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Description of VAS Processing Techniques

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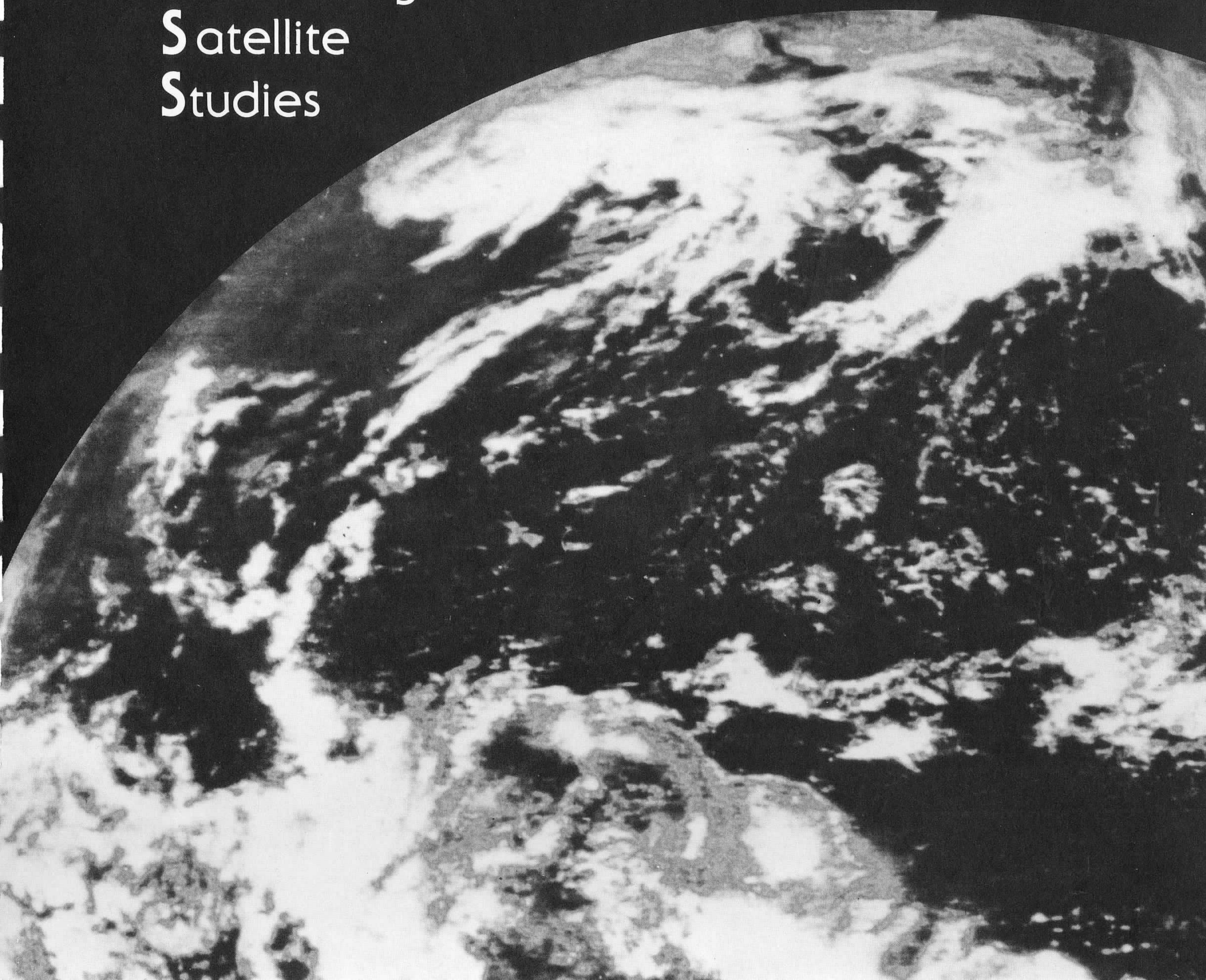

Description of VAS
Processing Techniques

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I. INTRODUCTION

This document describes the basic processing modules, which will be included with the delivery of the VDUC to NESDIS operations in the summer of 1986 for the reduction of radiances measured by the VAS into meteorological products. The intention here is to give an overview with a minimum of specifics so that the reader may understand the rationale of the entire system and recognize the roles played by the various modules. A more complete (though slightly outdated) description of temperature retrieval software can be found in the Documentation of the VAS Data Processing Software (Nelson, 1984). Wind derivation documentation and other information not specific to VAS is available in the McIDAS Reference Manual (SSEC, 1984).

The principle of remote sounding of temperature and moisture profiles is to measure outgoing radiation in several spectral bands chosen in such a way that each band detects radiation from a layer of the atmosphere, semi-independent but overlapping with layers sensed by the other bands. The task of the retrieval algorithm is to deconvolute these measurements, using radiative transfer theory, into atmospheric profiles of temperature and moisture. (See Appendix A.) The VAS measures radiation in 12 such spectral bands (though in the VDUC processing system only 11 are actually used).

There are three fundamental problems to be confronted in reducing the measurements:

- Because each measurement is a layer average, there is limited vertical resolution and the inversion solution is ambiguous. Many combinations of temperature/moisture distribution will give a radiometrically correct solution. To overcome the ambiguity it is useful to begin with best estimates of the true profiles (temperature and moisture) and perturb these only enough to satisfy the radiance measurements.

- Profile retrieval near the surface is difficult because bands which are sensitive at this altitude will also be sensitive to the solid surface which emits the dominant signal. Accuracy at low levels requires use of ancillary information to "bound" the solution. For this purpose, it is useful to include surface data obtained from other observations.
- None of the three contributors to the measurements: temperature distribution; moisture distribution; and surface skin temperature should be treated independently (although they frequently are). A change to any one affects the "calculated outgoing radiation" of many of the channels which we seek to match to the observation. The VDUC system uses the "simultaneous retrieval algorithm" (Smith et al., 1985) to mitigate this problem.

The principle of wind derivation is simply to follow a recognizable tracer in a sequence of images and derive its apparent velocity. This can be done using visible or infrared imagery. For VAS processing the 11, 6.7, and 7.2 micrometer channels are used. There are two fundamental problems.

- Tracer identification can be ambiguous, especially for the water vapor motion. To alleviate this problem, image enhancement techniques are available. Also, the capability exists to display a "best estimate" of the wind from a separate source. Analogous to temperature retrieval derivation, this estimate should be perturbed only enough to satisfy the apparent motion.

Pressure altitude estimation for the wind tracer has always been suspect. Recent work using the water vapor channels as predictors for the height assignment has been encouraging. The CO_2 absorption method of height assignment is also under investigation.

Throughout this document, it is assumed that the VAS data has been ingested on schedule and properly navigated. These procedures are documented elsewhere in the McIDAS Operators Manual (SSEC, 1986) and the McIDAS Navigation Manual (SSEC, 1986).

II. THE TEMPERATURE-MOISTURE RETRIEVAL METHOD

After ingest, VAS data reduction begins with the specification of initial profiles of temperature and moisture. In the current processing system, these are derived by time interpolation from the 12 and 24 hour predicted fields of the National Weather Service (NWS) Limited Fine Mesh (LFM) model, modified at the lower levels through blending with surface data. The latter are locally processed by objective analysis of hourly reports from land stations, ships, and ocean buoys to provide gridpoint fields of 1000 mb geopotential, mean sea-level temperature and dewpoint depression.

VAS radiances (at 11 frequencies) are processed at a nominal horizontal resolution of 80 km (an 11x11 array of small detector fields-of-view as described in the Documentation of the VAS Data Processing Software (Nelson, 1984)). Clear column estimates are sought by filtering the samples of 121 fovs to remove cloud contaminated members and averaging the remainder. The basic element of the filter is a comparison of the 11 micrometer "window" measurement with the surface air temperature obtained from the objective analysis discussed above. This comparison is not ideal since the surface data coverage is often inadequate (e.g. oceans) and surface air temperature is often unrepresentative of the 11 micron measurement, which is affected by the surface skin temperature and low level moisture. Consequently, other window channels and varying tolerances are used in the determination of "clear" versus "cloudy" as shown schematically in Table 1. Radiances determined to be either "clear" or "low overcast" are considered for further processing.

Another ingredient required for the retrieval of temperature and moisture profiles is an estimate of the skin temperature. This

TABLE 1: CLOUD SCREENING ALGORITHM

The filtering follows three steps: designate retrieval as clear or cloudy; accept or reject individual fov for all channels; accept or reject individual channel fov.

1) Find T8M, the warmest 11 micrometer (band 8) window observation in the sample. Calculate WD = T12M - T8M, the window difference between 3.7 (band 12) and 11 micrometer measurements and save T5M (band 5) and T7M (band 7) for the same fov.

2) If WD < - 4°C, set cloud flag for sample (stratus cloud). If WD > 0, set WD = 0 to eliminate sun effects, and continue cloud test.

3) Estimate an approximate "clear" band 11 from the surface air and a correction for moisture attenuation VSFC = TSFC - (T8M - T7M) and assign as cloud-free if VSFC - T8M + WD < TOL where:

TOL = 3 if T8M ≦ 270,
5 if T8M > 270.

otherwise, assign as cloudy.

4) Set minimum acceptable values for retaining observations in the sample.

TMIN5 =	T5M - 1		if clear,
	T5M - 2		if cloudy,
TMIN8 =	TSFC <	T8M - 3	if clear,
		T8M - 5	if cloudy.

WDMAX = WD + 2 .

5) Band 8 is used as a categorical filter for both small and large detector bands as follows.

For the small detector data, reject a fov if

T8 < TMIN8 or
WD > WDMAX

and reject the sample for retrieval if less than six fovs pass the above test.

For the large detector data, reject a fov if the small detector band 8 observations averaged over the large detector for fov

T8AVG < TMIN8

and reject the sample for retrieval if less than four fovs pass.

6) For accepting individual fov in bands 1, 2, 3, 9, and 10, band 5 is tested:

T5 > TMIN5

Bands 4, 5 and 7 use the small detector filter and bands 6 and 12 use the large detector filter described in 5.

is obtained from the filtered averages of the 11, 12 and 3.7 micrometer windows through an empirical regression model.

The retrieval algorithm is the "simultaneous" method described by Smith et al. (1986). Using the initial estimates of temperature, moisture, and skin temperature, outgoing radiances are calculated for the VAS channels. The discrepancy between observed and calculated values are used simultaneously to determine incremental changes which, when added to the initial estimates, provide new estimates of the temperature and water vapor profiles and the surface skin temperature. Some of the VAS channels are primarily sensitive to water vapor distribution whereas others are primarily sensitive to temperature distribution. Some, but not all, "see" the surface as well as the atmosphere. In general, the majority of measurements are affected by all three sources of signal. The simultaneous solution attempts to account for all factors in a single matrix inversion. In practice, the simultaneous solution is iterated once to update transmittance functions, themselves temperature and moisture dependent, which are then used for calculating the outgoing radiances. The result of the matrix inversion is a matrix which, when applied to the vector of radiance discrepancies, yields a vector of solution coefficients. These coefficients are applied to a set of basis functions (described below) to give incremental changes to the initial estimates of the meteorological parameters at each pressure level.

The basis functions used in the VAS processing are essentially the familiar "weighting functions" shown in Fig. 1. Five functions are applied to determine temperature (carbon dioxide channels 2 through 5 and the water vapor window, channel 7), and three for moisture (water

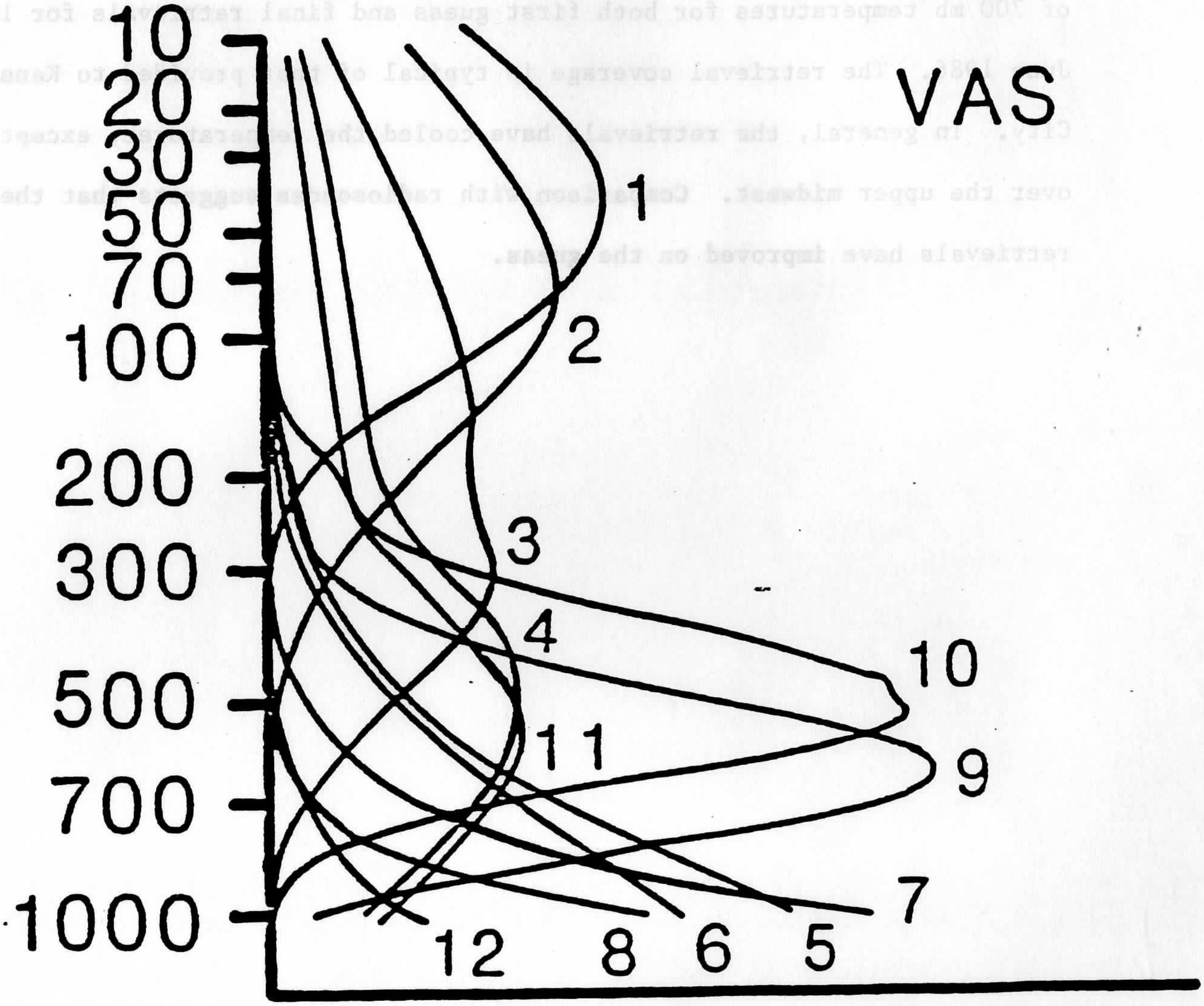


FIGURE 1

vapor channels 7, 9 and 10). The use of eight basis functions with ten VAS measurements plus surface temperature and mixing ratio gives a heavily over-determined system and thereby a stable solution.

From the temperature and moisture retrieval, various derived products are calculated. Table 2 lists one possible selection.

A sample retrieval output is shown if Fig. 2 which gives the field of 700 mb temperatures for both first guess and final retrievals for 13 June 1986. The retrieval coverage is typical of that provided to Kansas City. In general, the retrievals have cooled the temperatures, except over the upper midwest. Comparison with radiosondes suggests that the retrievals have improved on the guess.

TABLE 2: DERIVED PRODUCTS

Temperature at 15 levels

Dewpoint Temperature at 6 levels

Geopotential Height at 15 levels

Thermal Gradient Winds at 8 levels

Total Precipitable Water Vapor

Lifted Index

Surface Skin Temperature

Levels:	1000	700	250
	950	670	200
	920	500	150
	850	400	100
	780	300	50

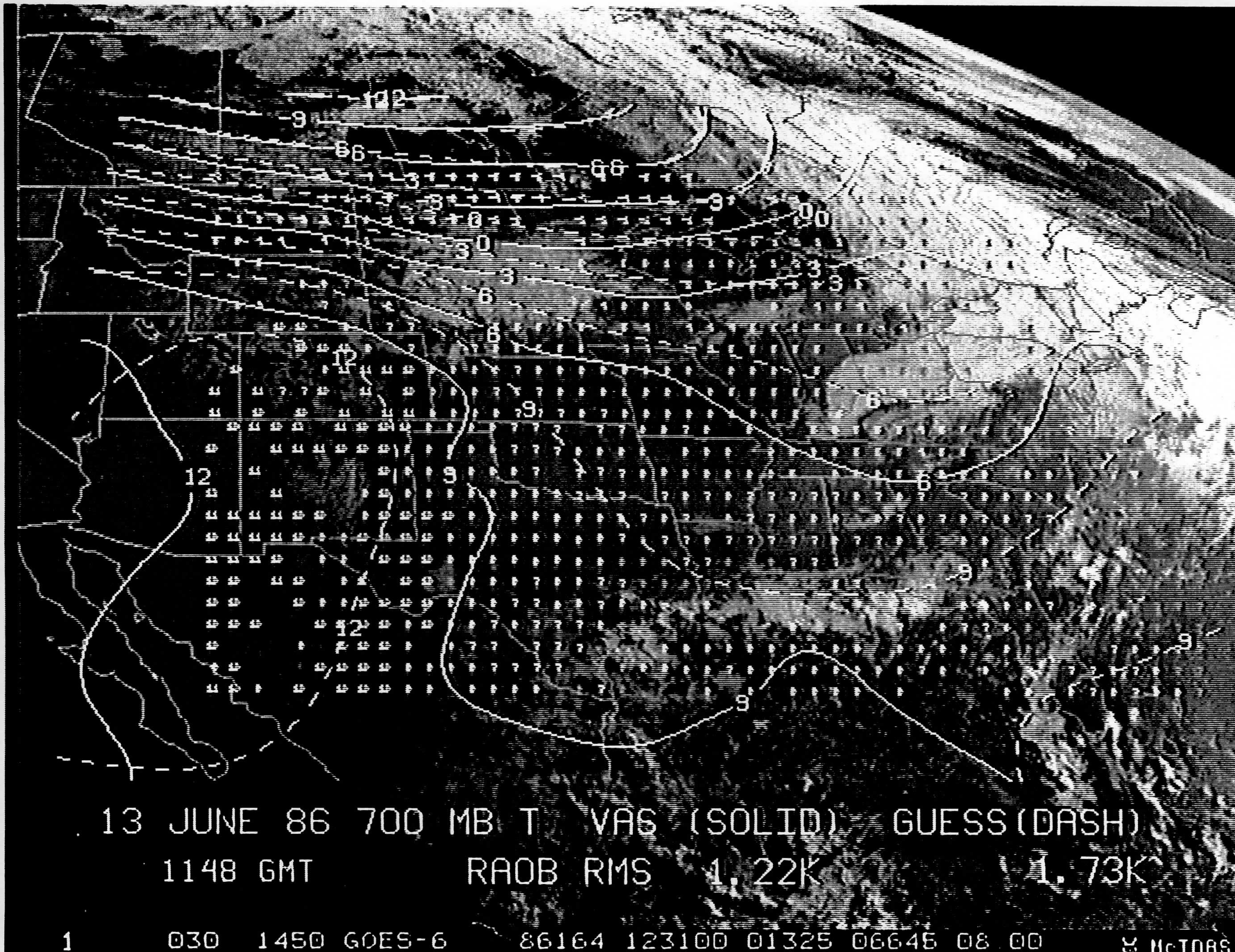

13 JUNE 86 700 MB T VAS (SOLID) GUESS(DASH)
1148 GMT RAOB RMS 1.22K 1.73K
1 030 1450 GOES-6 86164 123100 01325 06645 08 00
McIDAS

FIGURE 2

III. DERIVED PRODUCT IMAGERY

An important part of the VAS retrieval processing, in addition to the production of temperature and moisture profiles for the 11x11 fov samples, is the display of full resolution images of precipitable water and stability. For these images, a retrieval is sought for each individual fov so that the stability and precipitable water can be calculated at that resolution. It is prohibitive, in terms of computer usage, to attempt a complete retrieval for each fov, and not even sensible since cloud and noise filtering requires some sort of ensemble averaging. So a compromise is made. As described above, the 11x11 processing, if successful, provides a matrix to apply to the radiance discrepancy vector to produce the solution coefficients. For full resolution processing, this same matrix is applied to each of the 121 radiance discrepancy vectors (observation minus the final 11x11 estimate) individually, provided that they pass a rather lenient cloud test. The resultant solution coefficients are applied to the basis functions, exactly as in the case of the 11x11 retrieval, to produce the single fov retrieval. From this, preciptable water or stability is calculated and converted into a display value for storage in an area (see Section VI).

In the VDUC system the imaging cloud test requires that the 11 micrometer measurement be within 18K of the surface air temperature. Should the fov fail the cloud test, the VAS infrared window (11 micrometer) observation is inserted in the image to give an aesthetically pleasing "cloud picture" where the derived product cannot be determined.

The first half of the dynamic range of the image grey scale is allocated to the derived product; the second half to the 11 micrometer radiances. When the image is displayed one can color enhance the lower half to accentuate detail while leaving the cloud features as cloud images. Figure 3 provides an illustration of a derived image. The top shows a time sequence of the VAS derived lifted index over central U.S. on 13 May 1986 at 1430, 1730, and 2030 GMT. The bottom shows corresponding coverage of total precipitable water. Actual values can be interpreted from the grey scale provided (color presentation is considerably better). The images shown in the figure have been post-processed with a five point filter to slightly smooth the product. Even at that, the individual fov values are somewhat noisy since the single fov radiances are noisy relative to the areal average and since the cloud tolerance is loose. Nevertheless, coherent small scale features can be seen, particularly in regions where strong horizontal gradients exist.

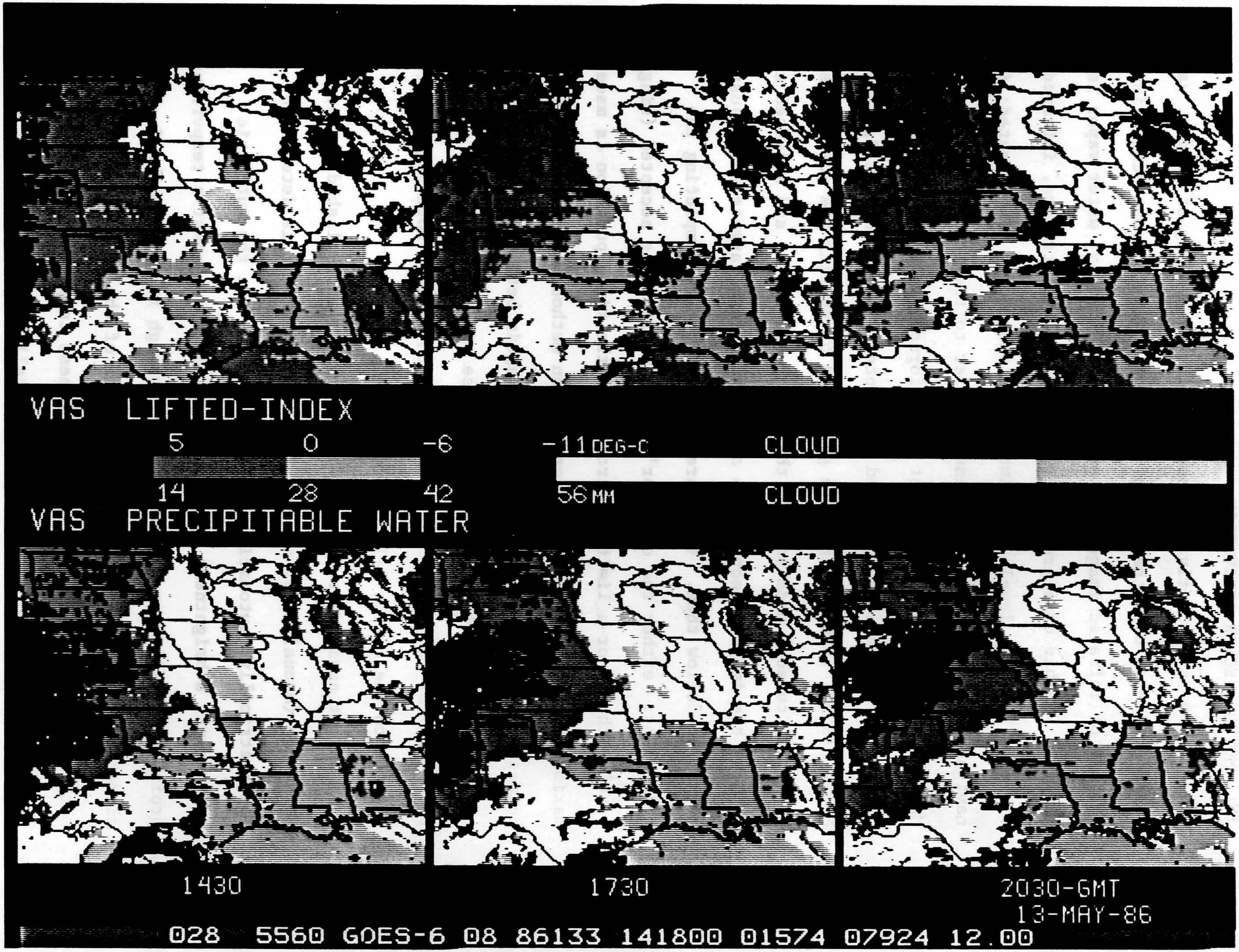

VAS LIFTED-INDEX
5
0
-6
-11 DEG-C
CLOUD
14
28
42
56 MM
CLOUD
VAS PRECIPITABLE WATER
1430
1730
2030-GMT
13-MAY-86
028 5560 GOES-6 08 86133 141800 01574 07924 12.00

FIGURE 3

IV. MOTION VECTOR DERIVATION

Motion vector derivation begins with the staging of images, usually three, centered over the area of interest. With current scheduling, visible or infrared images are selected half hourly; water vapor images hourly. Visible data are used to track low level tracers, infrared data are used for high level. The images are assumed to be navigated; if navigation corrections are necessary refer to the McIDAS Navigation Manual (SSEC, 1986). The ingest is performed via the ingest scheduler; maintenance of this is described in Chapter 2 of the McIDAS Operators Manual (SSEC, 1986). Winds are generated by putting the joy sticks into "velocity cursor" mode so that the cursor can be set and adjusted to move as the images "loop." The operator selects targets and adjusts the cursor to follow them. there are two methods for completing the adjustment: either the operator's final position is accepted (single pixel method); or a limited search about the final position is made to maximize pattern correlation (correlation method). A vector is computed between the first and second image, and again between the second and third image. These are expected to agree within a tolerance of 5 meters per second or they are flagged in the output file. Both vectors are written to the output file.

Height assignment for visible vectors is accomplished by operator selection (manual mode) and for infrared vectors it is determined radiometrically (automatic mode) or manually. In the automatic assignment, a brightness temperature is matched against a temperature profile, usually from a forecast model though it may also be from climatology, to derive the pressure level of the tracer. The model for matching is a simple temperature/brightness temperature regression relationship derived from matches of satellite measurements of wind and

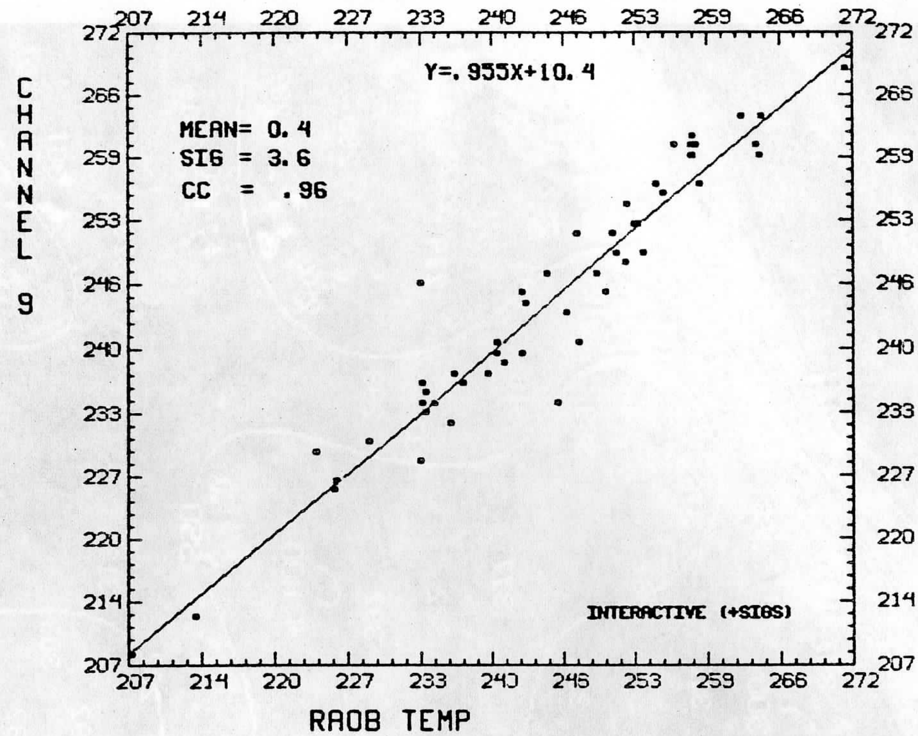


FIGURE 4

brightness temperature versus coincident radiosonde measurements of wind and temperature where the winds agree most closely. A typical sample for obtaining the relationship is shown in Fig. 4.

An initial estimate of the wind may be available for the infrared vectors if the operator chooses. This appears on the graphics over the images as three dots corresponding to the cursor position for the initial frame and the position forecast for the second and third frames. The initial estimate is usually derived from the 12 and 24 hour predicted wind fields of the NWS LFM just as in the case of the retrieval. It is interpolated from the standard pressure levels to the tracer level determined radiometrically. An initial estimate is especially desirable for water vapor motion tracing which can occasionally be ambiguous.

Fig. 5 shows an example of cloud height assignments for 6.7 micrometer wind tracers of 13 June 1986. Note that good coverage is achieved in the absence of cloud and that the assigned pressures are higher in the clearer areas.

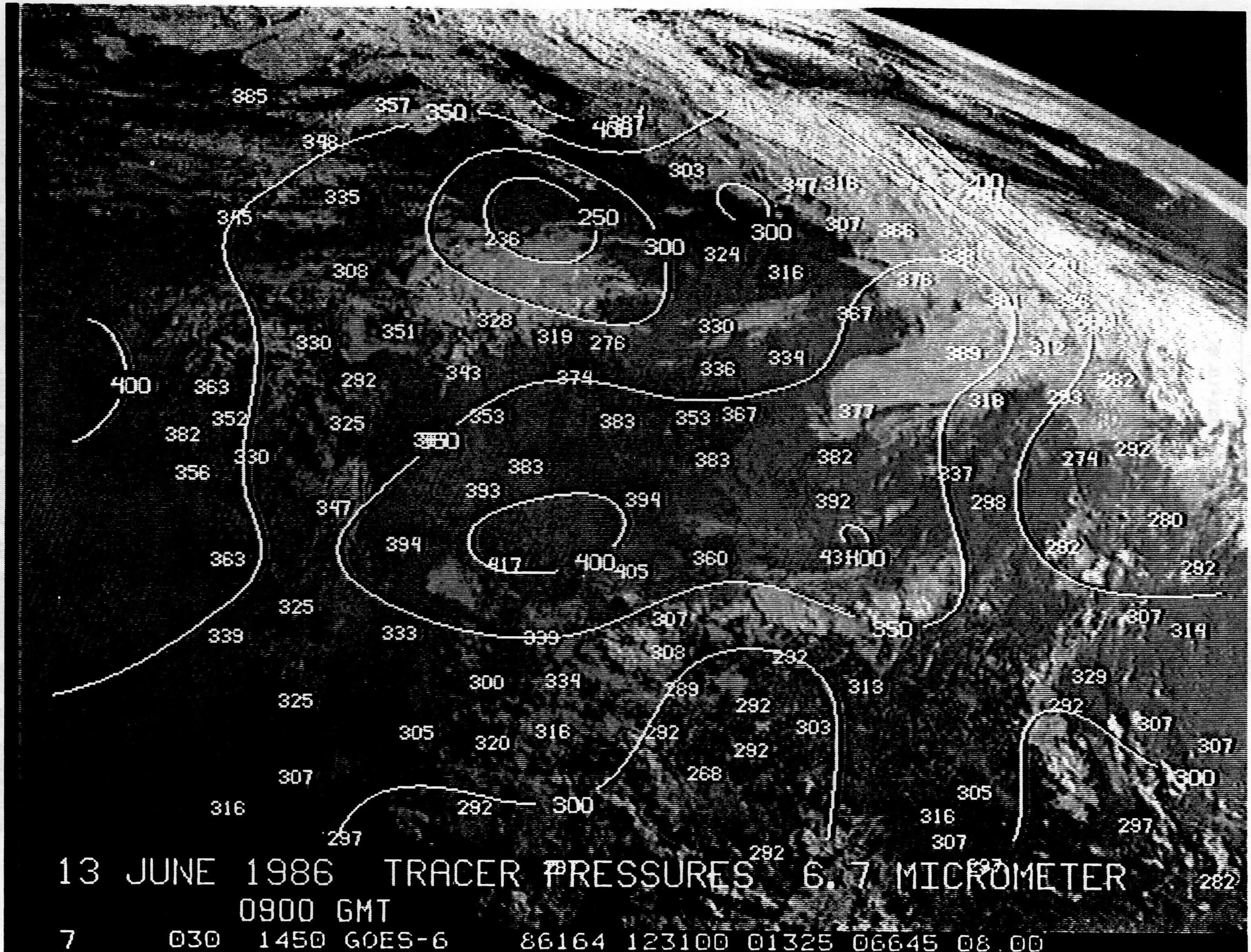

13 JUNE 1986 TRACER PRESSURES 6.7 MICROMETER
0900 GMT
7 030 1450 GOES-6 86164 123100 01325 06645 08.00

FIGURE 5

V. VAS PROCESSING

A. Retrievals

VAS processing in support of operations will be accomplished by specialized macros which link many individual programs. The VDUC operator is thus relieved of the responsibility of knowing the complete system. Appendix C lists the main macros used in support of the three national centers and the typical processing scenario that they enable (see Table 3). Nonetheless, it is useful to be familiar with the basic steps around which the macros are built. The sequence of simple steps outlined below traces the retrieval process through parts 1 and 2 of Table 3. A flow chart is shown as Fig. 6. Program names are included below as four letter capitalized acronyms enclosed in parentheses. A more complete description of these and other VAS programs associated with other processing steps is given in the following section.

- Create files required in VAS retrieval processing: these are comprised of MD and grid files (see Section VI for an explanation) to store products (e.g. first guess, surface data, output).
- Locate and point to a dwell sound file (VPVA). This pointer is used by all the VAS processing software to identify the basic data source.
- Initialize a terminal dependent text file which will establish a number of connections between the processing algorithms (IDVA). (See Appendix B for description of text file.)
- Prepare a special MD file for surface data (CSVA).
- Prepare grids of the surface parameters 1ØØØ mb height, sea level temperature and sea level dewpoint depression using the surface MD file to serve as a lower boundary condition for the retrieval (SFVA).

TABLE 3: A TYPICAL PROCESSING SCENARIO

1. Collect initial guess temperature profile from 0Z 12 hour LFM forecast.
2. Begin automatic generation of retrievals from northern and southern pairs of dwell sounds.
3. Edit the soundings manually by examining
   - horizontal consistency
   - deviation wrt first guess at 700, 500 and 300 mb
   - spot checking heights to current RAOB data

   or auto-edit with macro
4. Analyze objectively the edited fields
   - Z, T, T_D at 1000, 850, 700, 500, 250 mb
   - total totals and LI
   - total precip
5. Generate gradient winds.
6. Create and analyze energy parameters.

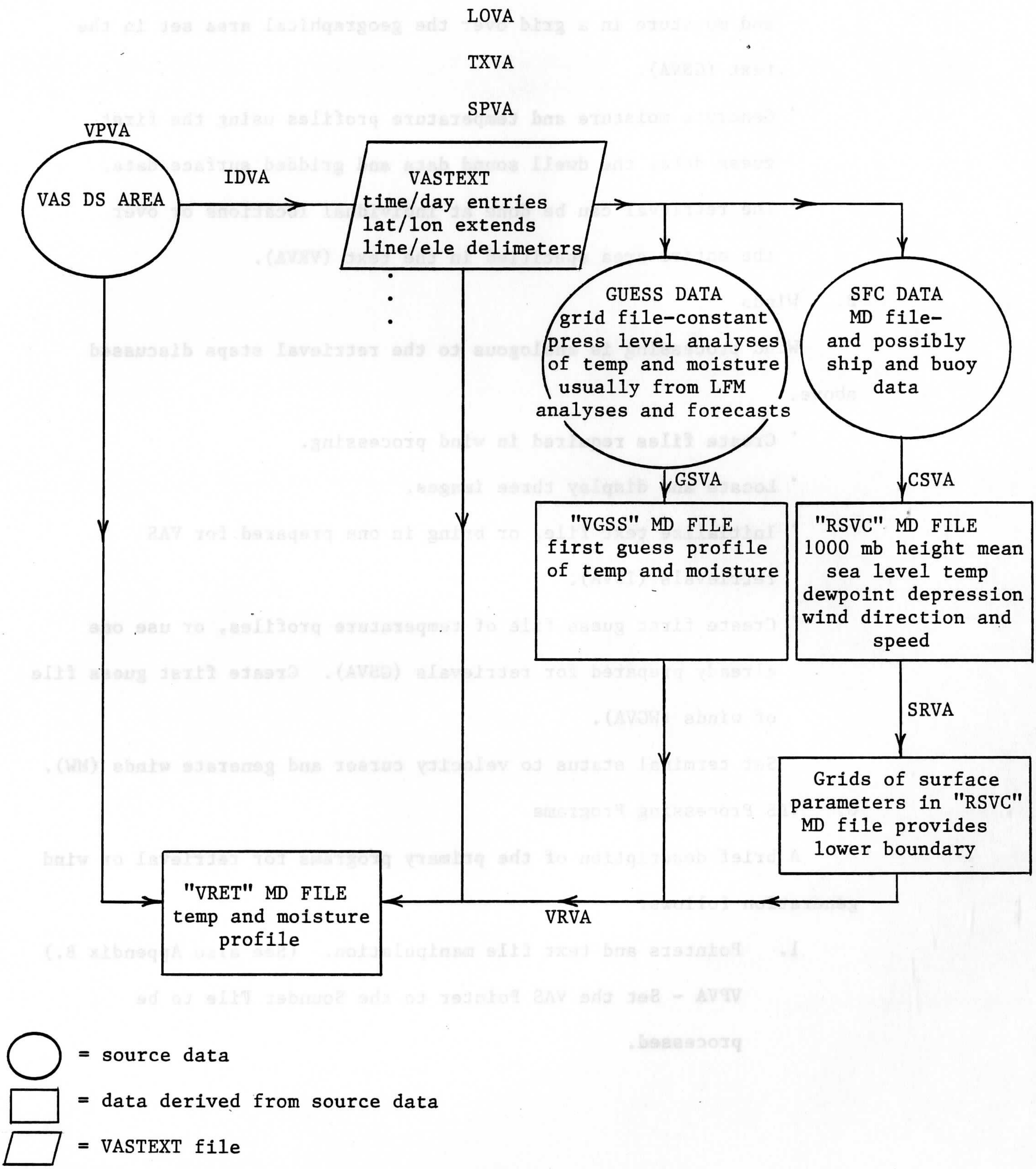

LOVA
TXVA
SPVA
VPVA
VAS DS AREA
IDVA
VASTEXT
time/day entries
lat/lon extends
line/ele delimeters
GUESS DATA
grid file-constant
press level analyses
of temp and moisture
usually from LFM
analyses and forecasts
SFC DATA
MD file-
and possibly
ship and buoy
data
GSVA
CSVA
"VGSS" MD FILE
first guess profile
of temp and moisture
"RSVC" MD FILE
1000 mb height mean
sea level temp
dewpoint depression
wind direction and
speed
SRVA
Grids of surface
parameters in "RSVC"
MD file provides
lower boundary
"VRET" MD FILE
temp and moisture
profile
VRVA
= source data
= data derived from source data
= VASTEXT file

FIGURE 6

- Create a first guess file containing profiles of temperature and moisture in a grid over the geographical area set in the text (GSVA).
- Generate moisture and temperature profiles using the first guess data, the dwell sound data and gridded surface data. The retrieval can be done at individual locations or over the entire area specified in the text (VRVA).

B. Winds

Wind processing is analogous to the retrieval steps discussed above.

- Create files required in wind processing.
- Locate and display three images.
- Initialize text file, or bring in one prepared for VAS retrievals (IDVA).
- Create first guess file of temperature profiles, or use one already prepared for retrievals (GSVA). Create first guess file of winds (WGVA).
- Set terminal status to velocity cursor and generate winds (MW).

C. VAS Processing Programs

A brief description of the primary programs for retrieval or wind generation follows:

1. Pointers and text file manipulation. (See also Appendix B.)

   VPVA - Set the VAS Pointer to the Sounder File to be processed.

IDVA - Initialize terminal dependent documentation text file according to the Sounder File set with VPVA and latitude/ longitude bounds selected by operator. Retrieval MD file and row are also initialized by this command.

SPVA - Set parameters in the terminal text file. Most parameters are set by the processing programs, However, this program may be used to change values. Parameters facilitate linkage of the retrieval program with ancillary data sets, e.g. surface grids, first guess profile, etc.

LOVA - List terminal text parameters on CRT.

TXVA - Move terminal documentation file to or from global save file "ALLTEXT" using user specified ID number.

2. Establishing ancillary data.

CSVA - Access current surface data (can also use historical data) in MD file corresponding to date/time in text file and write specialized surface MD file ("RSVC," see Appendix B) for use by SRVA surface grid analysis program. MD file and row number are written into text file. Multiple calls concatenate SVCA, ship and buoy data.

SFVA - Use MD file established by CSVA to create (by separate call) gridpoint analyses of mean sea level temperature, 1000 mb height, surface dewpoint depression and surface pressure to serve as boundary conditions for the retrieval. Output grid file and grid numbers for various parameters are written into text file.

GSVA - Prepare an MD file of first guess temperature and moisture profiles for use by the retrieval program (and also by the RFVA objective analysis program if a first guess is desired). Rows and columns of this MD file ("VGSS") correspond to a grid of guess vectors. These are prepared from a grid file containing constant pressure level analyses of temperature and moisture which is usually prepared from NMC analyses/forecasts. Source grid file and MD file numbers are written into text file.

WGVA - Prepare an MD file of wind components for use by wind programs. This is very similar to GSVA and MD file ("WGSS") is a grid of wind vectors. This is prepared from a grid file containing constant pressure level analyses of wind components, usually obtained from NWS analyses/forecasts.

3. Creating retrievals.

VRVA - Create VAS temperature profiles/images using information contained in text file (and in key-in). Retrievals are written into MD file ("VRET") initialized by IDVA (or by SPVA).

SNDVA - Create energy parameters in an MD file ("ENGY") for all unedited retrievals.

4. Creating gradient winds.

RFVA - Recursive filter objective analysis program. Uses text file to establish latitude/longitude limits, MD file for data and first guess (if desired). A primary use of this program is to analyze geopotential heights which are subsequently used to generate gradient winds. It is also used to provide gridded fields in auto editing, and to prepare gridded output for display.

GWVA - Calculate gradient winds from geopotential grid file and write wind speed and direction into retrieval MD file.

5. Creating winds from images.

MW - Create motion vectors using images and information contained in text file (and in key-in). Retrievals are written into MD file ("VWIN").

6. Examining, editing.

PLVA - Plots information contained in MD files on video graphics. Uses documentation file. Main advantage over other plot programs is that it allows simple plot of difference quantities which are useful in editing.

EXVA - Examine a sounding at the location of the cursor or by key-in number. Retrieved temperature and change to guess are displayed on CRT.

VL - lists (or plots SKEWT) VAS retrieval at cursor location. Differs from EXVA in providing geopotential, dewpoint, and wind information, but no first guess values.

