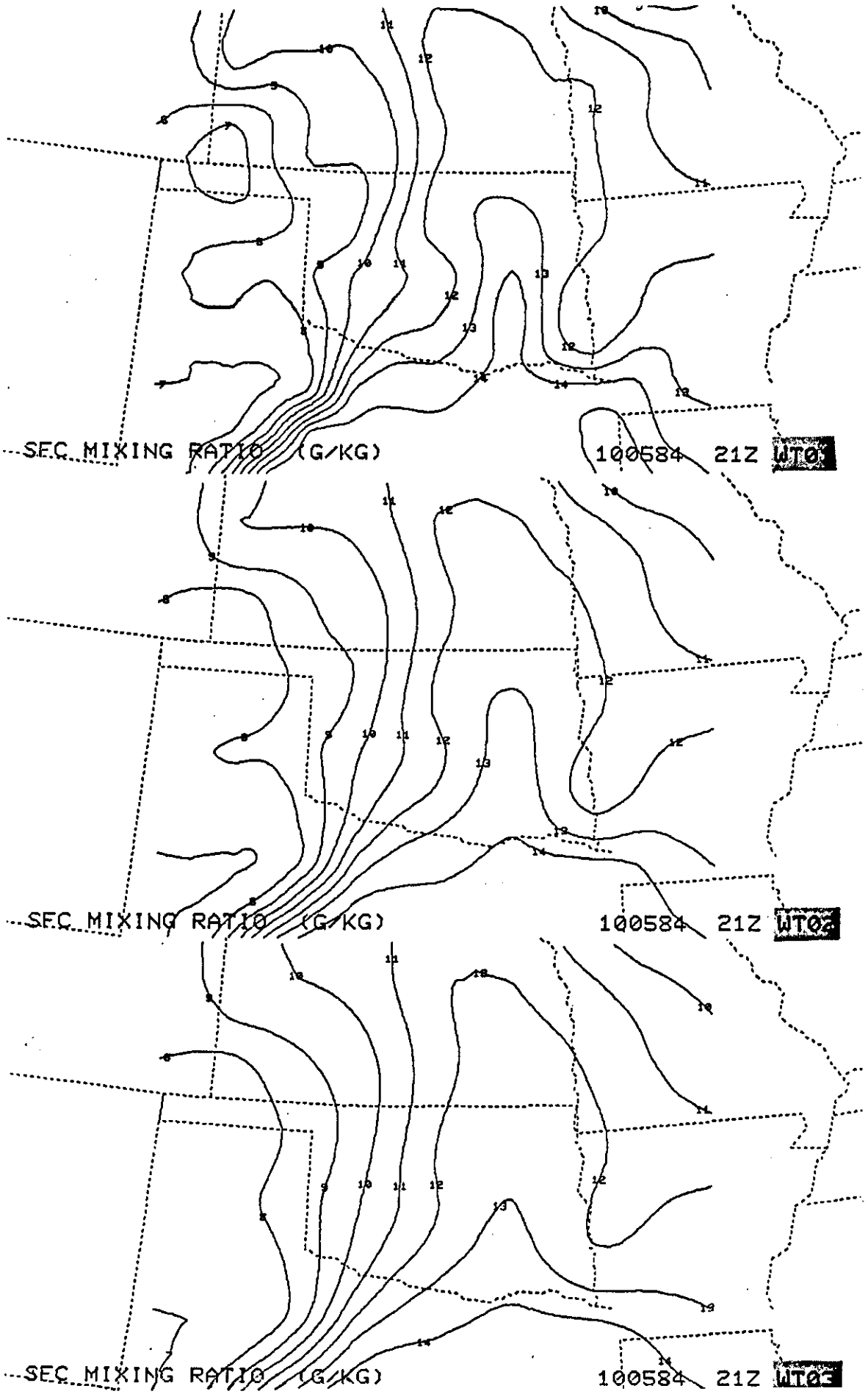
Figure B2a (Top) Objective analysis grid and stations for Florida.
Figure B2b (Bottom) Map produced from program BOXVIEW, HCOPY, and GENUTF. This map is the portion of the map above (B2a) that is enclosed in the rectangle.

