GEMINI — The GEneral Mesonet INterpolation Interface
(BATCH VERSION)

NCAR/MMM
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The GEMINI batch processor is designed to remap data collected by surface mesonet stations at irregularly spaced locations to a two-dimensional Cartesian grid. GEMINI is capable of adjusting for storm advection during the period of interest and allows for the inclusion of off-time reports from each site in order to resolve transient features. Additional features permit the user to modify the calibrated station reports and to override the measured wind information when determining the displacement of advected information. Time series plots can also be produced.

A variety of graphical products are generated, using the functions of NCAR Graphics version 3.0, which display the input data maps and the resultant objectively analyzed 2-D fields. Once an acceptable remapping has been performed, permanent datasets containing the processed fields may be produced for subsequent manipulation using the CEDRIC Cartesian space processor (Mohr et al. 1986). Current memory allocation within the program allows the generation of surface grids with dimensions of (255 x 255) containing up to 25 remapped fields.

GEMINI is also useful for examining the actual measurements collected by the Surface Mesonet stations in a map format. There is no requirement that any objective analyses be performed. See APPENDIX J for sample decks illustrating the use of input report display features.

The following pages contain a description of the commands which have been implemented in the batch version of GEMINI. Also included in this document are the following appendices:

APPENDIX B contains a description of the procedure used in GEMINI for remapping the mesonet data to 2-D Cartesian coordinates;

APPENDIX F contains the list of valid (4 character) field names to be used when running GEMINI;

APPENDIX J explains the procedures for setting up a GEMINI run along with sample scripts illustrating common processing requests;

APPENDIX S contains information relevant to the various weather projects available when running GEMINI;

As with any large software package it is possible there are errors which have escaped our scrutiny. Please report any annoying or inconsistent program behavior so that the appropriate corrections can be made.

REFERENCES:

Barnes, S.L., 1964: A technique for maximizing details in numerical weather map analysis. *J. Appl. Meteor.*, **3**, 396-409.

—— ,1973: Mesoscale objective map analysis using weighted time-series observations. *NOAA Tech. Memo.* ERL NSSL-62, 60 pp. [NTIS COM-73-10781].

Mohr, C.G., L.J. Miller, R.L. Vaughan and H.W. Frank, 1986: The merger of mesoscale datasets into a common Cartesian format for efficient and systematic analyses. *J. Atmos. and Ocean. Tech.*, **3**, No. 1 (March, 1986), 144-161.

DESCRIPTION OF THE COMMAND SYNTAX:

GEMINI commands consist of 80 character card image formats beginning with a keyword starting in column 1. Each card image is divided into 10 (8-column) fields referred to in the documentation as parameter positions P1 through P10. The keyword always occupies field 1. Fields 2-10 contain required parameters which are interpreted by the program as either floating-point (F8.0) or alphanumeric (A8) entities. These are designated as (F) and (A) respectively. (F) parameters must be right justified within the field if they do not have a decimal point. (A) parameters must always be left justified. There also exists a hybrid entity (H) which is first examined as an (A) parameter and if it does not match a predetermined mnemonic, it is interpreted as an (F) parameter. If a field contains less than 8 character, it must be filled with **spaces**; tabs will **not** be interpreted properly at this time.

Two of the commands (LIST and TIME) require additional information which cannot be contained on a single card image. This type of command is referred to as a multiple-card command and an EXTRA card image must be provided to supply all the necessary parameterization required. EXTRA is *not* a mandatory keyword but instead refers to the requirement for an additional card image whenever it appears in the documentation.

User supplied comments may be inserted at any location within the GEMINI command deck and will appear in the printed output generated by the program. A GEMINI comment contains the letter 'C' in column 1 of the 80 character card image and MUST be followed by at least two blanks (cols. 2 and 3). The contents of the remaining 77 columns are left to the discretion of the user. Any card image containing an asterisk ('*') in column 1 will also be treated as a comment.

Blank card images are *not* allowed.

Each GEMINI deck *must* contain a PROJECT command and a GRID command.

Documentation for each command includes a description of its functionality followed by a description of each of its parameters by position, type, and name.

Commands are processed in the order in which the appear and may be repeated as often as desired. Once a GEMINI command has been processed, the parameterization that it specifies will remain in effect until another command with the same name is encountered. Default values are used whenever a parameter field is left blank or if the information specified is erroneous. If a default value is not specified in the documentation, eight blanks will be supplied for an (A) field and 0.0 will be supplied for an (F) field. Whenever a command is left out of the GEMINI deck set up, the default values given in the documentation will be supplied internally should such information be required for processing.

In the event that a fatal syntax or procedural error should occur the the program is designed to terminate with a lucid message indicating the nature of the problem. Examples of non-lucid behavior will be gratefully accepted.

SUMMARY OF GEMINI COMMANDS

The following table contains a summary of all the GEMINI commands. Any command which requires an additional card image will be denoted by an (A) after its name.