XRVA - Delete all or a portion of retrieval at cursor location. For complete edit this program changes the MOD flag in the MD file to indicate rejection. For partial edit, the specified parameters are replaced by missing indicator.

RXVA - Restore edited report at cursor location by replacing the MOD flag. Cannot restore a partially edited report.

ESVA - Delete or add surface data to "RSVC" MD file. Former function is occasionally necessary when auto editor of SFVA does not work. This may be used to add information from sources not readily included when surface MD is created.

DV - Delete vectors from the wind file of change parameters within the file.

LISWIN - list the winds in the "VWIN" MD file; either within the cursor or by key-in.

7. Troubleshooting.

VDVA - Displays on CRT VAS Brightness Temperatures at cursor location.

GPVA - Displays on CRT first guess temperature profile and surface data at cursor location.

GVVA - Displays on CRT the value from a specified grid file, interpolated to the cursor location.

WINGES - Displays on CRT the value of pressure interpolated wind first guess at the cursor location.

8. Evaluating data.

CMMD - Compares collocated reports from different MD files; writes statistics on CRT and temporarily saves sample in "RGCOMP" LW file (see Section VI).

CMVA - Compares reports in MD with a gridded analysis; writes statistics and saves exactly as CMMD.

CGVA - compares two gridded analyses; writes statistics and saves sample. Grids may be different in extent, increment, but must be pseudo-mercator (the standard VDUC projection).

SVRG - Save (or restore) terminal dependent temporary file "RGCOMP" to/from LW file of user's choice. "Compare" programs all have option of adding to existing file.

PTVA - Plot scatter diagram on CRT and compute statistics for RGCOMP file. Also contains option to edit data by cursor location on scatter diagram.

D. Interactive Steps in the VAS Processing

Some of the interactive steps in the VAS processing are detailed in this section. The macros (MAKKC for NSSFC, MAKNHC for NHC, and MAKNMC for NMC) automatically process the VAS retrievals. The macros (PPKC, PPNHC, and PPNMC) also automatically generate derived products, gradient winds, and gridded analyses.

To check that the processing occurred, the following steps are useful (the numbers for files, areas, ... will need to be coordinated with the local VDUC allocations):

1. Did the VAS retrieval MD files get generated?

   For NSSFC, use VL AVA MDF, 1441

2. Did the grid files get generated?

   Use IGG LIST GRIDF, 1441

3. Did the derived product image areas get generated?

   Use LA 1460 1469 to see the PW images.

4. Did the gradient winds get generated?

   Use MDOX 1441 ROW,1 COL,1 and look for spd/dir parameters in the output. Alternately, plot the gradient winds by using PV 1441

5. Are the VAS dwell sounding areas present?

   Use LA 1300 1310

6. Is the Service A data in place?

   Use SL 10 12

7. Is the guess field in?

   For the LFM and GBL guesses, use IGU LIST 1600 1612

7a. If these are not found in gridfiles 1600-1612, check the CTF files by using NMCG.

7b. If the guess fields are not in, resubmit the request to NMC for the global or the LFM guess using XML NMNGBL00/12 or

XML NMNLFM00/12 and then transfer them to working gridfiles

DONMCO Ø 1600 L (for LFM).

8. Call the operator if any of these data streams are missing.

To perform quality control beyond that automatically done by the auto-editor in the "PP" macros, the following steps are useful.

9. If for some reason the "PP" program failed, resubmit it manually.

    Use PPKC...

10. Display the VAS coverage area by using

    DF...

11. Request the latest forecast to determine regions of special attention

    YA 289 MKC AC

12. Are you connected to the correct areas and files? Make sure by using

    VPVA (sounder area)

    TXVA (VRET file) IN

    MDU SET (VRET file)

    LOVA

13. To check for consistency with raobs, call up the raob plots using

    UP Z 300/500/850 SAT 12

    and plot selected parameters

    PLVA Z 300/500/850

    PLVA LI

    PLVA WV

    IGTV X 30 SAT GRIDF, (VRET GRIDFILE)

15. Edit bad values by positioning the cursor and using

XRVA

16. After data is approved, notify center of interest using

MAIL

Some of the commands suggested here are not VAS specific and are documented in the McIDAS Reference Manual (SSEC, 1984). Further, information can be found there or by using the HELP command.

VI. STORAGE OF PRODUCTS

The VDUC system provides for storage of data in four forms: LW files; MD files; grid files; and areas. The manner in which these are utilized in the VAS Processing is as follows.

A. LW Files

The LW file is the basic unformatted storage medium. Many data sets relevent to VAS processing are stored this way (e.g. regression coefficients, tuning constants, transmittance values), but the only ones with direct user interface are the terminal dependent text file VASTEXT and the terminal dependent RGCOMP for verification.

B. Grid Files

Grid files are a specially formatted way of storing two-dimensional (gridded) information which can be readily accessed using system subroutines. Grids are used internally in VAS processing (e.g. to represent surface data for use in the retrieval, to permit calculation of gradient winds from geopotential), but more importantly, for output of products which can be readily displayed on monitor graphics.

C. MD Files

MD files are a specially formatted way of storing data vectors. The files are three-dimensional (row, column, data). The most common usage is to differentiate time periods by rows, stations by column, with reported values under data. The formatting of an individual MD file can vary (within the row, column, data restriction) according to the specification of the SCHEMA, which defines the members of the three dimensions. There are four schemas used with VAS retrieval processing (VGSS, RSVC, VRET and ENGY for the initial guess vector, surface reports, retrieval values, and buoyant energy estimates, respectively). Additional MD files used in wind processing are WGSS and VWIN for guess and output, respectively. A description of these schemas is given in Appendix B. System supported routines for accessing and displaying station data expect the MD format.

D. Area Files

Area files are formatted three-dimensional files for storing satellite observations. VAS dwell soundings are stored as area files by line, element, band. System software exists for accessing these data, most notably for imaging data on the television monitor. The derived-product imagery produced by VAS processing is stored in area format.

VII. VAS PROCESSING MAINTENANCE

There are two aspects to processing maintenance. One concerns the stability of the retrieval algorithms, the other special tailoring for different users. The temperature retrieval software contains "bias" vectors which are periodically adjusted so that the retrievals will more closely match contemporary radiosonde measurements. This is currently done in a somewhat ad hoc manner which has yet to be formalized. Consequently, it is anticipated that the bias vectors will continue to be adjusted by the SDAB at Wisconsin and sent to the VDUC via the data link. This responsibility will be transferred when the problem is better understood and a regular procedure has been implemented. In addition, the regression relationships for assigning height to motion vectors are not fully understood. It is anticipated that SDAB will monitor this problem as well.

Special tailoring for different users involves the introduction of different schedules and macros when support is shifted from one national center to another. Since the scheduling is a fairly straightforward task, it is anticipated that it will be performed by the IPB at World Weather Building with support from the ASPP at Wisconsin. Initially, macros for processing the VAS will be provided for each of the major programs (e.g. EPAC, NSSFC, and NHC support; see Appendix C), but the IPB will be expected to initiate requested changes, and the macros will not be supported by Wisconsin to the extent that the lower level software will.

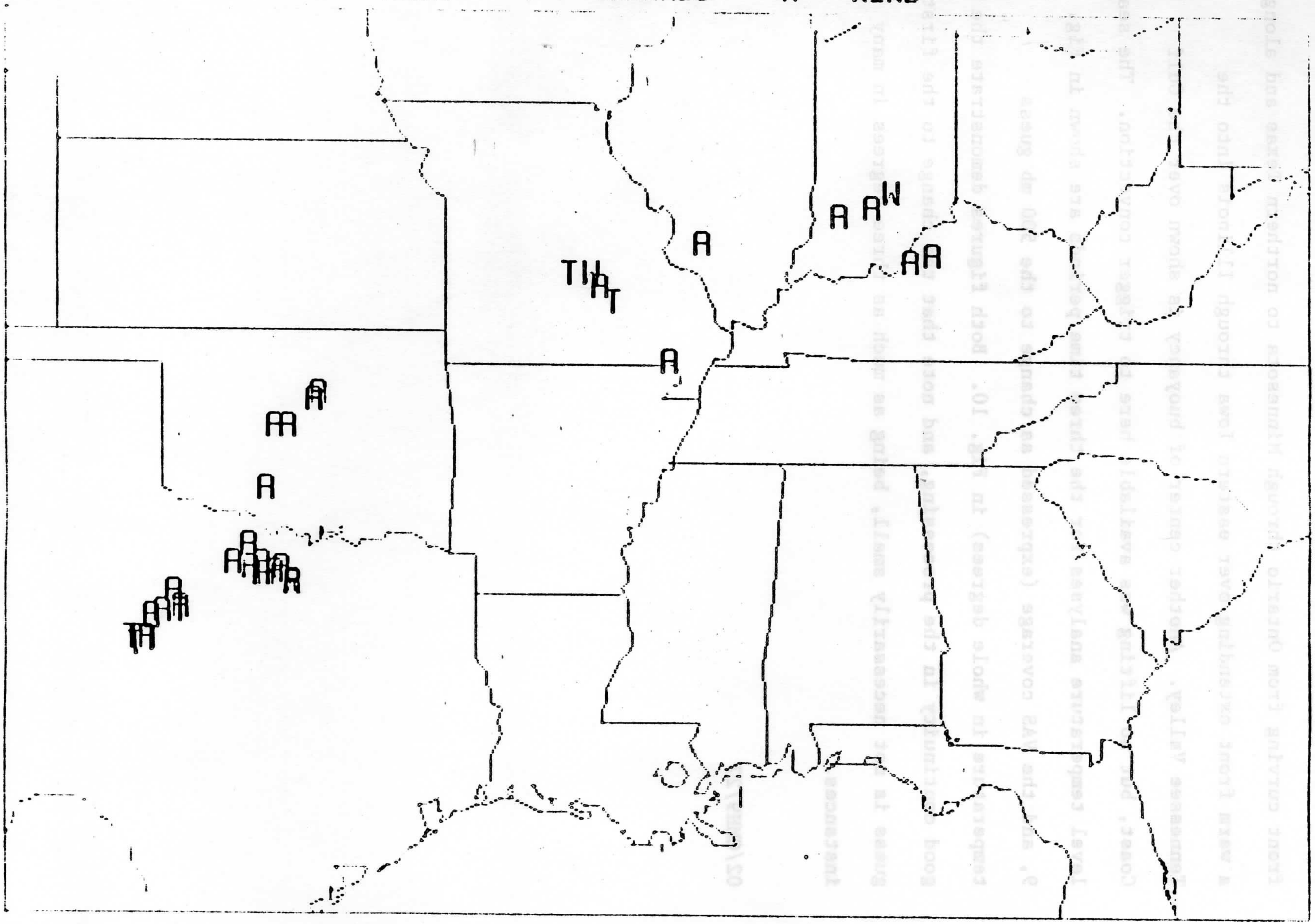
VIII. BENCHMARK DATA SET

A benchmark data set is being provided with the VDUC to validate the VAS software included with the system. The data consists of three time periods of dwell soundings for 13 May 1986, with ancillary data necessary for processing, and the final VAS products. This day is reasonably interesting in terms of VAS support to severe weather forecasting.

The synoptic situation is briefly summarized as follows. At 12 GMT, a well-defined upper trough was moving across the northern plains and was expected to continue moving eastward towards the mid-Mississippi Valley. A surface cold front curved across northwest Ontario through Minnesota and continued to a low over northern Texas. A warm front extended over eastern Iowa through Illinois and into the Tennessee Valley. Strong thunderstorm activity was expected along the frontal boundary where the airmass ranged from moderate to very unstable. The airmass continued to destabilize throughout the day as depicted in the derived lifted index imagery. The destabilization was most pronounced in Oklahoma and Texas where the first severe weather was reported as approximately 23 GMT. At upper levels, the subtropical jet was oriented across central Texas, with pronounced mid and upper level diffluence through the central plains. The dry intrusion associated with the subtropical jet and the evolution of the diffluence pattern can be monitored using the 6.7 μm water vapor imagery.

The severe reports are shown in Fig. 7, and these can be compared with the three analyses of buoyancy shown in Fig. 8 for 1030, 1200, and 1330 GMT. It is apparent that the VAS-derived energy is a consistently good indicator of where the severe weather can be expected along a cold front curving from Ontario through Minnesota to northern Texas and along a warm front extending over eastern Iowa through Illinois into the Tennessee Valley. Another center of buoyancy is shown over the Gulf Coast, but no lifting was available here to trigger convection. The sea level temperature analyses for the three time periods are shown in Fig. 9, and the VAS coverage (expressed as change to the 500 mb guess temperature in whole degrees) in Fig. 10. Both figures demonstrate the good continuity in the processing, and note that the change to the first guess is not necessarily small, being as much as three degrees in many instances.

02/CMH9/27



SEVERE REPORTS 13 MAY 1986

FIGURE 7

FIGURE 8

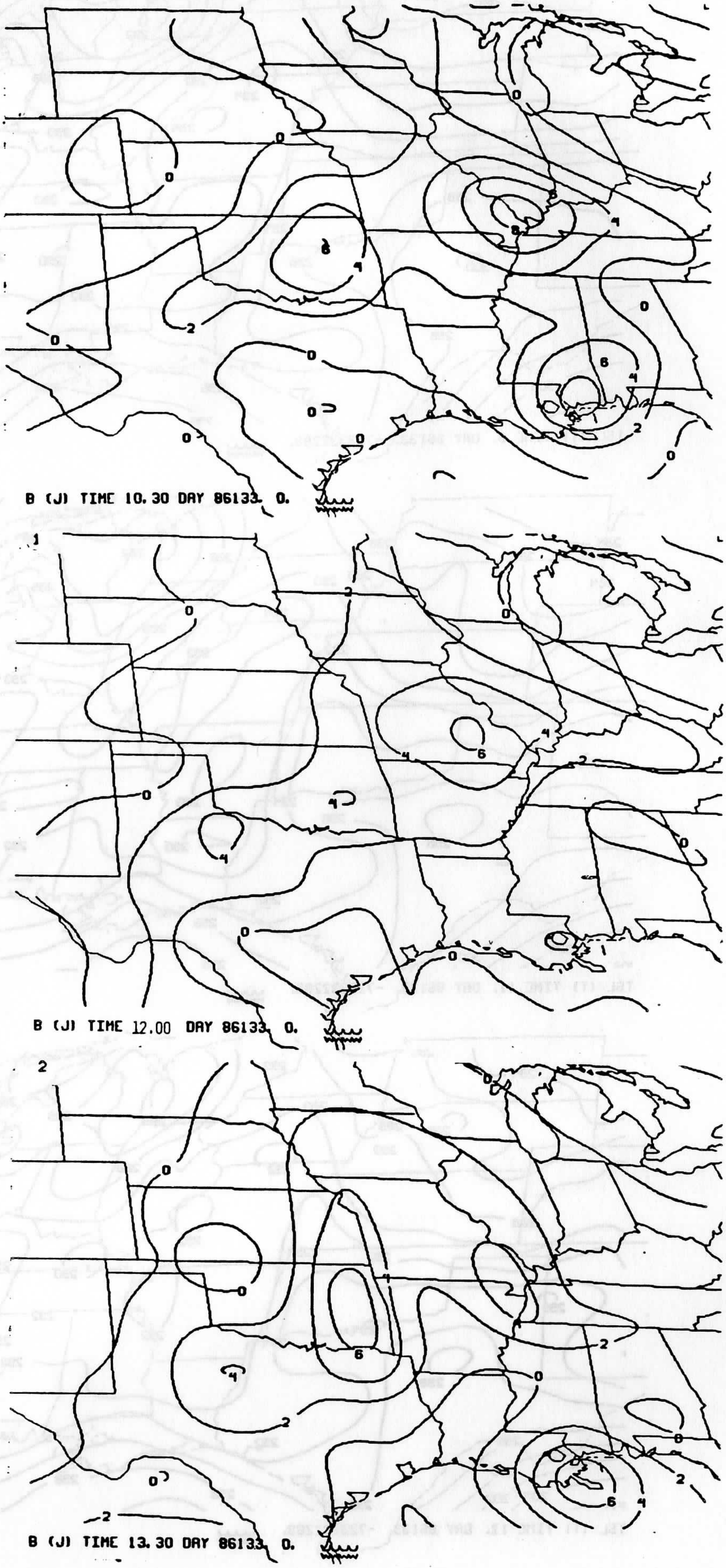
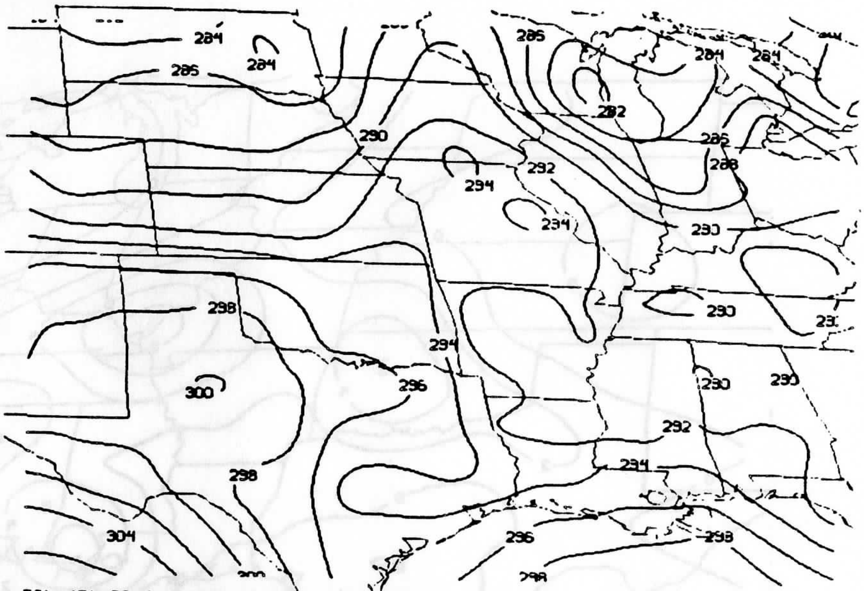
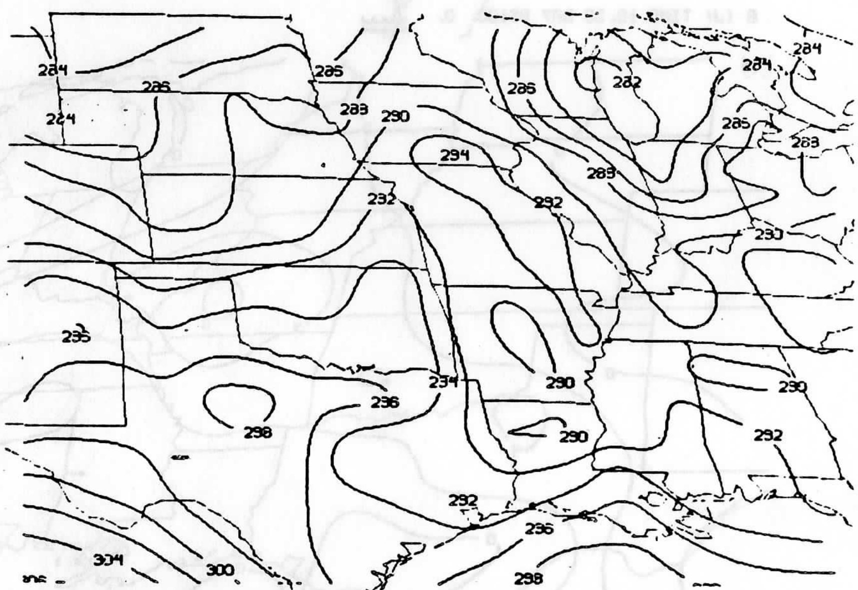

B (J) TIME 10.30 DAY 86133. 0.
B (J) TIME 12.00 DAY 86133. 0.
B (J) TIME 13.30 DAY 86133. 0.

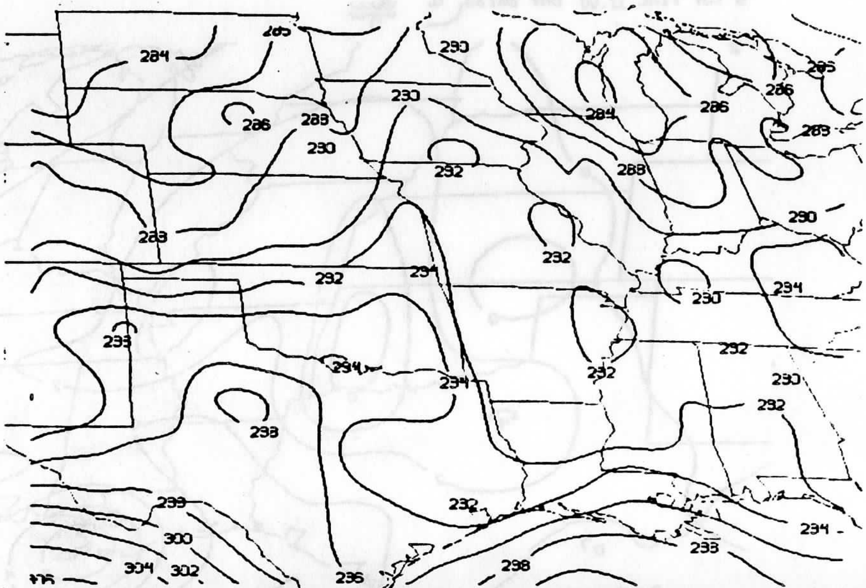
FIGURE 9



TSL (T) TIME 8. DAY 86133. -723332288.

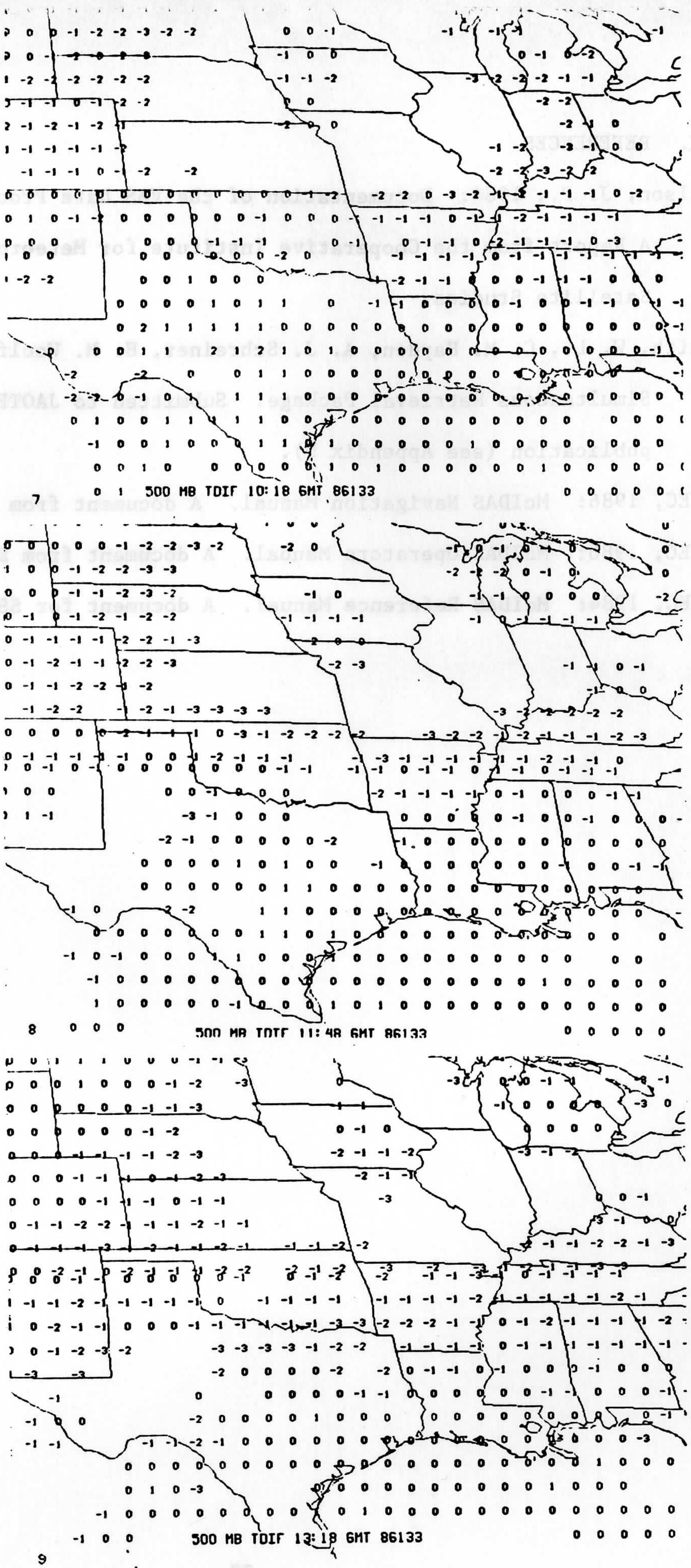


TSL (T) TIME 11. DAY 86133. -723332288.



TSL (T) TIME 12. DAY 86133. -723332288.

FIGURE 10



500 MB TDIF 10:18 GMT 86133
7
500 MB TDIF 11:48 GMT 86133
8
500 MB TDIF 13:18 GMT 86133
9

IX. REFERENCES

Nelson, J. P., 1984: Documentation of the VAS Data Processing Software. A Report from the Cooperative Institute for Meteorological Satellite Studies.

Smith, W. L., C. M. Hayden, A. J. Schreiner, H. M. Woolf, 1986: A Simultaneous Retrieval Package. Submitted to JAOTEC for publication (see Appendix D).

SSEC, 1986: McIDAS Navigation Manual. A document from SSEC.

SSEC, 1986: McIDAS Operators Manual. A document from SSEC.

SSEC, 1984: McIDAS Reference Manual. A document for SSEC.

APPENDIX A: TEMPERATURE PROFILE RETRIEVAL IN THE RADIATIVE TRANSFER FORMULATION

Radiative transfer serves as a mechanism for exchanging energy between the atmosphere and the underlying surface and between different layers of the atmosphere. Infrared radiation emitted by the atmosphere and intercepted by satellites is the basis for remote sensing of the atmospheric temperature structure.

The radiance leaving the earth-atmosphere system which can be sensed by a satellite borne radiometer is the sum of radiation emissions from the surface and each atmospheric level that are transmitted to the top of the atmosphere. Considering the earth's surface to be a blackbody emitter (emissivity equal to unity), the upwelling radiance intensity, I_λ, for a cloudless atmosphere is given in Table A1

$$I_\lambda = B_\lambda (T(p_s))\tau_\lambda(p_s) + \sum_p \varepsilon_\lambda(\Delta p)B_\lambda(T))\tau_\lambda(p)$$

where the first term is the surface contribution and the second term is the atmospheric contribution to the radiance to space.

The fundamental principle of atmospheric sounding from orbiting meteorological satellites utilizing the thermal infrared emission is based on the solution of the expression described by Table A1, known as the radiative transfer equation. In this equation, the upwelling radiance arises from the product of the Planck function, the spectral transmittance, and the weighting function. The Planck function consists of temperature information, while the transmittance is associated with the absorption coefficient and density profile of the relevant absorbing gases. Obviously, the observed radiance contains the temperature and gaseous profiles of the atmosphere, and therefore, the information content of the observed radiance from satellites must be physically related to the temperature field and absorbing gaseous concentration.

The mixing ratio of CO_2 is fairly uniform as a function of time and space in the atmosphere. Moreover, the detailed absorption characteristics of CO_2 in the infrared region are well-understood and its absorption parameters, i.e. half width, line strength, and line position, are known rather accurately. Consequently, the spectral transmittance and weighting functions for a given level may be calculated once the spectral interval and the instrumental response function have been given. The VAS temperature sounding channels have been chosen in the CO_2 absorption band.

It is apparent that measurements of the upwelling radiance in the CO_2 absorption band contain the information of temperature values in the interval $(p_s, 0)$, once the surface temperature has been determined. However, the information content of the temperature is under the integral operator which leads to an ill-conditioned mathematical problem. The method for the recovery of the temperature profile from a set of radiance observations in the CO_2 band has been discussed in Section II. Table A2 summarizes the ancillary data needed for solution of the temperature profile.

UPWELLING RADIANCE FROM EARTH-ATMOSPHERE SYSTEM

$$I_\lambda = B_\lambda(T(P_S))\tau_\lambda(P_S) + \sum_P \varepsilon_\lambda(\Delta P)B_\lambda(T(P))\tau_\lambda(P)$$

= SURFACE CONTRIBUTION + ATMOSPHERE CONTRIBUTION

WHERE I = INTENSITY

B = PLANCK FCN.

T = TEMPERATURE

τ = TRANSMITTANCE

ε = EMSSIVITY

OR IN INTEGRAL FORM

$$I_\lambda = B_\lambda(T(P_S))\tau_\lambda(P_S) + \int_{P_S}^{0} B_\lambda(T(P)) \frac{d\tau_\lambda(P)}{d\ln P} \, d\ln P$$

WHERE

$$\frac{d\tau_\lambda}{d\ln P} = \text{WEIGHTING FUNCTION}$$

TABLE A1

GIVEN $I_{\lambda 1}, I_{\lambda 2}, \ldots, I_{\lambda n}$ SOLVE FOR T(P).

I_λ FROM VAS OBSERVATIONS

P_S, $T(P_S)$ FROM CONVENTIONAL SURFACE OBSERVATIONS

τ_λ FROM TRANSMITTANCE MODELS

AND FOR PERTURBATION SOLUTION THE FIRST GUESS

$T°(P)$ FROM LFM PREDICT,

VAS UPDATE, OR

RADIOSONDE

TABLE A2

APPENDIX B: VAS PROCESSING SCHEMAS AND TEXT FILE

The basic storage medium for position (in space or time) dependent data (i.e. a "report") is the Meteorological Data (MD) file introduced in section VI. Data handling programs (e.g. plotting, gridding routines) on the VDUC expect to access data through a set of system subroutines which communicate with the MD file. The communication is handled by a special type of formatting known as a "SCHEMA." There are many SCHEMAS resident in the VDUC; each associated with a particular data type. When an operator wishes to establish a data file, he creates the MD file using the MD utility software (in this case, MDU MAKE), identifying the SCHEMA he wishes to use. The file is then formatted according to the SCHEMA which identifies the location of all variables associated with that MD file. Take the SCHEMA in Table B1 as an example. This is the RSVC SCHEMA. The VAS program CSVA (see VA) uses this SCHEMA to store surface data. For example, the MD output file specified in calling CSVA is anticipated to have this SCHEMA and the elevation of each report is stored in the fifth word of each data vector. Thereafter, when a plot program is asked to plot elevation from this MD file, it will identify the parameter "ZS," by means of the SCHEMA, as being located in the fifth word of the data vector.

For VAS processing, four schemas have been identified for retrievals (RSVC, VGSS, VRET, ENGY) and two for winds (WGSS, VWIN). Listing of these schemas are given in the following pages as Table B1 through B6.

The terminal dependent "text" file is used to establish linkage between programs. The text consists of 100 words identified as given in Table B7. The key-in LOVA is used to display (part of) the text on the CRT as shown in Table B8.

TABLE B1

```
 * RSVC C HAYDEN 0283 SCHEMA -- SVC-A SCHEMA
 * (CMH)

   SCHEMA RSVC  1 83035 0 *RETRIEVAL SURFACE EDIT FILE

   ROWS 24                        *24 HOURS

   DAY           SYD             *YEAR AND JULIAN DAY (YYDDD)
   TIME          HMS             *NOMINAL TIME (HH0000)
   CMAX                          *MAX COL FOR THIS ROW

   COLUMNS 1200                  *NO. REPORTS

   DATA

   MOD                           *(EDIT FLAG)
   LAT   4       DEG             *RANGE (-90 => +90) POSITIVE NORTH
   LON   4       DEG             *RANGE (-180 => +180) POSITIVE WEST
   HMS                           *ACTUAL TIME OF OBSERVATION
   ZS            M               *ELEVATION
   TSL   2       DEGK            *TEMPERATURE EXTRAPOLATED TO MSL
   DD    2       DEGK            *DEW POINT TEMPERATURE DEPRESSION
   DIR           DEG             *WIND DIRECTION
   SPD           MPS             *     SPEED
   PSL   1       MB              *ALTIMETER SETTING
   Z100          M               *1000 MB HEIGHT ESTIMATE
 ENDSCHEMA
```

TABLE B2

```
* VGSS HAYDEN 0183 SCHEMA--  RETRIEVAL GUESS PROFILES
*       NAME VSN DATE  ID *TEXTID
*       ---- --- -----  -- -------
SCHEMA VGSS  1 83026 0  *RETRIEVAL GUESS PROFILES

* KEY  SCALE UNITS
* ---- ----- -----

ROWS 68                   *DATE,HOUR,LATITUDE(MAX 65)

DAY         SYD           *YEAR AND JULIAN DAY (YYDDD)
TIME        HMS           *NOMINAL TIME (HH0000)
LAT   4     DEG           *RANGE (-90 => +90) POSITIVE NORTH

COLUMNS 65                *RETRIEVALS FORM 2-D ARRAY
LON   4     DEG           *RANGE (-180 => +180) POSITIVE WEST

DATA

T100 2      K       *1000T
T85  2      K       *850 T
T70  2      K       *700 T
T50  2      K       *500 T
T40  2      K       *400 T
T30  2      K       *300 T
T25  2      K       *250 T
T20  2      K       *200 T
T15  2      K       *150 T
T10  2      K       *100 T
T07  2      K       *70  T
T05  2      K       *50  T
T03  2      K       *30  T
T02  2      K       *20  T
T01  2      K       *10  T
D100 2      K       *1000D
D85  2      K       *850 D
D70  2      K       *700 D
D50  2      K       *500 D
D40  2      K       *400 D
D30  2      K       *300 D
Z100        M       *Z1000

* END SCHEMA
```

TABLE B3

```
* VRET HAYDEN 1282 SCHEMA-- VAS SATELLITE RETRIEVALS
*      NAME VSN DATE  ID *TEXTID
*      ---- --- ----- -- -------
  SCHEMA VRET   3 83091 0  *GEO SATELLITE OBSERVATIONS (UPPER AIR DA

* KEY  SCALE UNITS
* ---- ----- -----

  ROWS 16                    *ALLOW FOR 16 ORBITS (HOURS)

  DAY          SYD      *YEAR AND JULIAN DAY (YYDDD)
  TIME         HMS    *NOMINAL TIME (HH0000)
  CMAX                 *MAX COL # CURRENTLY IN USE IN THIS ROW
  USR          CHAR         *USER
  VER                       *VERSION
  DLN                       *DELTA LINE
  DEL                       *DELTA ELEMENT
  GFG          DDHH         *GUESS GRID DAY/HOUR/VT
  GFS          DDHH         *SFC GRID DAY/HOUR
  LAX   4      DEG          *MAX LAT ON SFC GRID
  LOX   4      DEG          *MAX LON ON SFC GRID
  LAM   4      DEG          *MIN LAT ON SFC GRID
  LOM   4      DEG          *MIN LON ON SFC GRID
  INC   4      DEG          *GRID INCREMENT
  GSS                       *GUESS INDICATOR
  PDT                       *PROCESSING YYDDD
  ST                        *STATE ID-IRRELEVANT
  ZS                        *SFC ELEV-ALSO IRRELEVANT

  COLUMNS 550            *RETRIEVALS FORM 2-D ARRAY

  DATA

  MOD                       *USER MODIFICATION FLAG (1=MODIFIED)
  IDN                       *SERIAL ID NUMBER
  LAT   4      DEG          *RANGE (-90 => +90) POSITIVE NORTH
  LON   4      DEG          *RANGE (-180 => +180) POSITIVE WEST
  HMS          HMS          *ACTUAL HHMMSS
  SAM                       *SAMPLE SIZE
  V01   2      K            *VAS CHANNEL TBO
  V02   2      K            *VAS CHANNEL TBO
  V03   2      K            *VAS CHANNEL TBO
  V04   2      K            *VAS CHANNEL TBO
  V05   2      K            *VAS CHANNEL TBO
  V06   2      K            *VAS CHANNEL TBO
  V07   2      K            *VAS CHANNEL TBO
  V08   2      K            *VAS CHANNEL TBO
  V09   2      K            *VAS CHANNEL TBO
  V10   2      K            *VAS CHANNEL TBO
  V11   2      K            *VAS CHANNEL TBO
  V12   2      K            *VAS CHANNEL TBO
```

```
V13   2     K              'VAS CHANNEL TRO
C01   2     K              'VAS CHANNEL EX*100
C02   2     K              'VAS CHANNEL EX*100
C03   2     K              'VAS CHANNEL EX*100
C04   2     K              'VAS CHANNEL EX*100
C05   2     K              'VAS CHANNEL EX*100
C06   2     K              'VAS CHANNEL EX*100
C07   2     K              'VAS CHANNEL EX*100
C08   2     K              'VAS CHANNEL EX*100
C09   2     K              'VAS CHANNEL EX*100
C10   2     K              'VAS CHANNEL EX*100
C11   2     K              'VAS CHANNEL EX*100
C12   2     K              'VAS CHANNEL EX*100
PST   1     MB             'STATION PRESSURE
WV    2     MM             'PRECIPITABLE WATER
TSK   2     K              'SKIN TEMPERATURE
FLX   2     W              'LONG WAVE FLUX
BDR                        'BI-DIRECTIONAL REFLECTANCE
SZA   2     DEG            'SOLAR ZENITH ANGLE
LZA   2     DEG            'LOCAL ZENITH ANGLE
TOT   2     K              'TOTAL-TOTALS
STOT  2     K              'AVERAGED TOTAL-TOTALS
LI    2     K              'LIFTED INDEX
RH1   2                    'RELATIVE HUMIDITY LAYER 1 (PCT)
RH2   2                    'RELATIVE HUMIDITY LAYER 2 (PCT)
RH3   2                    'RELATIVE HUMIDITY LAYER 3 (PCT)
CA                         'CLOUD AMOUNT
PCT   1     MB             'PRESSURE AT CLOUD TOP
TC    2     K              'CLOUD TOP TEMPERATURE
RT                         'RETRIEVAL TYPE

REPEAT 20                  'MANDATORY LEVELS ONLY
LEV         CHAR           'LEVEL (SFC OR TRO OR SAME AS P)
P     1     MB             'PRESSURE
T     2     K              'TEMPERATURE
TD    2     K              'DEW POINT TEMPERATURE
DIR         DEG            'WIND DIRECTION
SPD         MPS            '     SPEED
Z           M              'HEIGHT
GT    2     K              'GUESS TEMPERATURE
GTD   2     K              'GUESS DEW POINT
' END SCHEMA
```

TABLE B4

```
'ENGY C HAYDEN  0785 SCHEMA-- STABILITY/ENERGY PARAMETERS
'         NAME VSN DATE  ID 'TEXTID
'         ---- --- ----  -- -------
  SCHEMA ENGY   1 83052 0  'ENERGY/STABILITY PARAMETERS

' KEY   SCALE UNITS
' ----  ----- -----

  ROWS 24
  DAY          SYD      'YEAR AND JULIAN DAY (YYDDD)
  TIME         HMS      'NOMINAL TIME (HH0000)
  CMAX                   'MAX COL # CURRENTLY IN USE IN THIS ROW

  COLUMNS 550            'RETRIEVALS FORM 2-D ARRAY

  DATA

  MOD                      'USER MODIFICATION FLAG (1=MODIFIED)
  IDN                   'STATION NUMBER
  LAT    4     DEG         'RANGE (-90 => +90) POSITIVE NORTH
  LON    4     DEG         'RANGE (-180 => +180) POSITIVE WEST
  ZS           M           'ELEVATION
  ST           CHAR        'STATE ID
  DPL    2     K        'MEAN DEW POINT LOWEST KM
  WLKM 3       G/KG     'MEAN MIXING RATIO LOWEST KM
  HCB    0     M        'HEIGHT OF LIFTING CONDENSATION LEVEL
  PCB    1     M        'PRESSURE OF LCL
  TCB    2     K        'TEMPERATURE OF LCL
  WCB    3     G/KG     'MIXING RATIO OF LCL
  PLFC 1       MB       'PRESSURE AT LEVEL OF FREE CONVECTION
  PEL    1     MB       'PRESSURE AT EQUILIBRIUM LEVEL
  PCCL 1       MB       'PRESSURE AT CONVECTIVE CONDENSATION LEVEL
  LI     2     K        'LIFTED INDEX
  KINX 2       K        'K-INDEX
  TOT    2     K        'TOTALS INDEX
  B      2     J/KG     'BUOYANT ENERGY
  BNE    2     J/KG     'BUOYANT ENERGY (LCL-LFC)
  CNE    2     J/KG     'BUOYANT ENERGY (SFC-LCL)
  TNE    2     J/KG     'BUOYANT ENERGY (TOTAL BELOW LFC; BNE+CNE)
  TC     2     K        'CONVECTIVE TEMPERATURE
  HNE    2     J/KG     'ENERGY TO REACH CONVECTIVE TEMP
  B2E    2     J/KG     'HNE + ENERGY TO REACH CCL
  VVM    2     M/S      'MAX VERTICAL VELOCITY IN UPDRAFT
  TWMN 2       K        'MINIMUM WET BULB POTENTION TEMP
  HTTW 0       M        'HEIGHT OF MIN WET BULB
  DTW    0     DEG      'WIND DIRECTION AT MIN WET BULB
  STW    0     M/S      'SPEED AT MIN WET BULB
  HWBZ 0       M/KG     'HEIGHT OF 0C WET BULB TEMP
  ADR    0     DEG      'WIND DIRECTION,3-10 KM LAYER
  ASP    0     M/S      'WIND SPEED,3-10 KM LAYER
  SHR1 1       M/S/KM   'AV SHEAR 0-3 KM
  SHR2 1       M/S/KM   'AV SHEAR 3-10 KM
  TRN1 0       M/S/KM   'TURNING OF WIND 0-3 KM
  TRN2 0       M/S/KM   'TURNING OF WIND 3-10 KM
  RI     2              'MEAN RICHARDSON NO. CLOUDBASE-10 KM

ENDSCHEMA
```

TABLE B5

```
* (CMH)
* WGSS HAYDEN 0286 SCHEMA--   WIND GUESS PROFILES
*       NAME VSN DATE  ID *TEXTID
*       ---- --- ----- -- ------
  SCHEMA WGSS   1 86043 0  *WIND GUESS PROFILES

* KEY  SCALE UNITS
* ---- ----- -----

  ROWS 68                  *DATE,HOUR,LATITUDE(MAX 65)

  DAY         SYD          *YEAR AND JULIAN DAY (YYDDD)
  TIME        HMS          *NOMINAL TIME (HH0000)
  LAT   4     DEG          *RANGE (-90 => +90) POSITIVE NORTH

  COLUMNS 65               *RETRIEVALS FORM 2-D ARRAY
  LON   4     DEG          *RANGE (-180 => +180) POSITIVE WEST

  DATA

  U100 2      MPS         *1000U
  V100 2      MPS         *1000V
  U85   2     MPS         *850 U
  V85   2     MPS         *850 V
  U70   2     MPS         *700 V
  V70   2     MPS         *700 V
  U50   2     MPS         *500 U
  V50   2     MPS         *500 V
  U40   2     MPS         *400 U
  V40   2     MPS         *400 V
  U30   2     MPS         *300 U
  V30   2     MPS         *300 V
  U25   2     MPS         *250 U
  V25   2     MPS         *250 V
  U20   2     MPS         *200 U
  V20   2     MPS         *200 V
  U15   2     MPS         *150 U
  V15   2     MPS         *150 V
  U10   2     MPS         *100 U
  V10   2     MPS         *100 V

* END SCHEMA
```