APPENDIX C

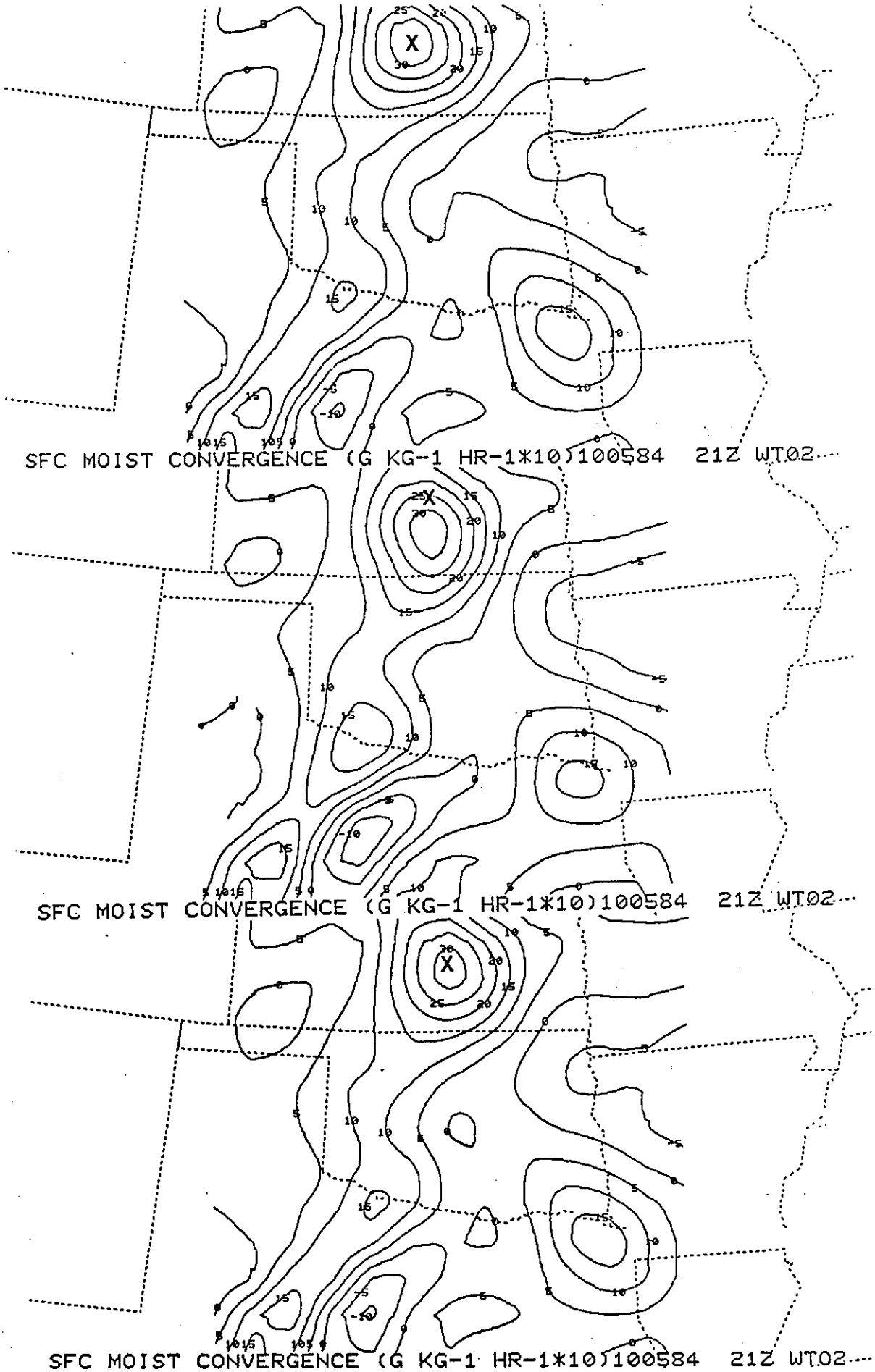
EXAMPLES OF TIME AND DISTANCE WEIGHTING IN MESOS

In Figure C1, examples of the three different distance filter weights (or weight tables) are shown. Weight table 3 produces the most smoothing of the data.

Figure C2 includes examples of the time weighting. The top figure (C2a) represents the actual moisture convergence computed for the 5th of OCT, 1984 at 21Z. X marks the location of the maximum convergence. This is very near Wichita, Kansas (ICT-refer to Figure 3). In Figure C2b, station ICT was purposely left out of the 21Z analysis and only data from 21Z was used in the analysis. It can be seen that without ICT data, the convergence center shifts to the south. In Figure C2c, data from 20Z and 19Z was included in the objective analysis. It can readily be seen that when time weighting is used, a better analysis will be produced.



Figures C1a (Top), C1b (Middle), and C1c (Bottom). Examples of distance weighting.



Figures C2a (Top), C2b (Middle), and C2c (Bottom). Examples of time weighting.

APPENDIX D

EXAMPLE OF HOW TO SAVE SURFACE AND UPPER-AIR DATA

Table D1 illustrates a SAVDATA AFOS macro written by the ASM at WSFO Oklahoma City, and used on a daily basis to save the surface and upper air data used during the day.

```
MESSAGE ***NOW SAVING DATA ON THE FLOPPY IN DP3.
INIT/F DP3
MOVE/A/V DP3 SA-Z.DT
MOVE/A/V DP3 -85U.-
MOVE/A/V DP3 MANDATAF.DT
MOVE/A/V DP3 SFCOUT-.DT
RELEASE DP3
MESSAGE ***FILES HAVE BEEN SAVED ONTO THE FLOPPY IN DP3. REMOVE SAVDATA
MESSAGE ***FLOPPY FROM DP3 AND RETURN IT TO CABINET. THE FILES THAT HAVE
MESSAGE ***BEEN SAVED WILL NOW BE DELETED FROM DP0.
DIR DP0:GDIR
DISK:GTOD
DELETE/V SA0(0,2,4,5,8,9)Z.DT
DELETE/V SA1(0,1,2,3,5,6)Z.DT
DELETE/V SA2(0,1,2,3)Z.DT
DELETE/V -85U.-
DELETE/V SFCOUT-.DT SFCOUT03Z.DT/N
DISK:GTOD
MESSAGE ***ALL DONE.
```

Table D1 The SAVDATA AFOS macro. Note that some files are left to allow the forecaster to compute 24 hour changes.