Command:	Description:
C	User supplied comment.
ANALYZE	Parameterizes the objective analysis remapping procedure.
DIGPLT	Generates a digital display of surface mesonet reports.
EDIT	Permits selective editing of reported data.
FIELD	Designates a field to be included in the objective analysis.
GRID	Defines the Cartesian space map background and analysis grid.
INPUT	Provides information specific to an data file to process.
LIST (A)	Generates an output listing of surface mesonet reports.
OUTTAPE	Writes the objectively analyzed fields to a CEDRIC output tape.
PROCESS	Initiates processing of all data within a specified interval.
PROJECT	Specifies weather project of interest; must be present.
QUIT	Terminates the GEMINI run.
RAIN	Informs GEMINI how to handle accumulated rainfall data.
STATION	Individual control over a site and its advection criteria.
STMSPD	Specifies general advection criteria for all sites.
TIME (A)	Generates analog data-versus-time reports.
VECTOR	Makes adjustments to wind fields.
WINDS	Designates winds and corresponding displays to be generated.

INVENTORY OF COMMANDS

ANALYZE Specifies the parameters to be used for transforming the surface mesonet reports to the 2-D Cartesian coordinate system. Options are available for selecting an areal subset of stations to be included in the analysis, for tuning the 2-D transfer function and for subsequent filtering of the gridded fields. Two methods are available for determining the radius of influence at each grid location. The FIXED method assigns radii to grid points depending upon their location in the network while the ADAPTIVE method selects a unique radius at each grid location depending upon the density and configuration of the surrounding input reports. Options are also provided for weighting the off-time reports as a function of time.

P2 (F) RADKM — Radius (km) at which the exponential weighting function=0.1. Weights are assigned to each analog input datum according to its distance from the destination Cartesian location in the 2-D grid. The final estimate at the Cartesian location is computed by multiplying each input datum by the weight, summing the results and normalizing by the sum of all the weights. The weight W assigned to any datum at distance D from the destination Cartesian grid location is given by: W = EXP ($\ln(0.1) \times D^2$ / $RADKM^2$) and is in the range 0 to 1.
(DEFAULT = Project-dependent)

P3 (F) RADSPR — Radius (km) of influence for station/report sparse regions. When the FIXED radius method is employed, RADSPR is the radius to use in regions outside the DENSE network. If the ADAPTIVE method is invoked, RADSPR will be the maximum radius allowed at any grid location regardless of report density. If RADSPR is set to 0.0 or is less than RADKM, RADKM will be used as the sole radius of influence at every location in the user specified GRID.
(DEFAULT = Project-dependent)

P4 (F) NPASS — Number of passes. The first pass of the remapping generates an estimate at each grid location using the distance weighting procedure described above. If NPASS is greater than 1, the residual between each original data value and the nearest Cartesian field estimate is computed immediately after the first pass of the objective analysis. Using the residuals as input, the analysis is performed again and adjustments are made to the current grid of Cartesian estimates. This iterative improvement procedure is performed NPASS-1 times. If NPASS is -1, each input data point is simply moved to the closest output grid point; no objective analysis is performed.
(DEFAULT = 2 — Objective analysis with 1 improvement step.)

P5 (F) RADBOX — Maximum distance (km) from the boundary of the analysis space (specified in the GRID command) for the inclusion of contributing input stations. Any mesonet report more than RADBOX kilometers from the analysis grid will be IGNORED.
(DEFAULT = 10.0)

P6 (F) FILT — Number of 2-D filtering steps to perform on the objectively analyzed Cartesian estimates. Each step reduces the retained scale sizes by a factor of two.
(DEFAULT = 0 — No 2-D filtering will be performed.)

P7 (A) METRAD — Method of radius selection at each grid location:

`FIXED` — RADKM will be the radius of influence in the DENSE network, RADSPR in the outer network; in regions of transition intermediate radii are chosen to effect a continuous blending of scales;

`ADAPTIVE` — RADKM will be the minimum possible radius, RADSPR the maximum; radii between the two are computed at each grid point depending upon the density and configuration of the surrounding input reports.

The so-called "DENSE" network varies from project to project; it is arbitrarily chosen, usually to coincide with any obvious subnetwork.

To force GEMINI to use the same radius of influence for all reports, simply set RADKM and RADSPR to the same value.

(DEFAULT = 'FIXED')

P8 (A) TIMWGT — Method of weighting off-time reports:

`UNIFORM` — all input reports will receive equal weight;

`GAUSSIAN` — advected input reports will be weighted according to the temporal difference in minutes between their acquisition time and the analysis time. This additional weight W assigned to any datum acquired TDIF minutes from the analysis time is given by:

$$\mathrm{W} = \mathrm{EXP}(\ln(0.1) \times \mathrm{TDIF}^2/\mathrm{RADTIM}^2)$$

where RADTIM is specified by the user in P9;

`SERIAL` — Gaussian weighting is applied as described above to the time series of input reports for each station and the result is assigned to the location of that station. NO advection of input reports will be performed.

(DEFAULT = 'UNIFORM')

P9 (F) RADTIM — Radius of influence in minutes to use for time weighting. (Only if TIMWGT is 'GAUSSIAN' or 'SERIAL') This will be the time difference in minutes at which the weighting function in the TIMWGT description will equal 0.1.
(DEFAULT = Twice the difference between the farthest requested report in time and the analysis time.)

DIGPLT Command used for producing digital plots of original surface mesonet data. The reports, when displayed, will represent calibrated measurements from each station prior to any user specified editing which may be subsequently invoked. As many as 8 individual digital plots may be defined by the user, each containing measurements from up to 6 fields. Values from each requested field are digitized alongside the site location at a position determined by the field name location in the DIGPLT command (given below). A list of valid field names is provided in APPENDIX F. Digital plots may be produced with or without wind vectors depicted at each surface mesonet site.