TABLE B6

```
' VWIN TOD STEWART 0386 SCHEMA -- MOTION VECTOR FIRST GUESS SCHEMA
' (TOD)

'        NAME VSN DATE  ID 'TEXTID
'        ---- --- ----- -- ------
SCHEMA VWIN  1  86085  0 "'FIRST GUESS MOTION VECTORS

ROWS 12                      '12 ROWS

SS                           'SS FOR THIS ROW (VIS ONLY FILED HERE)
DAY1        SYD              'YYDDD OF FIRST IMAGE
HMS1        HMS              'HHMMSS OF FIRST IMAGE
DAY2        SYD              'YYDDD OF SECOND IMAGE
HMS2        HMS              'HHMMSS OF SECOND IMAGE
DAY3        SYD              'YYDDD OF THIRD IMAGE
HMS3        HMS              'HHMMSS OF THIRD IMAGE
DAY4        SYD              'YYDDD OF FOURTH IMAGE
HMS4        HMS              'HHMMSS OF FOURTH IMAGE
DAY5        SYD              'YYDDD OF FIFTH IMAGE
HMS5        HMS              'HHMMSS OF FIFTH IMAGE
DAY6        SYD              'YYDDD OF SIXTH IMAGE
HMS6        HMS              'HHMMSS OF SIXTH IMAGE
DAY7        SYD              'YYDDD OF SEVENTH IMAGE
HMS7        HMS              'HHMMSS OF SEVENTH IMAGE
DAY8        SYD              'YYDDD OF EIGHTH IMAGE
HMS8        HMS              'HHMMSS OF EIGHTH IMAGE
DAY9        SYD              'YYDDD OF NINTH IMAGE
HMS9        HMS              'HHMMSS OF NINTH IMAGE
DAY0        SYD              'YYDDD OF TENTH IMAGE
HMS0        HMS              'HHMMSS OF TENTH IMAGE
CMAX                         'NUMBER OF COLUMNS WITH DATA IN THEM

COLUMNS 1250                 'UP TO 1250 WIND SEQUENCES PER ROW.

DATA

MOD                          'USER MODIFICATION FLAG
FLAG                         '0 - FIRST GUESS WIND ... 1 - MODIFIED WIN
SAT                          'SATELLITE BAND TYPE - 0=VIS , 1-12=IR
UG     2    MPS              'FIRST GUESS WIND U-COMPONENT
VG     2    MPS              'FIRST GUESS WIND V-COMPONENT
DIRG        DEG              'WIND DIRECTION OF FIRST GUESS
SPDG        MPS              'WIND SPEED OF FIRST GUESS
PW     1    MB               'PRESSURE OF WIND LEVEL
TC     2    K                'TEMPERATURE OF CLOUD
PCT    1    MB               'PRESSURE AT CLOUD TOP
PCB    1    MB               'PRESSURE AT CLOUD BOTTOM
ZCT         M                'HEIGHT OF CLOUD TOP
ZCB         M                'HEIGHT OF CLOUD BOTTOM
TH     1    MB               'MANUAL HEIGHT THICKNESS SETTING
WM          CHAR             'CORRELATION ALGORITHM SELECTION
CH          CHAR             'CLOUD HEIGHT MODE OPTION
```

```
  TYPE       CHAR          'MOTION VECTOR TYPE (IR), (VIS), (WV), (CO2)
REPEAT  10
  TIME                     'NOMINAL TIME FOR VECTOR.
  LIN                      'CURSOR CENTER LINE POS (IMAGE COOR)
  ELE                      'CURSOR CENTER ELEMENT POS (IMAGE COOR)
  LAT    4   DEG           'LATITUDE  VECTOR PAIR.
  LON    4   DEG           'LONGITUDE  VECTOR PAIR.
  U      2   MPS           'U-COMPONENT OF VECTOR
  V      2   MPS           'V-COMPONENT OF VECTOR
  DIR        DEG           'WIND DIRECTION
  SPD        MPS           'WIND SPEED
  ERR                      'REPRODUCABILITY ERROR
ENDSCHEMA
```

TABLE B7

```
          ************************************************
          VASTEXT ... CONTEXT FILE FOR VAS SOUNDING PROGRAMS
          ************************************************
               OWNER ... C.M.HAYDEN, NOAA/NESDIS, ROOM 219
               VERSION OF 12 JUNE 1986

WORD      CONTENT
****      *******
  1       SSYYDDD (SAT-YR-DAYOFYEAR)
  2       HHMMSS (TIME AT BEGINNING OF SOUNDER FILE)
  3       UPPER LEFT LINE NUMBER IN SATELLITE COORDINATES
  4       UPPER LEFT ELEM NUMBER IN SATELLITE COORDINATES
  5       UPPER LEFT HAND Z COORDINATE
  6       NUMBER OF LINES IN IMAGE
  7       NUMBER OF ELEMENTS IN IMAGE
  8       NUMBER OF BYTES IN IMAGE
  9       LINE RESOLUTION
 10       ELEMENT RESOLUTION
 11       Z RESOLUTION
 12-24    CHANNELS(BANDS) AVAILABLE, 1 = YES
 25       LLNW (LAT/LON AT NORTHWEST CORNER OF IMAGE)
 26       LLSE (LAT/LON AT SOUTHEAST CORNER OF IMAGE)
 27       DDHHMM OF SURFACE-DATA USED
 28       STATUS WORD
 29       SURFACE GRID FILE NUMBER
 30-33    GRID NUMBERS FOR SURFACE ANALYSES (Z,T,TD,P)
 34       GUESS PROFILE IDENTIFICATION
 35       SOUNDER FILE NUMBER
 36       SURFACE EDIT FILE MD NUMBER
 37       SURFACE EDIT FILE ROW NUMBER
 38       T/W GUESS FILE MD NUMBER
 39       WIND GUESS FILE MD  NUMBER
 40       RETRIEVAL FILE MD NUMBER
 41       RETRIEVAL FILE MD ROW NUMBER
 42       GUESS GRID FILE NUMBER
 43       MD FILE (MAND.LVLS) FOR SPECIAL PROFILE GUESS
 44       MD FILE (SIG. LVLS) FOR SPECIAL PROFILE GUES
 45       WIND FILE MD NUMBER
 46       WIND FILE MD ROW NUMBER
  *
 50       RETRIEVAL TYPE
 51       FIRST GUESS
 52       RETRIEVAL SPACING
 53       RETRIEVAL SIZE
 54       NOSFC OPTION
 55       LAST LINE
 56       LAST ELEMENT
 57       BEGIN LINE
 58       BEGIN ELEMENT
 59       TERMINAL NUMBER
 60       PLOT OPTION
 61-72    BIAS VALUES FOR CHAN RADIANCES..12 GMT
 73-84    BIAS VALUES FOR CHAN RADIANCES..00 GMT
 95       VISIBLE AREA NUMBER (CORRESPONDS TO SOUNDER FILE)
  *
100       NUMBER OF RETRIEVALS
```

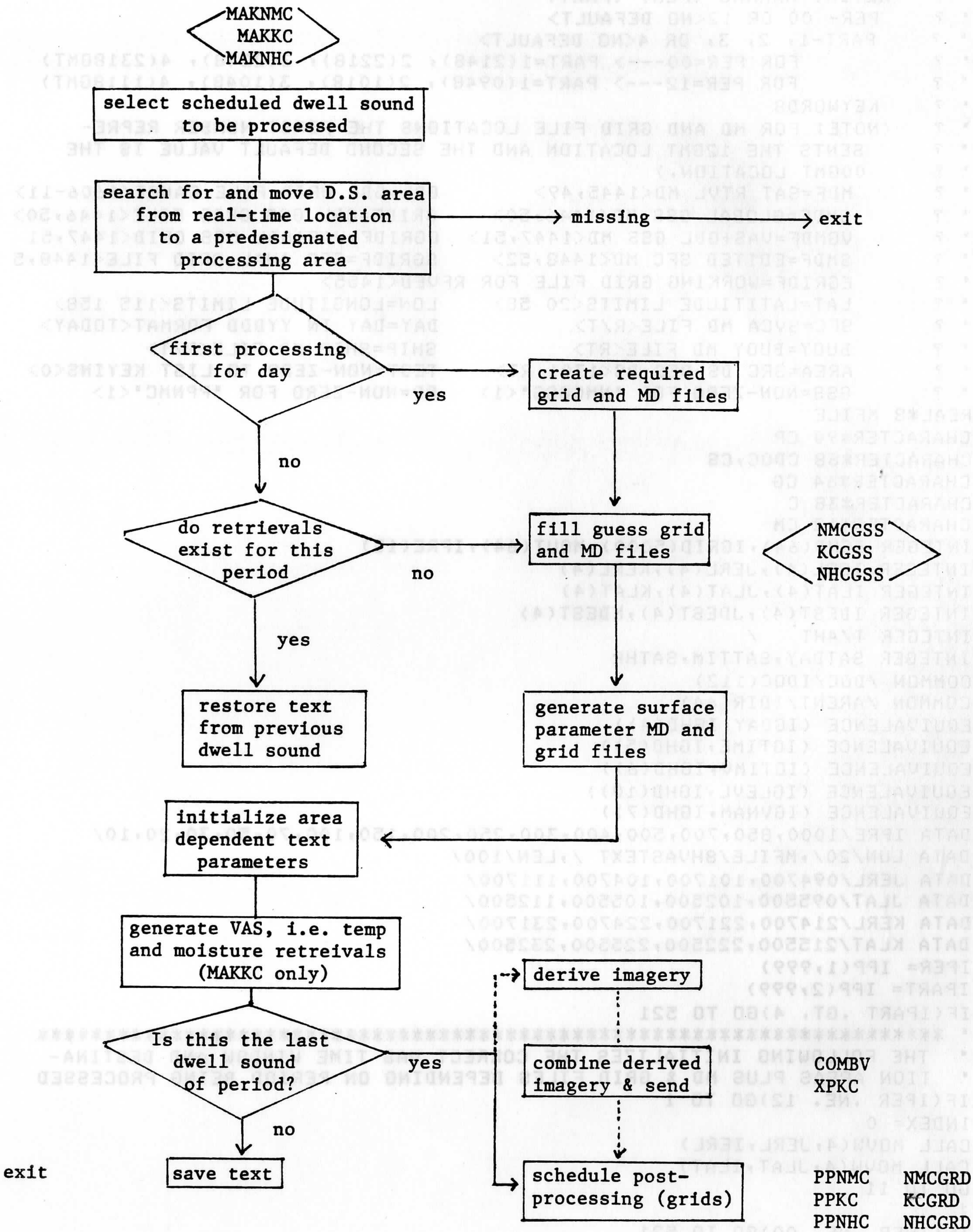
TABLE B8

```
  YYDDD   BEGIN    Y-RES    X-RES    LLNW    LLSE   STAT    NSAT  SNDAREA
  86163  114800        8        8   55115   19070      1      31     1443
   MDNS    MDRS     MDNG     MDWG     MDNR     MDRR     MDNW     MDRW
   1443      11     1442     5282     1441        2     5283        1
   NGFG    NGFS    ZGRID    TGRID    DGRID    PGRID
   1442    1443       16       17       18       19
NO. RETRIEVALS= 907
CURRENT RETRIEVAL OPTIONS..
  TYP   GSS   SPC   SIZ   SFC  ENDL   ENDE  BEGL  BEGE   TER   PLT
    0     0    20    11     0  4174  11597  3114  7480    70     0
```

APPENDIX C: TOP LEVEL MACROS FOR NWS SUPPORT

The main function of VDUC, initially, is to process VAS soundings in support of the NWS. This is a seasonal task, whereby support is given to the National Severe Storm Forecast Center (NSSFC) in spring/summer; to the National Hurricane Center (NHC) in summer/fall; and to the National Meteorological Center (NMC) in fall/winter. Day 1 processing macros are being supplied with the VDUC. It is expected that these will change as needs change, so there is no attempt here to provide a detailed documentation. Nevertheless, Fig. C1 is included to show the flow of the first level of macros MAKNMC; MAKKC; MAKNHC. These are different according to the different requirements of the three centers, but are structured in parallel. Note that second level macros exist for providing the appropriate initial guess; for post-processing (e.g. auto editing, gradient wind generation); and for preparing output grids of the meteorological parameters.

Fig. C1: First level macros for supporting NWS Operations, NMC KC, NHC. Second level macros are indicated in capital letters at right.



```
//* ULMAKNMC AJ   08/28/86; INSTALL GRID GENERATION FOR RFVED
//* ULMAKNMC BTR  07/01/86; MOVE FROM UD
//* UDMAKNMC BTR  07/01/86; CHANGE KEYWORDS
//  EXEC  MACRO2,MOD=MAKNMC
//SYSIN  DD  *
' ? **MAKNMC** VAS AUTO-PROCESSING FOR EAST PACIFIC       (AJ)
' ?   KEYIN: MAKNMC (PER) (PART)
' ?    PER- 00 OR 12<NO DEFAULT>
' ?    PART-1, 2, 3, OR 4<NO DEFAULT>
' ?          FOR PER=00---> PART=1(2148), 2(2218), 3(2248), 4(2318GMT)
' ?          FOR PER=12---> PART=1(0948), 2(1018), 3(1048), 4(1118GMT)
' ?    KEYWORDS
' ?   (NOTE: FOR MD AND GRID FILE LOCATIONS THE FIRST NUMBER REPRE-
' ?     SENTS THE 12GMT LOCATION AND THE SECOND DEFAULT VALUE IS THE
' ?     00GMT LOCATION.)
' ?      MDF=SAT RTVL MD<1445,49>          GBL=GBL GRID FILE RANGE<1606-11>
' ?      GMDF=GLOBAL GSS MD<1446,50>       GRIDF=GBL GSS GRID FILE<1446,50>
' ?      VGMDF=VAS+GBL GSS MD<1447,51>     GGRIDF=VAS+GBL GSS GRID<1447,51
' ?      SMDF=EDITED SFC MD<1448,52>       SGRIDF=SFC ANAL GRID FILE<1448,5
' ?      EGRIDF=WORKING GRID FILE FOR RFVED<1455>
' ?      LAT=LATITIUDE LIMITS<20 58>       LON=LONGITUDE LIMITS<115 158>
' ?      SFC=SVCA MD FILE<R/T>             DAY=DAY IN YYDDD FORMAT<TODAY>
' ?      BUOY=BUOY MD FILE<RT>             SHIP=SHIP MD FILE<R/T>
' ?      AREA=SRC DS-DES DS<1301 RT>       TEST=NON-ZERO TO LIST KEYINS<0>
' ?      GSS=NON-ZERO FOR 'NMCGSS'<1>      PP=NON-ZERO FOR 'PPNMC'<1>
REAL*8 MFILE
CHARACTER*90 CP
CHARACTER*68 CDOC,CS
CHARACTER*64 CG
CHARACTER*38 C
CHARACTER*12 CM
INTEGER IGHD(64),IGRID(5000),MOUT(64),IPRE(15)
INTEGER IERL(4),JERL(4),KERL(4)
INTEGER ILAT(4),JLAT(4),KLAT(4)
INTEGER IDEST(4),JDEST(4),KDEST(4)
INTEGER T/4HT    /
INTEGER SATDAY,SATTIM,SATHR
COMMON /DOC/IDOC(112)
COMMON /ARENT/IDIR(64)
EQUIVALENCE (IGDAY,IGHD(4))
EQUIVALENCE (IGTIME,IGHD(5))
EQUIVALENCE (IGTIMV,IGHD(6))
EQUIVALENCE (IGLEVL,IGHD(10))
EQUIVALENCE (IGVNAM,IGHD(7))
DATA IPRE/1000,850,700,500,400,300,250,200,150,100,70,50,30,20,10/
DATA LUN/20/,MFILE/8HVASTEXT /,LEN/100/
DATA JERL/094700,101700,104700,111700/
DATA JLAT/095500,102500,105500,112500/
DATA KERL/214700,221700,224700,231700/
DATA KLAT/215500,222500,225500,232500/
IPER= IPP(1,999)
IPART= IPP(2,999)
IF(IPART .GT. 4)GO TO 521
' *******************************************************************
'  THE FOLLOWING INITIALIZES THE CORRECT VAS TIME WINDOW AND DESTINA-
'  TION AREAS PLUS MD & GRID FILES DEPENDING ON PERIOD BEING PROCESSED
IF(IPER .NE. 12)GO TO 1
INDEX= 0
CALL MOVW(4,JERL,IERL)
CALL MOVW(4,JLAT,ILAT)
GO TO 11
1
IF(IPER .NE. 00)GO TO 521
INDEX= 4
```

```
CALL MOVW(4,KLAT,ILAT)
11
MDNR= 1445 + INDEX
MDNG= 1446 + INDEX
MDVG= 1447 + INDEX
MDNS= 1448 + INDEX
NGFG= 1446 + INDEX
NGVG= 1447 + INDEX
NGFS= 1448 + INDEX
NDARA= 1440 + INDEX
" ***********************************************************************
MDNR= IKWP('MDF',1,MDNR)
MDNG= IKWP('GMDF',1,MDNG)
MDVG= IKWP('VGMDF',1,MDVG)
MDNS= IKWP('SMDF',1,MDNS)
NGFG= IKWP('GRIDF',1,NGFG)
NGVG= IKWP('GGRIDF',1,NGVG)
NGFS= IKWP('SGRIDF',1,NGFS)
NGFE= IKWP('EGRIDF',1,1455)
MDSFC = IKWP('SFC',1,MDSVC('SVCA',IDAY))
MDBUOY= 60+MDSFC
MDSHIP= 30+MDSFC
MDBUOY= IKWP('BUOY',1,MDBUOY)
MDSHIP= IKWP('SHIP',1,MDSHIP)
NSARA= IKWP('AREA',1,1301)
NDARA= IKWP('AREA',2,NDARA)
IF(NSARA .NE. 1301)NDARA= NSARA
ITEST= IKWP('TEST',1,0)
KDAY= IKWP('DAY',1,IDAY)
" ***********************************************************************
"    TO PROCESS YESTERDAY'S DATA SET 'DAY' EQUAL TO NEGATIVE NUMBER
IF(KDAY.LT.0) CALL SUBDAY(IDAY,KDAY)
ITODAY= KDAY
CALL SUBDAY(ITODAY,IYSTDY)
" ***********************************************************************
IGFL= IKWP('GBL',1,1606)
IGFH= IKWP('GBL',2,1611)
IF(IGFL .NE. 1606)IGFH= IGFL
LS= IKWP('LAT',1,20)
LN= IKWP('LAT',2,58)
LE= IKWP('LON',1,115)
LW= IKWP('LON',2,158)
LLNW = (LN*1000)+LW
LLSE = (LS*1000)+LE
LLS  = LS-5
LLN  = LN+5
LLE  = LE-5
LLW  = LW+5
"
" FOLLOWING ITIM AND IDAY ARE MCIDAS DEFINED.
"
KTIM= ITIM
" +++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
"         ISF IS A FLAG TO GENERATE SFC ANAL(-999) OR NOT(1)
ISFC= -999
" +++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
" ***********************************************************************
"  THIS SECTION LOCATES DWELL SOUND. IF IN REAL TIME AREAS(1300-1310)
"  FIND DATA AND MOVE TO DAILY PERMANENT LOCATIONS OR DESIRED LOCATION
"          OTHERWISE JUST POINT(VFVA) TO DWELL SOUND
IF(NSARA .EQ. NDARA)THEN
CALL SDEST('DWELL SOUND NOT MOVED ',NDARA)
NSND= NDARA
GO TO 71
```

```
MAREA= N + (NSARA - 1)
CALL READD(MAREA,IDIR)
NDAY= IDIR(4)
NTIM= IDIR(5)
IF(NTIM .LT. IERL(IPART) .OR. NTIM .GT. ILAT(IPART))GO TO 51
IF(NDAY .NE. ITODAY)GO TO 51
NSND= NDARA
GO TO 61
51
GO TO 511
61
IF(ITEST .EQ. 1)THEN
:QA (5,NSND)
:AA (5,MAREA) (5,NSND) ' ASIZE=ALL'
ELSE
.QA (NSND)
.AA (MAREA) (NSND) ASIZE= ALL
ENDIF
" *****************************************************************
71
" ################################################################
"       POINT TO DWELL SOUND AND GET SATELLITE DAY AND TIME
IF(ITEST .EQ. 1)THEN
:VPVA (5,NSND)
ELSE
.VPVA (NSND)
ENDIF
CALL READD(NSND,IDIR)
SATDAY= IDIR(4)
SATTIM= IDIR(5)
SATHR= IDIR(5)/10000
" ################################################################
" ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
"    DETERMINE IF FIRST DWELL SOUND OF THE DAY AND IF SO GENERATE
"                APPROPRIATE GRID AND MD FILES
IF(IPART .EQ. 1)GO TO 31
IF(NDARA .EQ. NSARA .OR. NDARA .NE. (1440 + INDEX))GO TO 41
DO 21 I= 1,7
IFIND= IDEST(IPART) - I
CALL READD(IFIND,IDIR)
NDAY= IDIR(4)
NTIM= IDIR(5)
IF(NDAY .EQ. ITODAY .AND. NTIM .GT. 094700)GO TO 41
IF(IFIND .EQ. 1440)GO TO 31
21
31
IF(ITEST .EQ. 1)THEN
:MDU DEL (5,MDNR)
:MDU DEL (5,MDNG)
:MDU DEL (5,MDVG)
:MDU DEL (5,MDNS)
:IGU DEL (5,NGFG)
:IGU DEL (5,NGVG)
:IGU DEL (5,NGFS)
:IGU DEL (5,NGFE)
CALL CALDAY(ITODAY,NY,NM,ND,CM)
CALL ENCODE('("EPAC VAS RTVLS FOR: ",I2,A3,I2,4X)',CDOC,ND,CM,NY)
:MDU MAKE (5,MDNR) ' VRET 1 0 0' (6,ITODAY) ' ' (CDOC)
CDAY= CFU(ITODAY)
CDOC= 'GBL FCST '//CFU(ITODAY)
:MDU MAKE (5,MDNG) ' VGSS 1 0 0' (6,ITODAY) ' ' (CDOC)
CDOC= 'VAS + TOVS EPAC GSS '//CFU(ITODAY)
:MDU MAKE (5,MDVG) ' VGSS 1 0 0' (6,ITODAY) ' ' (CDOC)
CDOC= 'PAC SHIP DATA FOR '//CDAY(1:5)
```

```
:IGU MAKE (5,NGFG) ' ' (CDOC)
CDOC= 'VAS + TOVS EPAC ANAL '//CFU(ITODAY)
:IGU MAKE (5,NGVG) ' ' (CDOC)
CDOC= 'PAC SHIP SFC ANALYSES FOR '//CFU(ITODAY)
:IGU MAKE (5,NGFS) ' ' (CDOC)
CDOC= 'EPAC WORK FILE (RFVED) '//CFU(ITODAY)
:IGU MAKE (5,NGFE) ' ' (CDOC)
ELSE
CALL MDQUIT(MDNR)
CALL MDQUIT(MDNG)
CALL MDQUIT(MDVG)
CALL MDQUIT(MDNS)
CALL IGQUIT(NGFG)
CALL IGQUIT(NGVG)
CALL IGQUIT(NGFS)
CALL IGQUIT(NGFE)
CALL CALDAY(ITODAY,NY,NM,ND,CM)
CALL ENCODE('('EPAC VAS RTVLS FOR: ',I2,A3,I2,4X)',CDOC,ND,CM,NY)
IMD= MDMAKE(MDNR,'VRET',1,0,0,IDAY,CDOC)
CDAY= CFU(ITODAY)
CDOC= 'GBL FCST '//CFU(ITODAY)
IMD= MDMAKE(MDNG,'VGSS',0,0,0,ITODAY,CDOC)
CDOC= 'VAS + TOVS EPAC GSS '//CFU(ITODAY)
IMD= MDMAKE(MDVG,'VGSS',0,0,0,ITODAY,CDOC)
CDOC= 'PAC SHIP DATA FOR '//CDAY(1:5)
IMD= MDMAKE(MDNS,'RSVC',0,0,0,ITODAY,CDOC)
CDOC= 'GBL FCST '//CFU(ITODAY)
IG= IGMAKE(NGFG,CDOC)
CDOC= 'VAS + TOVS EPAC ANAL '//CFU(ITODAY)
IG= IGMAKE(NGVG,CDOC)
CDOC= 'PAC SHIP SFC ANALYSES FOR '//CFU(ITODAY)
IG= IGMAKE(NGFS,CDOC)
CDOC= 'EPAC WORK FILE (RFVED)' //CFU(ITODAY)
IG= IGMAKE(NGFE,CDOC)
ENDIF
" ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
41
" ****************************************************************
"   DETERMINE WHICH FORM OF "IDVA" TO USE DEPENDING ON WHETHER THIS
"              IS THE FIRST DWELL SOUND OF THE PERIOD
IROW= (IPART/3) + 1
INEW= MOD(IPART,2)
CALL DDEST('HR'//CFI(IPER)(9:12)//'DS'//CFI(IPART)(9:12)//'R=',IROW)
MOK= MDOPEN(MDNR,1)
IDIOT= MDGET(MDNR,IROW,0,MOUT)
NRET= MOUT(3)
IF(IDIOT .NE. 0 .OR. NRET .LE. 0 .OR. INEW .NE. 0)THEN
   IF(ITEST .EQ. 1)THEN
:IDVA (5,MDNR) (2,IROW) (6,LLNW) (6,LLSE) ' AUTO=1'
:'SPVA LLNW=' (5,LLNW) ' LLSE=' (5,LLSE)
:SPVA NRET=0
   ELSE
.IDVA (MDNR) (IROW) (LLNW) (LLSE) AUTO= 1 DEV= NNN
.SPVA LLNW= (LLNW) LLSE= (LLSE) DEV= NNN
.SPVA NRET= 0 DEV= NNN
   ENDIF
ELSE
ITXVA= NSND - 1
   IF(ITEST .EQ. 1)THEN
:TXVA (5,ITXVA) ' IN'
:IDVA (5,MDNR) ' 0' (6,LLNW) (6,LLSE) ' AUTO=1'
:'SPVA LLNW=' (5,LLNW) ' LLSE=' (5,LLSE)
:SPVA ROW= (1,IROW)
   ELSE
```

```
.SPVA LLNW= (LLNW) LLSE= (LLSE) DEV= NNN
.SPVA ROW= (IROW) DEV= NNN
   ENDIF
ISFC= 1
ENDIF
" ************************************************************************
" +++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
"
"                    DETERMINATION OF GUESS TYPE
"
NMCGSS= 1
IF(NRET .GT. 0)NMCGSS= 0
NMCGSS= IKWP('GSS',1,NMCGSS)
IF(NMCGSS .NE. 0)THEN
" #######################################################################
"   FOR 00GMT THE DAY FOR THE GUESS IS THE NEXT DAY (DATA IS B4 00Z)
NEXDAY= ITODAY
IF(IPER .EQ. 0)CALL ADDAY(ITODAY,NEXDAY)
" #######################################################################
IPORT= 1
IF(IPART .GE. 3)IPORT= 2
   IF(ITEST .EQ. 1)THEN
C=CFI(IPER)(11:12)//CFI(IPORT)(11:12)//' MDNG='//CFI(MDNG)(9:12)
C= C(1:14)//' NGFG='//CFI(NGFG)(9:12)//' GBL='
C= C(1:29)//CFI(IGFL)(9:12)//CFI(IGFH)(8:12)
CG=' LAT='//CFI(LS)(11:12)//CFI(LN)(10:12)//' LON='
CG= CG(1:15)//CFI(LE)(10:12)//CFI(LW)(9:12)//' DAY='
CG= CG(1:27)//CFI(NEXDAY)(8:12)//' MDNR='//CFI(MDNR)(9:12)
CG= CG(1:42)//' MDVG='//CFI(MDVG)(9:12)//' NGVG='//CFI(NGVG)(9:12)
:NMCGSS (C) (CG)
   ELSE
.NMCGSS (IPER) (IPORT) GMDF= (MDNG) GRIDF= (NGFG) GBL= (IGFL) (IGFH)-
 LAT= (LS) (LN) LON= (LE) (LW) DAY= (NEXDAY) MDF= (MDNR)-
 VMDF= (MDVG) GRIDV= (NGVG)
   ENDIF
ENDIF
" +++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
" #######################################################################
"       IF SFC ANALYSES ALREADY EXIST SKIP TO RTVL GENERATION
IF(ISFC .EQ. 1)GO TO 81
" #######################################################################
" ***********************************************************************
"
"                 DETERMINATION OF SURFACE ANALYSES
"
" +++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
"                    FIND MOST RECENT SVCA REPORTS
NROWE= 3*(1+SATHR)
NROWB= NROWE - 9
IF(NROWB.LE.0) NROWB= 1
IOK= MDOPEN(MDSFC,1)
DO 150 NR= NROWE,NROWB,-1
  IF(MDGET(MDSFC,NR,0,MOUT) .EQ. 0)THEN
    IF(MOUT(4) .GT. 0)GO TO 155
  ENDIF
150
CALL SDEST(' NO SFC DATA AVAILABLE IN MD FILE# ',MDSFC)
GO TO 551
155
ITSFC= (NR-1)/3
CALL MDCLOS(MDSFC)
" +++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
" #######################################################################
"                    FIND BUOY DATA IF AVAILABLE
```

```
ITBUOY= -1
IOK= MDOPEN(MDBUOY,1)
DO 160 NR=NROWB,NROWE
  IF(MDGET(MDBUOY,NR,0,MOUT) .EQ. 0)THEN
    IF(MOUT(3) .GT. 0)ITBUOY= NR-1
  ENDIF
160
CALL MDCLOS(MDBUOY)
IF(ITBUOY .LT. 0)THEN
  CALL SDEST(' NO TIMELY BUOY DATA FOUND IN MD FILE# ',MDBUOY)
  CALL SDEST(' ...PROCESSING IS CONTINUING WITHOUT BUOY DATA',0)
ENDIF
" ###########################################################################
ITSHIP= 6*(ITSFC/6)
IF(ITEST .EQ. 1)THEN
CS=CFI(MDNS)(9:12)//' LAT='//CFI(LLS)(11:12)//CFI(LLN)(10:12)
CS= CS(1:14)//' LON='//CFI(LLE)(10:12)//CFI(LLW)(9:12)//' MDF='
CS=CS(1:31)//CFI(MDSFC)(9:12)//' TIME='//CFI(ITSFC)(11:12)
CS=CS(1:43)//' DAY='//CFI(ITODAY)(8:12)
:CSVA (CS)
CS=CFI(MDNS)(9:12)//' LAT='//CFI(LLS)(11:12)//CFI(LLN)(10:12)
CS= CS(1:14)//' LON='//CFI(LLE)(10:12)//CFI(LLW)(9:12)//' MDF='
CS=CS(1:31)//CFI(MDSHIP)(9:12)//' TIME='//CFI(ITSHIP)(11:12)
CS=CS(1:43)//' DAY='//CFI(ITODAY)(8:12)//' ADD='
CS=CS(1:58)//CFI(ITSFC)(11:12)//' SHIP=1'
:CSVA (CS)
IF(ITBUOY .GE. 0)THEN
CS=CFI(MDNS)(9:12)//' LAT='//CFI(LLS)(11:12)//CFI(LLN)(10:12)
CS= CS(1:14)//' LON='//CFI(LLE)(10:12)//CFI(LLW)(9:12)//' MDF='
CS=CS(1:31)//CFI(MDBUOY)(9:12)//' TIME='//CFI(ITBUOY)(11:12)
CS=CS(1:43)//' DAY='//CFI(ITODAY)(8:12)//' ADD='
CS=CS(1:58)//CFI(ITSFC)(11:12)//' BUOY=1'
:CSVA (CS)
ENDIF
CDOC=CFI(NGFS)(9:12)//' LAT='//CFI(LLS)(11:12)//CFI(LLN)(10:12)
CDOC=CDOC(1:14)//' LON='//CFI(LLE)(10:12)//CFI(LLW)(9:12)
CDOC=CDOC(1:26)//' GSS=G INC=12 RF=1.'
:SFVA Z100 (CDOC)
:SFVA TSL  (CDOC)
:SFVA DD   (CDOC)
:'SPVA LLNW=' (5,LLNW) ' LLSE=' (5,LLSE)
:TXVA (4,NSND) ' OUT'
ELSE
.CSVA (MDNS) LAT= (LLS) (LLN) LON= (LLE) (LLW) MDF= (MDSFC)-
 TIME= (ITSFC) DAY= (ITODAY)
.CSVA (MDNS) LAT= (LLS) (LLN) LON= (LLE) (LLW) MDF= (MDSHIP)-
 SHIP= 1 DAY= (ITODAY) TIME= (ITSHIP) ADD= (ITSFC)
IF(ITBUOY.GE.0) THEN
.CSVA (MDNS) LAT= (LLS) (LLN) LON= (LLE) (LLW) MDF= (MDBUOY)-
 BUOY= 1 DAY= (ITODAY) TIME= (ITBUOY) ADD= (ITSFC)
ENDIF
.SFVA Z100 (NGFS) GSS= G INC= 12 LAT= (LLS) (LLN) LON= (LLE) (LLW)-
 RF= 1.
.SFVA TSL  (NGFS) GSS= G INC= 12 LAT= (LLS) (LLN) LON= (LLE) (LLW)-
 RF= 1.
.SFVA DD   (NGFS) GSS= G INC= 12 LAT= (LLS) (LLN) LON= (LLE) (LLW)-
 RF= 1.
.SPVA LLNW= (LLNW) LLSE= (LLSE)
.TXVA (NSND) OUT
ENDIF
" *************************************************************************
81
" $$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$
" $$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$
```

```
:TXVA (4,NSND) ' OUT'
  ELSE
.VRWA SPC= 16 20 GSS= G SFC= 0 PLT= 0 AUTO= 1
.TXVA (NSND) OUT
  ENDIF
* $$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$
* $$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$
* +++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
*       BEGIN POST-PROCESSING OF VAS RETRIEVALS, WHICH INCLUDES:
*   AUTO-EDITING, GRADIENT WINDS, AND ANALYSIS GRIDS FOR DISPLAY MACRO
IPPNMC= 0
IF(INEW .EQ. 0)IPPNMC= 1
IPPNMC= IKWP('PP',1,IPPNMC)
IF(IPPNMC .NE. 0)THEN
   IF(ITEST .EQ. 1)THEN
CP= CFI(IPER)(11:12)//CFI(IROW)(11:12)//' MDNR='//CFI(MDNR)(9:12)
CP= CP(1:14)//' MDNG='//CFI(MDNG)(9:12)//' NGFG='//CFI(NGFG)(9:12)
CP= CP(1:34)//' LAT='//CFI(LS)(11:12)//CFI(LN)(10:12)//' LON='
CP= CP(1:49)//CFI(LE)(10:12)//CFI(LW)(9:12)//' TXVA='
CP= CP(1:62)//CFI(ITXVA)(9:12)//' EGRIDF='//CFI(NGFE)(9:12)
CP= CP(1:76)//' EDIT=1 INC=10'
:PPNMC (CP)
  ELSE
.PPNMC (IPER) (IROW) MDF= (MDNR) GMDF= (MDNG) GRIDF= (NGFG)-
 LAT= (LS) (LN) LON= (LE) (LW) TXVA= (ITXVA) EDIT= 1 INC= 10-
 EGRID= (NGFE)
  ENDIF
ENDIF
* +++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
GO TO 551
511
:SOUNDER FILE REQUESTED IS NOT AVAILABLE (2,IPER) ' PART=' (1,IPART)
GO TO 551
521
:KEY-IN ERROR, CHECK HELP.
551
:MACRO*MAKNMC ENDED
* ******************************************************************
      SUBROUTINE ADDAY(NOWDAY,NEXDAY)
* *******************************************************************
* --- ADD 1 DAY TO NOWDAY TO GET NEXDAY (BOTH IN YYDDD FORMAT)
      IYEAR= NOWDAY/1000
      IDAY = MOD(NOWDAY,1000)
      IDAY = IDAY + 1
      NDAYS= 365
      IF(MOD(IYEAR,4).EQ.0) NDAYS= 366
         IF(IDAY.GT.NDAYS) THEN
            IDAY = 1
            IYEAR= IYEAR + 1
         ENDIF
      NEXDAY= IYEAR*1000+IDAY
* ******************************************************************
      SUBROUTINE SUBDAY(NOWDAY,LASDAY)
* *******************************************************************
* --- SUBTRACT 1 DAY FROM NOWDAY TO GET LASDAY (BOTH IN YYDDD FORMAT)
      IYEAR = NOWDAY/1000
      IDAY  = MOD(NOWDAY,1000)
      IDAY  = IDAY - 1
         IF(IDAY.EQ.0) THEN
            IDAY  = 365
            IYEAR = IYEAR - 1
            IF(MOD(IYEAR,4).EQ.0) IDAY = 366
         ENDIF
      LASDAY = IYEAR*1000+IDAY
```