P2 (A) UPRLFT — Field name specifier for the upper left position of area allocated to each station in the DIGPLT display. This name must be taken from the list of valid field names eligible for display as provided in APPENDIX F.
(DEFAULT = No information will appear at this position in the display.)

P3 (A) UPRRGT — Upper right field name. See description of UPRLFT above.

P4 (A) MIDLFT — Middle left field name.

P5 (A) MIDRGT — Middle right field name.

P6 (A) LWRLFT — Lower left field name.

P7 (A) LWRRGT — Lower right field name.

P8 (A) IDPGRD — Specifies area to use when plotting:

- `ANALYSIS` plotting area will be determined by the coordinates supplied in the GRID command;
- `INPUT` plotting area will also encompass any sites within RADBOX kilometers of the ANALYSIS region.

(DEFAULT = 'INPUT')

P9 (A) IDPOVR — Plot overlay option:

- `VECTOR` actual wind vectors will be depicted at each site;
- `RELVEC` vectors relative to the global wind on the STMSPD command will be depicted;
- `MAP` plot will have map background but no winds;
- `MAPVEC` same as VECTOR with map background;
- `MAPREL` same as RELVEC with map background;
- `NONE` no overlay.

(DEFAULT = 'NONE')

P10 (F) VREF — Vector reference speed (M/S) (Only if IDPVEC is 'VECTOR' or IDPVEC is 'MAPVEC'); Arrows on this display will be scaled so that a vector depicting VREF (M/S) will be one kilometer in length on the plot.
(DEFAULT = 2.0)

EDIT Permits the selective editing of calibrated reports at a station for a designated time period during the day to be processed. A maximum of 250 EDIT commands may appear in a job stream. EDIT commands take effect as the data are read, and are applied in the order in which they appear in the job stream; it is therefore possible to negate or alter the effects of previous EDIT commands.

Note that editing takes place before any secondary values are calculated from the data reported by the station; hence, it may be necessary to edit, for instance, WETB instead of MIXR, if MIXR is calculated from WETB.

P2 (A) NAMSTN — Mesonet station identifier. This must be taken from the list of valid (8 char.) station names provided in the appendix for the appropriate experiment.
(DEFAULT = This parameter must be specified.)

P3 (F) IEDBEG — Beginning time (project time) to edit out bad values (HHMM).
(DEFAULT = 0)

P4 (F) IEDEND — Ending time (project time) to edit out bad values (HHMM).
(DEFAULT = 2400)

P5 (A) NAME1 — Name of the first field to edit, taken from the list of four-character field names in APPENDIX F.
(DEFAULT = No field edited.)

P6 (H) ISPEC1 — Editing specifier to be applied to the first field. This specifier can be the keywords 'GOOD' or 'BAD' OR an explicit editing directive in the following 8-character format:

`Fnnnnnnn` where F is a single character editing Function and nnnnnnn is a 7-digit floating point number containing the associated value to be used in editing.
F is a single letter code that designates the editing to be performed:
`'='` replace the report with this value;
`'+'` add this value to the report;
`'-'` subtract this value from the report;
`'*'` multiply the report by this value.

`GOOD` data will be used as is over the interval;

`BAD` data will be flagged as missing over the interval.

(DEFAULT = 'GOOD')

P7 (A) NAME2 — Name of the second field to edit.
(DEFAULT = No field edited.)

P8 (H) ISPEC2 — Editing specifier for the second field; same format as ISPEC1.
(DEFAULT = 'GOOD')

P9 (A) NAME3 Name of the third field to edit.

(DEFAULT = No field edited.)

P10 (H) ISPEC3 Editing specifier for the third field; same format as ISPEC1.

(DEFAULT = 'GOOD')

Note that the program makes no assumption as to relationships between variables; in particular, if U is set to BAD, V is *not* automatically changed also. All suspect variables must be explicitly edited.

FIELD Designates a field for inclusion in the objective analysis. This command also contains a parameter for eliminating statistical outlyers associated with the field and supplies plotting specifications for the generation of graphical displays. There is no limit to the number of FIELD commands which may be designated. If more than one FIELD command appears with the same field name, information provided by the former FIELD command associated with that name will be overwritten. Any fields that are to be objectively analyzed must be identified by a FIELD command prior to initiation of the PROCESS command. A list of valid field names is provided in APPENDIX F.

P2 (A) NAMFLD — Field name identifier. This name must be taken from the list of valid field names eligible for objective analysis as provided in APPENDIX F.
(DEFAULT = This parameter must be specified.)

P3 (H) SMULT — If SMULT='DELETE', this field will no longer be included in the objective analysis. Otherwise SMULT is interpreted as the Standard Deviation Multiplier and will be used to omit statistical outlyers greater than SMULT standard deviations from the mean. This decimation operation is applied non-destructively to the input stream just prior to initiation of the objective analysis procedure.
(DEFAULT = 0.0 -No statistical decimation of this field.)

P4 (A) IPLT — Plot specification indicator:

`CONT` a contour plot of this field will be produced after it has been objectively analyzed, P5 through P8 will contain the plotting specifications;

`HAFT` a halftone plot will be produced;

`BOTH` both contour and halftone plotting will be performed;

`NONE` no plot will be produced.

(DEFAULT = 'NONE')

Contour-only plots may have up to 31 levels; halftone-only or contour-halftone may have up to 15 levels.

P5 (A) IOPTNS — Contouring options. IOPTNS is a string of 8 single digit numbers that specify the features that are to be invoked when plotting the analyzed 2-D field. Digits 1 through 6 and 8 indicate whether a particular feature is to be either turned off (0) or turned on (1); digit 7 designates an optional wind overlay. From left to right in the string these options are defined as follows:

#	Feature	DEFAULT
1:	Label the contour lines;	1
2:	Mark relative highs and lows;	0
3:	Repeating 3 pattern dash-lines;	1

4:	Stop contours at missing data locations;	0
5:	Indicate maximum value on the plot;	1
6:	Digitize the field on the plot background;	0
7:	Wind overlay type:	0
	0 = No overlay,	
	1 = Streamlines,	
	2 = Vectors;	
8:	Plot map background.	0

(DEFAULT = 10101000)

P6 (F) CNTMIN — Beginning contour level.
(DEFAULT = The program decides.)

P7 (F) CNTMAX — Ending contour level.
(DEFAULT = The program decides.)

P8 (F) CNTINT — Increment between levels.
(DEFAULT = The program decides.)

P9 (F) SCALE — Scale data by this factor before contouring.
(DEFAULT = 1.0)

P10 (F) NSTEP — Number of steps for the Leise filtering in time. Filtering is done on the data at the original resolution and this filtering is independent of the filtering done for the TIME series.
(DEFAULT = No filtering.)

GRID Defines the two-dimensional Cartesian space analysis grid upon which the surface mesonet data will be remapped by the objective analysis procedure. The resultant grid may not contain more than 255 grid points along either axis. This command also allows the user to control the angle of the U component of the wind relative to true North and the angle of the x-axis relative to true North.This command is MANDATORY. No processing of any kind can be performed unless the program knows the spatial area of interest.

P2	(F)	X1	Beginning X-coordinate (KM) of the (X,Y) grid. (DEFAULT = This parameter must be specified.)
P3	(F)	X2	Ending X-coordinate. (DEFAULT = This parameter must be specified.)
P4	(F)	Y1	Beginning Y-coordinate (KM) of the (X,Y) grid. (DEFAULT = This parameter must be specified.)
P5	(F)	Y2	Ending Y-coordinate. (DEFAULT = This parameter must be specified.)
P6	(F)	DELXY	Grid spacing (KM) along the X and Y axes. (DEFAULT = 1.0)
P7	(F)	VECANG	Angle of U component of wind, relative to true North. (V component is then adjusted to remain perpendicular to the new U.) (DEFAULT = 90.0)
P8	(F)	GRIDANG	Angle of X-axis, relative to true North. We strongly recommend that users keep GRIDANG and VECANG to be the same value so that when vectors are displayed, they are correctly displayed, relative to the fixed stars. (DEFAULT = 90.0)

INPUT Supplies information specific to the input datasets. GEMINI will use this information to determine which units (files) to search for requested PROCESS times. There should be one INPUT card per file of data. The cards can appear in any order in the command stack, but, of course, must appear before the PROCESS card. GEMINI assumes that each data file has no more than one day's worth of data in it. This command is MANDATORY. At least one INPUT card per run must be present.

P2 (F) UNIT — Unit number of file. All input data files must be named 'fort.x', where x is the UNIT number. This number must be greater than 15 since GEMINI uses lower units for internal operations.
(DEFAULT = 'NONE')

P3 (F) DATE — Date of data in file. This number must be in the form YYMMDD and must have a decimal point at the end (e.g., 810530. for May 31, 1981)
(DEFAULT = 'NONE')

P4 (A) NETWORK — Name of network corresponding to data in file. If data for all networks of experiment is in file, then 'ENTIRE' should be specified.
(DEFAULT = 'ENTIRE')

LIST Generates a listing of original surface mesonet data fields. The reports, when listed, will represent calibrated measurements from each station prior to any deletion procedures and filtering which may be subsequently invoked. As many as 5 individual output listings may be defined by the user, each containing measurements from up to 10 fields. Values from each requested field appear in the listing in a position determined by the field name location in the LIST command (given below). A list of valid field names is provided in APPENDIX F. The sites to be included in the listing are determined by the grid area specified. The LIST command is multiple-card image command which ALWAYS requires an EXTRA card image.

P2 (A) — P2 is not used

P3 (A) ILSGRD — Specifies the area of mesonet sites to include:

- `ANALYSIS` all sites within the area specified by the GRID command will be included;
- `INPUT` all sites within RADBOX kilometers of the ANALYSIS region will also be included.

(DEFAULT = 'INPUT')

P4 (A) ILSSUM — Specifies the type of summary line to print at the end of the listing:

- `AVERAGE` each column will be followed by the average of all entries in that column;
- `NONE` no summary line will be printed.

(DEFAULT = 'NONE')

P5 (A) ILSMSG — Specifies text to appear to indicate missing data in the listing.

(DEFAULT = '********')

P6 (A) ORDER — Specifies order by which data is listed.

- `STAT` data will be listed with data for all stations and a single time contiguous.
- `TIME` data will be listed with data for all times and a single stations contiguous.