TABLE C2

```
//   EXEC  MACRO3,MOD=MAKKC
//* ULMAKKC  CMH  09/02/86; MEMBER UPDATED
//* ULMAKKC  CMH  07/21/86; INCREASE MDEN SIZE
//* ULMAKKC  GSW  07/11/86; NOTHING DONE.
//* ULMAKKC  BTR  07/01/86; MOVE FROM UD
//* UDMAKKC  BTR  07/01/86; CHANGE KEYWORDS
//* UDMAKKC  BTR  06/25/86; ADD & DELETE XREF PARM
//* VLMAKKC  CMH  06/12/86; CHANGE SKIN T CHANGE LIMIT
//* VLMAKKC  ALS  06/10/86; CMAX IN MOUT(3) NOT MOUT(1)
//* VLMAKKC  ALS  06/06/86; ADD MDEN TO HELP
//* VLMAKKC  ALS  06/06/86; MOVE FROM 'VD' VERSION
//* VDMAKKC  ALS  06/03/86; DO GUESS IF NORTH 1/2 MISSED
//* VLMAKKC  ALS  05/23/86; PASS DAY TO KCGSS
//* VLMAKKC  ALS  05/21/86; CHANGE VTPX TO VRVA
//* VLMAKKC  ALS  05/19/86; SRVX TO SFVA
//* VLMAKKC  ALS  05/14/86; TEXT FOR BOUYANT MD FILE
//* VLMAKKC  ALS  05/12/86; ADD DELETE/CREATE 'ENGY' MD FILE
//* VLMAKKC  ALS  04/23/86; MAX RETS TO 1000
//* VLMAKKC  ALS  04/09/86; IMCL FROM 12 TO 18
//* VLMAKKC  CMH  04/08/86; IMCL FROM 10 TO 12
//* VLMAKKC  ALS  04/08/86; ADD IMCL TO VTPX
//* VLMAKKC  ALS  04/04/86; TAKE OUT DONE ASPLOG MESSAGE IF END ON ERROR
//* VLMAKKC  ALS  03/28/86; NEW COMBV VERSION
//* VLMAKKC  ALS  03/26/86; ADD TIME TO ASPLOG MSG
//* VLMAKKC  ALS  03/26/86; CHANGE LINES ON 'AA'
//* VDMAKKC  ALS  03/25/86; MAKE GUESS SEPERATE; KCGSS
//* VDMAKKC  ALS  03/21/86; ADD POST-PROCESSING
//* VLMAKKC  ALS  03/20/86; LIN TO 5800
//* VLMAKKC  ALS  03/20/86; DERIVED AREA NO.
//* VLMAKKC  ALS  03/20/86; SPVA WITH MDRR
//* VLMAKKC  ALS  03/20/86; FORGOT CSVA
//* VLMAKKC  ALS  03/19/86; NGFG TO 1442,1445;ROW DEPENDANT
//* VLMAKKC  ALS  03/17/86; 'TEST' DEFAULT TO 'NOTEST'
//* VDMAKKC  ALS  03/07/86; ADD KTEST
//* VLMAKKC  ALS  02/24/86; SRVA TO SRVX
//* VDMAKKC  ALS  01/31/86; ADD 'NEWG' KEYWORD FOR 00Z
//SYSIN  DD  *
' ? MAKKC  -- Make VAS retrievals/imagery over NSSFC area.  (ALS)
' ?   MAKKC   row   part   <Keywords>
' ? Parameters:
' ?   row|  row# (1-10) corresponding to dwell sound times (No dflt).
' ?          1 -- 948/1018    2 --1118/1148   3 --1248/1318
' ?          4 --1418/1448    5 --1548/1618   6 --1718/1748
' ?          7 --1848/1918    8 --2018/2048   9 --2148/2218  10 --2318/2348
' ?   part| N or S   for Northern or Southern dwell sound (No default).
' ? Keywords:
' ?  MDF= Retrieval MDF         <1441>   LFM=  beg end LFM gridf <1600-05>
' ?  GMDF= First guess MDF       <1442>  GRIDF= First guess gridf <1442-45>
' ?  SMDF= ED/SFC Data MDF       <1443> SGRIDF= ED/SFC Anal gridf     <1443>
' ?  LAT=  Latitude range     <24 50>  LON= Longitude range      <75 110>
' ?  SFC=  SVCA data MDF          <R/T>   DAY=  yyddd  year&day       <today>
' ?  DARA= Dest D.S. area         <R/T>  SARA= Source D.S. area       <R/T>
' ?  ARA=  wv li derived areas <R/T>    COMB= nonzero for 'COMBV'    <R/T>
' ?  XPA=  nonzero for 'XPORTA'<R/T>    PP=   nonzero for 'PPKC'      <R/T>
' ?  GSS=  nonzero for 'KCGSS' <R/T>    TEST= nonzero to list keyins   <0>
' ?  MDEN= MD file of'ENGY' <1444>
' ? Remarks: Try to do it all for NSSFC. Defaults are for real-time.
' ?  'PPKC' is post processing: auto edit and grid generation.
INTEGER IDIR(64),MOUT(400)
CHARACTER*32 CDOC
DIMENSION ATIM(20)
DATA IABEG/1440/,NAREAS/20/
'
```

```
DATA (ATIM(I),I= 8,14)/ 14.8, 15.8, 16.3, 17.3, 17.8, 18.8, 19.3/
DATA (ATIM(I),I=15,20)/ 20.3, 20.8, 21.8, 22.3, 23.3, 23.8/
:
: 'MAKKC '  BEGAN AT-(7,ITIM).    {WITH INTR-(3,INTR)}
:
CLOG = ''MAKKC -- '
NROW= IPP(1,-999)
CROW= CPP(1,'?')
  IF(NROW.LT.1.OR.NROW.GT.10) THEN
    CALL SDEST(' 1-10 ARE VALID ROW NUMBERS, YOU USED '//CROW,0)
    GOTO 1000
  ENDIF
CPART = CPP(2,'?')
IPART = 0
IF(CPART(1:1).EQ.'N') IPART=1
IF(CPART(1:1).EQ.'S') IPART=2
   IF(IPART.EQ.0) THEN
     CALL SDEST(' 2ND PARAMETER INPUT= '//CPART//' ...NOT VALID',0)
     CALL SDEST(' VALID INPUT IS   N  OR  S   (NORTH OR SOUTH)',0)
     GOTO 1000
   ENDIF
CDEV = CKWP('DEV',1,'C')
CDEVK= ' DEV='//CDEV
KTEST= IKWP('TEST',1,0)
'
' BLANK OUT THE 'ASPLOG' FILE IF THIS IS THE FIRT ROW, NORTH PART
' ----------------------------------------------------------------
IF(NROW.EQ.1 .AND. IPART.EQ.1) THEN
 IF(KTEST.NE.0) THEN
:ASPLOG 999
 ELSE
.ASPLOG 999
 ENDIF
'
ENDIF
' ------------------------------------------------------------------
MDNR = IKWP('MDF',1,1441)
MDNG = IKWP('GMDF',1,1442)
MDNS = IKWP('SMDF',1,1443)
MDEN = IKWP('MDEN',1,1444)
NGFG = IKWP('GRIDF',1,1442)
NGFS = IKWP('SGRIDF',1,1443)
ISGRD = IKWP('SCR',1,1440)
IGFL1= IKWP('LFM',1,1600)
IGFL2= IKWP('LFM',2,1605)
LS   = IKWP('LAT',1,24)
LN   = IKWP('LAT',2,50)
LE   = IKWP('LON',1,75)
LW   = IKWP('LON',2,110)
NDAY = IKWP('DAY',1,IDAY)
'
' DAY CAN BE ENTERED VIA KEYWORD AS YYDDD OR AS -1 (YSTDY)
'
IF(NDAY.LT.0) CALL SUBDAY(IDAY,NDAY)
ITODAY= NDAY
CALL SUBDAY(ITODAY,IYSTDY)
'
'  DEFAULT SFC MD FILE TO REAL TIME LOCATION BASED ON DAY
'
ISFC = IKWP('SFC',1,MDSVC('SVCA',ITODAY))
'
'  CHECK FOR LAT/LONS WITHIN LFM LIMITS - EXTEND SFC & GUESS BY 5 DEG.
'
   IF(LS.LT.20.OR.LN.GT.58.OR.LE.LT.50.OR.LW.GT.158) THEN
```

```
   ENDIF
LLNW = (LN*1000)+LW
LLSE = (LS*1000)+LE
LLS   = LS-5
LLN   = LN+5
LLE   = LE-5
LLW   = LW+5
LLLNW= (LLN*1000)+LLW
LLLSE= (LLS*1000)+LLE
*
*     ------------------- FIND DWELL SOUND AREA ------------------
*
*   SEARCH AREAS 1301-1310 FOR TIMES CORRESPONDING TO  row  AND  part
*   MOVE THAT AREA TO PRE-DEFINED LOCATION IN 1440-1459 SEQUENTIALLY.
*   SUBSECT SMALLER AREA FROM THE DWELL SOUNDS (190X700) STARTING WITH
*   FIRST LINE RECEIVED AND ELEMENT #6100 (PROVIDES E/W COVERAGE FOR USA)
*
* AREAS 1440-1459 --- DWELL SOUND AREAS MOVED HERE FROM REAL TIME SLOTS.
* AREAS 1460-1469 --- DERIVED PRECIP WATER IMAGES ARE CREATED HERE.
* AREAS 5890-5899 --- DERIVED LI IMAGES ARE CREATED HERE.
*
* DEFAULT SOURCE AREA (ORIGINAL DWELL SNDS) IS 1300-1310
*
* ISEQ (1-20) REPRESENTS THE DWELL SOUND SEQUENCE THRU THE DAY
*
ISEQ    = 2*(NROW-1)+ IPART
DTIM    = ATIM(ISEQ)
IATIM   = MFD(DTIM)/100
CATIM   = CFI(IATIM)
MAREA1 = IKWP('SARA',1,1301)
MAREA1 = MAREA1-1
DO 150 N= 1,10
 MAREA= N + MAREA1
 CALL READD(MAREA,IDIR)
 NDAY= IDIR(4)
   IF(NDAY .EQ. ITODAY) THEN
     TEST= FTIME(IDIR(5))-ATIM(ISEQ)
     IF(TEST .LT. 0.1   .AND.   TEST .GT. -0.1) GOTO 160
   ENDIF
150
*
*  DWELL SOUND NOT FOUND...
*
CALL SDEST(' DID NOT FIND DWELL SOUND AREA FOR TIME= ',IATIM)
IF(KTEST.NE.0) THEN
:ASPLOG (CLOG) DWELL-SOUND: (CATIM) Z---MISSING
ELSE
.ASPLOG (CLOG) DWELL-SOUND: (CATIM) Z---MISSING
ENDIF
GO TO 1000
160
*
*  DWELL SOUND FOUND, SET AREA NUMBER THAT DWELL-SOUND WILL BE MOVED TO.
*
NLIN   = IDIR(6)
LINES = IDIR(9)
NSND   = IABEG + ISEQ - 1
NSND   = IKWP('DARA',1,NSND)
*
*  QUIT AND MOVE AREA IF SOURCE AND DESTINATION FILE ARE NOT THE SAME
*
* 11111111111111111111111111111111111111111111111111111111111111111111
*
IF(MAREA.NE.NSND) THEN
```

```
IF(KTEST.NE.0) THEN
:QA (4,NSND)
:AA (4,MAREA) (4,NSND) 0 IU (4,NLIN) 6100 1 (5,LINES) 700 BAND= ALL
ELSE
.QA (NSND)
.AA (MAREA) (NSND) 0 IU (NLIN) 6100 1 (LINES) 700 BAND= ALL
ENDIF
*
* AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
*
ENDIF
*
* 111111111111111111111111111111111111111111111111111111111111111111111
*
* SET POINTER TO VAS DWELL SOUND AREA NUMBER (VPVA)
*
* BBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBB
*
IF(KTEST.NE.0) THEN
:VPVA (4,NSND)
ELSE
.VPVA (NSND)
ENDIF
* BBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBB
*
*     ---------------------- FILE CREATION -------------------------
*
*   CHECK IF THIS IS THE 1ST TIME PERIOD OF THE DAY TO BE PROCESSED
*      DO THIS BY LOOKING THRU AREAS WHERE DWELL SNDS ARE MOVED
*
IAEND = IABEG + NAREAS -1
DO 110 IA=IABEG,IAEND
  IF(IA.NE.NSND) THEN
    CALL READD(IA,IDIR)
    NDAY= IDIR(4)
    IF(NDAY .EQ. ITODAY)GOTO 130
  ENDIF
110
*
: NO AREAS WITH TODAYS DATE EXIST...QUIT AND CREATE FILES
*
* CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
*
CALL CALDAY(IDAY,NY,NM,ND,CM)
IF(KTEST.NE.0) THEN
:MDU DEL (4,MDNR)
:MDU DEL (4,MDNS)
:MDU DEL (4,MDNG)
:MDU DEL (4,MDEN)
:IGU DEL (4,NGFS)
:IGU DEL (4,NGFG)
:IGU DEL (4,ISGRD)
CALL ENCODE('("R/T VAS RETRVLS FOR: ",I2,A3,I2,4X)',CDOC,ND,CM,NY)
:MDU MAKE (4,MDNR) VRET 1 0 1200 (5,IDAY) (CDOC)
CALL ENCODE('("VAS FIRST-GUESS FOR: ",I2,A3,I2,4X)',CDOC,ND,CM,NY)
:MDU MAKE (4,MDNG) VGSS 1 0  0  (5,IDAY) (CDOC)
CALL ENCODE('("VAS ED/SFC-DATA FOR: ",I2,A3,I2,4X)',CDOC,ND,CM,NY)
:MDU MAKE (4,MDNS) RSVC 1 0  0  (5,IDAY) (CDOC)
CALL ENCODE('("BOUYANT ENERGY FOR:  ",I2,A3,I2,4X)',CDOC,ND,CM,NY)
:MDU MAKE (4,MDEN) ENGY X 16 1200 (5,IDAY) (CDOC)
CALL ENCODE('("VAS SFC-ANLYS FOR: ",I2,A3,I2,6X)',CDOC,ND,CM,NY)
:IGU MAKE (4,NGFS) (CDOC)
CALL ENCODE('("LFM (VAS-GUESS) FOR: ",I2,A3,I2,4X)',CDOC,ND,CM,NY)
```

```
:IGU MAKE (4,ISGRD) (CDOC)
ELSE
CALL MDQUIT(MDNR)
CALL MDQUIT(MDNS)
CALL MDQUIT(MDNG)
CALL MDQUIT(MDEN)
CALL IGQUIT(NGFS)
CALL IGQUIT(NGFG)
CALL IGQUIT(ISGRD)
CALL ENCODE('('R/T VAS RETRVLS FOR: ',I2,A3,I2,4X)',CDOC,ND,CM,NY)
IMD= MDMAKE(MDNR,'VRET',1,0,1200,IDAY,CDOC)
CALL ENCODE('('VAS FIRST-GUESS FOR: ',I2,A3,I2,4X)',CDOC,ND,CM,NY)
IMD= MDMAKE(MDNG,'VGSS',1,0,0,IDAY,CDOC)
CALL ENCODE('('VAS ED/SFC-DATA FOR: ',I2,A3,I2,4X)',CDOC,ND,CM,NY)
IMD= MDMAKE(MDNS,'RSVC',1,0,0,IDAY,CDOC)
CALL ENCODE('('BOUYANT ENERGY FOR: ',I2,A3,I2,4X)',CDOC,ND,CM,NY)
IMD= MDMAKE(MDEN,'ENGY',1,16,1200,IDAY,CDOC)
CALL ENCODE('('VAS SFC-ANLYS FOR: ',I2,A3,I2,6X)',CDOC,ND,CM,NY)
IG= IGMAKE(NGFS,CDOC)
CALL ENCODE('('LFM (VAS-GUESS) FOR: ',I2,A3,I2,4X)',CDOC,ND,CM,NY)
IG= IGMAKE(NGFG,CDOC)
CALL ENCODE('(I5,' VAS SCRATCH FILE: ',A8)',CDOC,ITODAY,CDATE)
IG= IGMAKE(ISGRD,CDOC)
ENDIF
"
" CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
"
130
   IF(MDOPEN(MDNR,1).LT.0) THEN
     CALL EDEST(' VAS MD FILE MUST ALREADY EXIST ',MDNR)
     GOTO 1000
   ENDIF
"
" ------------------ FIND AND PREPARE GUESS GRIDS ------------------
" ------------------ FOR NORTH 1/2, OR IF REQUESTED. ------------------
"
" CHECK TO SEE IF RETIEVALS ALREADY EXIST FOR THIS ROW (ICMAX.GT.0)
"
IOK    = MDGET(MDNR,NROW,0,MOUT)
ICMAX = MOUT(3)
KCGSS = 1
CALL DDEST(' ICMAX   MOUT(3) = ',ICMAX)
IF(ICMAX.GT.0) KCGSS = 0
KCGSS = IKWP('GSS',1,KCGSS)
IF(KCGSS.NE.0) THEN
"
IF(KTEST.NE.0) THEN
:KCGSS (3,NROW) GMDF= (4,MDNG) GRIDF= (4,NGFG) LFM= (4,IGFL1) (4,IGFL2)
:      LAT= (5,LS) (5,LN) LON= (5,LE) (5,LW) DAY= (ITODAY)
ELSE
.KCGSS (NROW) GMDF= (MDNG) GRIDF= (NGFG) LFM= (IGFL1) (IGFL2) -
LAT= (LS) (LN) LON= (LE) (LW) DAY= (ITODAY)
ENDIF
"
ENDIF
"
" ---------------- SET TXVA AND PREPARE SFC DATA ----------------
"
" IF RETRIEVALS ALREADY EXIST FOR THIS ROW--SFC GRIDS ALREADY EXIST
"     THIS CHECKED SO SOUTH 1/2 CAN BE PROCESSED IF NORTH MISSED
" SFC DATA ALWAYS GENERATED FOR NORTH DWELL SOUND, SOUTH DONE IF NEEDED.
"
"
" SSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSS
```

```
:  SFC DATA EXISTS -- LOAD THE 'TXVA' FROM THE ALREADY DONE N'TH-HALF.
   ITXVA= NSND - 1
.
. GGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGG
.
IF(KTEST.NE.0) THEN
:TXVA (4,ITXVA) IN
:IDVA (4,MDNR) 0 (5,LLNW) (5,LLSE) AUTO= 1
:SPVA ROW= (3,NROW) LLNW= (5,LLNW) LLSE= (5,LLSE)
ELSE
.TXVA (ITXVA) IN
.IDVA (MDNR) 0 (LLNW) (LLSE) AUTO= 1
.SPVA ROW= (NROW) LLNW= (LLNW) LLSE= (LLSE)
ENDIF
.
. GGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGG
.
 ELSE
.
:   NEED TO GENERATE SFC DATA
.
. HHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHH
.
IF(KTEST.NE.0) THEN
:IDVA (4,MDNR) (3,NROW) (5,LLNW) (5,LLSE) AUTO= 1 TOP= 1 IBOX= 11
:SPVA ROW= (3,NROW) LLNW= (5,LLNW) LLSE= (5,LLSE)
:SPVA NRET= 0
ELSE
.IDVA (MDNR) (NROW) (LLNW) (LLSE) AUTO= 1 TOP= 1 IBOX= 11
.SPVA ROW= (NROW) LLNW= (LLNW) LLSE= (LLSE)
.SPVA NRET= 0
ENDIF
.
. HHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHH
.
.  LOAD, AUTO-EDIT (BASED ON NEIGHBORS, NOT FIRST-GUESS), AND ANALYZE
.    SURFACE OBSERVATIONS (FROM 'CURRENT' OR SPECIFIED ('ISFC') SVCA
.    MD-FILE) FOR THE LARGER AREA. (GUESS LARGER AREA THAN RETRIEVALS)
.
. IIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII
.
IS= NGFS
IF(KTEST.NE.0) THEN
CDOC = 'GSS= G INC= 10 RF= 1.'
:CSVA (4,MDNS) LAT= (3,LLS) (3,LLN) LON= (4,LLE) (4,LLW) MDF= (4,ISFC)
:SFVA Z100 (4,IS) LAT= (2,LLS) (2,LLN) LON= (3,LLE) (3,LLW) (CDOC)
:SFVA TSL  (4,IS) LAT= (2,LLS) (2,LLN) LON= (3,LLE) (3,LLW) (CDOC)
:SFVA DD   (4,IS) LAT= (2,LLS) (2,LLN) LON= (3,LLE) (3,LLW) (CDOC)
:SPVA LLNW= (5,LLLNW) LLSE= (5,LLLSE)
:TXVA (4,NSND) OUT
:SPVA LLNW= (5,LLNW) LLSE= (5,LLSE)
ELSE
.CSVA (MDNS) LAT= (LLS) (LLN) LON= (LLE) (LLW) MDF= (ISFC)
.SFVA Z100 (IS) GSS= G INC= 10 LAT= (LLS) (LLN) LON= (LLE) (LLW) RF= 1.
.SFVA TSL  (IS) GSS= G INC= 10 LAT= (LLS) (LLN) LON= (LLE) (LLW) RF= 1.
.SFVA DD   (IS) GSS= G INC= 10 LAT= (LLS) (LLN) LON= (LLE) (LLW) RF= 1.
.SPVA LLNW= (LLLNW) LLSE= (LLLSE)
.TXVA (NSND) OUT
.SPVA LLNW= (LLNW) LLSE= (LLSE)
ENDIF
.
. IIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII
.
ENDIF
```

```
.
.  NORTHERN-HALF PRODUCT IMAGES ARE PLACED IN: 1470 (WV), 5900 (LI).
.  SOUTHERN-HALF PRODUCT IMAGES ARE PLCAED IN: 1471 (WV), 5901 (LI).
.  AREA 5902 IS USED AS TEMPORARY SCRATCH BY MACRO 'COMBV'.
.
IWV = 1469 + IPART
ILI = 5899 + IPART
IWV = IKWP('ARA',1,IWV)
ILI = IKWP('ARA',2,ILI)
.
.  GENERATE RETRIEVALS, SAVE 'TXVA' WITH 'NRET' SAVED AFTER 'VRVA'
.
. JJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJ
.
IF(KTEST.NE.0) THEN
:VRVA ARA= (4,IWV) (4,ILI) BOX= 11 SPC= 11 11 AUTO= 1 TOP= 1 BIAS= 99
:      IMCL= 18  SKIN= 6.
:SPVA LLNW= (5,LLLNW) LLSE= (5,LLLSE)
:TXVA (4,NSND) OUT
ELSE
.VRVA ARA= (IWV) (ILI) BOX= 11 SPC= 11 11 AUTO= 1 TOP= 1 BIAS= 99 -
IMCL= 18  SKIN= 6.
.SPVA LLNW= (LLLNW) LLSE= (LLLSE)
.TXVA (NSND) OUT
ENDIF
.
. JJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJ
.
. ---------------- COMBINE AND SEND DERIVED IMAGES ----------------
.
ICOMB = IPART-1
ICOMB = IKWP('COMB',1,ICOMB)
.
. 77777777777777777777777777777777777777777777777777777777777777777
.
IF(ICOMB.GT.0) THEN
 IWV = 1459 + NROW
 ILI = 5889 + NROW
.
. KKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKK
.
IF(KTEST.NE.0) THEN
:COMBV 1470 1471 5902 (4,IWV) TYP= WV
:COMBV 5900 5901 5902 (4,ILI) TYP= LI
ELSE
.COMBV 1470 1471 5902 (IWV) TYP= WV
.COMBV 5900 5901 5902 (ILI) TYP= LI
ENDIF
.
. KKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKKK
.
   ISEND = IKWP('XPA',1,1)
   IF(ISEND.NE.0) THEN
.
. LLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLL
.
IF(KTEST.NE.0) THEN
:XPKC (3,NROW) AREA
ELSE
.XPKC (NROW) AREA
ENDIF
.
. LLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLL
.
```

```
*
* 7777777777777777777777777777777777777777777777777777777777777777777777777777
*
* --------- SCHEDULE THE POST PROCESSING FOR THE SOUTHERN HALF --------
* ----- THIS IS DONE TO AVOID THE 600CPU SECOND MAXIMUM TIME LIMIT -----
*
IPPKC= IPART-1
IPPKC= IKWP('PP',1,IPPKC)
IF(IPPKC.NE.0) THEN
CALL GETDAY(IDAY)
CALL GETTIM(ITIM)
DTIM=FTIME(ITIM)
C = '*PPKC'
*
IF(KTEST.NE.0) THEN
:SKE (6,IDAY) (5,DTIM) (C) (CROW) (CDEVK)
ELSE
.SKE (IDAY) (DTIM) (C) (CROW) (CDEVK)
ENDIF
*
ENDIF
*
* ****************** END OF SCHEDULED POST-PROCESSING ****************
*
C = CROW(1:2)//'/'//CPART
IF(KTEST.NE.0) THEN
:ASPLOG (CLOG) DONE:-TIME- (CATIM) Z--ROW/PART: (C)
ELSE
.ASPLOG (CLOG) DONE:-TIME- (CATIM) Z--ROW/PART: (C)
ENDIF
1000
CALL EDEST(' DONE:'//CATIM//'Z--ROW/PART: '//C,0)
* ***************************************************************************
      SUBROUTINE SUBDAY(NOWDAY,LASDAY)
* ****************************************************************************
* --- SUBTRACT 1 DAY FROM NOWDAY TO GET LASDAY (BOTH IN YYDDD FORMAT)
      IYEAR = NOWDAY/1000
      IDAY  = MOD(NOWDAY,1000)
      IDAY  = IDAY - 1
         IF(IDAY.EQ.0) THEN
            IDAY  = 365
            IYEAR = IYEAR - 1
            IF(MOD(IYEAR,4).EQ.0) IDAY = 366
         ENDIF
      LASDAY = IYEAR*1000+IDAY
//* EOF
```

```
// EXEC MACRO3,MOD=MAKNHC
//* ULMAKNHC CMH 09/02/86: MEMBER UPDATED
//* ULMAKNHC CMH 09/02/86; MAKE OUTPUT GRID CREATION LOCAL
//* ULMAKNHC CMH 08/26/86; ADD SCRATCH GRID FILE
//* ULMAKNHC BTR 07/02/86; CHANGE KEYWORD
//* ULMAKNHC BTR 07/01/86; MOVE FROM UD
//* UDMAKNHC BTR 07/01/86; CHANGE KEYWORDS
//* UDMAKNHC BTR 06/25/86; ADD & DELETE XREF PARM
//* VLMAKNHC ALS 06/16/86; SPC FROM 30 40 TO 30 30
//* VLMAKNHC ALS 06/13/86; FORMAT (CDOC)
//* VLMAKNHC ALS 06/12/86; CDOC FOR GRIDS
//* VLMAKNHC ALS 06/12/86; LET PARTS BE PROCESSED OUT OF ORDER
//* VLMAKNHC ALS 06/12/86; MDNR TO MDF
//* VLMAKNHC ALS 06/12/86; POST PROCESS NOT SCHEDULED
//* VLMAKNHC ALS 06/11/86; FILE CREATION
//* VLMAKNHC ALS 06/11/86; INC FROM 10 TO 12
//SYSIN DD *
" ? MAKNHC -- Make VAS retrievals over NHC area. (ALS)
" ?   MAKNHC   time   part   <Keywords>
" ? Parameters:
" ?   time|  0  or  12   <No default>
" ?   part|  1, 2, 3 or 4   Dwell sound sequence number <No default>.
" ?          12Z:   1) 10:18,   2) 10:48,    3) 11:18,    4) 11:48
" ?          00Z:   1) 21:48,   2) 22:18,    3) 22:48,    4) 23:18
" ? Keywords:
" ?  MDF=  Retrieval MDF    <5568,71>   GBL=  beg end GBL grid# <1606-11>
" ?  GMDF= First guess MDF  <5569,72>  GRIDF= First guess gridf <5569,72>
" ?  SMDF= ED/SFC Data MDF  <5570,73> SGRIDF= ED/SFC Anal gridf <5570,73>
" ?  LAT=  Latitude range       <5 55>   LON=  Longitude range    <40 105>
" ?  SFC=  SVCA data MDF        <R/T>    DAY=  yyddd  year&day     <today>
" ?  DARA= Dest D.S. area       <R/T>    SARA= Source D.S. area      <R/T>
" ?  GSS=  nonzero for 'NHCGSS'<R/T>     TEST= nonzero to list keyins <0>
" ?  BUOY= Buoy MD file         <R/T>    SHIP= Ship MD file          <R/T>
" ?  PP=   nonzero for 'PPNHC' <R/T>     TXVA= TXVA number           <R/T>
" ?  SCR= scratch grid (def:5576)
" ? Remarks: Defaults are for real-time. TXVA saved with MDF number.
" ?  'PPNHC' is post processing: auto edit and grid generation.
" ?  N.B.  output grid file no. is same as MDF (5568,5571)
" ?  DAY can be entered as -1 for yesterday...useful for scheduling 00z
INTEGER IDIR(64),MOUT(400)
CHARACTER*32 CDOC
DIMENSION ATIM(8)
DATA IABEG/1600/,NAREAS/8/,NROW/1/,ISGRD/5576/
"
" ATIM IS THE DWELL SOUND TIME OF AREAS;12Z= 10:18, 10:48, 11:18, 11:48
"                                          00Z= 21:48, 22:18, 22:48, 23:18
"
DATA (ATIM(I),I= 1,8)/10.3,10.8,11.3,11.8,21.8,22.3,22.8,23.3/
:
: 'MAKNHC '  BEGAN AT-(7,ITIM).  {WITH INTR-(3,INTR)}
:
NTIM = IPP(1,-999)
  IF(NTIM.NE.12 .AND. NTIM.NE.0) THEN
    CALL SDEST(' 0 OR 12 ARE VALID TIMES, NOT '//CPP(1,'?'),0)
    GOTO 1000
  ENDIF
NPART=IPP(2,-999)
  IF(NPART.LT.1.OR.NPART.GT.4) THEN
    CALL SDEST(' 1-4 ARE VALID PART NUMBERS, NOT '//CPP(2,'?'),0)
    GOTO 1000
  ENDIF
"
" INDEX IS 1 FOR 12Z, 5 FOR 00Z ... USED FOR INDEX INTO ATIM ARRAY
```

```
MDF    = 5568 + 3*(INDEX/5)
MDNG   = 5569 + 3*(INDEX/5)
MDNS   = 5570 + 3*(INDEX/5)
NGFG   = 5569 + 3*(INDEX/5)
NGFS   = 5570 + 3*(INDEX/5)
CDEV   = CKWP('DEV',1,'C')
KTEST  = IKWP('TEST',1,0)
MDF    = IKWP('MDF',1,MDF)
MDNG   = IKWP('GMDF',1,MDNG)
MDNS   = IKWP('SMDF',1,MDNS)
NGFG   = IKWP('GRIDF',1,NGFG)
NGFS   = IKWP('SGRIDF',1,NGFS)
ISGRD  = IKWP('SCR',1,5576)
IGFL1  = IKWP('GBL',1,1606)
IGFL2  = IKWP('GBL',2,1611)
LS     = IKWP('LAT',1,5)
LN     = IKWP('LAT',2,55)
LE     = IKWP('LON',1,40)
LW     = IKWP('LON',2,105)
NDAY   = IKWP('DAY',1,IDAY)
ITXVA  = MDF
ITXVA  = IKWP('TXVA',1,ITXVA)
"
" DAY CAN BE ENTERED VIA KEYWORD AS YYDDD OR AS -1 (YSTDY)
"
IF(NDAY.LT.0) CALL SUBDAY(IDAY,NDAY)
ITODAY= NDAY
CALL SUBDAY(ITODAY,IYSTDY)
"
"  DEFAULT SFC MD FILE (&SHIP,BUOY) TO REAL TIME LOCATION BASED ON DAY
"
MDSFC = IKWP('SFC',1,MDSVC('SVCA',ITODAY))
MDBUOY= 60+MDSFC
MDSHIP= 30+MDSFC
MDBUOY= IKWP('BUOY',1,MDBUOY)
MDSHIP= IKWP('SHIP',1,MDSHIP)
"
"  CHECK FOR LAT/LONS WITHIN GBL LIMITS - EXTEND SFC & GUESS BY 5 DEG.
"
  IF(LS.LT.0.OR.LN.GT.61.OR.LE.LT.40.OR.LW.GT.180) THEN
     CALL SDEST(' LAT/LONS LIMITED FROM 0-61 N, 40-180 W',0)
     GOTO 1000
  ENDIF
LLNW = (LN*1000)+LW
LLSE = (LS*1000)+LE
LLS  = LS-5
LLN  = LN+5
LLE  = LE-5
LLW  = LW+5
"
"    -------------------- FIND DWELL SOUND AREA --------------------
"
"  SEARCH AREAS 1301-1310 FOR TIMES CORRESPONDING TO  DWELL SOUND NEEDED
"  MOVE THAT AREA TO PRE-DEFINED LOCATION IN 1600-1607 SEQUENTIALLY.
"  SUBSECT SMALLER AREA FROM THE DWELL SOUNDS (190X700) STARTING WITH
"  FIRST LINE RECEIVED AND ELEMENT #6100 (PROVIDES E/W COVERAGE FOR USA)
"
" AREAS 1600-1607 --- DWELL SOUND AREAS MOVED HERE FROM REAL TIME SLOTS.
"
" DEFAULT SOURCE AREA (ORIGINAL DWELL SNDS) IS 1300-1310
"
" ISEQ (1-8) REPRESENTS THE DWELL SOUND SEQUENCE THRU THE DAY
" WITH 12 GMT CONSIDERED THE BEGINNING...SEE ATIM DATA STATEMENT.
"
```

```
IATIM  = MFD(DTIM)/100
CATIM  = CFI(IATIM)
MAREA1 = IKWP('SARA',1,1301)
DO 50 N= 1,10
 MAREA= MAREA1 + N - 1
 CALL READD(MAREA,IDIR)
 NDAY= IDIR(4)
   IF(NDAY .EQ. ITODAY) THEN
     TEST= FTIME(IDIR(5))-ATIM(ISEQ)
     IF(TEST .LT. 0.1  .AND.  TEST .GT. -0.1) GOTO 60
   ENDIF
50
.
.   DWELL SOUND NOT FOUND...
.
CALL EDEST(' DID NOT FIND DWELL SOUND AREA FOR TIME= ',IATIM)
GO TO 1000
60
.
.  DWELL SOUND FOUND, SET AREA NUMBER THAT DWELL-SOUND WILL BE MOVED TO.
.
NHR    = IDIR(5)/10000
NLIN   = IDIR(6)
LINES  = IDIR(9)
NSND   = IABEG + ISEQ - 1
NSND   = IKWP('DARA',1,NSND)
.
.  QUIT AND MOVE AREA IF SOURCE AND DESTINATION FILE ARE NOT THE SAME
.
. 1111111111111111111111111111111111111111111111111111111111111111111
.
IF(MAREA.NE.NSND) THEN
.
. AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
.
IF(KTEST.NE.0) THEN
:QA (4,NSND)
:AA (4,MAREA) (4,NSND) 0 IU (4,NLIN) 6100 1 (5,LINES) 1200 BAND= ALL
ELSE
.QA (NSND)
.AA (MAREA) (NSND) 0 IU (NLIN) 6100 1 (LINES) 1200 BAND= ALL
ENDIF
.
. AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
.
ENDIF
.
. 1111111111111111111111111111111111111111111111111111111111111111111
.
. SET POINTER TO VAS DWELL SOUND AREA NUMBER (VPVA)
.
. BBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBB
.
IF(KTEST.NE.0) THEN
:VPVA (4,NSND)
ELSE
.VPVA (NSND)
ENDIF
. BBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBB
.
.      ----------------------- FILE CREATION -------------------------
.
.  CHECK IF THIS IS THE 1ST PART TO BE PROCESSED FOR THIS TIME PERIOD
.      DO THIS BY LOOKING AT DATE IN RETREIVAL MD FILE.
```

```
ICMAX = MOUT(3)
CALL MDCLOS(MDF)
IF(IOK.NE.0 .OR. IOK2.NE.0 .OR. MOUT(1).NE.ITODAY) THEN
*
: ----> FILES ARE BEING CREATED
*
* CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
*
IOK   = -1
ICMAX = -1
CALL CALDAY(ITODAY,NY,NM,ND,CM)
CALL ENCODE('(I2,A3,I2)',CDATE,ND,CM,NY)
IF(KTEST.NE.0) THEN
:MDU DEL (4,MDF)
:MDU DEL (4,MDNG)
:MDU DEL (4,MDNS)
:IGU DEL (4,NGFG)
:IGU DEL (4,NGFS)
:IGU DEL (4,MDF)
:IGU DEL (4,ISGRD)
CALL ENCODE('("R/T VAS RETRVLS FOR: ",A11)',CDOC,CDATE)
:MDU MAKE (4,MDF) VRET 1 0 1000 (5,ITODAY) (CDOC)
CALL ENCODE('("VAS FIRST-GUESS FOR: ",A11)',CDOC,CDATE)
:MDU MAKE (4,MDNG) VGSS 1 0  0  (5,ITODAY) (CDOC)
CALL ENCODE('("VAS ED/SFC-DATA FOR: ",A11)',CDOC,CDATE)
:MDU MAKE (4,MDNS) RSVC 1 0  0  (5,ITODAY) (CDOC)
CALL ENCODE('(I5," VAS GLOBAL GUESS: ",A8)',CDOC,ITODAY,CDATE)
:IGU MAKE (4,NGFG) (CDOC)
CALL ENCODE('(I5," VAS SFC ANALYSES: ",A8)',CDOC,ITODAY,CDATE)
:IGU MAKE (4,NGFS) (CDOC)
CALL ENCODE('("R/T VAS ANALYSES FOR: ",A11)',CDOC,CDATE)
:IGU MAKE (4,MDF) (CDOC)
CALL ENCODE('(I5," VAS SCRATCH FILE: ",A8)',CDOC,ITODAY,CDATE)
:IGU MAKE (4,ISGRD) (CDOC)
ELSE
CALL MDQUIT(MDF)
CALL MDQUIT(MDNS)
CALL MDQUIT(MDNG)
CALL IGQUIT(NGFS)
CALL IGQUIT(NGFG)
CALL IGQUIT(MDF)
CALL IGQUIT(ISGRD)
CALL ENCODE('("R/T VAS RETRVLS FOR: ",A11)',CDOC,CDATE)
IMD= MDMAKE(MDF,'VRET',1,0,1000,ITODAY,CDOC)
CALL ENCODE('("VAS FIRST-GUESS FOR: ",A11)',CDOC,CDATE)
IMD= MDMAKE(MDNG,'VGSS',1,0,0,ITODAY,CDOC)
CALL ENCODE('("VAS ED/SFC-DATA FOR: ",A11)',CDOC,CDATE)
IMD= MDMAKE(MDNS,'RSVC',1,0,0,ITODAY,CDOC)
CALL ENCODE('(I5," VAS SFC ANALYSES: ",A8)',CDOC,ITODAY,CDATE)
IG= IGMAKE(NGFS,CDOC)
CALL ENCODE('(I5," VAS GLOBAL GUESS: ",A8)',CDOC,ITODAY,CDATE)
IG= IGMAKE(NGFG,CDOC)
CALL ENCODE('(I5," VAS SCRATCH FILE: ",A8)',CDOC,ITODAY,CDATE)
IG= IGMAKE(ISGRD,CDOC)
CALL ENCODE('("R/T VAS ANALYSES FOR: ",A11)',CDOC,CDATE)
IG= IGMAKE(MDF,CDOC)
ENDIF
*
* CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
*
ENDIF
*
* ----------------- FIND AND PREPARE GUESS GRIDS -------------------
* ------  IF PART=1 , IF REQUESTED, OR IF NO RETRIEVALS EXIST YET ------
```

```
* CHECK TO SEE IF RETRIEVALS ALREADY EXIST FOR THIS ROW (ICMAX>0)
*
NHCGSS = 1
IF(ICMAX.GT.0) NHCGSS = 0
NHCGSS = IKWP('GSS',1,NHCGSS)
IF(NHCGSS.NE.0) THEN
*
* FOR OOGMT THE DAY FOR THE GUESS IS THE NEXT DAY (DATA IS B4 00Z)
*
NEXDAY = ITODAY
IF(NTIM.EQ.0) CALL ADDAY(ITODAY,NEXDAY)
*
IF(KTEST.NE.0) THEN
:NHCGSS (2,NTIM) GMDF=(4,MDNG) GRIDF=(4,NGFG) GBL=(4,IGFL1) (4,IGFL2) -
 LAT=(2,LS) (2,LN) LON=(3,LE) (3,LW) DAY=(5,NEXDAY)
ELSE
.NHCGSS (NTIM) GMDF= (MDNG) GRIDF= (NGFG) GBL= (IGFL1) (IGFL2) -
LAT= (LS) (LN) LON= (LE) (LW) DAY= (NEXDAY)
ENDIF
*
ENDIF
*
* ----------------- SET TXVA AND PREPARE SFC DATA ------------------
*
* IF RETRIEVALS ALREADY EXIST FOR THIS ROW--SFC GRIDS ALREADY EXIST
*     THIS CHECKED SO SOUTH D.S. CAN BE PROCESSED IF NORTH MISSED
* SFC DATA ALWAYS GENERATED FOR NORTH-MOST D.S., OTHERS DONE IF NEEDED.
*
*
* 55555555555555555555555555555555555555555555555555555555555555555555555
*
 IF(IOK.GE.0 .AND. ICMAX.GT.0 ) THEN
:  SFC DATA EXISTS -- LOAD THE 'TXVA' FROM THE ALREADY DONE N'TH-PART.
*
* GGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGG
*
IF(KTEST.NE.0) THEN
:TXVA (4,ITXVA) IN
:IDVA (4,MDF) 0 (5,LLNW) (5,LLSE) AUTO= 1
:SPVA ROW= (3,NROW) LLNW= (5,LLNW) LLSE= (5,LLSE)
ELSE
.TXVA (ITXVA) IN
.IDVA (MDF) 0 (LLNW) (LLSE) AUTO= 1
.SPVA ROW= (NROW) LLNW= (LLNW) LLSE= (LLSE)
ENDIF
*
* GGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGG
*
 ELSE
*
*   NEED TO GENERATE SFC DATA...BUILD NEW TXVA PARAMETERS FIRST
*
* HHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHH
*
IF(KTEST.NE.0) THEN
:IDVA (4,MDF) (3,NROW) (5,LLNW) (5,LLSE) AUTO= 1
:SPVA ROW= (3,NROW) LLNW= (5,LLNW) LLSE= (5,LLSE)
:SPVA NRET= 0
ELSE
.IDVA (MDF) (NROW) (LLNW) (LLSE) AUTO= 1
.SPVA ROW= (NROW) LLNW= (LLNW) LLSE= (LLSE)
.SPVA NRET= 0
ENDIF
*
```

```
.
NROWE = 3*(1+NHR)
NROWB = NROWE - 9
IF(NROWB.LE.0) NROWB = 1
IOK = MDOPEN(MDSFC,1)
.
. MOUT(4) IS NUMBER OF RECORDS IN THE ROW...TO SEE IF DATA EXISTS
.
DO 150 NR=NROWE,NROWB,-1
  IF(MDGET(MDSFC,NR,0,MOUT).EQ.0) THEN
    IF(MOUT(4).GT.0) GOTO 155
  ENDIF
150
CALL EDEST(' NO SFC DATA AVAILABLE IN MD FILE# ',MDSFC)
GOTO 1000
155
ITSFC = (NR-1)/3
CALL MDCLOS(MDSFC)
.
. NOW LOOK FOR LATEST BUOY DATA AVAILABLE
.
NROWB  = ITSFC - 5
NROWE  = ITSFC + 1
ITBUOY = -1
IOK = MDOPEN(MDBUOY,1)
.
. MOUT(3) IS NUMBER OF RECORDS IN THE ROW...TO SEE IF DATA EXISTS.
.
DO 160 NR=NROWB,NROWE
  IF(MDGET(MDBUOY,NR,0,MOUT).EQ.0) THEN
    IF(MOUT(3).GT.0) ITBUOY = NR-1
  ENDIF
160
CALL MDCLOS(MDBUOY)
IF(ITBUOY.LT.0) THEN
  CALL EDEST(' NO TIMELY BUOY DATA FOUND IN MD FILE# ',MDBUOY)
  CALL EDEST(' ...PROCESSING IS CONTINUING WITHOUT BUOY DATA',0)
ENDIF
.
. NO CHECK ON AVAIL. OF SHIP DATA...SINCE IT IS FAIRLY OLD (6HR CYCLE)
.
ITSHIP = 6*(ITSFC/6)
.
.  LOAD, AUTO-EDIT (BASED ON NEIGHBORS, NOT FIRST-GUESS), AND ANALYZE
.    SURFACE OBSERVATIONS (FROM 'CURRENT' OR SPECIFIED ("MDSFC") SVCA
.    MD-FILE) FOR THE LARGER AREA. (GUESS LARGER AREA THAN RETRIEVALS)
.
. IIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII
.
IF(KTEST.NE.0) THEN
:CSVA (4,MDNS) LAT=(2,LLS) (2,LLN) LON=(3,LLE) (3,LLW) -
 MDF=(4,MDSFC) TIME=(2,ITSFC) DAY=(5,ITODAY)
. ______________________________________________________________________________
:CSVA (4,MDNS) LAT=(2,LLS) (2,LLN) LON=(3,LLE) (3,LLW) -
 MDF=(4,MDSHIP) TIME=(2,ITSHIP) DAY=(5,ITODAY) ADD=(2,ITSFC) SHIP=1
. ______________________________________________________________________________
IF(ITBUOY.GE.0) THEN
:CSVA (4,MDNS) LAT=(2,LLS) (2,LLN) LON=(3,LLE) (3,LLW) -
 MDF=(4,MDBUOY) TIME=(2,ITBUOY) DAY=(5,ITODAY) ADD=(2,ITSFC) BUOY=1
ENDIF
. ______________________________________________________________________________
:SFVA Z100 (4,NGFS) LAT= (2,LLS) (2,LLN) LON= (3,LLE) (3,LLW) -
 GSS=G INC=12 RF=1.
:SFVA TSL   (4,NGFS) LAT= (2,LLS) (2,LLN) LON= (3,LLE) (3,LLW) -
```

```
:SFVA DD    (4,NGFS) LAT= (2,LLS) (2,LLN) LON= (3,LLE) (3,LLW) -
 GSS=G INC=12 RF=1.
:SPVA LLNW= (5,LLNW) LLSE= (5,LLSE)
:TXVA (4,ITXVA) OUT
ELSE
.CSVA (MDNS) LAT= (LLS) (LLN) LON= (LLE) (LLW) MDF= (MDSFC) -
TIME= (ITSFC) DAY= (ITODAY)
" -------------------------------------------------------------------------
.CSVA (MDNS) LAT= (LLS) (LLN) LON= (LLE) (LLW) MDF= (MDSHIP) -
SHIP= 1 DAY= (ITODAY) TIME= (ITSHIP) ADD= (ITSFC)
" -------------------------------------------------------------------------
IF(ITBUOY.GE.0) THEN
.CSVA (MDNS) LAT= (LLS) (LLN) LON= (LLE) (LLW) MDF= (MDBUOY) -
BUOY= 1 DAY= (ITODAY) TIME= (ITBUOY) ADD= (ITSFC)
ENDIF
" -------------------------------------------------------------------------
.SFVA Z100 (NGFS) GSS= G INC= 12 LAT= (LLS) (LLN) LON= (LLE) (LLW) -
RF= 1.
.SFVA TSL  (NGFS) GSS= G INC= 12 LAT= (LLS) (LLN) LON= (LLE) (LLW) -
RF= 1.
.SFVA DD   (NGFS) GSS= G INC= 12 LAT= (LLS) (LLN) LON= (LLE) (LLW) -
RF= 1.
.SPVA LLNW= (LLNW) LLSE= (LLSE)
.TXVA (ITXVA) OUT
ENDIF
"
" IIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII
"
ENDIF
"
" 555555555555555555555555555555555555555555555555555555555555555555
"
"
"  GENERATE RETRIEVALS, SAVE 'TXVA' WITH 'NRET' SAVED AFTER "VRVA"
"
" JJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJ
"
IF(KTEST.NE.0) THEN
:VRVA BOX= 11 SPC= 30 40 AUTO= 1 TOP= 1 SKIN= 6 BIAS= 99 EMISS= .96
:TXVA (4,ITXVA) OUT
ELSE
.VRVA BOX= 11 SPC= 30 40 AUTO= 1 TOP= 1 BIAS= 99 SKIN= 6 EMISS= .96
.TXVA (ITXVA) OUT
ENDIF
"
" JJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJ
"
" ------- START THE POST PROCESSING FOR THE SOUTH-MOST PART ---------
"
IPPNHC= 0
IF(NPART.EQ.4) IPPNHC = 1
IPPNHC= IKWP('PP',1,IPPNHC)
IF(IPPNHC.NE.0) THEN
"
IF(KTEST.NE.0) THEN
:PPNHC (2,NTIM) MDF=(4,MDF) GMDF=(4,MDNG) GRIDF=(4,NGFG) TXVA=(4,ITXVA)-
SCR= (ISGRD)  LAT=(2,LS) (2,LN) LON=(3,LE) (3,LW) DEV=(CDEV)
ELSE
.PPNHC (NTIM) MDF= (MDF) GMDF= (MDNG) GRIDF= (NGFG) TXVA= (ITXVA) -
SCR= (ISGRD) LAT= (LS) (LN) LON= (LE) (LW) DEV= (CDEV)
ENDIF
"
ENDIF
"
```

```
      SUBROUTINE SUBDAY(NOWDAY,LASDAY)
* ****************************************************************************
* --- SUBTRACT 1 DAY FROM NOWDAY TO GET LASDAY (BOTH IN YYDDD FORMAT)
      IYEAR = NOWDAY/1000
      IDAY  = MOD(NOWDAY,1000)
      IDAY  = IDAY - 1
         IF(IDAY.EQ.0) THEN
            IDAY  = 365
            IYEAR = IYEAR - 1
            IF(MOD(IYEAR,4).EQ.0) IDAY = 366
         ENDIF
      LASDAY = IYEAR*1000+IDAY
* ****************************************************************************
      SUBROUTINE ADDAY(NOWDAY,NEXDAY)
* ****************************************************************************
* --- ADD 1 DAY TO NOWDAY TO GET NEXDAY (BOTH IN YYDDD FORMAT)
      IYEAR = NOWDAY/1000
      IDAY  = MOD(NOWDAY,1000)
      IDAY  = IDAY + 1
      NDAYS = 365
      IF(MOD(IYEAR,4).EQ.0) NDAYS = 366
         IF(IDAY.GT.NDAYS) THEN
            IDAY  = 1
            IYEAR = IYEAR + 1
         ENDIF
      NEXDAY = IYEAR*1000+IDAY
//* EOF
```