(DEFAULT = 'STAT')

The following card image contains the names of the fields to include in the listing to be generated ...

EXTRA

P1 through

P10 (A) NAMLST — Field name specifiers in the order in which they are to appear (from left to right) alongside the site name in the output listing. These names must be taken from the list of field names eligible for display as provided in APPENDIX F. A

maximum of 10 fields may be displayed in any one listing. If any position is left BLANK, no information will appear in that column in the output listing.
(DEFAULT = At least one field name must be supplied; otherwise GEMINI will abort with an error message.)

OUTTAPE Activates the generation of output volumes that contain the gridded data. The data is written to a file using the 16-bit Cartesian format described in APPENDIX H of the Cedric documentation. Each analysis (at a particular time) will correspond to a single volume of information readable by Cedric and will contain all *analyzed* surface mesonet fields – that is, only those specified in FIELD commands. All fields not so specified will NOT be written to the output file. Up to 25 volumes can be written into a single file.

BEG: the disk file is written to at the beginning (i.e., any existing volumes will be lost);

APP: the disk file is appended to;

Once initial positioning has been performed, all subsequent volumes will be written in consecutive order into the file.

P2	(F)	LUN	Fortran logical unit number of the OUTPUT tape. LUN must be predefined in the JCL. It should be between 20 and 99; units 1-19 are reserved for program use. (DEFAULT = This parameter must be specified.)
P3	(A)	NAMTAP	Internal volume name. (DEFAULT = 'UNKNOWN')
P4	(A)	IPOSN	OUTPUT file initial positioning code: `BEG` position at the beginning; `APP` append at the end; (DEFAULT = This parameter must be specified.)
P5	(F)	unused	
P6	(F)	unused	
P7	(A)	NAMSCI	Name of the investigator. (8 char. maximum) (DEFAULT = 'NONE')
P8	(A)	NAMPRO	Name of project. (4 char. maximum) (DEFAULT = 'COPE')

PROCESS Initiates the analysis of map sequences based upon the current information set constructed by all the previous commands in the job stream. Each PROCESS card designates a beginning and ending analysis time, and the interval between consecutive maps and analyses. Additional parameters specify the number of off-time reports to include from each station, the network to analyze (e.g., PROBE, PAM or ENTIRE for CCOPE) and whether site locations are to be plotted and statistical field summaries are to be generated.

Any number of PROCESS commands may appear in a GEMINI run. At least one PROCESS must be present in order for anything to happen and any commands applicable to the processing step must appear prior to the PROCESS command. All dates and times on the PROCESS command are in project time.

Note that it is possible to specify an ending time greater than 2400; this will extend processing to the following day. This is useful in creating unbroken analog plots between two days. (Note, however, that memory will limit the length of an analog plot; see the TIME command for current limitations.)

P2 (F) IDATE — Date to be processed (YYMMDD).
(DEFAULT = This parameter must be specified.)

P3 (F) IBEGTM — Beginning time to process (HHMM). IBEGTM must be a multiple of the project's data resolution.
(DEFAULT = 0)

P4 (F) IENDTM — Ending time to process (HHMM). IENDTM must be a multiple of the project's data resolution.
(DEFAULT = 2400)

P5 (F) MINAVG — Number of minutes between any offtime reports to be included in the analysis. This parameter is only active if NMAPS is greater than 0. This number must be a multiple of the original data resolution.
(DEFAULT = 5)

P6 (F) INTERV — The time interval in minutes between successive maps and analyses. For example, if INTERV=10.0 the temporal increment between consecutive input map reports will be 10 minutes and the corresponding objective analyses times will also be spaced 10 minutes apart. INTERV must be a multiple of the project's data resolution.
(DEFAULT = 5)

P7 (F) NMAPS — Defines the number of maps before and after the current map to be involved in the analysis. NMAPS may be an integer from 0 to 36.
(DEFAULT = 0)

P8 (A) NETWRK — Indicates the network to be analyzed; each project will have different networks available. (For instance, CCOPE would recognize ‘PAM’ or ‘PROBE’.) If ‘ENTIRE’ is specified, all available stations will be included. If ’STACK’ is specified, then a list of network names will be expected in subsequent indented lines. The list will be ended by an ’END’ command in position 1 (P1), following the lines containing the network names.

(DEFAULT = ‘ENTIRE’)

P9 (A) SITMAP — Site map display option:

`SITE` — a plotted display of all sites to be included in the processing will be produced for each analysis time;

`MAP` — the SITE display, with a map background added;

`NONE` — no display of mesonet sites will be produced.

(DEFAULT = ‘NONE’)

P10 (A) STATS — Statistical summary of fields option:

`STATS` — statistics will be generated for every field upon which objective analysis is to be performed;

`NONE` — no statistical summary will be generated.

(DEFAULT = ‘NONE’)

PROJECT Permits the user to specify the weather project whose data are to be analyzed. This is a MANDATORY command; many of GEMINI's functions (especially those relevant to individual stations) require project-specific data. This command also allows the user to specify the reference elevation for the PRED (pressure reduced to common elevation) field and to redefine the coordinate origin for the experiment. A list of valid project names can be found in APPENDIX S.

The PROJECT command may be repeated within the command deck; it will clear the parameters of any TIME, LIST, DIGPLT, WINDS, EDIT, or FIELD commands previously specified. Caution should be exercised if the PROJECT command is used to change to another experiment, as some quantities (such as those set by the GRID, and ANALYZE commands) are NOT reset. If unexpected results occur in a multi-project deck, try again with separate decks for each project.

P2 (A) IPROJ — Name of project of interest (e.g. CCOPE, CINDE, or GALE). The name should be in all uppercase.
(DEFAULT = This parameter must be specified.)

P3 (F) ORELEV — Elevation in meters to which all values in the PRED field will be referenced.
(DEFAULT = Elevation of project reference point)

P4 (F) ORLAT — Latitude of origin.
(DEFAULT = Latitude of pre-defined experiment origin. US is positive lat.)

P5 (F) ORLON — Longitude of origin.
(DEFAULT = Longitude of pre-defined experiment origin. US is positive lon.)

QUIT Terminates the GEMINI run. This should be the last command in any deck.

RAIN Enables the user to set the parameters governing GEMINI's handling of accumulated rainfall. GEMINI's RNRL field contains the value, in millimeters, of rain accumulated over a user-selectable time interval. It is known that for some PAM datasets, the reported rainfall is subject to occasional glitches and resets; therefore, the user may activate a deglitching algorithm designed to eliminate spikes and negative values from the RNRL field.

P2 (F) RDELTA Time period, in minutes, over which relative rainfall is to be calculated.
(DEFAULT = 1.0)

P3 (A) DGLTCH Data deglitching option:

`YES` Deglitching algorithm activated;

`NO` raw mesonet data reported.

(DEFAULT = 'YES')

P3 (A) NORM Data normalization option:

`YES` Normalize RNAB field so that total rainfall since beginning of PROCESS period reported;

`NO` raw mesonet data reported.

(DEFAULT = 'YES')

STATION Enables the user to exclude all the measurements collected at a particular mesonet site from consideration by the objective analysis procedure. This command also permits the user to override the general advection criteria (specified by the STMSPD command) at an individual site. Detailed descriptions of the advection technique and objective analysis procedure are contained in APPENDIX B. There is no limit to the number of STATION commands which may appear in a job stream. If more than one STATION command appears with the same station name, information provided by the former STATION command with that name will be overwritten. A list of valid station names is provided in APPENDIX S.

P2 (A) NAMSTN — Mesonet station identifier. This must be taken from the list of valid (8 char.) station names provided in APPENDIX S.
(DEFAULT = This parameter must be specified.)

P3 (A) IGNOPT — Station exclusion option:

- `IGNORE` all measurements from this site will be EXCLUDED from the analysis;
- `EXCLUDE` all measurements from this site will be EXCLUDED from both analysis and display (i.e., DIGPLT, LIST, and TIME output);
- `USE` this site's data will be INCLUDED in the analysis.

(DEFAULT = 'USE')

P4 (A) ADVOPT — Advection criteria to apply at this site:

- `GLOBAL` apply advection criteria as specified in the STMSPD command;
- `LOCAL` advect reports using the local winds as measured at the site (if available); otherwise use the general storm speed provided in the STMSPD command
- `USER` advect using the criteria supplied by the user in parameters P5 through P7 of this command. See the STMSPD command description for additional information regarding these criteria;
- `DISABLE` advection will be disabled at this site; only the report at the analysis time will be used.

(DEFAULT = 'GLOBAL')

P5 (F) DIR — Storm direction (DEG) (Only if ADVOPT='USER'); This is defined as degrees clockwise from North in the direction from which the storm is approaching. (Same as a wind is defined.)
(DEFAULT = This parameter must be supplied.)

P6 (F) SPEED — Storm speed (M/S) (Only if ADVOPT='USER');
(DEFAULT = This parameter must be supplied.)

P7 (F) DIFMAX Maximum angular difference (DEG) (Only if ADVOPT='USER'); This is the maximum angular difference permissible between 2 consecutive input wind reports at the site. Local wind measurements are used to advect the input reports unless this difference is exceeded. Should this occur at a particular analysis time, all input reports at this site will be advected using the DIRection and SPEED defined above. If DIFMAX=0.0 the USER specified storm motion will always be used to advect the reports at this site.
(DEFAULT = 0.0)

STMSPD Specifies general advection criteria to apply when relocating input reports for subsequent objective analysis. The information provided by STMSPD will be in effect for all sites unless superseded by individual criteria specified for a particular site through the use of the STATION command. Advection direction and speed are determined as follows:

- Local winds as measured at each site are used to relocate the input reports so long as they exist and the angular difference in degrees between consecutive wind reports does NOT exceed a maximum value specified by the user. Whenever local winds are NOT used, the GLOBAL storm speed and direction (also supplied by the user) will be used to relocate the input reports.
- If the user specifies that only LOCAL winds are to be used and the winds are missing at a particular site the only reports that will be used at that site will be those corresponding to the analysis time; any off-time reports will be ignored.

The information provided in the STMSPD command may be updated at any time through the appearance of an additional STMSPD command. Detailed descriptions of the advection technique and objective analysis procedure are contained in APPENDIX B.