TABLE C4

```
//  EXEC  MACRO2,MOD=NMCGSS
//* ULNMCGSS BTR  07/01/86; MOVE FROM UD
//* UDNMCGSS BTR  07/01/86; CHANGE KEYWORDS
//* UDNMCGSS BTR  07/01/86; CHANGE KEYWORDS
//* UDNMCGSS DJL  06/26/86; MOVE TO UD
//SYSIN  DD  *
' ? **NMCGSS**   SET UP GUESS FOR 'MAKNMC' VAS RETRIEVALS.  (AJ)
' ?   KEYIN: NMCGSS  (PER)  (PART)  <KEYWORDS>
' ?    PER- 0 OR 12      TIME OF RETRIEVAL SET<NO DEFAULT>
' ?    PART- 1(EARLY D.S. PAIR), 2(LATE D.S. PAIR)<NO DEFAULT>
' ?    KEYWORDS
' ?   (NOTE: FOR MD AND GRID FILE LOCATIONS THE FIRST NUMBER REPRE-
' ?     SENTS THE 12GMT LOCATION AND THE SECOND DEFAULT VALUE IS THE
' ?     00GMT LOCATION.)
' ?      GMDF=GLOBAL GUESS MD<1446,50> GRIDF=GLOBAL GUESS GRID<1446,50>
' ?      VGMDF=VAS+GBL GSS MD<1447,51> GGRIDF=VAS+GBL GSS GRID<1447,51>
' ?      LAT=LATITIUDE LIMITS<20 58>    LON=LONGITUDE LIMITS<115 158>
' ?      GBL=RANGE OF GRID FILES CONTAINING GUESS<1606 1611>
' ?      ANAL=NON-ZERO TO USE INITIAL ANALYSIS<0>
' ?      DAY=DAY OF DATA IN YYDDD FORMAT<TODAY>
' ?      TEST=NON-ZERO TO GENERATE LIST OF KEY-IN'S<0>
' ? REMARKS: PREPARE GUESS MD FILE FOR NMC. DEFAULTS ARE REAL-TIME.
'
' DETERMINE WHICH GLOBAL 12Z FCST (EITHER 12HR OR 24HR) TO USE
'
CHARACTER*70 CS
INTEGER IDIR(64),MOUT(64),IPRE(15)
DATA IPRE/1000,850,700,500,400,300,250,200,150,100,70,50,30,20,10/
DATA IGGBL/-1/,IG12/-1/,IG24/-1/,IANAL/-1/
NTIM= IPP(1,-999)
IF(NTIM .NE. 0 .AND. NTIM .NE. 12)THEN
CALL SDEST('USED INVALID TIME',NTIM)
CALL ABORT
GO TO 999
ENDIF
IPART= IPP(2,-999)
IF(IPART .NE. 1 .AND. IPART .NE. 2)THEN
CALL SDEST('USED INVALID PART ',IPART)
CALL ABORT
GO TO 999
ENDIF
KDAY= IKWP('DAY',1,IDAY)
' *********************************************************************
'    TO PROCESS YESTERDAY'S DATA SET 'DAY' EQUAL TO NEGATIVE NUMBER
IF(KDAY.LT.0) CALL SUBDAY(IDAY,KDAY)
ITODAY= KDAY
CALL SUBDAY(ITODAY,IYSTDY)
' *********************************************************************
IVDAY= -999
NRET= -999
' +++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
'  LOAD THE APPROPRIATE MD AND GRID FILE LOCATIONS FOR 00GMT OR 12GMT
'                          REAL TIME PROCESSING
'  I00HR, I12HR, I24HR ARE THE 00HR, 12HR, 24HR FORECAST GROUPS USED
IF(NTIM .EQ. 12)THEN
MDNR= 1445
MDNG= 1446
NGFG= 1446
MDVG= 1447
NGVG= 1447
I00HR= ITODAY*100 + 12
I12HR= ITODAY*100 + 00
I24HR= IYSTDY*100 + 12
ELSE
```

```
NGFG= 1450
MDVG= 1451
NGVG= 1451
IOOHR= ITODAY*100 + 00
I12HR= IYSTDY*100 + 12
I24HR= IYSTDY*100 + 00
ENDIF
* ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
MDNR= IKWP('MDF',1,MDNR)
MDNG= IKWP('GMDF',1,MDNG)
MDVG= IKWP('VGMDF',1,MDVG)
NGFG= IKWP('GRIDF',1,NGFG)
NGVG= IKWP('GGRIDF',1,NGVG)
IGFL= IKWP('GBL',1,1606)
IGFH= IKWP('GBL',2,1611)
IF(IGFL .NE. 1606)IGFH= IGFL
LS= IKWP('LAT',1,20)
LN= IKWP('LAT',2,58)
LE= IKWP('LON',1,115)
LW= IKWP('LON',2,158)
LLNW= (LN*1000)+LW
LLSE= (LS*1000)+LE
LLS= LS-5
LLN= LN+5
LLE= LE-5
LLW= LW+5
ITEST= IKWP('TEST',1,0)
* ######################################################################
*  IF THIS IS THE SECOND DWELL SOUND PAIR TO BE PROCESSED GENERATE
*                          A VAS UPDATED GUESS
IF(MOD(IPART,2) .EQ. 0)GO TO 101
* ######################################################################
* **********************************************************************
*     BEGIN TO FIND THE APPROPRIATE GRID FILES CONTAINING THE DESIRED
*                             FORECAST GROUPS
*  PRIORITY OF SELECTION IS: (1)12HR FCST, (2)00HR FCST OR ANALYSIS,
*        AND (3)24HR FCST. IF NONE ARE AVAILABLE END PROGRAM.
DO 11 IGF= IGFL,IGFH
IOK= IGGET(IGF,1,-1,IDUM,NR,NC,IDIR)
JTEST= IDIR(4)*100 + IDIR(5)/10000
IF(JTEST .EQ. IOOHR)IANAL= IGF
IF(JTEST .EQ. I12HR)IG12= IGF
IF(JTEST .EQ. I24HR)IG24= IGF
11
CALL DDEST('IANAL='//CFI(IANAL)//'IG12='//CFI(IG12)//'IG24=',IG24)
IGGBL= IG12
IFCST= 12
IDATIM= I12HR
IF(IGGBL .LT. 0 .OR. IKWP('ANAL',1,0) .NE. 0)THEN
IGGBL= IANAL
IFCST= 00
IDATIM= IOOHR
ENDIF
IF(IGGBL .LT. 0)THEN
IGGBL= IG24
IFCST= 24
IDATIM= I24HR
ENDIF
IF(IGGBL .LT. 0)THEN
CALL SDEST('GUESS IS NOT AVAILABLE',0)
CALL ABORT
GO TO 999
ENDIF
IGDAY= IDATIM/100
```

```
CALL SDEST('IGGBL= '//CFI(IGGBL)(7:12)//' IFCST= '//IFCST)
CALL GETGRD(IGGBL,IGDAY,IGTIM,IFCST,'T   ',1000,IGRD)
IF(IGRD .LE. 0)THEN
CALL SDEST('1000MB TEMP NOT AVAILABLE IN GRID FILE ',IGGBL)
CALL ABORT
GO TO 999
ENDIF
* ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
*    GENERATE GRID FILE AND MOVE DESIRED FCST GROUP INTO IT, THEN
*                   GENERATE GUESS MD FILE
IENGRD= IGRD + 43
CDOC= 'GBL GUESS '//CFU(ITODAY)
IMD= MDMAKE(MDNG,'VGSS',0,0,0,ITODAY,CDOC)
CDOC= 'GBL GUESS '//CFU(ITODAY)
   IF(ITEST .EQ. 1)THEN
:IGU MAKE (4,NGFG)
:IGG GET (4,IGGBL) (3,IGRD) (3,IENGRD) (5,NGFG)
:GSVA (4,IGGBL) (3,IGRD) (5,MDNG) (6,LLNW) (6,LLSE) ' 20'
   ELSE
IG= IGMAKE(NGFG,CDOC)
.IGG GET (IGGBL) (IGRD) (IENGRD) (NGFG)
.GSVA (IGGBL) (IGRD) (MDNG) (LLNW) (LLSE) 20
   ENDIF
* ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
* ********************************************************************
101
* $$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$
*   SECTION TO GENERATE UPDATED FIRST GUESS USING VAS DATA(RTVLS)
*   FROM FIRST DWELL SOUND PAIR OF PERIOD FOLLOWING CHECKS TO MAKE
*            SURE DATA IS THERE, IF NOT END PROGRAM
IF(MOD(IPART,2) .NE. 0)GO TO 999
IOK= MDOPEN(MDNR,1)
IDIOT= MDGET(MDNR,1,0,MOUT)
IF(IDIOT .EQ. -1)THEN
CALL SDEST('RTVLS FROM FIRST PERIOD NOT EXIST',MDNR)
CALL ABORT
GO TO 999
ENDIF
IVDAY= MOUT(1)
NRET= MOUT(3)
IF(IVDAY .NE. ITODAY .AND. NRET .LE. 0)THEN
CALL SDEST('RTVLS ARE NOT CURRENT OR DO NOT EXIST',IVDAY)
CALL ABORT
GO TO 999
ENDIF
   IF(ITEST .EQ. 1)THEN
:SPVA MDF= (4,MDNR) ' ROW= 1 DEV= NNN'
:SPVA GMDF= (4,MDNG) ' DEV= NNN'
   ELSE
.SPVA MDF= (MDNR) ROW= 1 DEV= NNN
.SPVA GMDF= (MDNG) DEV= NNN
   ENDIF
CALL IGCURF(NGVG)
* ####################################################################
*    ANALYZE UPDATED TEMPERATURE, DEW POINT, AND 1000MB Z GRIDS AND
*    PUT THEM INTO APPROPRIATE GRID FILE. FINAL STEP IS TO GENERATE
*                        GUESS MD FILE
DO 221 I=1,15
IL= IPRE(I)
   IF(ITEST .EQ. 1)THEN
CS= ' T'//CFI(IL)(9:12)//' INC=15 GSS=G LAT='//CFI(LS)(11:12)
CS= CS(1:26)//CFI(LN)(10:12)//' LON='//CFI(LE)(10:12)//CFI(LW)(9:12)
CS= CS(1:41)//' RF=1.5 RL=10 GINC=6 DEV=NNN'
:RFVA (CS)
```

```
   ENDIF
221
DO 222 I=1,6
IL= IPRE(I)
   IF(ITEST .EQ. 1)THEN
CS= ' TD'//CFI(IL)(9:12)//' INC=15 GSS=G LAT='//CFI(LS)(11:12)
CS= CS(1:27)//CFI(LN)(10:12)//' LON='//CFI(LE)(10:12)//CFI(LW)(9:12)
CS= CS(1:42)//' RF=1.5 RL=10 GINC=6 DEV=NNN'
:RFVA (CS)
   ELSE
.RFVA TD (IL) INC= 15 LAT= (LS) (LN) LON= (LE) (LW) DEV= NNN-
 RF= 1.5 RL= 10.
   ENDIF
222
   IF(ITEST .EQ. 1)THEN
CS= ' Z 1000 INC=15 LAT='//CFI(LS)(11:12)//CFI(LN)(10:12)//' LON='
CS= CS(1:29)//CFI(LE)(10:12)//CFI(LW)(9:12)//' RF=1.5 RL=10 DEV=NNN'
:RFVA (CS)
:GSVA (5,NGVG) ' 1'(5,MDVG) (6,LLNW) (6,LLSE) ' 20'
   ELSE
.RFVA Z 1000 INC= 15 LAT= (LS) (LN) LON= (LE) (LW) DEV= NNN-
 RF= 1.5 RL= 10.
.GSVA (NGVG) 1 (MDVG) (LLNW) (LLSE) 20
   ENDIF
* ###########################################################################
* $$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$
999
* ****************************************************************************
      SUBROUTINE SUBDAY(NOWDAY,LASDAY)
* ****************************************************************************
* --- SUBTRACT 1 DAY FROM NOWDAY TO GET LASDAY (BOTH IN YYDDD FORMAT)
      IYEAR = NOWDAY/1000
      IDAY  = MOD(NOWDAY,1000)
      IDAY  = IDAY - 1
         IF(IDAY.EQ.0) THEN
            IDAY   =  365
            IYEAR = IYEAR - 1
            IF(MOD(IYEAR,4).EQ.0) IDAY = 366
         ENDIF
      LASDAY = IYEAR*1000+IDAY
//* EOF
```

```
//KCGSSJOV JOB ,MSGLEVEL=(0,0),CLASS=2
//  EXEC  MACRO3,MOD=KCGSS
//* ULKCGSS  BTR  07/01/86; MOVE FROM UD
//* UDKCGSS  BTR  07/01/86; CHANGE KEYWORDS
//* UDKCGSS  BTR  06/26/86; ADD & DELETE XREF PARM
//* UDKCGSS  BTR  06/26/86; ADD & DELETE XREF PARM
//* UDKCGSS  DJL  06/26/86; MOVE TO UD
//* VLKCGSS  ALS  06/06/86; MOD TO HELP
//* VLKCGSS  ALS  03/25/86; ADD ASPLOG MSGS
//SYSIN  DD  *
' ? KCGSS  -- Set up guess for 'MAKKC' VAS retrievals.  (ALS)
' ?   KCGSS   row     <Keywords>
' ? Parameters:
' ?   row|  row# (1-10) corresponding to dwell sound times (No dflt).
' ?         1 -- 948/1018    2 --1118/1148   3 --1248/1318
' ?         4 --1418/1448    5 --1548/1618   6 --1718/1748
' ?         7 --1848/1918    8 --2018/2048   9 --2148/2218   10 --2318/2348
' ? Keywords:
' ?  GMDF= First guess MDF      <1442>    GRIDF= First guess gridf    <1442>
' ?  LAT=  Latitude range      <24 50>    LON=  Longitude range      <75 110>
' ?  LFM=  beg end LFM gridf <1600 1605>
' ?  ANAL= nonzero to use initial analysis and 12hr fcst guess      <0>
' ?        default is to use 12hr and 24hr time interpolated fcst.
' ?  DAY=  day   yyddd format      <current>
' ?  TEST= nonzero to list keyins instead of executing them <0>
' ? Remarks: Prepare guess MD file for NSSFC. Defaults are real-time.
INTEGER IDIR(64)
REAL TIMINC(10)
CHARACTER*32 CDOC
'
' TIMINC IS FRACTIONAL TIME INCREMENT FROM EARLIER GUESS TIME (0-1.0).
' THIS IS USED BY 'GSVA' TO INTERPOLATE THE GUESS BETWEEN 2 FCST PERIODS
' NEGATIVE NUMBERS INDICATE NO TIME INTERPOLATION FOR THAT TIME PERIOD.
'
DATA TIMINC/-1.,-1.,-1.,.2083,.3333,.4583,.5833,.7083,.8333,.9583/
DATA IGLFM/-1/,IG12/-1/,IG24/-1/,IANAL/-1/
:
: 'KCGSS '  BEGAN AT-(7,ITIM).    {WITH INTR-(3,INTR)}
:
NROW= IPP(1,-999)
   IF(NROW.LT.1.OR.NROW.GT.10) THEN
     CALL SDEST(' 1-10 ARE VALID ROW NUMBERS, YOU USED ',NROW)
     CALL ABORT
     GOTO 999
   ENDIF
MDNG = IKWP('GMDF',1,1442)
NGFG = IKWP('GRIDF',1,1442)
IGFL1= IKWP('LFM',1,1600)
IGFL2= IKWP('LFM',2,1605)
LS   = IKWP('LAT',1,24)
LN   = IKWP('LAT',2,50)
LE   = IKWP('LON',1,75)
LW   = IKWP('LON',2,110)
NDAY = IKWP('DAY',1,IDAY)
KTEST= IKWP('TEST',1,0)
'
' DAY CAN BE ENTERED VIA KEYWORD AS YYDDD OR AS -1 (YSTDY)
'
IF(NDAY.LT.0) CALL SUBDAY(IDAY,NDAY)
ITODAY= NDAY
CALL SUBDAY(ITODAY,IYSTDY)
'
'  CHECK FOR LAT/LONS WITHIN LFM LIMITS - EXTEND SFC/GUESS BY 5 DEG.
'
```

```
      CALL ABORT
      GOTO 999
    ENDIF
LLS  = LS-5
LLN  = LN+5
LLE  = LE-5
LLW  = LW+5
LLNW= (LLN*1000)+LLW
LLSE= (LLS*1000)+LLE
*
* -------------------- FIND AND PREPARE GUESS GRIDS --------------------
* --------------------- IF NEEDED OR IF REQUESTED -----------------------
*
* I00HR=00HR FCST DAY/TIME (YYDDDHH) --> DAY/TIME OF LFM IF ANALYSIS.
* I12HR=12HR FCST DAY/TIME (YYDDDHH) --> DAY/TIME OF LFM IF 12HR FCST.
* I24HR=24HR FCST DAY/TIME (YYDDDHH) --> DAY/TIME OF LFM IF 24HR FCST.
*
I00HR = ITODAY*100+12
I12HR = ITODAY*100
I24HR = IYSTDY*100+12
*
* WHAT EXISTS ? --> FIND ANALYSIS,12 OR 24 HR FCST FOR PROPER DAY/TIME.
*
DO 10 IGFL=IGFL1,IGFL2
  IOK   = IGGET(IGFL,1,-1,IDUM,NR,NC,IDIR)
  ITEST = IDIR(4)*100+IDIR(5)/10000
  IF(ITEST.EQ.I00HR) IANAL = IGFL
  IF(ITEST.EQ.I12HR) IG12  = IGFL
  IF(ITEST.EQ.I24HR) IG24  = IGFL
10
; LFM GRIDFILES: ANAL= (5,IANAL) 12HR= (5,IG12) 24HR= (5,IG24)
*
* USE ANALYSIS ONLY IF KEYWORD 'ANAL' USED OR IF 12HR NOT AVAILABLE.
*
IF(IG12.LT.0 .OR. IKWP('ANAL',1,0).NE.0) THEN
  IF(IANAL.GT.0) THEN
    IGLFM = IANAL
    IFCST1= 0
    IFCST2= 12
    CALL EDEST(' LFM--> USING ANALYSIS IN GRIDF=',IANAL)
  ENDIF
ENDIF
*
* DEFAULT IS TO USE 12HR GUESS AND INTERPOLATE BETWEEN 12&24 HR GUESS.
*
IF(IGLFM.LT.0 .AND. IG12.GT.0) THEN
  IGLFM = IG12
  IFCST1= 12
  IFCST2= 24
  CALL EDEST(' LFM--> USING 12HR FCST IN GRIDF=',IG12)
ENDIF
*
* USE 24HR GUESS IF BOTH OF THE OTHERS FAILED.
*
IF(IGLFM.LT.0 .AND. IG24.GT.0) THEN
  IGLFM = IG24
  IFCST1= 24
  IFCST2= -1
  CALL EDEST(' LFM--> USING 24HR FCST IN GRIDF=',IG24)
ENDIF
*
* 333333333333333333333333333333333333333333333333333333333333333333333
*
IF(IGLFM .LE. 0) THEN
```

```
.ASPLOG 'GUESS -- NO GUESS AVAILABLE
 ENDIF
   CALL ABORT
   GOTO 999
ENDIF
*
* 33333333333333333333333333333333333333333333333333333333333333333333333
*
* SEE IF GRID FILE WAS ALREADY TRANSFERED BY CHECKING 1ST GRID DAY/TIME.
*
IOK   = IGGET(IGLFM,1,-1,IDUM,NR,NC,IDIR)
ILDAY = IDIR(4)
ILTIM = IDIR(5)
LFMDT = ILDAY*100+ILTIM/10000
*
* GOT DAY/TIME OF LFM (LFMDT)...NOW GET DAY/TIME OF 'NGFG' (NGFDT).
*
IOK = IGGET(NGFG,1,-1,IDUM,NR,NC,IDIR)
IGDAY = IDIR(4)
IGTIM = IDIR(5)
NGFDT = IGDAY*100+IGTIM/10000
*
* MOVE THE SOURCE LFM GRIDS TO 'NGFG' IF DAY/TIMES ARE DIFFERENT
*
IF(LFMDT.NE.NGFDT) THEN
*
IF(KTEST.NE.0) THEN
:IGU DEL  (5,NGFG)
:IGU COPY (5,IGLFM) (5,NGFG)
ELSE
.IGU DEL (NGFG)
.IGU COPY (IGLFM) (NGFG)
ENDIF
*
ENDIF
*
* FIND GRID NUMBER OF 1000 MB TEMP GRID FOR FCST TIMES (IFCST1,IFCST2).
*
CALL GETGRD(NGFG,ILDAY,ILTIM,IFCST1,'T   ',1000,IGRD)
  IF(IGRD.LE.0) THEN
   CALL SDEST(' NO 1000 MB TEMP. GRID FOUND IN LFM GRIDF=',IGLFM)
 IF(KTEST.NE.0) THEN
.ASPLOG 'GUESS MISSING 1000MB TEMPERATURE.
 ENDIF
   CALL ABORT
   GOTO 999
  ENDIF
*
* FOR 24HR FCST LFM --> NO TIME INTERPOLATION OF GUESS NEEDED.
* FOR TIMINC .LE. 0 --> NO TIME INTERPOLATION OF GUESS NEEDED.
*
IF(IFCST2.LT.0 .OR. TIMINC(NROW).LT.0.0) THEN
*
IF(KTEST.NE.0) THEN
:GSVA (4,NGFG) (3,IGRD) (4,MDNG) (5,LLNW) (5,LLSE)
ELSE
.GSVA (NGFG) (IGRD) (MDNG) (LLNW) (LLSE)
ENDIF
*
GOTO 999
ENDIF
*
* FIND 1000 MB TEMP FOR INTERPOLATION WITH FIRST FCST TIME
*
CALL GETGRD(NGFG,ILDAY,ILTIM,IFCST2,'T   ',1000,IGRD2)
```

```
 IF(KTEST.NE.0) THEN
.ASPLOG 'GUESS MISSING 1000MB TEMPERATURE (FOR INTERPOLATION)
 ENDIF
  CALL ABORT
  GOTO 999
  ENDIF
*
*  MAKE 1ST GUESS GRIDS INTO MD FILE OVER 'LARGER' AREA; 5 DEG PADDING.
*
DTIM = TIMINC(NROW)
* EEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEE
*
IF(KTEST.NE.0) THEN
:GSVA (4,NGFG) (3,IGRD2) (4,MDNG) (5,LLNW) (5,LLSE) 20 (3,IGRD) (DTIM)
ELSE
.GSVA (NGFG) (IGRD2) (MDNG) (LLNW) (LLSE) 20 (IGRD) (DTIM)
ENDIF
*
* EEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEE
*
999
CALL EDEST(' DONE',0)
* ********************************************************************
SUBROUTINE GETGRD(IGRDF,KDAY,KTIM,IVTIM,CPARM,LEV,IGRD)
* ********************************************************************
* INPUT : IGRDF = GRID FILE NUMBER TO SEARCH
*         KDAY  = YYDDD OF GRID TO SEARCH FOR
*         KTIM  = HHMMSS TIME OF GRID TO SEARCH FOR
*         IVTIM = HH FCST TIME OF GRID TO SEARCH FOR (IE 0, 12, 24, 36)
*         CPARM = CHARACTER*4  PARAMETER NAME ('T', 'TD' ...)
*         LEV   = LEVEL OF GRID TO SEARCH FOR (1000, 'MSL', 'TRO'..)
* OUTPUT: IGRD  = GRID NUMBER (NEGATIVE IF NOT FOUND)
*
* ASSUMES DATA IN GRID ALL HAVE SAME DAY/TIME, ONLY FCST TIME VARIES
*
CHARACTER*4 CPARM
INTEGER IGHD(64)
EQUIVALENCE (IGDAY, IGHD(4))
EQUIVALENCE (IGTIME,IGHD(5))
EQUIVALENCE (IGTIMV,IGHD(6))
EQUIVALENCE (IGVNAM,IGHD(7))
EQUIVALENCE (IGLEVL,IGHD(10))
IPARM = LIT(CPARM)
* ---> RETURN IGRD .LT -1   IF GRID FILE NON-EXIST
IGRD = -2
IF(IGGET(IGRDF,IG,-1,IDUM,NR,NC,IGHD).LT.-1) GOTO 999
DO 100 IG=1,159
IOK= IGGET(IGRDF,IG,-1,IDUM,NR,NC,IGHD)
IF(IGDAY .NE. KDAY .OR. IGTIME .NE. KTIM) GOTO 200
IF(IGTIMV.NE.IVTIM.OR.IGLEVL.NE.LEV.OR.IGVNAM.NE.IPARM) GOTO 100
IGRD = IG
GOTO 999
100
* GRID SEARCHING FOR IS NON-EXIST
200
IGRD = -1
999
* ********************************************************************
      SUBROUTINE SUBDAY(NOWDAY,LASDAY)
* ********************************************************************
* --- SUBTRACT 1 DAY FROM NOWDAY TO GET LASDAY (BOTH IN YYDDD FORMAT)
      IYEAR = NOWDAY/1000
      IDAY  = MOD(NOWDAY,1000)
      IDAY  = IDAY - 1
```

```
         IDAY  = 365
         IYEAR = IYEAR - 1
         IF(MOD(IYEAR,4).EQ.0) IDAY = 366
      ENDIF
    LASDAY = IYEAR*1000+IDAY
//* EOF
```

```
//   EXEC  MACRO3,MOD=NHCGSS
//* ULNHCGSS BTR  07/01/86; MOVE FROM UD
//* UDNHCGSS BTR  07/01/86; CHANGE KEYWORDS => GMDF, GRIODF
//* UDNHCGSS BTR  06/26/86; ADD & DELETE XREF PARM
//* VLNHCGSS  ALS  06/06/86; MOD TO HELP
//SYSIN  DD  *
* ? NHCGSS  -- Set up guess for 'MAKnhC' VAS retrievals.  (ALS)
* ?   NHCGSS   time   <Keywords>
* ? Parameters:
* ?   time! 0 or 12    time of retrieval set (No dflt).
* ? Keywords:
* ?  GMDF= First guess MDF    <5569>  GRIDF= First guess gridf     <5569>
* ?  LAT=  Latitude range     <5 55>    LON=  Longitude range     <40 105>
* ?  GBL=  beg end GBL gridf <1606 1611>
* ?  ANAL= nonzero to use initial analysis. <0>
* ?        default is to use 12hr (anal if 12hr missing, 24hr last try)
* ?  DAY=  day   yyddd format    <current>
* ?  TEST= nonzero to list keyins instead of executing them <0>
* ? Remarks: Prepare guess MD file for NHC. Defaults are real-time.
INTEGER IDIR(64)
CHARACTER*32 CDOC
DATA IGGBL/-1/,IG12/-1/,IG24/-1/,IANAL/-1/
:
: 'NHCGSS '  BEGAN AT-(7,ITIM).    {WITH INTR-(3,INTR)}
:
NTIM= IPP(1,-999)
   IF(NTIM.NE.0 .AND. NTIM.NE.12) THEN
     CALL EDEST(' 0 OR 12 ARE VALID TIMES, YOU USED ',NTIM)
     CALL ABORT
     GOTO 999
   ENDIF
MDNG = IKWP('GMDF',1,5569)
NGFG = IKWP('GRIDF',1,5569)
IGFL1= IKWP('GBL',1,1606)
IGFL2= IKWP('GBL',2,1611)
LS   = IKWP('LAT',1,5)
LN   = IKWP('LAT',2,55)
LE   = IKWP('LON',1,40)
LW   = IKWP('LON',2,105)
NDAY = IKWP('DAY',1,IDAY)
KTEST= IKWP('TEST',1,0)
*
* DAY CAN BE ENTERED VIA KEYWORD AS YYDDD OR AS -1 (YSTDY)
*
IF(NDAY.LT.0) CALL SUBDAY(IDAY,NDAY)
ITODAY= NDAY
CALL SUBDAY(ITODAY,IYSTDY)
*
*  CHECK FOR LAT/LONS WITHIN GBL LIMITS - EXTEND SFC/GUESS BY 5 DEG.
*
   IF(LS.LT.0.OR.LN.GT.61.OR.LE.LT.40.OR.LW.GT.180) THEN
     CALL EDEST(' LAT/LONS LIMITED FROM 0-61N, 40-180W',0)
     CALL ABORT
     GOTO 999
   ENDIF
LLS  = LS-5
LLN  = LN+5
LLE  = LE-5
LLW  = LW+5
LLNW= (LLN*1000)+LLW
LLSE= (LLS*1000)+LLE
*
* ------------------- FIND AND PREPARE GUESS GRIDS --------------------
* -------------------- IF NEEDED OR IF REQUESTED -------------------
```

```
* IOOHR=OOHR FCST DAY/TIME (YYDDDHH) --> DAY/TIME OF GBL IF ANALYSIS.
* I12HR=12HR FCST DAY/TIME (YYDDDHH) --> DAY/TIME OF GBL IF 12HR FCST.
* I24HR=24HR FCST DAY/TIME (YYDDDHH) --> DAY/TIME OF GBL IF 24HR FCST.
*
IOOHR = ITODAY*100+12
I12HR = ITODAY*100
I24HR = IYSTDY*100+12
*
  IF(NTIM.EQ.0) THEN
    IOOHR = ITODAY*100
    I12HR = IYSTDY*100+12
    I24HR = IYSTDY*100
  ENDIF
*
* WHAT EXISTS ? --> FIND ANALYSIS,12 OR 24 HR FCST FOR PROPER DAY/TIME.
*
DO 10 IGFL=IGFL1,IGFL2
  IOK   = IGGET(IGFL,1,-1,IDUM,NR,NC,IDIR)
  ITEST = IDIR(4)*100+IDIR(5)/10000
  IF(ITEST.EQ.IOOHR) IANAL = IGFL
  IF(ITEST.EQ.I12HR) IG12  = IGFL
  IF(ITEST.EQ.I24HR) IG24  = IGFL
10
: GBL GRIDFILES: ANAL= (5,IANAL) 12HR= (5,IG12) 24HR= (5,IG24)
*
* USE ANALYSIS ONLY IF KEYWORD 'ANAL' USED OR IF 12HR NOT AVAILABLE.
*
IF(IG12.LT.0 .OR. IKWP('ANAL',1,0).NE.0) THEN
  IF(IANAL.GT.0) THEN
    IGGBL = IANAL
    IFCST = 0
    IGTIM = IOOHR
    CALL EDEST(' GBL--> USING ANALYSIS IN GRIDF=',IANAL)
  ENDIF
ENDIF
*
* DEFAULT IS TO USE 12HR GUESS .
*
IF(IGGBL.LT.0 .AND. IG12.GT.0) THEN
  IGGBL = IG12
  IFCST = 12
  IGTIM = I12HR
  CALL EDEST(' GBL--> USING 12HR FCST IN GRIDF=',IG12)
ENDIF
*
* USE 24HR GUESS IF BOTH OF THE OTHERS FAILED.
*
IF(IGGBL.LT.0 .AND. IG24.GT.0) THEN
  IGGBL = IG24
  IFCST = 24
  IGTIM = I24HR
  CALL EDEST(' GBL--> USING 24HR FCST IN GRIDF=',IG24)
ENDIF
*
* 33333333333333333333333333333333333333333333333333333333333333333
*
IF(IGGBL .LE. 0) THEN
:   GBL ANAL/12/24HR GUESS NOT AVAILABLE; GRIDS (4,IGFL1) - (4,IGFL2)
    CALL ABORT
    GOTO 999
ENDIF
*
* 33333333333333333333333333333333333333333333333333333333333333333333
*
```

```
ILDAY = IGTIM/100
ILTIM = 10000*MOD(IGTIM,100)
CALL GETGRD(IGGBL,ILDAY,ILTIM,IFCST,'T    ',1000,IGRD)
  IF(IGRD.LE.0) THEN
   CALL SDEST(' NO 1000 MB TEMP. GRID FOUND IN GBL GRIDF=',IGGBL)
   CALL SDEST(' DAY= '//CFI(ILDAY)//'   TIME= ',ILTIM)
   CALL ABORT
   GOTO 999
  ENDIF
*
* TRANSFER GRID FILE FROM REAL-TIME AREA TO 'NGFG'
*
CTEXT = '"'//CR5(CFI(ITODAY))//' VAS G'
CTEX2 = 'LOBAL GUESS:'
CALL CALDAY(ITODAY,NY,NM,ND,CM)
CALL ENCODE('(I3,A3,I2,4X)',CDATE,ND,CM,NY)
IF(KTEST.NE.0) THEN
:IGU DEL  (5,NGFG)
:IGU COPY (5,IGGBL) (5,NGFG)
:IGU DIR (4,NGFG) (6,IDAY) X " (5,ITODAY) VAS GLOBAL GUESS: (CDATE)
ELSE
.IGU DEL (NGFG)
.IGU COPY (IGGBL) (NGFG)
.IGU DIR (NGFG) (IDAY)  X (CTEXT) (CTEX2) (CDATE)
ENDIF
*
* MAKE THE GUESS MD FILE IF IT DOES NOT EXIST
*
IOK = MDOPEN(MDNG,0)
* ---------------------------------------------------------------
IF(IOK.NE.0) THEN
CALL ENCODE('("VAS FIRST-GUESS FOR:",A12)',CDOC,CDATE)
IF(KTEST.NE.0) THEN
:MDU MAKE (4,MDNG) VGSS 1 0 0 (5,ITODAY) (CDOC)
ELSE
IMD= MDMAKE(MDNG,'VGSS',1,0,0,ITODAY,CDOC)
ENDIF
*
ENDIF
* ---------------------------------------------------------------
* CHANGE GUESS FROM GRIDS TO MD FORMAT FOR 'VRVA' USE
*
IF(KTEST.NE.0) THEN
:GSVA (4,NGFG) (3,IGRD) (4,MDNG) (5,LLNW) (5,LLSE)
ELSE
.GSVA (NGFG) (IGRD) (MDNG) (LLNW) (LLSE)
ENDIF
*
*
999
CALL EDEST(' DONE',0)
* ********************************************************************
SUBROUTINE GETGRD(IGRDF,KDAY,KTIM,IVTIM,CPARM,LEV,IGRD)
* ********************************************************************
* INPUT : IGRDF = GRID FILE NUMBER TO SEARCH
*         KDAY  = YYDDD OF GRID TO SEARCH FOR
*         KTIM  = HHMMSS TIME OF GRID TO SEARCH FOR
*         IVTIM = HH FCST TIME OF GRID TO SEARCH FOR (IE 0, 12, 24, 36)
*         CPARM = CHARACTER*4  PARAMETER NAME ('T', 'TD' ...)
*         LEV   = LEVEL OF GRID TO SEARCH FOR (1000, 'MSL', 'TRO'...)
* OUTPUT: IGRD  = GRID NUMBER (NEGATIVE IF NOT FOUND)
*
* ASSUMES DATA IN GRID ALL HAVE SAME DAY/TIME, ONLY FCST TIME VARIES
*
CHARACTER*4 CPARM
```

```
EQUIVALENCE (IGDAY, IGHD(4))
EQUIVALENCE (IGTIME,IGHD(5))
EQUIVALENCE (IGTIMV,IGHD(6))
EQUIVALENCE (IGVNAM,IGHD(7))
EQUIVALENCE (IGLEVL,IGHD(10))
IPARM = LIT(CPARM)
* ---> RETURN IGRD .LT -1    IF GRID FILE NON-EXIST
IGRD = -2
IF(IGGET(IGRDF,IG,-1,IDUM,NR,NC,IGHD).LT.-1) GOTO 999
DO 100 IG=1,159
IOK= IGGET(IGRDF,IG,-1,IDUM,NR,NC,IGHD)
IF(IGDAY .NE. KDAY .OR. IGTIME .NE. KTIM) GOTO 200
IF(IGTIMV.NE.IVTIM.OR.IGLEVL.NE.LEV.OR.IGVNAM.NE.IPARM) GOTO 100
IGRD = IG
GOTO 999
100
* GRID SEARCHING FOR IS NON-EXIST
200
IGRD = -1
999
* ******************************************************************
      SUBROUTINE SUBDAY(NOWDAY,LASDAY)
* ******************************************************************
* --- SUBTRACT 1 DAY FROM NOWDAY TO GET LASDAY (BOTH IN YYDDD FORMAT)
      IYEAR = NOWDAY/1000
      IDAY  = MOD(NOWDAY,1000)
      IDAY  = IDAY - 1
         IF(IDAY.EQ.0) THEN
            IDAY  = 365
            IYEAR = IYEAR - 1
            IF(MOD(IYEAR,4).EQ.0) IDAY = 366
         ENDIF
      LASDAY = IYEAR*1000+IDAY
//* EOF
```

```
//COMBJJUU JOB  MSGLEVEL=(0,0),CLASS=L
//  EXEC  MACRO3,MOD=COMBV
//* ULCOMBV   BTR   07/01/86; MOVE FROM UD
//* VDCOMBV   ALS   04/17/86; DO IT IF ONLY 1/2 IS THERE
//* VLCOMBV   ALS   04/09/86; CHECK FOR NAV EXIST
//* VLCOMBV   ALS   04/09/86; ADD QUIT AREAS TO END
//* VLCOMBV   ALS   03/28/86; NEW DEST AREA
//* VLCOMBV   ALS   03/11/86; CHECK TO SEE IF SOURCE AREA EXISTS
//* VLCOMBV   ALS   04/18/85; ADD FILTER MEMO TO SMOOTH PROG
//* VLCOMBV   ALS   04/12/85; CHANGE 'XYFIL' TO 'SMOOTH'
//* VLCOMBV   GSW   03/21/85; COSMETICS.
//* VDCOMBV   GSW   01/21/85; ORIGINAL VERSION.
//SYSIN  DD  *
* ?  COMBV -- Combine/filter VAS SFOV Product Images.    (GSW)
* ?    COMBV  source1  source2  scratch1  destarea  <Keyword=VALUE>
* ?  Parameters:
* ?    source1|  One VAS product image area.             <No Def>
* ?    source2|  Second VAS product image area.          <Def| source1+1>
* ?    scratch1| One available scratch area.             <Def| source1+2>
* ?    destarea| Destination area for combined image.   <No Def>
* ?  Keywords:
* ?    FIL= nonzero   to run 'SMOOTH' filter.      <Def= 1 smooth>
* ?    TYP= 4 character text for insertion in memo portion of directory.
* ?Remarks: Combine images from 2 VAS Dwell Sounds. Combined image
* ?   is stored in 'destarea'. The original areas are deleted.
DIMENSION IARR(64)
ISRC1 = IPP(1,-99)
ISRC2 = IPP(2,(ISRC1+1))
ITEMP1= IPP(3,(ISRC1+2))
IDEST = IPP(4,0)
IFIL  = IKWP('FIL',1,1)
CTYP  = CKWP('TYP',1,' ')
:
: 'COMBV' BEGAN AT-(7,ITIM).  {VERSION OF 14MAR86 WITH INTR-(3,INTR)}
:
CO = ''COMBINED VA'
C1 = ''COMB/FIL VA'
C2 = 'S IMAGE TYP='
C3 = ''ONE HALF VA'
*
* CHECK DESTINATION AREA FOR VALIDITY
*
IF(IDEST.LE.1000) THEN
  CALL EDEST(' INVALID DESTINATION AREA = ',IDEST)
  GOTO 999
ENDIF
*
* CHECK TO SEE THAT BOTH SOURCE AREAS EXIST
*
CALL READD(ISRC1,IARR)
IOK1 = IARR(1)
CALL READD(ISRC2,IARR)
IOK2 = IARR(1)
IF(IOK1.LT.0 .OR. IOK2.LT.0) THEN
  CALL EDEST(' SOURCE AREA NON-EXIST'//CFI(ISRC1)//' OR ',ISRC2)
  CALL EDEST(' ...processing is continuing with single area...',0)
  GOTO 200
ENDIF
*
* CHECK THAT NAV EXISTS FOR BOTH AREAS.
*
IOK1 = NVSET('AREA',ISRC1)
IOK2 = NVSET('AREA',ISRC2)
IF(IOK1.LT.0 .OR. IOK2.LT.0) THEN
  CALL EDEST('NAV NON-EXIST FOR AREA'//CFI(ISRC1)//' OR ',ISRC2)
```

```
ENDIF
.QA (ITEMP1)
.QA (IDEST)
*
*   CO-LOCATE ORIGINAL IMAGES SO THEY CAN BE COMBINED WITH 'MC'.
*
.AA (ISRC1) (ITEMP1) 0 EC 36 88
.QA (ISRC1)
.AA (ISRC2) (ISRC1) 0 EC 36 88
.QA (ISRC2)
.MC (ITEMP1) (ISRC1) (ISRC2) MAX
*
*   BRANCH TO 'SMOOTH' IF REQUESTED.
*
IF(IFIL.NE.0) THEN
.SMOOTH (ISRC2) (IDEST) RAN= 1 150 NP= 2 (C1) (C2) (CTYP)
ELSE
.AA (ISRC2) (IDEST)
.CA (IDEST) (C0) (C2) (CTYP)
ENDIF
.QA (ISRC1)
.QA (ISRC2)
.QA (ITEMP1)
GOTO 999
*
* --- AT LEAST ONE SOURCE AREA DOES NOT EXIST ---
*
200
IAREA = 0
IF(IOK1.GE.0) IAREA = ISRC1
IF(IOK2.GE.0) IAREA = ISRC2
IF(IAREA.LE.0) THEN
  CALL EDEST(' AREAS NON-EXIST: '//CFI(ISRC1)//' & ',ISRC2)
  GOTO 999
ENDIF
.QA (IDEST)
IF(IFIL.NE.0) THEN
.SMOOTH (IAREA) (IDEST) RAN= 1 150 NP= 2 (C3) (C2) (CTYP)
ELSE
.AA (IAREA) (IDEST)
ENDIF
.QA (IAREA)
999
CALL EDEST(' DONE, AREA = ',IDEST)
//* EOF
```

```
//   EXEC  MACRO2,MOD=XPKC
//* ULXPKC    BTR  07/01/86; MOVE FROM UD
//* UDXPKC    BTR  06/26/86; ADD & DELETE XREF PARM
//* VLXPKC    ALS  03/04/86; NEW NSSFC AREAS 1986
//* VLXPKC    ALS  02/03/86; NEW AREAS FOR GALE
. ? XPKC -- Send VAS derived images/retrieval MD/gridfiles to K.C. (ALS)
. ?    XPKC   row#   type
. ? Parameters:
. ?    row# | Row number (1-10) corresponding to time period of data.
. ?    type | AREA, MD or GRID    Type of data to transfer (Def is AREA)
.
. Commands must execute on terminal 45 (NSSFC terminal #)
.        This is done using the 'tcr' command.
.
IROW = IPP(1,0)
   IF(IROW.LT.1.OR.IROW.GT.10) THEN
     CALL EDEST('1-10 ARE VALID ROW NUMBERS, YOU USED ',IROW)
     GOTO 999
   ENDIF
CTYP = CPP(2,'AREA')
.
.    IWV   = 1459 + IROW
.    ILI   = 5889 + IROW
.
.     XPORTA (IWV)  503 ----> (503 IS DESTINATION AREA ON HARRIS)
.     XPORTA (ILI)  505 ----> (505 IS DESTINATION AREA ON HARRIS)
.
.     DESTINATION GRID FILE= 201-210 (ROW 1-10)
.
. ------------------------------------------------------------
.
IF(IROW.EQ.1) THEN
.
 IF(CTYP.EQ.'AREA') THEN
.TCR 45 'XPORTA 1460 503
.TCR 45 'XPORTA 5890 505
 ENDIF
.
 IF(CTYP.EQ.'MD') THEN
.TCR 45 'XPVAS 1441 201 ROW= 1
 ENDIF
.
 IF(CTYP.EQ.'GRID') THEN
.TCR 45 'XPGRID 1440 201
 ENDIF
.
ENDIF
.
. ------------------------------------------------------------------
.
IF(IROW.EQ.2) THEN
.
 IF(CTYP.EQ.'AREA') THEN
.TCR 45 'XPORTA 1461 503
.TCR 45 'XPORTA 5891 505
 ENDIF
.
 IF(CTYP.EQ.'MD') THEN
.TCR 45 'XPVAS 1441 202 ROW= 2
 ENDIF
.
 IF(CTYP.EQ.'GRID') THEN
.TCR 45 'XPGRID 1440 202
```

```
ENDIF
.
. ------------------------------------------------------------------------
.
IF(IROW.EQ.3) THEN
.
 IF(CTYP.EQ.'AREA') THEN
.TCR 45 'XPORTA 1462 503
.TCR 45 'XPORTA 5892 505
 ENDIF
.
 IF(CTYP.EQ.'MD') THEN
.TCR 45 'XPVAS 1441 203 ROW= 3
 ENDIF
.
 IF(CTYP.EQ.'GRID') THEN
.TCR 45 'XPGRID 1440 203
 ENDIF
.
ENDIF
.
. ------------------------------------------------------------------------
.
IF(IROW.EQ.4) THEN
.
 IF(CTYP.EQ.'AREA') THEN
.TCR 45 'XPORTA 1463 503
.TCR 45 'XPORTA 5893 505
 ENDIF
.
 IF(CTYP.EQ.'MD') THEN
.TCR 45 'XPVAS 1441 204 ROW= 4
 ENDIF
.
 IF(CTYP.EQ.'GRID') THEN
.TCR 45 'XPGRID 1440 204
 ENDIF
.
ENDIF
.
. ------------------------------------------------------------------------
.
IF(IROW.EQ.5) THEN
.
 IF(CTYP.EQ.'AREA') THEN
.TCR 45 'XPORTA 1464 503
.TCR 45 'XPORTA 5894 505
 ENDIF
.
 IF(CTYP.EQ.'MD') THEN
.TCR 45 'XPVAS 1441 205 ROW= 5
 ENDIF
.
 IF(CTYP.EQ.'GRID') THEN
.TCR 45 'XPGRID 1440 205
 ENDIF
.
ENDIF
.
. ------------------------------------------------------------------------
.
IF(IROW.EQ.6) THEN
.
 IF(CTYP.EQ.'AREA') THEN
```

```
 ENDIF
.
 IF(CTYP.EQ.'MD') THEN
.TCR 45 'XPVAS 1441 206 ROW= 6
 ENDIF
.
 IF(CTYP.EQ.'GRID') THEN
.TCR 45 'XPGRID 1440 206
 ENDIF
.
ENDIF
.
. -----------------------------------------------------------------------
.
IF(IROW.EQ.7) THEN
.
 IF(CTYP.EQ.'AREA') THEN
.TCR 45 'XPORTA 1466 503
.TCR 45 'XPORTA 5896 505
 ENDIF
.
 IF(CTYP.EQ.'MD') THEN
.TCR 45 'XPVAS 1441 207 ROW= 7
 ENDIF
.
 IF(CTYP.EQ.'GRID') THEN
.TCR 45 'XPGRID 1440 207
 ENDIF
.
ENDIF
.
. -----------------------------------------------------------------------
.
IF(IROW.EQ.8) THEN
.
 IF(CTYP.EQ.'AREA') THEN
.TCR 45 'XPORTA 1467 503
.TCR 45 'XPORTA 5897 505
 ENDIF
.
 IF(CTYP.EQ.'MD') THEN
.TCR 45 'XPVAS 1441 208 ROW= 8
 ENDIF
.
 IF(CTYP.EQ.'GRID') THEN
.TCR 45 'XPGRID 1440 208
 ENDIF
.
ENDIF
.
. -----------------------------------------------------------------------
.
IF(IROW.EQ.9) THEN
.
 IF(CTYP.EQ.'AREA') THEN
.TCR 45 'XPORTA 1468 503
.TCR 45 'XPORTA 5898 505
 ENDIF
.
 IF(CTYP.EQ.'MD') THEN
.TCR 45 'XPVAS 1441 209 ROW= 9
 ENDIF
.
 IF(CTYP.EQ.'GRID') THEN
```

```
.
ENDIF
.
. ------------------------------------------------------------------
.
IF(IROW.EQ.10) THEN
.
 IF(CTYP.EQ.'AREA') THEN
.TCR 45 'XPORTA 1469 503
.TCR 45 'XPORTA 5899 505
 ENDIF
.
 IF(CTYP.EQ.'MD') THEN
.TCR 45 'XPVAS 1441 210 ROW= 10
 ENDIF
.
 IF(CTYP.EQ.'GRID') THEN
.TCR 45 'XPGRID 1440 210
 ENDIF
.
ENDIF
.
. ------------------------------------------------------------------
.
999
CALL EDEST(' DONE; TYPE= '//CTYP//' ROW= ',IROW)
//* EOF
```

```
//   EXEC   MACRO2,MOD=PPNMC
//* ULPPNMC   AJ    08/28/86; UPDATE RFVED PORTION OF MACRO
//* ULPPNMC   BTR   07/01/86; MOVE FROM UD
//* UDPPNMC   BTR   07/01/86; CHANGE KEYWORDS
//SYSIN   DD   *
' ? **PPNMC**    POST PROCESS VAS RETRIEVALS FOR NMC AREA    (AJ)
' ?    KEYIN: PPNMC   (PER)   (PART)   <KEYWORDS>
' ?     PER-    0 OR 12      TIME OF RETRIEVAL SET<NO DEFAULT>
' ?     PART- 1(EARLY D.S. PAIR), 2(LATE D.S. PAIR)<NO DEFAULT>
' ?     KEYWORDS:
' ?      MDF= VAS RETRIEVAL FILE<1445 FOR 12Z; 1449 FOR 00Z>
' ?      GMDF= FIRST GUESS MD<1446 FOR 12Z; 1450 FOR 00Z>
' ?      GRIDF= FIRST GUESS GRIDF<1446 FOR 12Z; 1450 FOR 00Z>
' ?      EGRIDF= WORKING GRID FILE FOR RFVED<1455>
' ?      LAT=  LATITUDE RANGE<20 58>
' ?      LON=  LONGITUDE RANGE<115 158>
' ?      EDIT= NONZERO FOR 'RFVED'<1>
' ?      TXVA= NUMBER OF VASTEXT FILE TO RESTORE<DEF= MDF NUMBER>
' ?      INC=  GRID INCREMENT IN DEGREES*10<10>
' ?      TEST= NONZERO TO LIST KEYINS<0>
'
'       THE FOLOWING AUTO-EDITS(RFVED) THE RETRIEVALS, GENERATES THE
'       GRADIENT THERMAL WINDS(WINNVT), AND GENERATES THE GRIDS(NMCGRD)
'       USED IN THE DISPLAY MACRO.
'
CHARACTER*50 C
NTIM= IPP(1,-999)
IF(NTIM .NE. 0 .AND. NTIM .NE. 12)THEN
CALL SDEST('USED INVALID TIME ',NTIM)
CALL ABORT
GO TO 999
ENDIF
IPART= IPP(2,-999)
IF(IPART .NE. 1 .AND. IPART .NE. 2)THEN
CALL SDEST('USED INVALID PART ',IPART)
CALL ABORT
GO TO 999
ENDIF
IF(NTIM .EQ. 12)THEN
MDNR= 1445
MDNG= 1446
NGFG= 1446
ELSE
MDNR= 1449
MDNG= 1450
NGFG= 1450
ENDIF
MDNR= IKWP('MDF',1,MDNR)
MDNG= IKWP('GMDF',1,MDNG)
NGFG= IKWP('GRIDF',1,NGFG)
NGFE= IKWP('EGRIDF',1,1455)
LS= IKWP('LAT',1,20)
LN= IKWP('LAT',2,58)
LE= IKWP('LON',1,115)
LW= IKWP('LON',2,158)
LLNW= (LN*1000)+LW
LLSE= (LS*1000)+LE
LLS= LS-5
LLN= LN+5
LLE= LE-5
LLW= LW+5
IEDIT= IKWP('EDIT',1,1)
IADJ= 2
IF(MOD(IPART,2) .NE. 0)IADJ= 0
```

```
ITXVA= IKWP('TXVA',1,ITXVA)
INC= IKWP('INC',1,10)
ITEST= IKWP('TEST',1,0)
* ********************************************************************
*                      AUTO-EDIT RETRIEVALS
IF(IEDIT.NE.0) THEN
   IF(ITEST .EQ. 1)THEN
C=' LAT='//CFI(LLS)(11:12)//CFI(LLN)(10:12)//' LON='
C =C(1:15)//CFI(LLE)(10:12)//CFI(LLW)(9:12)//' EGRIDF='
C= C(1:30)//CFI(NGFE)(9:12)//' INC='//CFI(INC)(11:12)
:RFVED 1 (C)
   ELSE
.RFVED 1 LAT= (LLS) (LLN) LON= (LLE) (LLW) EGRIDF= (NGFE) INC= (INC)
   ENDIF
ENDIF
* ********************************************************************
* ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
*                      GENERATE GRADIENT WINDS
   IF(ITEST .EQ. 1)THEN
:WINNVT DEV=NNN
   ELSE
.WINNVT DEV= NNN
   ENDIF
* ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
* ####################################################################
*                ANALYZE GRIDS FOR DISPLAY MACRO(NMCDIS)
   IF(ITEST .EQ. 1)THEN
:NMCGRD (2,NTIM) ' PER=' (1,IPART) ' DEV=NNN'
   ELSE
.NMCGRD 12 PER= (IPER) DEV= NNN
   ENDIF
* ####################################################################
999
//* EOF
```

```
//PPKC5550 JOB  MSGLEVEL=(0,0),CLASS=B
//  EXEC  MACRO3,MOD=PPKC
//* ULPPKC   RLS  09/05/86: MEMBER UPDATED
//* ULPPKC   RLS  09/05/86: MEMBER UPDATED TO MODIFY SCRATCHFILE
//* ULPPKC   CMH  09/02/86; ADD SCRATCH GRID
//* ULPPKC   CMH  08/29/86; CHANGE TO EGRIDF
//* ULPPKC   BTR  07/01/86; MOVE FROM UD
//* UDPPKC   BTR  07/01/86; CHANGE KEYWORDS
//* VLPPKC   ALS  03/21/86; CHANGE DEFAULTS
//SYSIN  DD  *
' ? PPKC  -- Post process VAS retrievals for NSSFC area.  (ALS)
' ?   PPKC   row   <Keywords>
' ? Parameters:
' ?   row!  row# (1-10) corresponding to dwell sound times (No dflt).
' ?          1 -- 948/1018   2 --1118/1148   3 --1248/1318
' ?          4 --1418/1448   5 --1548/1618   6 --1718/1748
' ?          7 --1848/1918   8 --2018/2048  9 --2148/2218   10 --2318/2348
' ? Keywords:
' ?  MDF= VAS retrieval MDF   <1441>
' ?  GMDF= First guess MDF      <1442>   GRIDF= First guess gridf   <1445>
' ?  LAT=  Latitude range      <24 50>   LON=  Longitude range     <75 110>
' ?  UGV=  nonzero for 'UGVAS'     <0>    XPG=  nonzero for 'XPGRID'      <1>
' ?  EDIT= nonzero for 'RFVED'    <1>    XPV=  nonzero for 'XPVAS'       <0>
' ?  SCR= scratch grid (def:1440)
' ?  TEST= nonzero to list keyins<0>
' ? Remarks: Auto-edit, update the guess and generate grids for KC.
:
: PPKC   BEGAN AT-(7,ITIM),     WITH INTR-(3,INTR)
:
NROW= IPP(1,-999)
   IF(NROW.LT.1.OR.NROW.GT.10) THEN
     CALL SDEST(' 1-10 ARE VALID ROW NUMBERS, YOU USED ',NROW)
     GOTO 999
   ENDIF
MDNR = IKWP('MDF',1,1441)
MDNG = IKWP('GMDF',1,1442)
NGFG = IKWP('GRIDF',1,1442)
ISGRD = IKWP('SCR',1,1440)
' MAKE SURE SCRATCH GRID IS EMPTY FOR INITIAL 16 FIELDS
.IGG DEL 1 25 GRIDF= (ISGRD)
LS    = IKWP('LAT',1,24)
LN    = IKWP('LAT',2,50)
LE    = IKWP('LON',1,75)
LW    = IKWP('LON',2,110)
KTEST= IKWP('TEST',1,0)
'
'  CHECK FOR LAT/LONS WITHIN LFM LIMITS - EXTEND SFC/GUESS BY 5 DEG.
'
   IF(LS.LT.20.OR.LN.GT.58.OR.LE.LT.50.OR.LW.GT.158) THEN
     CALL SDEST(' LAT/LONS LIMITED FROM 20-58N, 50-158W',0)
     GOTO 999
   ENDIF
LLNW = (LN*1000)+LW
LLSE = (LS*1000)+LE
LLS  = LS-5
LLN  = LN+5
LLE  = LE-5
LLW  = LW+5
IEDIT= IKWP('EDIT',1,1)
'
' SET VAS POINTER (VPVA) AND BRING IN PROPER TXVA (TXVA)
'
ITXVA = 1439+NROW*2
IF(KTEST.NE.0) THEN
'VPVA (4,ITXVA)
```

```
ELSE
.VPVA (ITXVA)
.TXVA (ITXVA) IN
ENDIF
*
* ---------------------- AUTO-EDIT RETRIEVALS -----------------------
*
  IF(IEDIT.NE.0) THEN
*
* ........................................................................
*
IF(KTEST.NE.0) THEN
:RFVED 1 LAT= (2,LLS) (2,LLN) LON= (3,LLE) (3,LLW) EGRIDF= (3,ISGRD)
ELSE
.RFVED 1 LAT= (LLS) (LLN) LON= (LLE) (LLW) EGRIDF= (ISGRD)
ENDIF
.IGG DEL 1 3 GRIDF= (ISGRD)
*
* ........................................................................
*
  ENDIF
*
* ****************** END AUTO-EDIT RETRIEVALS ********************
*
* --------------- UPDATE THE GUESS IF NEEDED/REQUESTED  ------------------
* ------- DEFAULT IS NO UPDATE : TIME INTERPOLATED GUESS USED --------
*
IF(IKWP('UGV',1,0).NE.0) THEN
*
* ........................................................................
*
IF(KTEST.NE.0) THEN
:UGVAS (2,NROW) MDF= (4,MDNR) GMDF= (4,MDNG) GRIDF= (4,NGFG) INC= 10
:            LAT= (3,LS) (3,LN) LON= (4,LE) (4,LW)
ELSE
.UGVAS (NROW) MDF= (MDNR) GMDF= (MDNG) GRIDF= (NGFG) INC= 10 -
LAT= (LS) (LN) LON= (LE) (LW)
ENDIF
*
* ........................................................................
*
ENDIF
*
* ********************** END UPDATE RETRIEVALS ***********************
*
ISEND = IKWP('XPV',1,0)
*
* ------------- TRANSFER THE RETRIEVAL MD FILE TO NSSFC --------------
* ---------   !!! FOR NOW DEFAULT IS NO MD TRANSFERS !!! ----------
*
  IF(ISEND.NE.0) THEN
*
* ........................................................................
*
IF(KTEST.NE.0) THEN
:XPKC (3,NROW) MD
ELSE
.XPKC (NROW) MD
ENDIF
*
* ........................................................................
*
  ENDIF
*
```

```
ISEND = IKWP('XPG',1,1)
  IF(ISEND.NE.0) THEN
*
* ---------------------- GENERATE THE GRIDS ------------------------
*
* ...................................................................
*
IF(KTEST.NE.0) THEN
:KCGRD (3,NROW) SEND= (2,ISEND) LAT= (3,LS) (3,LN) LON= (3,LE) (3,LW)
ELSE
.KCGRD (NROW) SEND= (ISEND) LAT= (LS) (LN) LON= (LE) (LW)
ENDIF
*
* ...................................................................
*
ENDIF
*
* *********************** END OF GRID GENERATION ***********************
*
999
CALL EDEST(' DONE: ROW=',NROW)
//* EOF
```

```
//PPNH1450 JOB  MSGLEVEL=(0,0),CLASS=B
//  EXEC  MACRO3,MOD=PPNHC
//* ULPPNHC  CMH  09/02/86: MEMBER UPDATED
//* ULPPNHC  CMH  09/02/86; FIX SCRATCH GRID AGAIN
//* ULPPNHC  CMH  09/02/86; REMOVE OUTPUT GRID FROM NHCGRD
//* ULPPNHC  CMH  08/26/86; ADD SCRATCH GRID FILE
//* ULPPNHC  BTR  07/01/86; MOVE FROM UD
//* UDPPNHC  BTR  07/01/86; CHANGE KEYWORDS
//* VLPPNHC  ALS  06/12/86; TXVA WITH MD NUMBER
//* VLPPNHC  ALS  06/11/86; PASS TXVA TO NHCGRD
//* VLPPNHC   ALS  03/21/86; CHANGE DEFAULTS
//SYSIN  DD  *
' ? PPNHC  -- Post process VAS retrievals for NHC area.   (ALS)
' ?   PPNHC   time   <Keywords>
' ? Parameters:
' ?   time|  0  or  12    time of retrieval set (No dflt).
' ? Keywords:
' ?   MDF=  VAS retrieval and grid file <5568 for 12z; 5571 for 00z>
' ?   GMDF= First guess MDF     <5569 for 12z; 5572 for 00z>
' ?   LAT=  Latitude range      <0 55>
' ?   LON=  Longitude range    <40 105>
' ?   EDIT= nonzero for 'RFVED'     <1>
' ?   TXVA= number of VASTEXT file to restore <Def= MDF number>
' ?   INC=  grid increment in degrees*10 <12>
' ?   TEST= nonzero to list keyins <0>
' ?   SCR= scratch grid (def:5576)
' ? Remarks: Auto-edit and generate grids for NHC.
:
: PPNHC   BEGAN AT-(7,ITIM).    WITH INTR-(3,INTR)
:
NTIM= IPP(1,-999)
   IF(NTIM.NE.0 .AND. NTIM.NE.12) THEN
     CALL SDEST(' 0 OR 12 ARE VALID TIMES, YOU USED ',NTIM)
     GOTO 999
   ENDIF
MDF  = 5571 - 3*(NTIM/12)
MDNG = 5572 - 3*(NTIM/12)
NGFG = 5571 - 3*(NTIM/12)
MDF  = IKWP('MDF',1,MDF)
MDNG = IKWP('GMDF',1,MDNG)
ISGRD = IKWP('SCR',1,5576)
' MAKE SURE SCRATCH GRID IS EMPTY FOR INITIAL 16 FIELDS
.IGG DEL 1 20 GRIDF= (ISGRD)
LS   = IKWP('LAT',1,0)
LN   = IKWP('LAT',2,55)
LE   = IKWP('LON',1,40)
LW   = IKWP('LON',2,105)
KTEST= IKWP('TEST',1,0)
INC  = IKWP('INC',1,12)
'
'  CHECK FOR LAT/LONS WITHIN LFM LIMITS - EXTEND SFC/GUESS BY 5 DEG.
'
   IF(LS.LT.0.OR.LN.GT.61.OR.LE.LT.40.OR.LW.GT.180) THEN
     CALL SDEST(' LAT/LONS LIMITED FROM 0-61N, 40-180W',0)
     GOTO 999
   ENDIF
LLNW = (LN*1000)+LW
LLSE = (LS*1000)+LE
LLS  = LS-5
LLN  = LN+5
LLE  = LE-5
LLW  = LW+5
IEDIT= IKWP('EDIT',1,1)
'
```

```
ITXVA = MDF
ITXVA = IKWP('TXVA',1,ITXVA)
IF(KTEST.NE.0) THEN
:VPVA (4,ITXVA)
:TXVA (4,ITXVA) IN
ELSE
.VPVA (ITXVA)
.TXVA (ITXVA) IN
ENDIF
*
* --------------------- AUTO-EDIT RETRIEVALS ---------------------
*
  IF(IEDIT.NE.0) THEN
*
* ...................................................................
*
IF(KTEST.NE.0) THEN
:RFVED 1 LAT= (2,LLS) (2,LLN) LON= (3,LLE) (3,LLW) EGRIDF= (3,ISGRD) -
 INC= (2,INC)
ELSE
.RFVED 1 LAT= (LLS) (LLN) LON= (LLE) (LLW) EGRIDF= (ISGRD) INC= (INC)
*DELETE GRIDS IN SCRATCH TO PREPARE FOR NEXT MACRO
.IGG DEL 1 3 GRIDF= (ISGRD)
ENDIF
*
* ...................................................................
*
  ENDIF
*
* ****************** END AUTO-EDIT RETRIEVALS ********************
*
* --------------------- GENERATE THE GRIDS ------------------------
*
* ...................................................................
*
IF(KTEST.NE.0) THEN
:NHCGRD (3,NTIM) MDF= (4,MDF) LAT= (3,LS) (3,LN) LON= (3,LE) (3,LW) -
INC= (2,INC) TXVA= (4,ITXVA)
ELSE
.NHCGRD (NTIM) MDF= (MDF) LAT= (LS) (LN) LON= (LE) (LW)-
INC= (INC) TXVA= (ITXVA) SCR=(ISGRD)
ENDIF
*
* ...................................................................
*
* *********************** END OF GRID GENERATION *********************
*
999
CALL EDEST(' DONE: TIME= ',NTIM)
//* EOF
```

```
//NMCG5500 JOB  MSGLEVEL=(0,0),CLASS=B
//  EXEC  MACRO3,MOD=NMCGRD
//* ULNMCGRD BTR  07/01/86; MOVE FROM UD
//* UDNMCGRD BTR  07/01/86; CHANGE KEYWORDS
//* UDNMCGRD BTR  06/26/86; ADD & DELETE XREF PARM
//* VLNMCGRD ALS  02/04/86; NEW LFM LOCATIONS
//* VLNMCGRD ALS  02/03/86; NEWEST GETGRD SUBROUTINE
//* VLNMCGRD ALS  11/18/85; ADD CHECK ON CMAX
//* VLNMCGRD ALS  11/18/85; CHANGE BNVA ORDER
//* VLNMCGRD ALS  11/18/85; ADD 250 MB Z
//* VLNMCGRD ALS  11/15/85; CHANGE MD ROW NUMBERS
//* VDNMCGRD ALS  11/15/85; NEW FILE ORGANIZATION
//SYSIN  DD  *
' ? NMCGRD -- Generate grids of VAS (&LFM) products for NMC  (ALS)
' ?   NMCGRD   time    <Keywords>
' ? Parameters:
' ?   TIME|  EITHER  0  OR  12
' ? Keywords:
' ?   MDF= MD file containing VAS data (Dflt = real time <1445,1449>)
' ?   GRIDF= Grid file for analyses    (Dflt = real time <1445,1449>)
' ?   PER= Period 1 or 2 (for early or late period within time) Def=2
' ?   GMDF= MD file number of the 1st guess (Dflt= 1446,1450)
' ?
' ? Remarks : Generates the following grids:
' ?   1) VAS 1000-500 MB thickness analysis.          (#8 Gulf)
' ?   2) VAS  850-400 MB thickness analysis.          (#9 Gulf)
' ? 3-5) VAS 850, 500, 250 mb temperature analyses.   (#10-12 Gulf)
' ?   6) VAS 250 MB Z analysis.                       (#13 Gulf)
' ?   7) VAS 500 MB Z analysis.                       (#14 Gulf)
' ?  15) LFM 1000 MB Z analysis.
' ?  16) LFM 500 MB Z analysis.
' ?  17) LFM 1000-500 MB thickness analysis.
DIMENSION MOUT(400)
JDAY   = IDAY
ITIME  = 0
         IF(IHOU.GE.100000.AND.IHOU.LE.220000) ITIME = 12
ITIME  = IPP(1,ITIME)
IF(ITIME.NE.0.AND.ITIME.NE.12) THEN
  CALL EDEST(' 0 OR 12 ARE VALID TIMES, YOU USED ',ITIME)
  GOTO 999
ENDIF
IPER   = IKWP('PER',1,2)
         IF(IPER.LT.1.OR.IPER.GT.2) IPER = 2
MDF    = 1445
         IF(ITIME.EQ.0) MDF = 1449
IGRIDF = MDF
MDF    = IKWP('MDF',1,MDF)
IGRIDF = IKWP('GRIDF',1,IGRIDF)
IGSCRA = 1455
ITXVA  = 1438 + 2*IPER
         IF(ITIME.EQ.0) ITXVA = ITXVA + 10
IF(MDOPEN(MDF,1).LT.0) THEN
  CALL EDEST(' CAN NOT OPEN VAS MD FILE # ',MDF)
  GOTO 999
ENDIF
IOK    = MDGET(MDF,IPER,0,MOUT)
JDAY   = MOUT(1)
NAVA   = MOUT(3)
CALL EDEST('VAS DATA FOR DAY='//CFI(JDAY)//' TIME=',MOUT(2))
IF(JDAY.LT.IDAY)CALL EDEST('***WARNING*** DAY IS NOT TODAY ',JDAY)
IF(NAVA.LE.0) THEN
  CALL EDEST('NO DATA AVAIL. IN MD#'//CFI(MDF)//' PER=',IPER)
  GOTO 999
ENDIF
```

```
MDNG    = 1446
IGTIM1 = 0
IGTIM2 = 120000
IGDAY1 = NOWDAY
IGDAY2 = LASDAY
IVTIM  = 12
IGS12  = 1611
IGS24  = 1612
  IF(ITIME.EQ.0) THEN
    MDNG   = 1450
    IGTIM1 = 120000
    IGTIM2 = 0
    IGDAY1 = LASDAY
    IGS12  = 1612
    IGS24  = 1611
  ENDIF
IGS12  = IKWP('GUESS',1,IGS12)
MDNG   = IKWP('GMDF' ,1,MDNG)
.TXVA 12948 OUT DEV= NNN
.VPVA (ITXVA) DEV= NNN
.TXVA (ITXVA) IN DEV= NNN
CALL IGQUIT(IGSCRA)
IG = IGMAKE(IGRIDF,'WORKING GRID FILE FOR NMCGRD      ')
IG = IGMAKE(IGSCRA,'SCRATCH GRID FILE FOR NMCGRD      ')
LAT1 = 25
LAT2 = 58
LON1 = 110
LON2 = 158
"
" DO 2 SETS OF GRIDS... 1 FOR EPAC AND 1 FOR GULF MEX
"
DO 100 I=1,2
  IF(I.EQ.2) THEN
    LAT1 = 22
    LAT2 = 34
    LON1 = 75
    LON2 = 100
  ENDIF
.RFVA Z 500 LEV2= 1000 INC= 10 GSS= G RF= 1.5 GMDF= (MDNG) -
LAT= (LAT1) (LAT2) LON= (LON1) (LON2) GRIDF= (IGSCRA) MDF= (MDF) -
ROW= (IPER)
.RFVA Z 400 LEV2= 850 INC= 10 GSS= G RF=1.5 GMDF= (MDNG) -
LAT= (LAT1) (LAT2) LON= (LON1) (LON2) GRIDF= (IGSCRA) MDF= (MDF)
ROW= (IPER)
.RFVA T 850 INC= 10 GSS= G RF= 1.5 GMDF= (MDNG) GRIDF= (IGSCRA) -
LAT= (LAT1) (LAT2) LON= (LON1) (LON2) ROW= (IPER) MDF= (MDF)
.RFVA T 500 INC= 10 GSS= G RF= 1.5 GMDF= (MDNG) GRIDF= (IGSCRA) -
LAT= (LAT1) (LAT2) LON= (LON1) (LON2) ROW= (IPER) MDF= (MDF)
.RFVA T 250 INC= 10 GSS= G RF= 1.5 GMDF= (MDNG) GRIDF= (IGSCRA) -
LAT= (LAT1) (LAT2) LON= (LON1) (LON2) ROW= (IPER) MDF= (MDF)
.RFVA Z 250 INC= 10 GSS= G RF= 1.5 GMDF= (MDNG) GRIDF= (IGSCRA) -
LAT= (LAT1) (LAT2) LON= (LON1) (LON2) ROW= (IPER) MDF= (MDF)
.RFVA Z 500 INC= 10 GSS= G RF= 1.5 GMDF= (MDNG) GRIDF= (IGSCRA) -
LAT= (LAT1) (LAT2) LON= (LON1) (LON2) ROW= (IPER) MDF= (MDF)
100
"
" FIND LFM GRIDS TO MAKE THICKNESS (1000-500MB)
"
CALL DDEST('LOOKING FOR DAY/TIM '//CFI(IGDAY1)//'  ',IGTIM1)
DO 110 IGUESS=1600,1605
CALL GETGRD(IGUESS,IGDAY1,IGTIM1,IVTIM,'Z    ',1000,IZ1000)
IF(IZ1000.GT.0) GOTO 125
110
```

```
  IGDAY1 = IGDAY2
  IGTIM1 = IGTIM2
  DO 115 IGUESS=1600,1605
  CALL GETGRD(IGUESS,IGDAY2,IGTIM2,IVTIM,'Z    ',1000,IZ1000)
  IF(IZ1000.GT.0) GOTO 125
115
  CALL EDEST('LFM DATA NOT AVAIL. IN GRID FILES 1600-1605',0)  .
  GOTO 800
125
CALL GETGRD(IGUESS,IGDAY1,IGTIM1,IVTIM,'Z    ',500,IZ500)
  IF(IZ500.LE.0) THEN
    CALL EDEST('LFM DATA NOT AVAIL. IN GRID FILES 1600-1605',0)
    GOTO 800
  ENDIF
200
.IGG GET (IGUESS) (IZ1000) (IZ1000) (IGSCRA)  15
.IGG GET (IGUESS) (IZ500)  (IZ500)  (IGSCRA)  16
.IGG MAKE 16 SUB 15 GRIDF= (IGSCRA)
*
* NOW MOVE ALL THE GRIDS IN SCRATCH FILE TO FINAL RESTING PLACE
*
800
IGBEG = 1
        IF(IPER.NE.1) IGBEG = 21
IGEND = IGBEG+19
.IGG DEL (IGBEG) (IGEND) GRIDF= (IGRIDF)
.IGG GET (IGSCRA) 1 20 (IGRIDF) (IGBEG)
999
CALL EDEST(' DONE ',0)
SUBROUTINE GETGRD(IGRDF,KDAY,KTIM,IVTIM,CPARM,LEV,IGRD)
* INPUT : IGRDF = GRID FILE NUMBER TO SEARCH
*         KDAY =  YYDDD OF GRID TO SEARCH FOR
*         KTIM = HHMMSS TIME OF GRID TO SEARCH FOR
*         IVTIM = HH FCST TIME OF GRID TO SEARCH FOR (IE 12, 24, 36)
*         CPARM = CHARACTER PARAMETER NAME ('T', 'TD' ...)
*         LEV = LEVEL OF GRID TO SEARCH FOR (1000, 'MSL', 'TRO'...)
* OUTPUT: IGRD = GRID NUMBER (-1 IF NOT FOUND; -2 IF FILE NON-EXIST)
*
CHARACTER*4 CPARM
INTEGER IGHD(64)
EQUIVALENCE (IGSIZE,IGHD(1))
EQUIVALENCE (IGDAY, IGHD(4))
EQUIVALENCE (IGTIME,IGHD(5))
EQUIVALENCE (IGTIMV,IGHD(6))
EQUIVALENCE (IGLEVL,IGHD(10))
EQUIVALENCE (IGVNAM,IGHD(7))
IPARM = LIT(CPARM)
CALL DDEST(' INPUT PARM (C)='//CLIT(IPARM)//'  (I)= ',IPARM)
CALL DDEST(' IVTIM='//CFI(IVTIM)//' LEV=  ',LEV)
IGRD = -2
IF(IGGET(IGRDF,1,-1,IDUM,NR,NC,IGHD).LT.-1) GOTO 999
DO 100 IG=1,159
IOK= IGGET(IGRDF,IG,-1,IDUM,NR,NC,IGHD)
IF(IGSIZE.LE.0.OR.IGVNAM.NE.IPARM.OR.IGLEVL.NE.LEV)    GOTO 100
IF(IGTIMV.NE.IVTIM.OR.IGDAY.NE.KDAY.OR.IGTIME.NE.KTIM) GOTO 100
IGRD = IG
GOTO 999
100
* DID NOT FIND A GRID WHICH FITS THE DESCRIPTORS... IGRD= -1
IGRD = -1
999
      SUBROUTINE SUBDAY(NOWDAY,LASDAY)
* --- SUBTRACT 1 DAY FROM NOWDAY TO GET LASDAY (BOTH IN YYDDD FORMAT)
      IYEAR = NOWDAY/1000
```

```
      IF(IDAY.EQ.0) THEN
         IDAY  = 365
         IYEAR = IYEAR - 1
         IF(MOD(IYEAR,4).EQ.0) IDAY = 366
      ENDIF
   LASDAY = IYEAR*1000+IDAY
 999
//* EOF
```