P2 (A) ADVOPT General advection criteria to apply at all sites:

`GLOBAL` apply the storm DIRection and SPEED specified by parameters P3 and P4 respectively whenever the difference in wind direction between 2 consecutive input reports at a site exceeds the maximum permissible angle (DIFMAX) established by the user in parameter P6;

`LOCAL` advect reports using the local winds as measured at each site (if available); otherwise no off-time reports at a site with missing wind measurements will be included in the analysis.

(DEFAULT = 'GLOBAL')

P3 (F) DIR Storm direction (DEG) (Only if ADVOPT='GLOBAL'); This is defined as degrees clockwise from North in the direction from which the storm is approaching. (Same as a wind is defined.)

(DEFAULT = This parameter must be supplied.)

P4 (F) SPEED Storm speed (M/S) (Only if ADVOPT='GLOBAL');

(DEFAULT = This parameter must be supplied.)

P5 (F) DIFMAX Maximum angular difference (DEG) (Only if ADVOPT='GLOBAL'); This is the maximum angular difference permissible between 2 consecutive input wind reports at each site. Local wind measurements are used to advect the input reports unless this difference is exceeded. Should this occur at a particular analysis time, all input reports at that site will be advected using the DIRection and

SPEED defined above. If DIFMAX=0.0 the GLOBAL storm motion will always be used to advect the reports at every site.
(DEFAULT = 0.0)

TIME Generates a series of analog time plots of surface mesonet data. These plots are produced after all other processing is complete, and display the value of a variable over the time indicated by the PROCESS command. The user may specify the stations for which analog plots are to be produced and the amount of Leise filtering in time to be performed on the original data before it is plotted. The filtering for the time series and the filtering for the analysis (specified on the FIELD card) are totally independent. Both operate on the original data(with user edits applied.) As many as 30 TIME commands may be given by the user. The TIME command is a stack operation and must be terminated by an END card. Each entry in the stack refers to a different field to be plotted; a list of valid field names is provided in APPENDIX F. Additionally, the user may overlay one variable on the display of another, for comparison. The user can also control the number of plots per frame and the min and max values to be plotted for each field.

P2 (A) ITMGRD Specifies the area of mesonet sites to include:

- `ENTIRE` all mesonet sites;
- `ANALYSIS` all sites within the area specified by the GRID command will be included;
- `INPUT` all sites within RADBOX kilometers of the ANALYSIS region will also be included;
- `SINGLE` a single individual station will be included.

(DEFAULT = 'SINGLE')

P3 (A) ITMSTN If P2 is 'SINGLE', this field should hold the 8-character name (from APPENDIX S) of the desired station.

(DEFAULT = This parameter must be specified if needed.)

P4 (A) CONSTANT If P4 is 'FIELD', the plots will be produced with the FIELD being constant on each frame and that field will be plotted as measured at several stations. If P4 is 'STATION', the plots will be produced with the STATION being fixed for each frame and several fields for that station will be plotted on each frame.

(DEFAULT = 'STATION'.)

P5 (F) PLTSFRM Number of time series plots per frame. Maximum allowed is 6.

(DEFAULT = 3.0)

Additional cards of the following format must be used for each field to be plotted. Note that they are indented and start at position 2 (P2). They must be closed off with an END card in position 1 (P1).

EXTRA

P2 (A) FIELD Field name specifier. This name must be taken from the list of field names eligible for display as provided in APPENDIX F. Also, to create an overlay of a different

field on the same plot, specify the second field name in the last 4 characters of this entry. For example, the string, 'U SPD ' would plot U with a dashed overlay of SPD.
(DEFAULT = None. User must specify.)

P3 (A) MINVAL — Minimum value of field to be plotted.
(DEFAULT = Program chooses minimum based on actual minimum in dataset.)

P4 (A) MAXVAL — Maximum value of field to be plotted.
(DEFAULT = Program chooses maximum based on actual maximum in dataset.)

P5 (F) NSTEP — Number of Leise filtering steps to be performed on data before it is plotted.
(DEFAULT = 0)

P6 (F) FREQ — Frequency with which data is to be plotted. '1' means plot data at original resolution, '2' means plot every other data point. The plotting is done after filtering has been applied.
(DEFAULT = 1)

VECTOR Adjusts the wind fields (U, V, SPD, DIR) by subtracting off a constant vector field. The user defines the constant vector field by specifying a magnitude and a direction. This direction is taken to be relative to an x-axis at 90 degrees (a true North coordinate system). The direction is also taken as the direction from which the wind is coming, not the direction the vector is pointing.

P2 (F)	SPD	Speed of wind field to be subtracted. (DEFAULT = 'None. User must specify.')
P3 (F)	DIR	Direction wind is coming from, relative to u-axis. (DEFAULT = 'None. User must specify.')

WINDS Provides information regarding the wind measurements collected by the surface mesonet and specifies which, if any, displays of wind data are to be generated in conjunction with each objective analysis performed. Four types of wind displays may be produced:

1. A map of advected report locations on a background of the INPUT grid: each report is identified by a signed digit indicating its temporal map position relative to the analysis time;
2. A map of advected wind measurements on a background of the INPUT grid: this display is similar to (1) described above with vectors depicting the measured winds plotted at their advected positions;
3. A vector display of the objectively analyzed horizontal winds: options permit the specification of vector length, arrowhead type and spacing;
4. A streamline display of the objectively analyzed horizontal winds: options permit the selection of streamline spacing.