TABLE C13

```
//KCGR1450 JOB  MSGLEVEL=(0,0),CLASS=B
//  EXEC  MACRO3,MOD=KCGRD
//* ULKCGRD  CMH  09/02/86; WORK ON SCRATCH GRID
//* ULKCGRD  BTR  07/01/86; MOVE FROM UD
//* UDKCGRD BTR 07/01/86; CHANGE KEYWORDS
//* UDKCGRD  BTR  06/26/86; MOVED FROM UL
//* VLKCGRD  ALS  06/06/86; MOD TO HELP
//* VLKCGRD  ALS  06/06/86; KEYWORD FOR SCRATCH GRID
//* VLKCGRD  ALS  06/05/86; CHANGE RF FOR ENGY AND ADD EDIT=-1
//* VLKCGRD  ALS  05/28/86; ADD TXVA KEYWORD
//* VLKCGRD  ALS  05/21/86; CHANGE RFVX TO RFVA
//* VLKCGRD  ALS  05/21/86; CHANGE RF FROM 1.5 TO 2.0
//* VLKCGRD  ALS  05/14/86; DIVIDE ENGY GRIDS BY 100
//* VLKCGRD  ALS  05/12/86; MDX TO RFVX FOR ENGY TERMS
//* VLKCGRD  ALS  05/12/86; ADD 'ENGY' CALULATIONS FOR EVEN ROWS
//* VLKCGRD  ALS  05/02/86; RFVA TO RFVX
//* VLKCGRD  GJJ  03/26/86; GRID CREATION
//* VLKCGRD  ALS  03/19/86; ADD COMMENT
//SYSIN  DD  *
' ? KCGRD -- Generate VAS retrieval analyses for Kansas City.    (ALS)
' ?   KCGRD   row   <Keywords>
' ? Parameters:
' ?   rowl  row# (1-10) corresponding to dwell sound times (No dflt).
' ?         1 -- 948/1018   2 --1118/1148  3 --1248/1318
' ?         4 --1418/1448   5 --1548/1618  6 --1718/1748
' ?         7 --1848/1918   8 --2018/2048  9 --2148/2218  10 --2318/2348
' ?  Keywords:
' ?   LAT=  minlat maxlat   Latitude bounds for analyses     <Def=24 50>
' ?   LON=  minlon maxlon  Longitude bounds for analyses    <Def=75 110>
' ?   INC=  Grid increment (spacing) (DEG-LAT)*10.                <Def=10>
' ?   GSS=  First-guess use: (G) 'VASGSS'; (O) No guess.        <Def=G>
' ?   OPT=  nonzero  to make needed files if not row #1 or #6   <Def=0>
' ?   SEND= nonzero  to send grids to KC when done          <Def=1 send>
' ?   GRIDF=grid file number       <Def=1441 rows 1-5; =1444 rows 6-10>
' ?   ENGY= nonzero  to compute bouyancy <Def=1 for even rows, else 0>
' ?   MDF=  MD file of VAS data <Def=1441>
' ?   MDEN= MD file of 'ENGY' data <Def=1444>
' ?   TXVA= VASTEXT file to resore <Def=real time;1441-1459>
' ?   SCR=  Scratch grid file to do analyses in <Def=1440>
' ?
' ?  Remarks: Analyze (RFVX) VAS retrieval fields and grad winds.
' ?   GRIDF 1440 is scratch; GRIDF 1441 stores grids for rows 1-5.
' ?                          GRIDF 1444 stores grids for rows 6-10.
DIMENSION IP(5),KEYS(3),LOCS(3),IDATA(3),ISCALE(3),IUNIT(3)
DIMENSION IDIR(64),IDAF(10)
CHARACTER*32 CDOC
DATA IP/1000,850,700,500,250/
DATA IDAF/-1,11,-1,14,-1,17,-1,20,-1,23/
:
: KCGRD --- BEGAN AT-(7,ITIM).  {WITH INTR-(3,INTR)}
:
IROW   = IPP(1,999)
INC    = IKWP('INC',1,10)
CGSS   = CKWP('GSS',1,'G')
IOPT   = IKWP('OPT',1,0)
MDF    = IKWP('MDF',1,1441)
MDEN   = IKWP('MDEN',1,1444)
*
*      GRIDF=1441 FOR ROWS 1-5 ; GRIDF=1444 FOR ROWS 6-10
*
       IGRID = 1441+3*(IROW/6)
IGRID = IKWP('GRIDF',1,IGRID)
XLAT1 = DKWPLL('LAT',1,24.0)
XLAT2 = DKWPLL('LAT',2,50.0)
```

```
LAT1  = XLAT1
LAT2  = XLAT2
LON1  = XLON1
LON2  = XLON2
*
*   GRIDFILE 1440 IS USED AS SCRATCH FOR A PARTICULAR TIME PERIOD.
*   THEN, ALL GRIDS FOR A DAY ARE STORED IN GRIDFILE 1441 & 1444.
*
IF(IROW.LT.1.OR.IROW.GT.10) THEN
  CALL SDEST(' 1-10 ARE VALID ROWS...YOU USED ',IROW)
  GOTO 999
ENDIF
*
* GET DAY/TIME INFO FROM MD FILE FOR PROPER ROW
*
CALL MOVCW('CMAXTIMEDAY ',KEYS)
IOK  = MDKEYS(MDF,3,KEYS,ISCALE,IUNIT,LOCS)
IOK  = MDI(MDF,IROW,0,3,LOCS,IDATA)
JTIM = IDATA(2)
JDAY = IDATA(3)
CALL SDEST('MD DATA HAS DAY = '//CFI(JDAY)//' TIME =',JTIM)
*
* CREATE GRID FILE FOR FINAL GRID DESTINATION
*
IF(IROW.EQ.1 .OR. IROW.EQ.6 .OR. IOPT.EQ.1) CALL IGQUIT(IGRID)
CALL CALDAY(IDAY,NY,NM,ND,CM)
CALL ENCODE('("VAS R/T ANAL (NSSFC):",I2,A3,I2,4X)',CDOC,ND,CM,NY)
IG= IGMAKE(IGRID,CDOC)
*
*
IGSCR = IKWP('SCR',1,1440)
.IGU SET (IGSCR)
.IGG DEL 1 20
*
*   RESTORE APPROPRIATE 'VASTEXT' FILE (PER REAL-TIME MACRO 'MAKKC').
*
.TXVA 5700 OUT
IVTX = 1439+(2*IROW)
IVTX = IKWP('TXVA',1,IVTX)
.TXVA (IVTX) IN
: TXVA (4,IVTX) IN ---> OLD TXVA SAVED IN 5700
*
DO 10 I=1,5
*
.RFVA Z (IP(I)) INC= (INC) GSS= (CGSS) GRIDF= (IGSCR) RF= 2.0 GINC= 4 -
MDF= (MDF) ROWR= (IROW) LAT= (LAT1) (LAT2) LON= (LON1) (LON2)
*
.RFVA T (IP(I)) INC= (INC) GSS= (CGSS) GRIDF= (IGSCR) RF= 2.0 GINC= 4 -
MDF= (MDF) ROW= (IROW) LAT= (LAT1) (LAT2) LON= (LON1) (LON2)
*
*  NO GUESS USED FOR DEW POINT ANALYSIS...NO TD ABOVE 300 MB
*
IF(IP(I).GE.300) THEN
.RFVA TD (IP(I)) INC= (INC) GRIDF= (IGSCR) RF= 2.0 -
MDF= (MDF) ROW= (IROW) LAT= (LAT1) (LAT2) LON= (LON1) (LON2)
ENDIF
*
10
*
.RFVA LI  INC= (INC) GRIDF= (IGSCR) LAT= (LAT1) (LAT2) LON= (LON1) -
(LON2) RF= 2.0
*
.RFVA TOT INC= (INC) GRIDF= (IGSCR) LAT= (LAT1) (LAT2) LON= (LON1) -
(LON2) RF= 2.0
```

```
.RFVA WV INC= (INC) GRIDF= (IGSCR) LAT= (LAT1) (LAT2) LON= (LON1) -
(LON2) RF= 2.0
*
* DEFAULT: DO ENERGY ANALYSIS FOR EVEN ROWS ONLY
*
IENGY = MOD(IROW,2) - 1
IENGY = IKWP('ENGY',1,IENGY)
IF(IENGY.NE.0) THEN
FTIM = FTIME(JTIM)
.SNDVA (MDF) (MDEN) (FTIM) (JDAY) IROW= (IROW) OROW= (IROW)
.RFVA B MDF= (MDEN) LAT= (LAT1) (LAT2) LON= (LON1) (LON2) -
INC= (INC) GRIDF= (IGSCR) ROW= (IROW) RF= 1.5 EDIT= -1
.RFVA TNE MDF= (MDEN) LAT= (LAT1) (LAT2) LON= (LON1) (LON2) -
INC= (INC) GRIDF= (IGSCR) ROW= (IROW) RF= 1.5 EDIT= -1
.RFVA HNE MDF= (MDEN) LAT= (LAT1) (LAT2) LON= (LON1) (LON2) -
INC= (INC) GRIDF= (IGSCR) ROW= (IROW) RF= 1.5 EDIT= -1
.RFVA B2E MDF= (MDEN) LAT= (LAT1) (LAT2) LON= (LON1) (LON2) -
INC= (INC) GRIDF= (IGSCR) ROW= (IROW) RF= 1.5 EDIT= -1
*
* DIVIDE ALL THESE ENERGY GRIDS BY 100 TO PREVENT OVERFLOW ON HARRIS.
*
.IGG MAKE 18 DIV -100 GRIDF= (IGSCR)
.IGG MAKE 19 DIV -100 GRIDF= (IGSCR)
.IGG MAKE 20 DIV -100 GRIDF= (IGSCR)
.IGG MAKE 21 DIV -100 GRIDF= (IGSCR)
*
* NOW GET RID OF THE UNSCALED GRIDS AND REPACK
*
.IGG DEL 18 21 GRIDF= (IGSCR)
.IGG GET (IGSCR) 22 25 (IGSCR) 18
.IGG DEL 22 25 GRIDF= (IGSCR)
ENDIF
*
* MOVE CURRENT GRIDS TO SET LOCATIONS IN GRIDFILE 1441 & 1444.
*
NROW = IROW
      IF(NROW.GT.5) NROW=NROW-5
IGI   = 1+(30*(NROW-1))
IGEND = IGI+29
.IGG DEL (IGI) (IGEND) GRIDF= (IGRID)
.IGG GET (IGSCR) 1 30 (IGRID) (IGI)
*
* SEND THE GRIDS TO K.C. IF REQUESTED (DEFAULT)
*
ISEND = IKWP('SEND',1,0)
IF(ISEND.NE.0) THEN
.XPKC (IROW) GRID
ENDIF
*
* SUBMIT JOB FOR DIAL ACCESS FACILITY FOR TIMES OF 11,14,17,20,23
*
IF(IDAF(IROW).GT.0) THEN
.VASDAF (IDAF(IROW))
ENDIF
*
*   RETURN GRIDFILE POINTER TO SAME NUMBER AS TERMINAL.
*
.IGU SET (ITRM)
999
CALL EDEST(' DONE: ROW=',IROW)
//* EOF
```

```
//NHCG1450 JOB  MSGLEVEL=(0,0),CLASS=B
//  EXEC  MACRO3,MOD=NHCGRD
//* ULNHCGRD CMH  09/02/86: MEMBER UPDATED
//* ULNHCGRD CMH  09/02/86; REMOVE OUTPUT GRID CREATION
//* ULNHCGRD CMH  08/27/86; PUT IN VASTEXT DEFAULT FOR MD ROW
//* ULNHCGRD CMH  08/26/86; MAKE SCRATCH GRID 5576
//* ULNHCGRD BTR  07/01/86; MOVE FROM UD
//* UDNHCGRD BTR  07/01/86; CHANGE KEYWORDS
//* VLNHCGRD ALS  06/13/86; FORMAT (CDOC)
//* VLNHCGRD ALS  06/12/86; MDNR TO MDF
//* VLNHCGRD ALS  06/12/86; TXVA DEFAULT
//* VLNHCGRD GSW  10/18/85; ADD 'DAF' CODES, INCL AREA SELECTION.
//* VLNHCGRD ALS  08/01/85; ADD COPY TO 5583
//* VLNHCGRD ALS  07/30/85; CHANGE SCALE
//SYSIN  DD  *
' ? NHCGRD -- Generate VAS retrvl anlys & grad-winds    (ALS)
' ?    NHCGRD   time   <Keywords>
' ? Parameters:
' ?   time| time of VAS data (0 or 12) in real time MD file (no dflt)
' ?  Keywords:
' ?   MDF=    MD file with VAS data  <5568 for 12z; 5571 for 00z>
' ?           also output grid file no.
' ?   LAT=    minlat   maxlat   Latitude bounds for analyses <def=0 50>
' ?   LON=    minlon   maxlon  Longitude bounds for analyses <def=40 105>
' ?   INC=    Grid increment (spacing) (DEG-LAT)*10.      <Def=12>
' ?   GSS=    First-guess use: (G) 'VASGSS'; (0) No guess. <Def=G>
' ?   SCR=    scratch grid file <Def=5576>
' ?   GRIDF= final grid file <5568 for 12z; 5571 for 00z>
' ?   TXVA=  number of VASTEXT to restore <Def=MDF number>
' ?
' ?  Remarks: Analyze VAS retrieval fields and grad winds.
DIMENSION IP(8),KEYS(3),LOCS(3),IDATA(3),ISCALE(3),IUNIT(3)
COMMON /DOC/IDOC(112)
CHARACTER*32 CDOC
CHARACTER*8 MFILE
DATA IP/1000,850,700,500,400,300,250,200/
DATA LUN/20/,MFILE/'VASTEXT '/,LEN/100/
'
'  CAUTION !  PLEASE KEEP VERSION DATE CORRECT.
:
: 'NHCGRD' BEGAN AT-(7,ITIM).  {VERSION OF 10JUN86 WITH INTR-(3,INTR)}
:
ITIM  = IPP(1,-1)
IF(ITIM.NE.0 .AND. ITIM.NE.12) THEN
  CALL EDEST(' 0  OR  12  ARE VALID TIMES, NOT ',ITIM)
  GOTO 999
ENDIF
'
'.  RESTORE APPROPRIATE 'VASTEXT' FILE (PER REAL-TIME MACRO 'MAKRET').
'
IDFLT  = 5571 - 3*(ITIM/12)
MDF    = IKWP('MDF',1,IDFLT)
IVTX = IKWP('TXVA',1,MDF)
.VPVA (IVTX)
.TXVA (IVTX) IN
ITERM= LUC(0)
CALL DOPEN(MFILE,LUN,LEN)
CALL DREAD(LUN,ITERM,IDOC)
'
INC    = IKWP('INC',1,12)
CGSS   = CKWP('GSS',1,'G')
IOPT   = IKWP('OPT',1,1)
IGRID = MDF
ISGRD = IKWP('SCR',1,5576)
```

```
XLAT1  = DKWPLL('LAT',1,0.0)
XLAT2  = DKWPLL('LAT',2,50.0)
XLON1  = DKWPLL('LON',1,40.0)
XLON2  = DKWPLL('LON',2,105.)
LAT1   = XLAT1
LAT2   = XLAT2
LON1   = XLON1
LON2   = XLON2
IF(MDOPEN(MDF,1).LT.0) THEN
   CALL EDEST(' NO VAS DATA IN MD FILE # ',MDF)
   GOTO 999
ENDIF
.
. GET DAY/TIME INFO FROM MD FILE FOR PROPER ROW
.
CALL MOVCW('CMAXTIMEDAY ',KEYS)
IOK = MDKEYS(MDF,3,KEYS,ISCALE,IUNIT,LOCS)
IOK = MDI(MDF,NROW,0,3,LOCS,IDATA)
JTIM = IDATA(2)
JDAY = IDATA(3)
DTIM = FTIME(JTIM)
CALL SDEST(' MD FILE DAY ='//CFI(JDAY)//' TIME =',JTIM)
IF(IDATA(1).LE.0) THEN
  CALL EDEST(' NO VAS DATA IN MD FILE # ',MDF)
  GOTO 999
ENDIF
.IGU SET (ISGRD)
.   ANALYZE Z WITH 'RFVA' SO THAT GUESS CAN BE USED
.
DO 100 I=1,8
.RFVA Z (IP(I)) INC= (INC) GSS= (CGSS) GRIDF= (ISGRD) RF= 2.0 GINC= 4 -
MDF= (MDF) ROW= (NROW) LAT= (LAT1) (LAT2) LON= (LON1) (LON2)
100
DO 150 I=1,8
.SCLG (I) 400 FILE= (ISGRD)
150
.
.   ABOVE GRIDS NOW USED FOR GRADIENT WIND CALCUXLATIONS.
.
:... 1000/850/700/500/400/300/250/200 MB GRADIENT WINDS BEING MADE ...
DO 200 I=1,8
J = I+8
.GWVA (J) (IP(I)) PLOT= 1 GRIDF= (ISGRD) MDF= (MDF) ROW= (NROW)
200
.
:... COMPLETION OF WIND GENERATION ...
.
.   MOVE CURRENT GRIDS TO SET LOCATIONS IN GRIDFILE .
.
.IGG GET (ISGRD) 9 16 (IGRID) 1
999
CALL EDEST(' DONE ',ITIM)
//* EOF
```

APPENDIX D: THE INTERNATIONAL TOVS PROCESSING PACKAGE

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1. INTRODUCTION

An ongoing activity of the Cooperative Institute for Meteorological Studies (CIMSS) is the development, deployment, and support of software for processing direct readout TIROS Operation Vertical Sounder (TOVS) data from the NOAA polar orbiting satellites from raw data to finished profiles of temperature and moisture. This is accomplished in coordination with the International TOVS Working Group, subsidiary to the Radiation Commission of the International Association of Meteorology and Atmospheric Physics (IAMAP). The major focus of the Working Group has been a standardization of the retrieval algorithm, from the input of all members, such that the processed data of all members will be compatible. Toward this end there have been two International TOVS Study Conferences held in August 1983 and February 1985, and in conjunction with these two International TOVS Processing Packages have been developed (ITPP-1 and ITPP-2). These are discussed in technical reports resulting from the conferences (Menzel, 1983, 1985). The purpose of this paper is to provide a brief summary of ITPP-1, but more especially to describe the ITPP-2 to a broad audience. A case study using the ITPP-2 (with variations in some of its options, is also given. The low sensitivity of the ITPP-2 to the initial guess profile and an improved performance compared to the previously established iterative methods (Smith et al., 1983; Susskind, 1984) are demonstrated from TOVS orbits over Europe obtained during the ALPine EXperiment (ALPEX).

2. ITPP-1

Temperature and moisture retrievals in the ITPP-1 were accomplished by application of the Smith-Iterative Solution (Smith, 1970) for temperature and moisture profiles. In that approach, (1) an initial profile for temperature and water vapor is specified from climatology, statistical regression or from an NWP model, (2) radiances are calculated from the initial profiles, (3) the temperature profile is adjusted in an iterative manner until there is agreement between the observed and calculated radiances in the cloud insensitive microwave O_2 channels, (4) the infrared window channels are used to define either the surface skin temperature or the temperature of cloud within the instrument's field of view and the cloud level is defined using the microwave specified temperature profile, (5) the guess moisture profile is adjusted to reflect the existence of cloud by assuming 100% relative humidity at the cloud level and then further adjusted in an iterative manner in order to achieve convergence between observed and calculated radiance for the water vapor channels, and (6) the temperature profile is then further adjusted in an iterative manner in order to achieve convergence between the radiances observed and calculated in the infrared CO_2 channels.

3. ITPP-2

Since the introduction of the ITPP-1, a new retrieval algorithm was developed and tested for processing the VISSR Atmospheric Sounder (VAS) data received from the GOES satellites (Smith and Woolf, 1984). That algorithm is the basis for ITPP-2. In contrast to the iterative technique described above, it permits the simultaneous retrieval of surface-skin (or cloud) temperature, and the temperature and moisture profiles. The advantage of the "simultaneous solution" is two-fold: (1) the radiances observed in all channels are used to solve for all parameters simultaneously, thus alleviating the problem of the interdependence of the radiance observation upon the three parameters, and (2) since a direct analytical solution is employed, the process is computationally efficient.

As with the prior "iterative" algorithm, the physical nature of the solution permits the influence of surface variables (i.e., terrain elevation, emissivity, and temperature) and cloudiness to be accounted for in the profile determinations. The cloud handling algorithm has been modified from ITPP-1 to enable the infrared data to be utilized in partly cloudy as well as cloud overcast sky conditions. The physics for treating surface emissivity, terrain elevation, and reflected sunlight are not described here since these aspects have been provided in the previous report (Smith et al., 1983).

a) Direct Physical Solution

In order to achieve the simultaneous solution, a simplified form of the integral form of the radiative transfer equation is treated:

$$R = B_o + \int_o^{P_s} \tau dB \tag{1}$$

where R is the radiance, τ is the transmittance, and B is the Planck radiance. Dependency on angle, pressure, and frequency are eliminated for simplicity. The subscript s refers to the surface level. Thus, in perturbation form:

$$\delta R \cong \int_o^{P_s} \delta\tau \, dB + \int_o^{P_s} \tau d\,(\delta\beta) \tag{2}$$

Integrating the second term on the r.h.s. by parts:

$$\delta R \cong \int_o^{P_s} \delta\tau \, dB + \tau_s \delta B_s - \int_o^{P_s} \delta B \, d\tau \tag{3}$$

Letting

$$\delta R \cong \delta T^* \frac{\partial B}{\partial T^*}; \quad \delta B \cong \delta T \frac{\partial B}{\partial T}$$

$$dB = \frac{\partial B}{\partial T}\frac{\partial T}{\partial p} dp; \quad d\tau = \frac{\partial \tau}{\partial p} dp$$

$$\delta T^* = \int_o^{P_s} \delta\tau \frac{\partial T}{\partial p} \frac{(\partial B/\partial T)}{(\partial B/\partial T^*)} dp - \int_o^{P_s} \delta T \frac{\partial T}{\partial p} \frac{(\partial B/\partial T)}{(\partial B/\partial T^*)} dp + \delta T_s \frac{(\partial B_s/\partial T_s)}{(\partial B/\partial T^*)} \tau_s \qquad (4)$$

where T* is the brightness temperature, T is temperature, and T_s is the surface skin temperature.

Finally, we make the assumption that the transmittance perturbation is dependent only on the uncertainty in the column of precipitable water u according to

$$\delta\tau = \frac{\partial\tau}{\partial u} \delta u \qquad (5)$$

leading to the final form,

$$\delta T^* = \int_o^{P_s} \delta U \frac{\partial T}{\partial p} \frac{\partial\tau}{\partial U} \frac{(\partial B/\partial T)}{(\partial B/\partial T^*)} dp - \int_o^{P_s} \delta T \frac{\partial\tau}{\partial p} \frac{(\partial B/\partial T)}{(\partial B/\partial T^*)} dp + \delta T_s \frac{(\partial B_s/\partial T_s)}{(\partial B/\partial T^*)} \tau_s \, . \qquad (6)$$

The perturbations δ, are with respect to an <u>a-priori</u> condition which may be estimated from climatology, regression, or more commonly from an analysis/forecast provided by a numerical model. In order to solve for the perturbations from a set of spectrally independent radiance observations, the perturbation profiles are represented in terms of arbitrary pressure functions, $\phi(p)$:

$$\delta T_s = \alpha_o \phi_o \qquad (7a)$$

$$\delta U(p) = \sum_{i=1}^{N} \alpha_i \int_o^{P} q(p) \phi_i(p) dp \qquad (7b)$$

$$\delta T(p) = - \sum_{i=N+1}^{M} \alpha_i \phi_i(p) \qquad (7c)$$

where (7b) is derived from the definition

$$\delta q(p) = g \sum_{i=1}^{N} \alpha_i q(p) \phi_i(p) \qquad (7d)$$

where q(p) is the water vapor mixing ratio and g is the acceleration of gravity. The formulation of (7d), which is used to determine the retrieved mixing ratio profile, is in terms of percent change in q in order to have all elements of the matrix ϕ, described below, approximately the same order of magnitude.

Substituting (7a - 7c) into (6) yields for each spectral radiance observation, δT_j, for a set of K channels:

$$\delta T_j^* = \sum_{i=0}^{M} \alpha_i \Phi_{ij} \qquad j=1,2,\ldots,K \tag{8}$$

where

$$\Phi_{0,j} = \frac{\partial B_j/\partial T_s}{\partial B_j/\partial T_j^*} \tau_{s,j}$$

$$\Phi_{i,j} = \int_0^{P_s} [\int_0^{P} q\, \phi_i dp] [\frac{\partial T}{\partial p} \frac{\partial \tau_j}{\partial U} \frac{\partial B_j/\partial T}{\partial B_j/\partial T_j^*}] dp \qquad i \leq N \tag{9}$$

$$\Phi_{i,j} = \int_0^{P_s} \phi_i [\frac{\partial \tau_j}{\partial p} \frac{\partial B_j/\partial T}{\partial B_j/\partial T_j^*}] dp \qquad N<i\leq M .$$

There are many reasonable choices for the selection of pressure basis functions $\phi(p)$. For example, empirical orthogonal functions (i.e., eigenvectors of the water vapor and temperature profile covariance matrices) can be used in order to include statistical information in the solution. This approach has been taken by Susskind et al., (1984) for processing the temperature data for the First Garp Global Experiment. It would seem reasonable that some set which contains the characteristics of the atmosphere for the appropriate season/airmass and the characteristics of the sounding instrument is desirable. After limited testing, application to the TOVS observations, physical functions, the profile weighting functions ($d\tau/d\ln p$) of the radiative transfer equation, have been selected as the basis functions. Certainly, this is an area which needs further investigation, since it is readily demonstrable that the solution for temperature and moisture does depend somewhat on the choice of basis function.

The other quantities in (9) which are needed to calculate the Φ matrix are estimated from the <u>a-priori</u> profile using a 40 level discretization. Derivatives of the Planck function are calculated from the analytic derivation. An estimate of $\partial\tau/dU$ is derived by obtaining a second profile of the transmittance using a mixing ratio profile with values at each level which are half the <u>a-priori</u> value. Again, we make no claim that this is the optimal way of treating moisture problem; it is only one choice which is reasonably efficient computationally.

Written in matrix form (9) becomes

$$t^* = \Phi\alpha \tag{10}$$

where t^* is a row vector of K brightness temperature observations, α is a row vector of M+1 coefficients, and Φ is a matrix having dimensions (K×M+1). Assuming that K≥M+1, then the least squares solution of (10) is employed to give

$$\alpha = (\Phi^T\Phi)^{-1} \Phi^T t^* \approx (\Phi^T\Phi + \gamma I)^{-1} \Phi^T t^* \tag{11}$$

where $(\ )^T$ indicates matrix transposition and $(\ )^{-1}$ indicates matrix inverse. The γI term, where γ (nominally 0.1) is a scalar and I is the identity matrix, is incorporated to stabilize the matrix inverse. Once the α_i's are determined, δT_s, δq, and δT are specified from (7) and added to the a-priori estimates to yield the final solutions for surface-skin temperature and the water vapor mixing ratio and temperature profiles.

Ancillary information, such as surface observations, can be easily incorporated into the profile solutions. For example, for surface observations it follows from (7c) and (7d) that

$$q_o - q(p_s) = g \sum_{i=1}^{N} \alpha_i q(p_s)\phi_i(p_s) \tag{12}$$

and

$$T_o - T(p_s) = - \sum_{i=N+1}^{M} \alpha_i \phi_i(p_s) \ .$$

These can be added to the set to expand (9) to yield K+2 equations to solve for M+1 unknowns (α).

In summary, the main advantage of the "simultaneous" retrieval algorithm is that it enables the temperature and water vapor profiles and the surface skin temperature to be determined simultaneously using all the radiance information available. The simultaneity directly addresses the problems associated with water vapor radiance dependence upon temperature and the dependence of several of the carbon dioxide channel radiance observations used for temperature profiling, on the water vapor concentration. The dependence of the radiance observations on surface emissions is accounted for in the simultaneous solution by the inclusion of surface temperature as an unknown. Also, since only a single matrix inversion is required for the specification of all parameters, the solution is potentially more computationally efficient than the iterative technique (although this advantage can easily be obviated by iterating the "simultaneous" retrieval with updated cloud, transmittance, emissivity estimates). Finally, but significantly, ancillary observations of temperature and/or moisture from surface sensors or aircraft, for example, can be readily incorporated in the solution.

b) Logistics

The physical retrieval algorithms require the specification of an initial profile. There are two options available with the ITPP. A climatology option interpolates atmospheric profiles of temperature and mixing ratio from a set of fixed profiles for five latitude zones and two seasons (derived from the U.S. Standard Supplemental Atmospheres). A regression option provides the atmospheric profiles using statistics which have been generated from a sample of radiosonde profiles and synthetic brightness temperatures calculated from these radiosondes (with random error added, for the two operating, morning and afternoon satellites). Because of the diversity of operating environments into which the ITPP is placed, a third option for using profiles generated from current analyses and forecasts is not included, although it has been implemented by a number of users. It is recommended that the user provide surface boundary conditions in the form of mean sea level temperature and dewpoint, and 1000 mb geopotential. The ITPP will use these in combination with the climatological or regression estimates if they are provided.

Once a guess profile is generated, MSU and HIRS radiances are obtained for a particular 3x3 array of HIRS FOV's, as described in the earlier report (Smith et al., 1983); the MSU data having been interpolated to each HIRS FOV. As described in the next section, a search through the nine FOV's is performed to arrive at a set of "clearest" radiances for the sounding retrieval.

There are two passes through the retrieval algorithm. On the first pass, the stratospheric HIRS brightness temperatures (channels 1-3), the MSU brightness temperatures (MSU 1-4), and the middle and upper tropospheric HIRS water vapor channels (HIRS 11 and 12) are used to derive a first estimate of the temperature and moisture profile for the sounding location. Because of the channels used, this estimate should be relatively free of error due to cloud attenuation. The weighting functions for HIRS-1 and MSU 2-4 are utilized as the basis functions for temperature and the HIRS 7 and 12 weighting functions are used as the basis function for water vapor in the initial retrieval. These are chosen to represent the element being retrieved and to cover the pressure range of the retrieval. Once the first estimate of the temperature and water vapor profile is achieved, the height and amount of any cloud affecting the infrared observations is determined by the method described in the next section. After this is accomplished, all channels (except those eliminated because of suspected cloud induced error) are used to calculate the final surface temperature and the temperature and water vapor profiles. For the achievement of the final profile estimates the weighting functions for HIRS 1, 3, 7 and MSU 2-4 are used as the temperature profile basis functions and those for HIRS 7, 11, and 12 are used as the water vapor profile basis functions. Since as many as 19 different spectral radiance observations are used for the surface temperature and profile retrievals, the system of equations to be inverted is heavily overdetermined, thereby stabilizing the solution. (It should be noted that ozone and geopotential height are determined in the same manner as described for the iterative solution ITPP-1.)

c) Handling the Influence of Clouds

In the TOVS data processing, soundings are derived from a 3 x 3 matrix of HIRS fields of view (FOV). From the array, the observations for the "clearest" FOV's, defined as those whose 11μm radiance values are within 2°K of the local maximum, are averaged for the sounding determination. The magnitude of the visible channel reflectance and the 3.7μm, 4.0μm, and 11μm window channel brightness temperatures are used in conjunction with surface temperature observations, if available, to specify whether the "clearest" radiances are contaminated by clouds. If so, the cloud pressure height and fractional coverage are specified on the basis of certain CO_2 channel infrared radiances and the temperature profile resulting from the first estimate which uses opaque CO_2 channels and the microwave. The cloud height is calculated using the CO_2 slicing technique (Smith and Platt, 1977, Menzel et al., 1983) from the relation

$$\frac{I(\nu_1) - \hat{I}_c(\nu_1)}{I(\nu_2) - \hat{I}_c(\nu_2)} = \frac{\int_{P_c}^{P_o} \tau(\nu_1,p) \frac{\partial B(\nu_1,\hat{T})}{\partial p} dp}{\int_{P_c}^{P_o} \tau(\nu_2,p) \frac{\partial B(\nu_2,\hat{T})}{\partial p} dp} \tag{13}$$

where $\hat{I}_c$ is the clear-column radiance calculated from the microwave specified temperature profile, T, and ν_1 and ν_2 refer to HIRS channels 5 and 7 respectively. The cloud pressure P_c is obtained by decreasing the cloud pressure until the absolute value of the numerator on the left times the denominator on the right less the numerator on the right times the denominator on the right of (13) is minimized. The cloud fraction, N, is then obtained from the relation

$$N = \frac{\hat{I}_c(\nu_2) - I(\nu_2)}{\hat{I}_c(\nu_2) - \hat{I}_{cd}(\nu_2)} \tag{14}$$

where $\hat{I}_{cd}(\nu_2)$ is the radiance calculated for an opaque cloud overcast condition at level P_c.

Given P_c and N, the guess mixing ratio profile is adjusted by assuming that the mixing ratio at the cloud level is given by

$$W(p_c) = NW_{sat}[\hat{T}(p_c)] + (1 - N)\hat{W}(p_c) \tag{15}$$

where W_{sat} is the saturation mixing ratio corresponding to the microwave specified temperature at the cloud pressure P_c and W is the original guess value of mixing ratio. Below the cloud a new guess mixing profile is achieved by interpolation using the original surface mixing ratio value.

Once the cloud parameters and the guess mixing ratio are established the brightness temperature discrepancies from the guess conditions, δT^*, can be calculated, including the effects of cloud within the field of view of the HIRS instrument. Also, for the infrared channels the effects of cloud and the transmittance function, τ, employed in equation (9) can be properly included by assuming that

$$\tau = (1 - N)\,\tau^{orig} \tag{16}$$

for pressures greater than the cloud pressure. This latter transmittance function modification is important to reduce the influence of the infrared observations on the solution below the cloud in proportion to the cloud obscuration. Once this step is employed, the simultaneous solution proceeds in exactly the same manner as the clear sky condition.

4. CASE STUDY

Four NOAA-9 orbits over Europe on 4 and 5 March 1982 have been used by the International TOVS Working Group for comparative studies. In this section, we present results obtained for these orbits using both the ITPP-1 and -2 for comparison with each other and with operational analyses of radiosonde data for this area produced by the European Center for Medium-range Weather Forecasting (ECMWF). We shall consider objective analyses of the retrievals. These were obtained using a Recursive Filter analysis scheme (Hayden and Purser, 1986) with a horizontal resolution of approximately 100 km. We shall focus on two aspects; the guess dependence of the algorithms and the accuracy of the results, using the ECMWF analyses as the standard.

Figures 1-3 show the temperature analyses at 700 mb, 500 mb, and 300 mb using a regression first guess (solid) for the iterative algorithm (A) and the Simultaneous version (B). The dashed contours are derived by differencing the results using an operational regression first guess minus the results obtained from a climatological first guess and thus represent guess dependency. At both 700 and 500 mb (Figs. 1 and 2), the Simultaneous algorithm tends to slightly intensify the upper level thermal trough over France and the cut-off low over Crete relative to the Iterative version. This condition is not nearly as obvious at 300 mb (Fig. 3). Examining the dashed contours at each level, it is seen that the iterative scheme as well as the simultaneous algorithm demonstrate some reliance to the first guess. A close inspection, especially in the area of the upper level trough and cut-off low, reveals that the ITPP-2 is less dependent than ITPP-1.

The comparisons of Fig. 4 are equivalent to those of Fig. 1-3, except dew points at 700 mb are presented. An area of agreement between the analyses is a moist area in southern and eastern Europe, although the location of the maximum moist areas varies depending on which retrieval algorithm is used. Otherwise, the analyses deviate considerably. The simultaneous scheme (Fig. 4B) defines two dry wedges, one in Algeria and western Tunisia and the other located in southwestern Spain, which are virtually non-existent in the iterative version (4A). Conversely, Fig. 4A shows a dry pocket in northeastern France for which there is no counterpart in Fig. 4B (ITPP-2). The dew point comparisons also show dramatic differences in guess dependency (dashed analysis). With the exception of the northern boundary, the Simultaneous scheme does not have a contour with a greater absolute value of two, while Fig. 4A (ITPP-1) shows numerous contours with absolute values of four, and even six. Thus, for dewpoint the simultaneous solution is markedly less guess dependent.

Comparison between the simultaneous algorithm, using either a regression (A and B) or climatological (C and D) first guess, and the operational ECMWF analyses are depicted in Figs. 5-7 for 4 March 1982 12GMT and 5 March 1982 00GMT. The satellite analyses are shown in solid contours, while the dashed lines represent the satellite analysis minus the operational ECMWF analysis. The synoptic situation described by the satellite retrievals at 700 mb (Fig. 5) shows a thermal trough located in southwestern France on 4 March 1982 12GMT with trough axis showing a slight tilt from the southwest toward the northeast. On 5 March 1982 00GMT, the thermal trough has moved into the Mediterranean Sea just north of Algiers. The trough axis, at this time, is from the northwest to the southeast. A thermal ridge with its axis running through the center of Italy during the first time period is located just southeast of the "boot," 12 hours

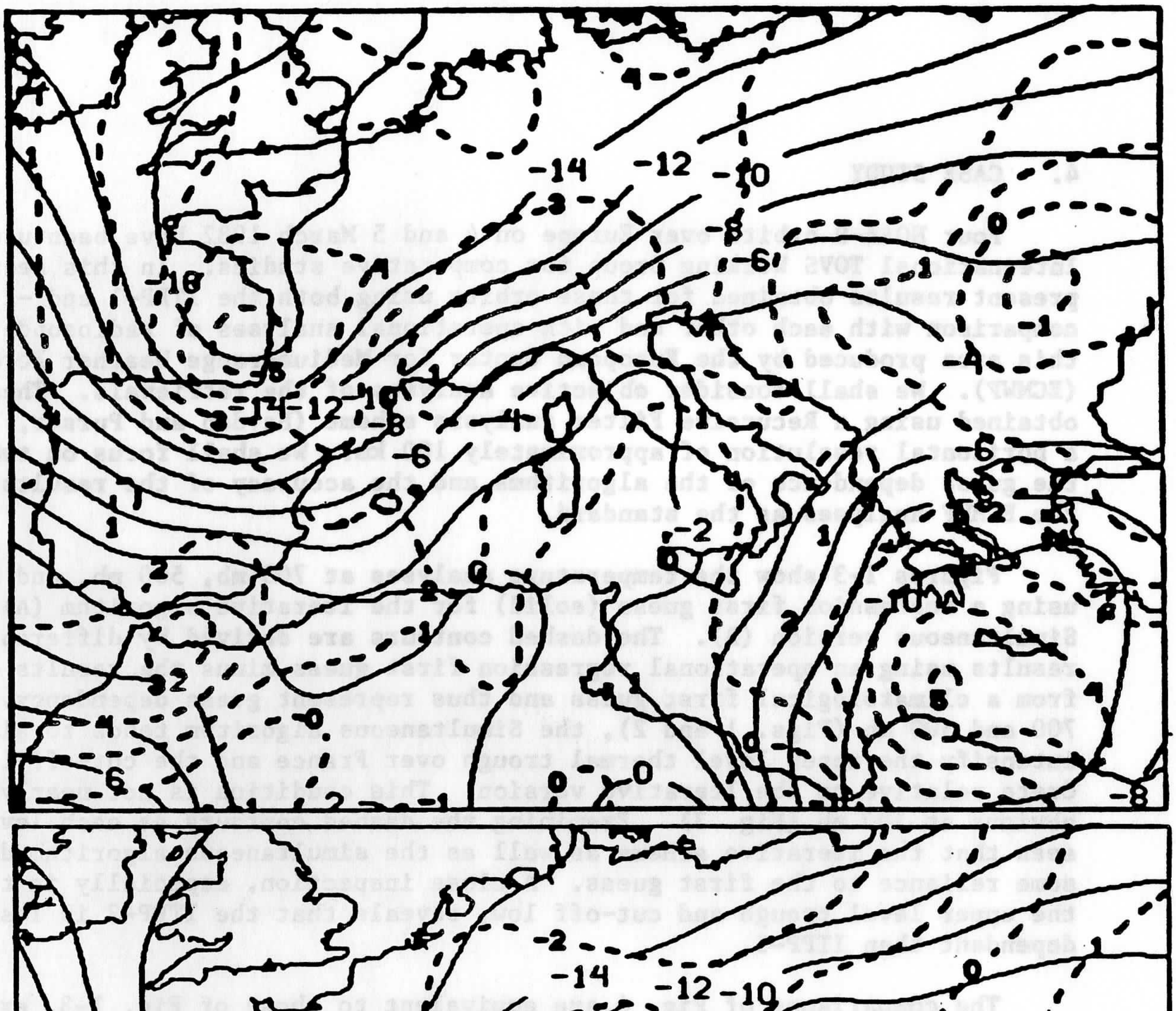

Fig. 1: Analyses of temperature in degrees celsius of TOVS retrievals (solid contours) using an iterative (A) or simultaneous (B) algorithm with a regression first guess at 700 mb for 4 March 1982 1200GMT. The dashed contours represent the difference between retrievals obtained by using a regression or climatology first guess for two algorithms.

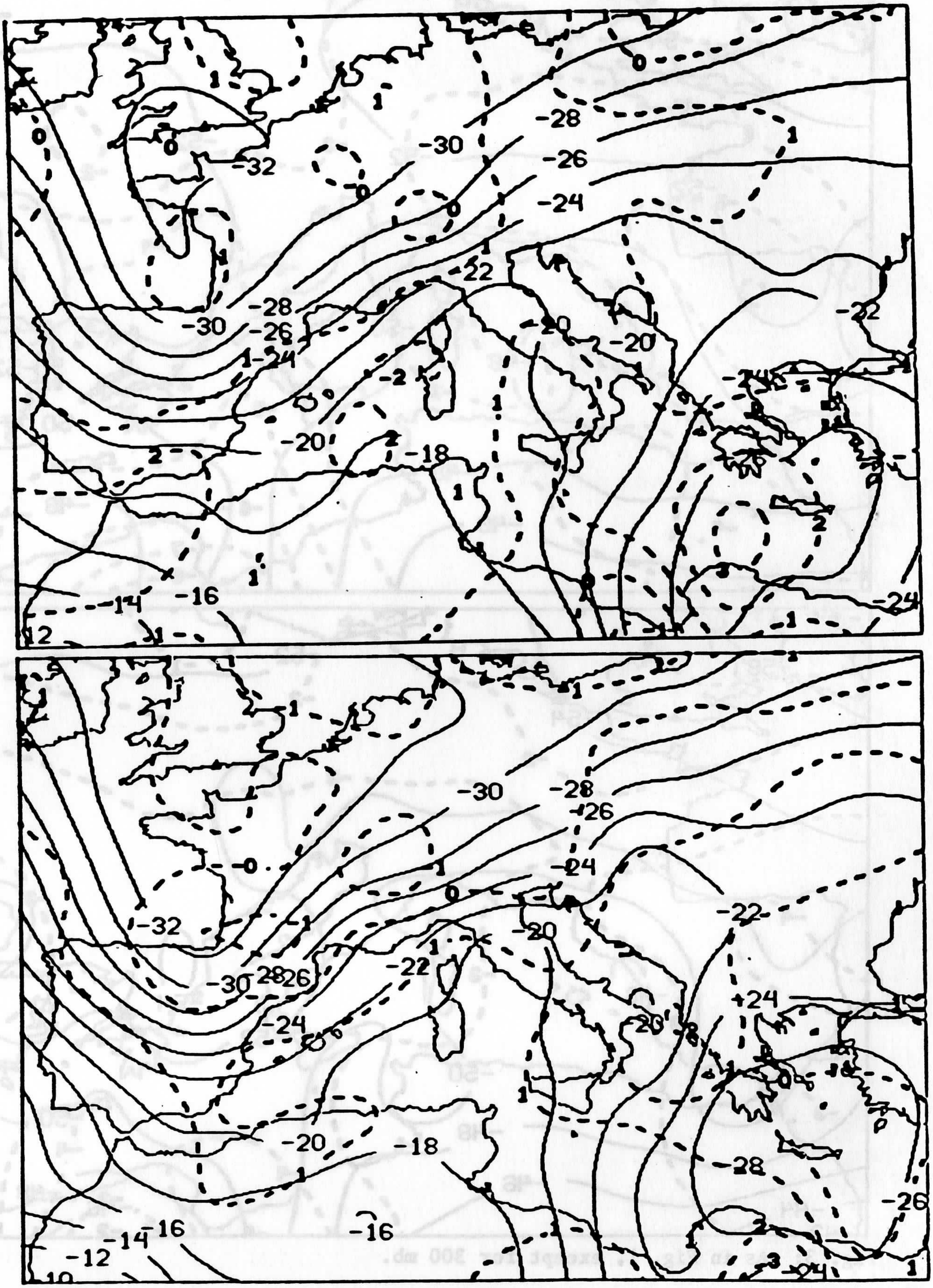

Fig. 2: As in Fig. 1, except for 500 mb.

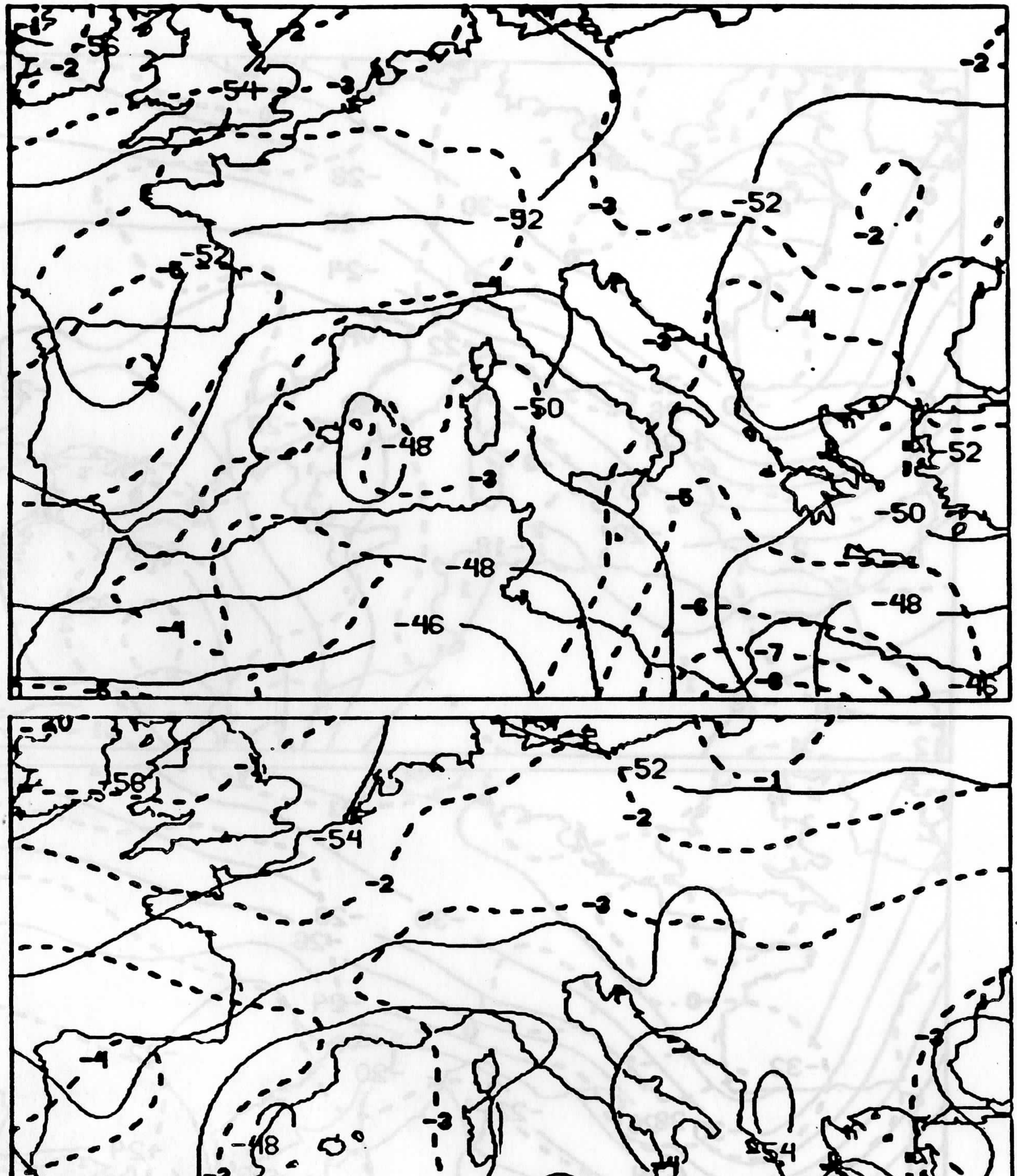

Fig. 3: As in Fig. 1, except for 300 mb.

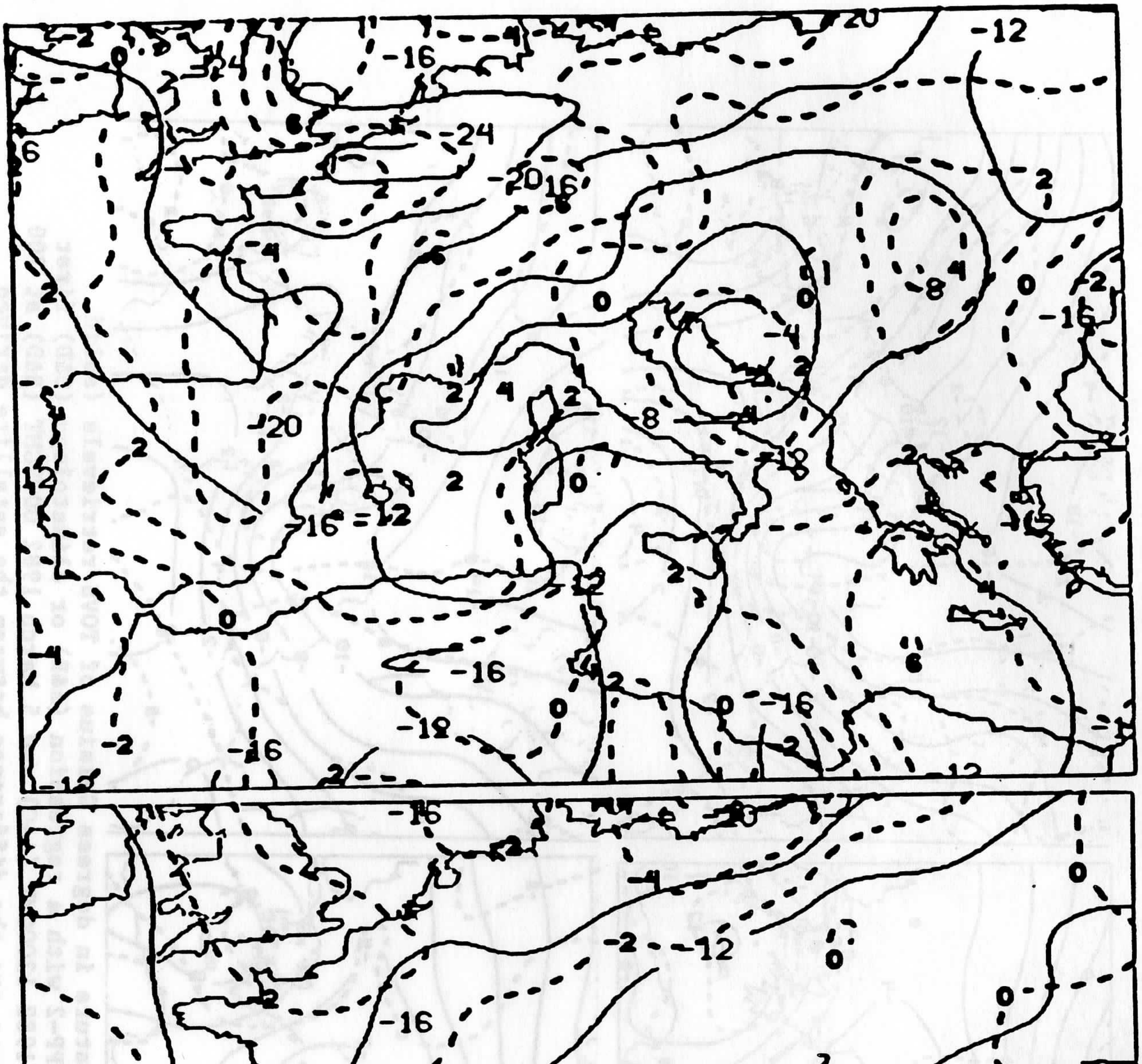

Fig. 4: As in Fig. 1, except for 700 mb dewpoint in degrees celsius.

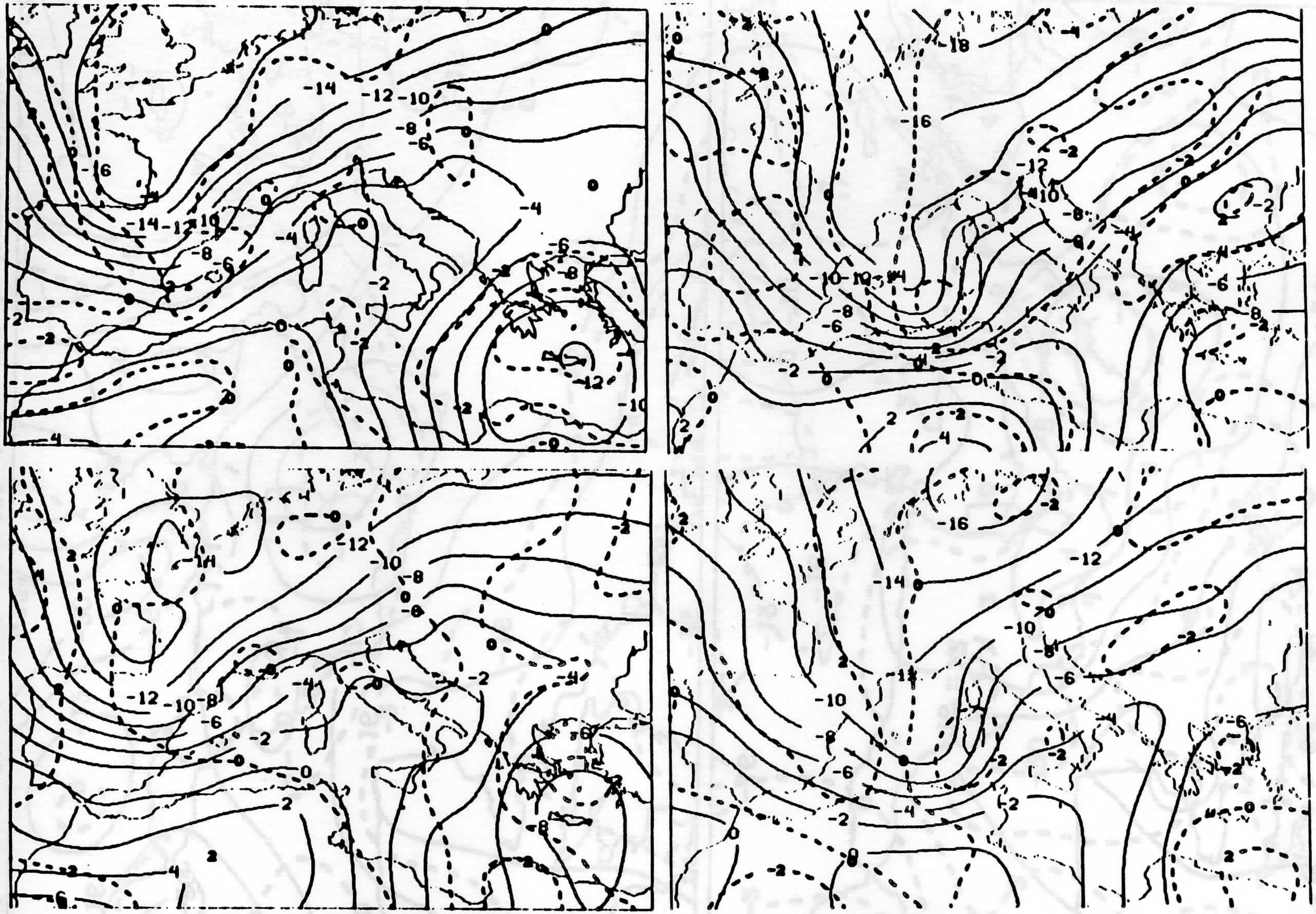

Fig. 5: Analyses of temperature in degrees Celsius of TOVS retrievals (solid contours) using ITPP-2 with a regression (A&B) or climatology (C&D) first guess for 4 March 1982 1200GMT (A&C) and 5 March 1982 0000GMT (B&D) at 700 mb. The dashed lines are the difference between the satellite derived analysis and the appropriate ECMWF analysis.

later. At 12GMT a cut-off thermal low is located over Crete and a slight, almost imperceptible eastward shift is noted at 00GMT on 5 March. The temperature analysis at 500 mb shows a pattern similar to 700 mb. Well-defined patterns at 300 mb are not obvious during the first period, but the building of a thermal ridge in response to the intensification of a wave lower in the troposphere at the same location is depicted in the second nominal period of satellite analyses.

Although both ITPP-1 and ITPP-2 analyses display the same salient features at all three levels, the analysis using a regression first guess tends to intensify the thermal troughs and ridges described above, especially at 700 mb and 300 mb. The 500 mb temperature analysis shows a filling or warming of the cut-off low located over Crete during the 12 hour period for the regression case (Figs. 6A and 6B), while the climatology version (Figs. 6C and 6D) depicts this low as remaining constant or deepening slightly. Further inspection shows that this problem is due to data coverage. It is found that the satellite derived temperature/moisture retrievals using a regression first guess shows comparable temperatures to the climatology first guess version (Fig. 7) with a slight difference in density of soundings.

There are two major differences between the satellite derived analyses and the ECMWF analyses (dashed lines). The first are the dashed bull's eyes located in the thermal trough over the Mediterranean Sea at 500 mb (Figs. 6B and 6D) and to some extent at 700 mb (Figs. 5B and 5D). This is due to a difference in the location of the thermal trough between the satellite derived analysis and the ECMWF analysis. Most of this is due to a discrepancy in time between the satellite data (approximately 0230GMT) and the model derived analysis (0000GMT). A second reason, however, is the difference in intensity of the trough defined by the two analyses. The second major disagreement is at 300 mb (Fig. 8). A thermal trough develops at 0000GMT (Figs. 8B and 8D) just east of Spain, being considerably stronger in the regression case (Fig. 8B) than the climatology first guess version (Fig. 8D). Of interest is the fact that the ECMWF analysis apparently does not define this synoptic feature. Again, a reason may be due to the discrepancy in time between analyses.

Figure 9 shows the satellite derived (simultaneous algorithm) dew point analysis at 700 mb (solid) for 12GMT 4 March 1982 (Fig. 9A) and 00GMT 5 March 1982 (Fig. 9B) along with radiosonde observations plotted for the same times. The major feature of these two analysis is the dramatic increase of the moisture gradients at this level during the 12 hour period over Great Britain, the Straits of Gibraltar and Libya. With the exception of Libya, where there is no conventional data available for verification, these dry instrusions correspond well to radiosonde observations. Over the remainder of the domain for both time periods, there is good agreement in the location of gradients of moisture, but not necessarily agreement in point values with the radiosonde observations.

5. STATISTICS

Statistical comparisons between the TOVS retrievals and the ECMWF analyses are restricted here to the root mean square deviation (RMSD) after the mean difference has been removed. Curves of the mean difference are not given because they are generally less than 2°C and very similar for the "regression" and "climatology" cases, except for the 300 mb level where there exists a 2°C mean difference between the two retrieval types.

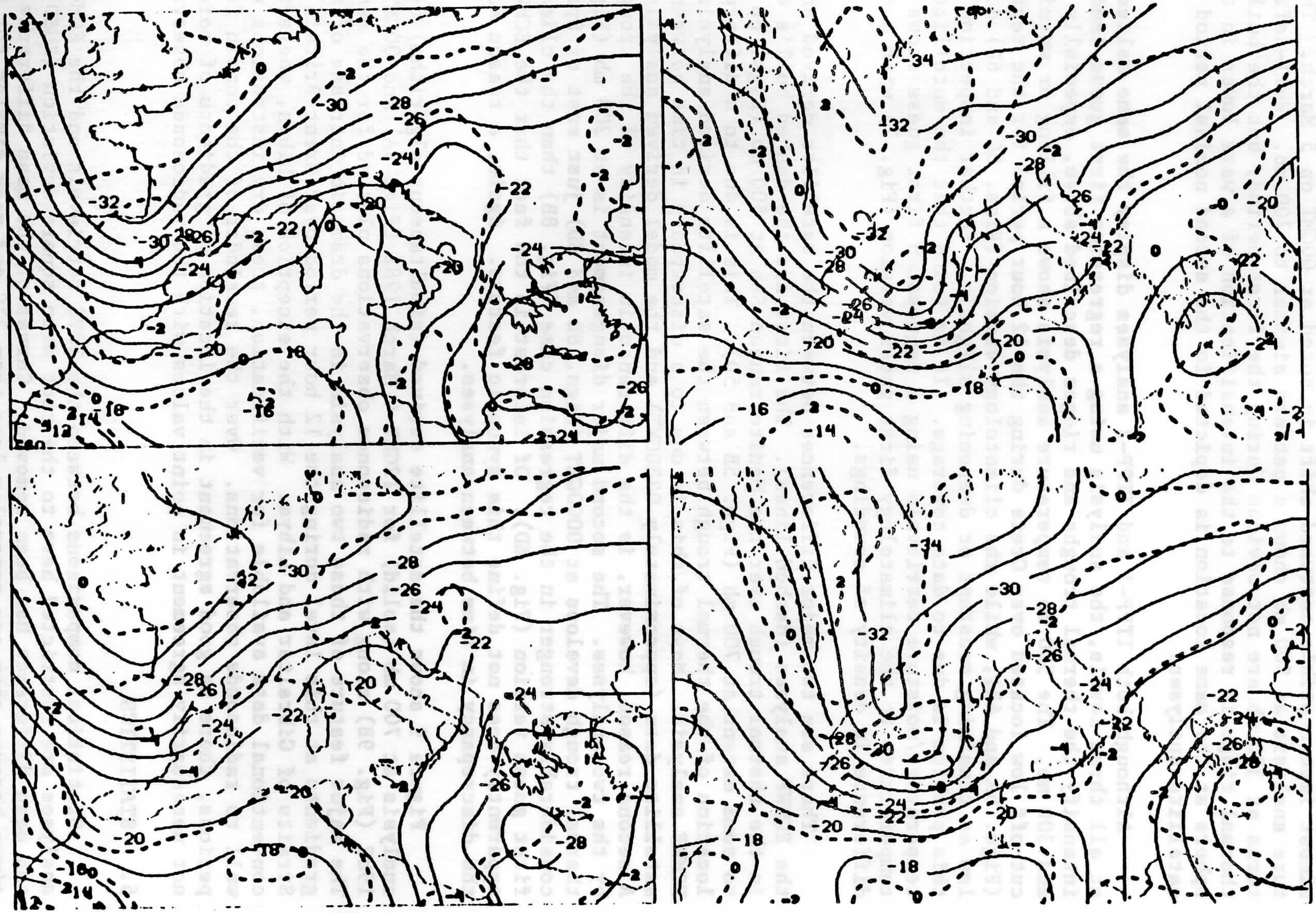

Fig. 6: As in Fig. 5, except for 500 mb.

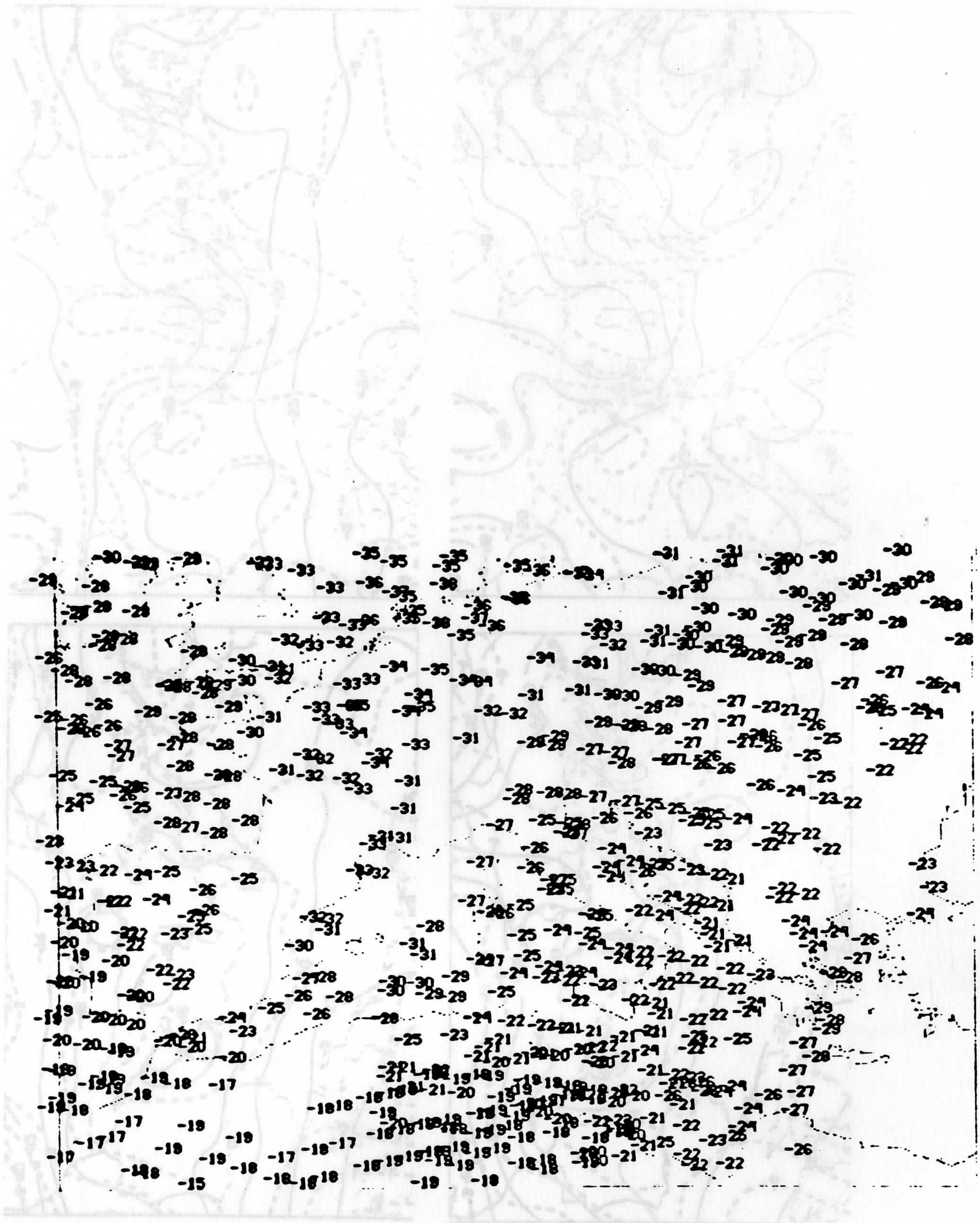

Fig. 7: Locations of satellite derived retrievals (ITPP-2) using a climatological first guess for 500 mb temperatures in degrees Celsius on 5 March 1982 0000GMT.

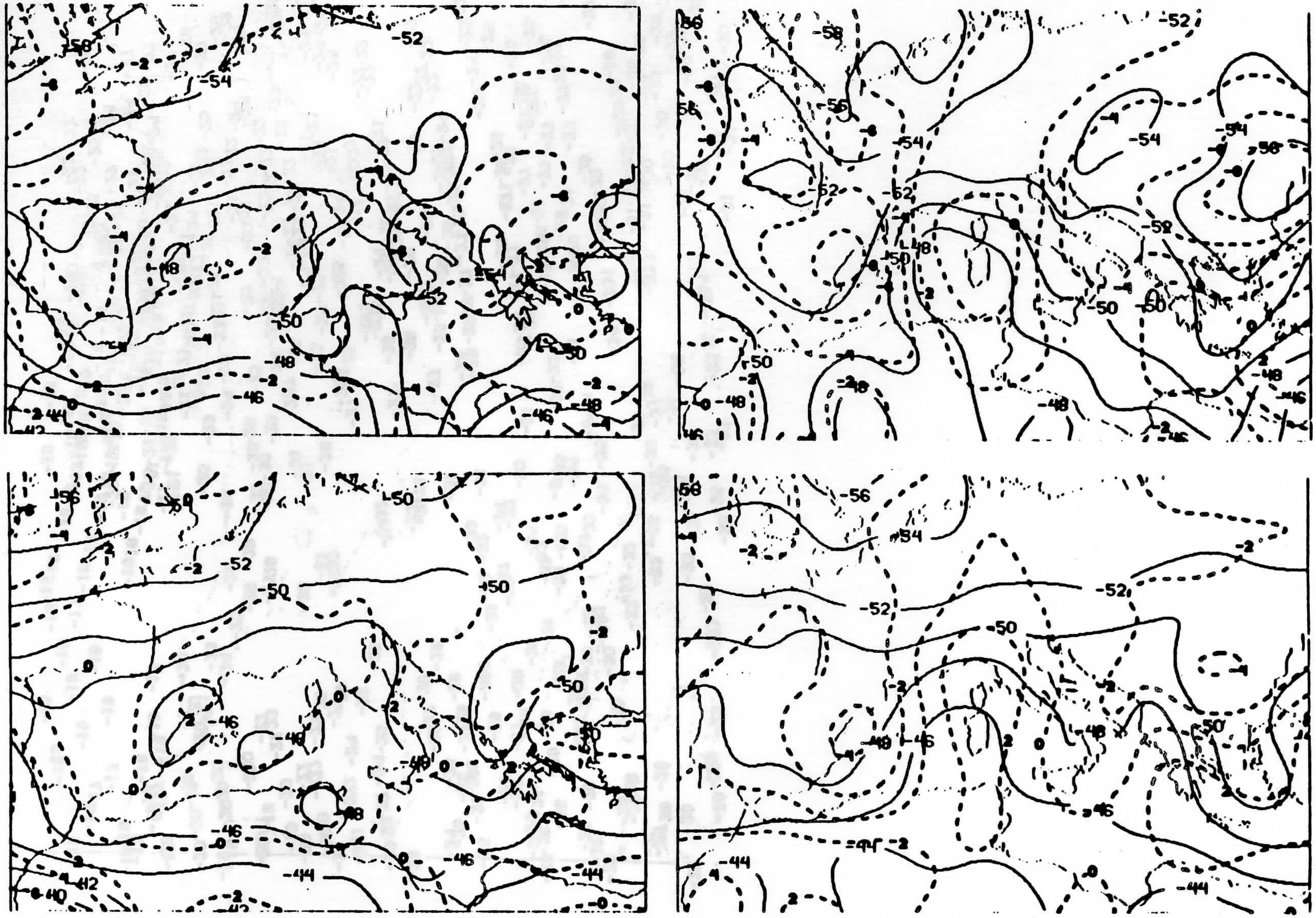

Fig. 8: As in Fig. 5, except for 300 mb.

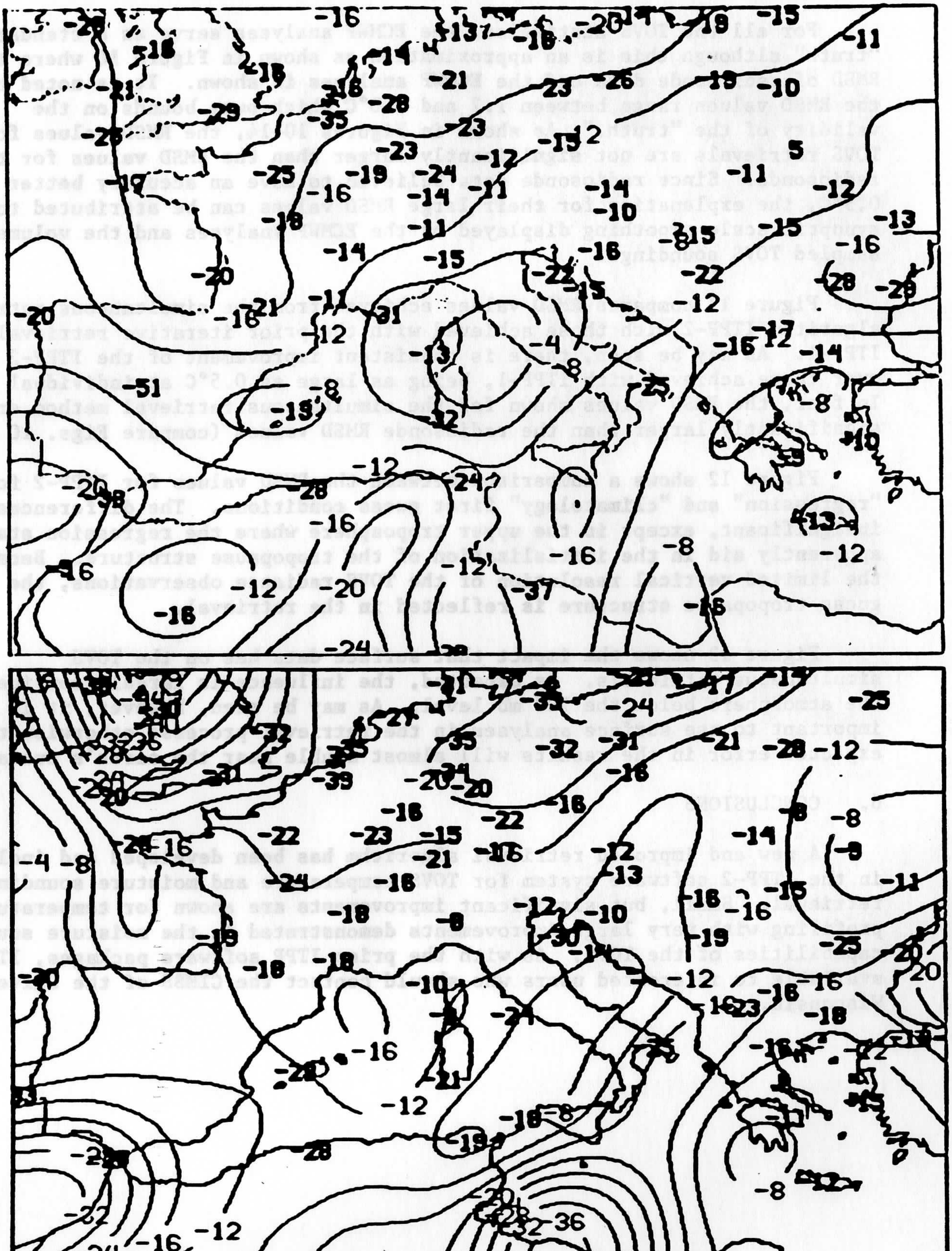

Fig. 9: Analyses of dew points in degrees Celsius of TOVS retrievals (solid contours) using the simultaneous algorithm with a regression first guess at 700 mb for 4 March 1982 1200GMT (A) and 5 March 1982 0000GMT (B).

For all the TOVS statistics, the ECMWF analyses serve as a standard of "truth" although this is an approximation as shown in Figure 10 where the RMSD of radiosonde data and the ECMWF analyses is shown. It is noted that the RMSD values range between 1.2 and 3.0°C which puts bounds on the validity of the "truth." As shown in Figures 10-14, the RMSD values for the TOVS retrievals are not significantly larger than the RMSD values for the radiosonde. Since radiosonde data believed to have an accuracy better than 0.5°C, the explanation for their large RMSD values can be attributed to the synoptic scale smoothing displayed by the ECMWF analyses and the volume sampled TOVS soundings.

Figure 11 compares RMSD values achieved from the simultaneous retrieval algorithm ITPP-2 with those achieved with the prior iterative retrieval method ITPP-1. As may be seen, there is consistent improvement of the ITPP-2 soundings over those achieved with ITPP-1, being as large as 0.5°C at individual levels. In fact, the RMSD values shown for the simultaneous retrieval method are not significantly larger than the radiosonde RMSD values (compare Figs. 10 and 11).

Figure 12 shows a comparison between the RMSD values for ITPP-2 for the "regression" and "climatology" first guess conditions. The differences are insignificant, except in the upper troposphere where the regression statistics apparently aid in the initialization of the tropopause structure. Because of the limited vertical resolution of the TOVS radiance observations, the initial guess tropopause structure is reflected in the retrieval.

Figure 13 shows the impact that surface data has on the TOVS simultaneous retrievals. As expected, the influence is largely confined to the atmosphere below the 700 mb level. As may be seen, however, it is important to use surface analyses in the retrieval process; otherwise the expected error in the results will almost double near the earth's surface.

6. CONCLUSIONS

A new and improved retrieval algorithm has been developed and included in the ITPP-2 software system for TOVS temperature and moisture sounding retrieval. Small, but significant improvements are shown for temperature profiling with very large improvements demonstrated in the moisture sounding capabilities of the TOVS. As with the prior ITPP software packages, ITPP-2 is available to interested users who should contact the CIMSS of the University of Wisconsin.

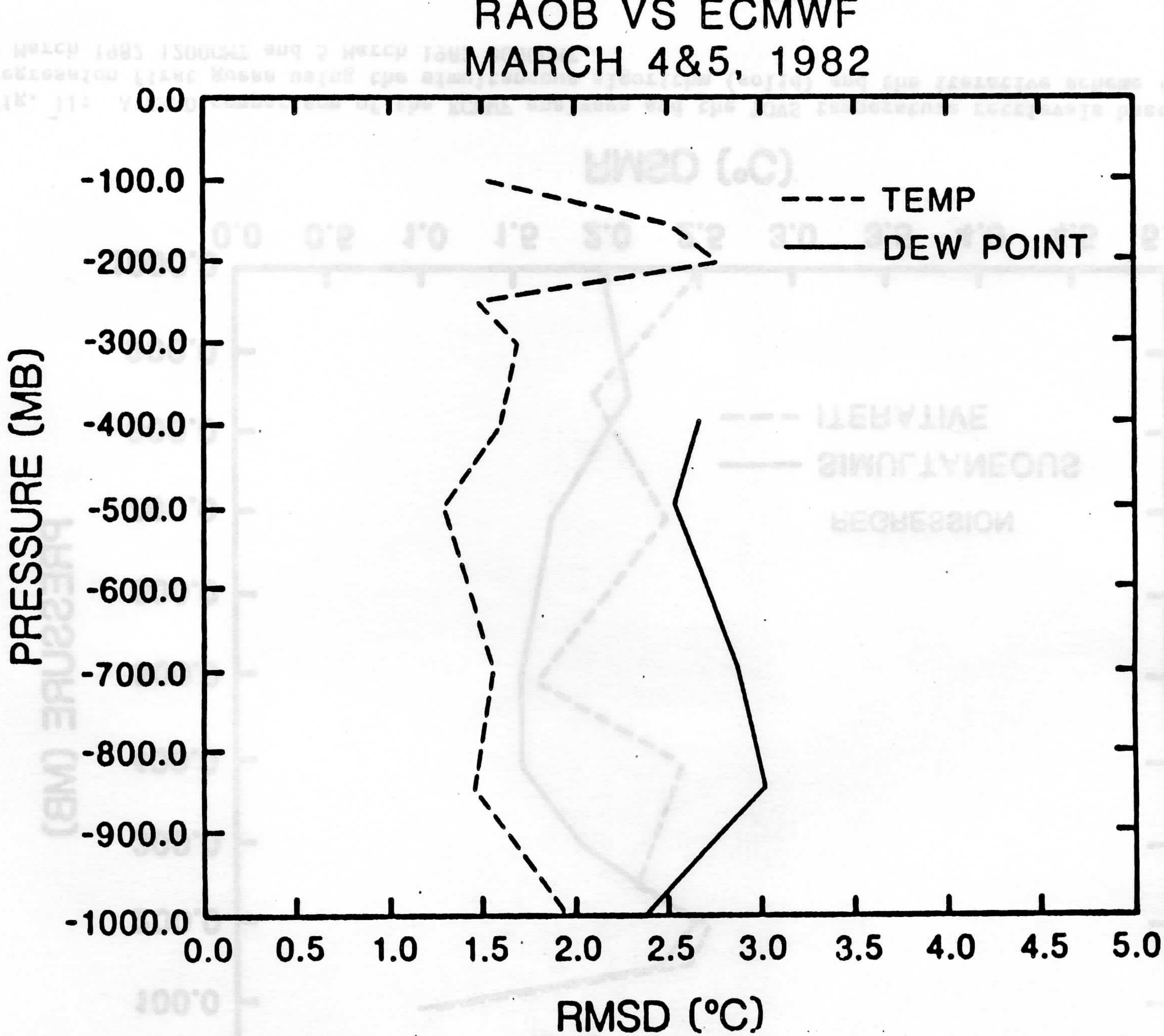

Fig. 10: A root mean square deviation (RMSD) comparison between radiosonde data and the ECMWF analyses for temperature (dashed) and dewpoint (solid) on 4 March 1982 1200GMT and 5 March 1982 0000GMT.

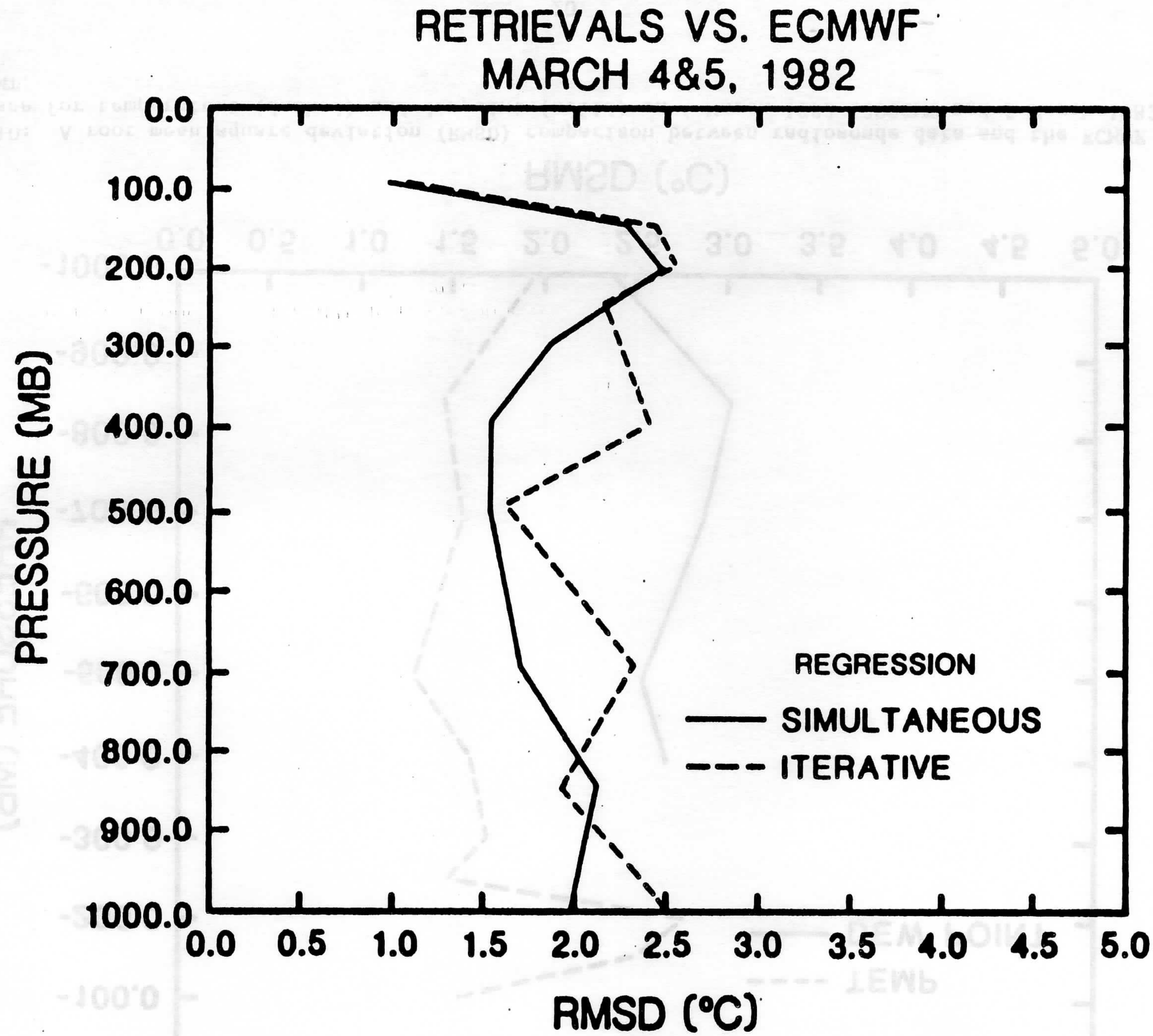

Fig. 11: A RMSD comparison of the ECMWF analyses and the TOVS temperature retrievals based on a regression first guess using the simultaneous algorithm (solid) and the iterative scheme (dashed) on 4 March 1982 1200GMT and 5 March 1982 0000GMT.

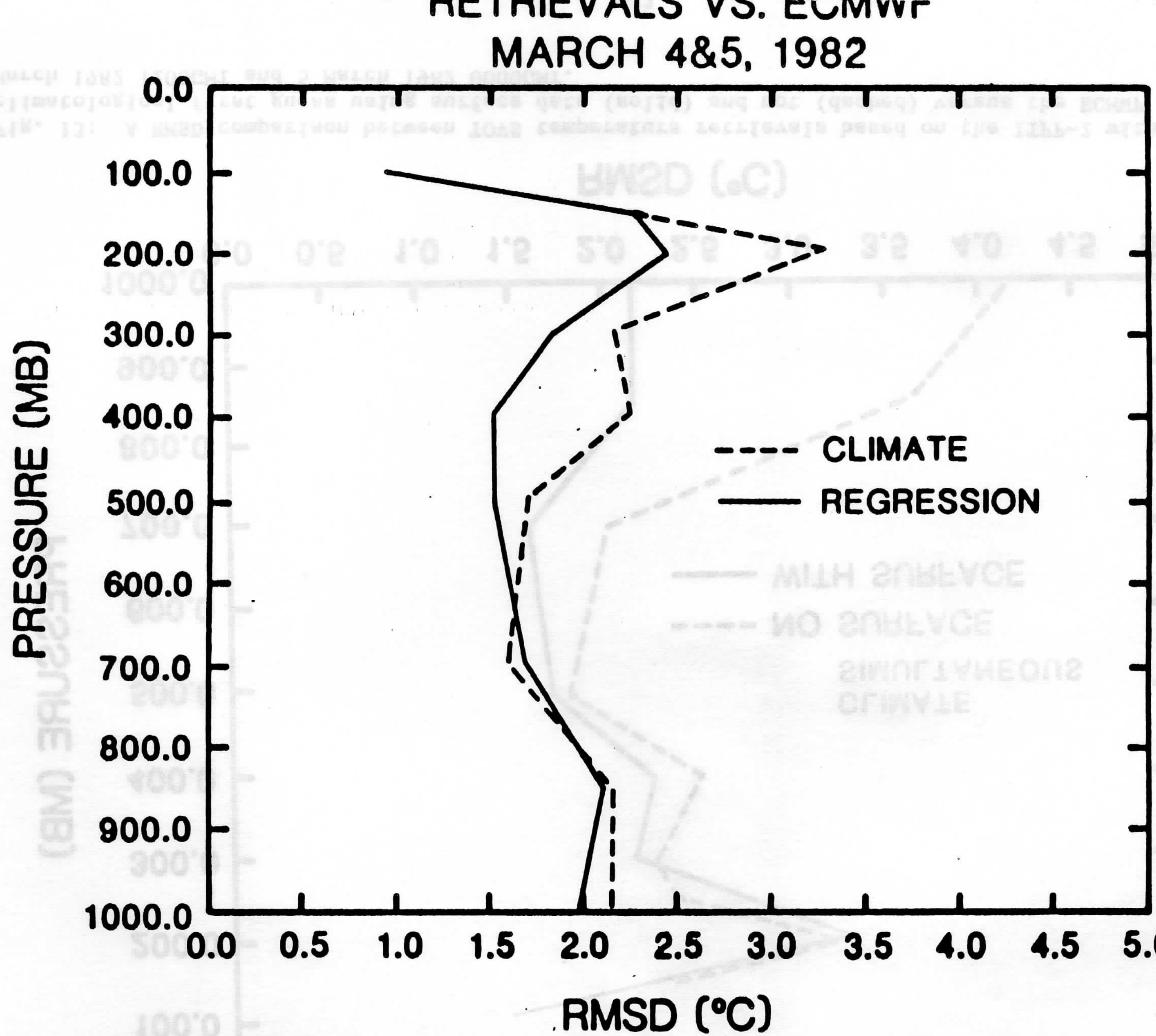

Fig. 12: A RMSD comparison between TOVS temperature retrievals using the simultaneous scheme based on a climatological first guess (dashed) and a regression first guess (solid) versus the ECMWF analyses on 4 March 1982 1200GMT and 5 March 1982 0000GMT.

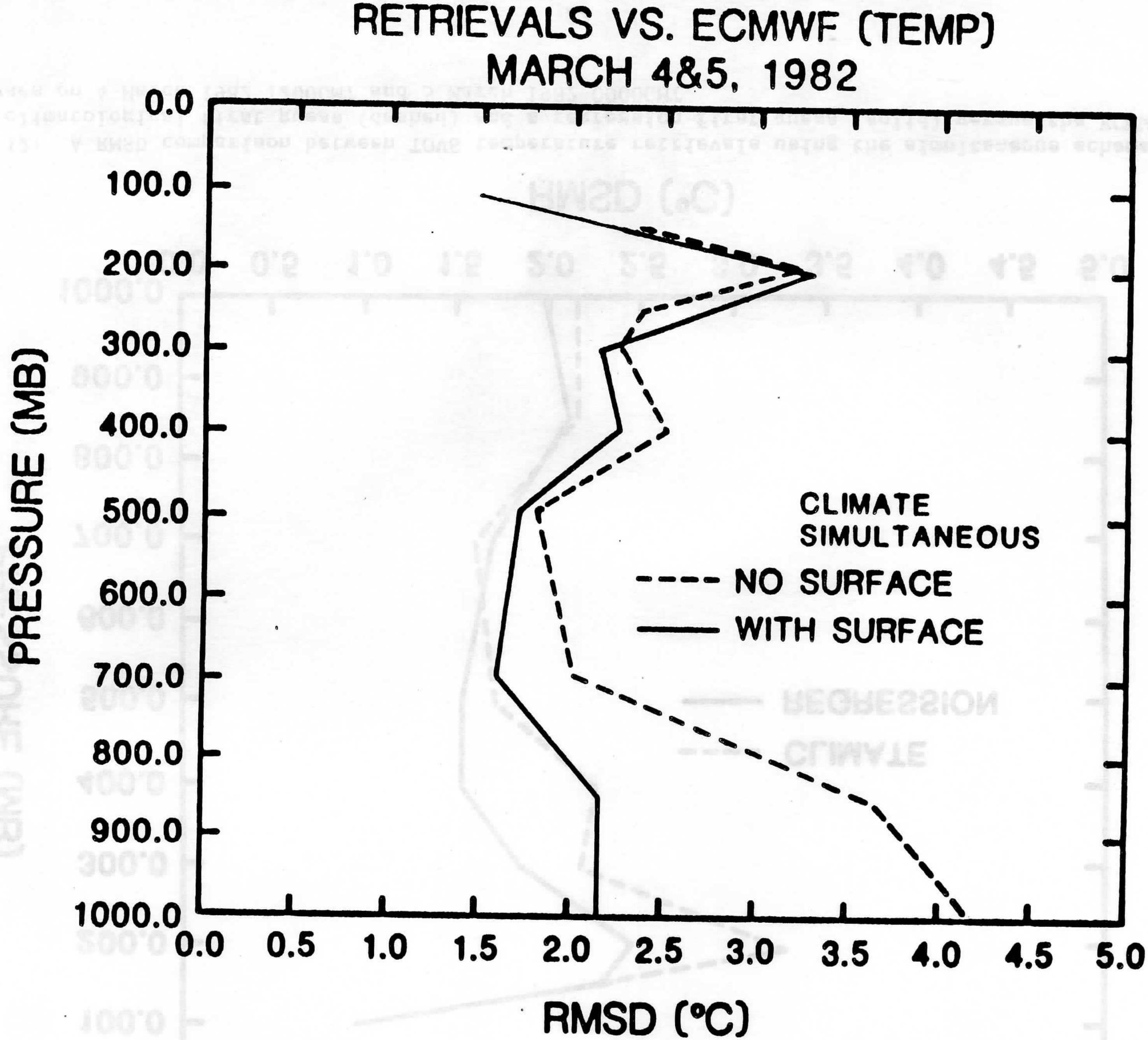

Fig. 13: A RMSD comparison between TOVS temperature retrievals based on the ITPP-2 with a climatological first guess using surface data (solid) and not (dashed) versus the ECMWF analyses on 4 March 1982 1200GMT and 5 March 1982 0000GMT.

7. REFERENCES

Greaves, J. R., H. E. Montgomery, L. W. Uccellini, and D. L. Endres, 1982: AVE/VAS Field Experiment NASA/GSFC Technical Report X-903-82-17, September 1982.

Hayden, C. M. and R. J. Purser, 1986: Applications of a recursive filter, objective analysis in the processing and presentation of VAS data. Preprints of the 6th Conference on Atmospheric Radiation, Williamsburg, VA, May 12-16, 1986. Published by the Amer. Meteor. Soc., Boston, MA, 82-87.

Menzel, W. P., 1983: A report on the First International TOVS Study Conference, Cooperative Institute for Meteorological Satellite Studies, Space Science and Engineering Center, Madison, Wisconsin.

Menzel, W. P., 1985: A report on the Second International TOVS Study Conference, Cooperative Institute for Meteorological Satellite Studies, Space Science and Engineering Center, Madison, Wisconsin.

Smith, W. L., 1970: Iterative Solution of the radiative transfer equation for temperature and absorbing gas profiles of an atmosphere. Applied Optics, 9, 1993-1999.

Smith, W. L., 1983: The retrieval of atmospheric profiles from VAS geostationary radiance observations. J. Atmos. Sci., 40, 2025-2035.

Smith, W. L., H. M. Woolf, C. M. Hayden, A. J. Schreiner, and J. M. Le Marshall, 1983: The physical retrieval TOVS export package. Presented at the First International TOVS Study Conference, Igls, Austria, 29 August - 2 September 1983.

Smith, W. L., and H. M. Woolf, 1984: Improved vertical soundings from an amalgamation of polar and geostationary radiance observations. Preprint volume: Conference on Satellite Meteorology/Remote Sensing and Applications, June 25-29, 1984, Clearwater Beach, Florida. Published by American Meteorological Society, Boston, Massachusetts.

Susskind, J., J. Rosenfield, D. Reuter, and M. T. Chahine: Remote Sensing of Weather and Climate Parameters from HIRS 2/MSU on TIROS-N, Journal of Geophysical Research, Vol. 89, No. D3, June 20, 1984.

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APPENDIX E: VAS READING FILE

A. VAS Instrument: Characteristics and Early Results

1. Suomi et al., 1971, "Possibilities for sounding the atmosphere from a geosynchronous spacecraft."
2. Smith et al., 1981, "First sounding results from VAS-D."
3. Menzel et al., 1981, "Visible infrared spin--scan radiometer atmospheric sounder radiometric calibration: an inflight evaluation from intercomparisons with HIRS and radiosonde measurements."
4. Greaves et al., 1982, "1982 AVE/VAS ground truth field experiment: satellite data acquisition summary and preliminary meteorological review."
5. Menzel et al., 1983, "Atmospheric soundings from a geostationary satellite."
6. Smith, W. L., 1983, "VAS--characteristics and applications."
7. Chesters and Robinson, 1983, "Performance appraisal of VAS radiometry for GOES-4, -5 and -6.
8. Menzel et al., 1984, "The advantages of sounding with the smaller detectors of the VISSR atmospheric sounder."

B. VAS Overview

1. Burdsall, E., 1982, "A study of VAS sounding capabilities in New England during November 1982."
2. Smith et al., 1984, "Nowcasting--advances with McIDAS III."
3. Montgomery and Uccellini (Ed.), 1985, "VAS demonstration: (VISSR atmospheric sounder) description and final report."
4. Smith et al., 1986, "The meteorological satellite: overview of 25 years of operation."

C. VAS Algorithm Development

1. Smith and Woolf, 1981, "Algorithms used to retrieve surface-skin temperature and vertical temperature and moisture profiles from VISSR atmospheric sounder (VAS) radiance observations."
2. Smith and Zhou, 1982, "Rapid extraction of layer relative humidity, geopotential thickness, and atmospheric stability from satellite sounding radiometer data."
3. Smith, W. L., 1982, "The retrieval of atmospheric profiles from VAS geostationary radiance observations."
4. Smith and Woolf, 1984, "Improved vertical soundings from an amalgamation of polar and geostationary radiance observations."
5. Lee et al., 1983, "The impact of conventional surface data upon VAS regression retrievals in the lower troposphere."
6. Smith et al., 1984, "Recent advances in satellite remote sounding."
7. Hayden et al., 1984, "The clouds and VAS."
8. Robinson et al., 1986, "Optimized retrievals of precipitable water fields from combinations of VAS satellite and conventional surface observations."
9. Hayden and Purser, 1986, "Applications of a recursive filter, objective analysis in the processing and presentation of VAS data."
10. Chesters et al., 1986, "Optimum retrieval of precipitable water fields from VAS and surface data."

D. VAS Retrieval Evaluation

1. Jedlovec, G. J., 1984, "Application of VISSR atmospheric sounder (VAS) data."
2. Jedlovec, G. J., 1985, "An evaluation and comparison of vertical profile data from the VISSR atmospheric sounder (VAS)."
3. Mostek et al., 1986, "Assessment of VAS soundings in the analysis of a preconvective environment."
4. Fuelberg and Meyer, 1986, "An analysis of mesoscale VAS retrievals using statistical structure functions."

E. VAS Derived Imagery for Nowcasting

1. Petersen et al., 1984, "Delineating mid- and low-level water vapor patterns in pre-convective environments using VAS moisture channels."
2. Smith et al., 1985, "Combined atmospheric sounding/cloud imagery--a new forecasting tool."
3. Zehr and Green, 1985, "Mesoscale applications of VAS imagery."
4. Birkenheuer and Snook, 1985, "Results of the PROFS real-time VAS product assessment.
5. Chesters et al., 1986, "VAS sounding images of atmospheric stability parameters."

F. VAS and Severe Weather

1. Keller and Smith, 1981, "A statistical technique for forecasting severe weather from vertical soundings by satellite and radiosonde."
2. Smith et al., 1982, "Nowcasting applications of geostationary satellite atmospheric sounding data."
3. Anthony and Wade, 1983, "VAS operational assessment findings for spring 1982/83."
4. Wade et al., 1985, "An examination of current atmospheric stability and moisture products retrieved from VAS measurements in real-time for the NSSFC."
5. Smith and Kelly, 1985, "Use of satellite imagery and soundings in mesoscale analysis and forecasting."
6. Zehr, R. M., 1985, "Analysis of mesoscale air masses with VAS retrievals."
7. Kitzmiller, D. H., 1985, "An objective comparison of severe local storm predictors derived from VAS temperature and new point profiles."
8. Leftwich, P. W., Jr., 1985, "Operational estimations of hail diameter from VAS-derived vertical sounding data."

G. VAS and Modelling

1. Lewis et al., 1983, "Adjustment of VAS and RAOB geopotential analysis using quasi-geostrophic contraints."
2. LeMarshall et al., 1984, "Hurricane Debby--analysis and numerical forecasts using VAS soundings."
3. Hayden and Schreiner, 1984, "Real time meteorological applications of the geostationary satellite sounder on GOES-6: battling the computer, code and clock."
4. Executive Summary, 1984, "Eastern Pacific LFM Impact Study (EPAC) 1984-85," NMC VAS Operational Evaluation.

5. Lewis and Derber, 1985, "The use of adjoint equations to solve a variational adjustment problem with advective constraints."
6. Cram and Kaplan, 1985, "Variational assimilation of VAS data into a mesoscale model; assimilation method and sensitivity experiments."
7. CIMSS View, 1986, "VAS Eastern Pacific Experiment."
8. Mostek and Olson, 1986, "Eastern Pacific Model Impact Study (EPAC) at the National Meteorological Center."
9. Goodman et al., 1986, "Analysis and forecast experiments incorporating satellite soundings and cloud and water vapor drift wind information."
10. Mlynczak et al., 1986, "Impact of the initial specification of moisture and vertical motion on precipitation forecasts with a mesoscale model--implications for a satellite mesoscale data base."
11. Diak, G., 1986, "A comparison of analyses and forecasts using scalar versus horizontal gradient information from the VISSR atmospheric sounder (VAS) for a case study of 6 March 1982.

H. VAS Winds

1. Menzel et al., 1982, "Improved cloud motion wind vector and altitude assignment using VAS."
2. Lord et al., 1984, "ACARS wind measurements: an intercomparison with radiosonde, cloud motion and VAS thermally derived winds."
3. Stewart et al., 1985, "A note on water-vapor wind tracking using VAS data on McIDAS."
4. Stewart and Hayden, 1985, "A FGGE water vapor wind data set."

I. VAS and Hurricanes

1. Velden et al., 1984, "Applications of VAS and TOVS to tropical cyclones."
2. Velden and Smith, 1984, "Quantitative satellite applications--tropical cyclone intensity monitoring and track forecasting."
3. Le Marshall et al., 1985, "Hurricane Debby--an illustration of the complementary nature of VAS soundings and cloud and water vapor motion winds.
4. Lewis et al., 1985, "The use of VAS winds and temperatures as input to barotropic hurricane track forecasting."
5. CIMSS View, 1985, "Support for the National Hurricane Center," newsletter of the Cooperative Institute for Meteorological Satellite Studies.

J. VAS and SST

1. Zandlo et al., 1982, "Surface temperature determination from an amalgamation of GOES and TIROS-N radiance measurements."
2. Smith, W. L., 1982, "Sea surface temperature: improved observation from goestationary satellites."
3. Bates and Smith, 1985, "Sea surface temperature: observations from geostationary satellites."
4. Xu and Smith, 1986, "Numerical simulation of the influence of volcanic aerosols on VAS derived SST determinations."

K. VAS and Flux

1. Smith and Woolf, 1983, "Geostationary satellite sounder (VAS) observations of longwave radiation flux."
2. Herman and Smith, 1986, "Intercomparison of preliminary earth radiation budget satellite (ERBS) flux estimates and geostationary satellite multi-spectral "VAS" radiance measurements."

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