The information provided in the WINDS command may be updated at any time through the appearance of an additional WINDS command.

P2 (A) NAMU — Field name specifier of the U-component of air motion. The list of valid field names and their descriptions is given in APPENDIX F.
(DEFAULT = 'U')

P3 (A) NAMV — Field name specifier of the V-component of air motion. The list of valid field names and their descriptions is given in APPENDIX F.
(DEFAULT = 'V')

P4 (A) IRELVP — Advected report display option:

`REPORT`	wind display #1 (described above) will be generated for each analysis time;
`VECTOR`	wind display #2 (described above) will be generated for each analysis time, vector arrows will be drawn according to the values specified by parameters P6 and P8;
`BOTH`	wind displays #1 and #2 will both be generated;
`MREPORT`	same as REPORT with map background;
`MVECTOR`	same as VECTOR with map background;
`MBOTH`	same as BOTH with map background;
`NONE`	no display will be generated.

(DEFAULT = 'NONE')

P5 (A) IWINDP — Wind plot specifier:

`ARROW`	vector wind display #3 (described above) will be generated and vector arrows will be drawn according to the values specified by parameters P6 through P8;

	`STREAM`	streamline wind display #4 (described above) will be generated according to the value specified by parameter P9;
	`BOTH`	both arrows and streamlines will be produced;
	`MARROW`	same as ARROW with map background;
	`MSTREAM`	same as STREAM with map background;
	`MBOTH`	same as BOTH with map background;
	`NONE`	no display will be generated.
	(DEFAULT = 'NONE')	
P6 (F) VREF	Vector reference speed (M/S). Arrows on displays #2 and #3 will be scaled so that a vector depicting VREF (M/S) will be equal to one kilometer in length on the plots.	
	(DEFAULT = 2.0)	
P7 (F) IVSPAC	Vector display spacing. If IWINDP = 'ARROW' :	
	`-1`	interleaved (odd border points);
	`-2`	interleaved (even border points);
	`value > 0`	every `value`th vector will be plotted.
	(DEFAULT = -1)	
P8 (A) IVHEAD	Arrowhead type:	
	`FIX`	heads will be a fixed size;
	`PRO`	heads will be proportional to the arrow lengths.
	(DEFAULT = 'FIX')	
P9 (F) ISTRM	Streamline display spacing. If wind display #4 has been activated:	
	`>0`	a streamline will be initiated every ISTRM grid locations.
	(DEFAULT = 2)	

APPENDIX B

Description of the Objective Analysis Procedure used to remap
Surface Mesonet Data to 2-D Cartesian coordinates in GEMINI

The following computational steps are employed (in the order in which they appear) when transforming the Surface Mesonet measurements to a two-dimensional Cartesian coordinate grid. These procedures are identical to those utilized by Fankhauser and Mohr (4).

CALIBRATION: All original Surface Mesonet reports are automatically subjected to the latest calibrations and corrections available. As additional refinements become evident they will also be incorporated.

SELECTING INPUT: The spatial set of Surface Mesonet sites contributing to the objective analysis procedure is determined by the location of the Cartesian coordinate system defined on the GRID command and by the RADBOX parameter on the ANALYZE command. Any mesonet site bounded by or within RADBOX kilometers of the limits of the Cartesian grid will be included in the objective analysis. The temporal set of input reports is determined by the number of maps to be considered backward and forward in time relative to the analysis time. This information is supplied on the PROCESS command by the parameter NMAPS. The total number of input reports from each contributing site is equal to: NMAPS $\times$ 2 + 1. (NMAPS may be 0,1,2 or 3). Any mesonet report that is advected farther than RADBOX km. from the limits of the Cartesian grid will be excluded from the analysis.

TOSSOUT EDITING: Two mechanisms exist for excluding suspicious mesonet reports from the objective analysis procedure. The STATION command enables the user to completely eliminate all reports from a designated site. Implicit editing may be performed by the SMULT parameter (on the FIELD command) which directs an automated editing procedure to throw away any input values in the corresponding field which are more than SMULT standard deviations from the mean.

ADVECTION: Whenever off-time reports are to be included in the analysis (i.e. NMAPS ¿ 0) advection criteria must be provided. Reports are displaced either by local wind measurements (if they satisfy a continuity requirement) or by a direction and speed determined by the user. General storm motion and continuity criteria is specified for the entire network on the STMSPD command. These general criteria can be superceded at any site through the use of the STATION command. Displacement of reports is as follows:

LOCAL winds are used to displace the off-time reports so long as the difference in wind direction between any two consecutive reports does not exceed the user designated maxmium. 15 degrees is a reasonable value. If the wind from a LOCAL report OPPOSES the user specified wind direction, earlier reports are displaced upstream; later downstream. If the local winds AGREE (i.e., are within 90 deg of the user specified wind direction) earlier reports are displaced downstream; later upstream. Reports at the analysis time ALWAYS remain fixed. If NO user specified wind is supplied reports are ALWAYS displaced as if they were OPPOSING the general flow.

USER specified winds are used to displace reports at a site whenever two consecutive local wind directions exceed the maximum tolerance or if any of the local wind measurements are missing. Earlier reports are always displaced downstream and later reports are always displaced upstream.

Two plotted display products generated by the IRELVP parameter on the WINDS command illustrate the behavior of this advection procedure as applied to each analysis time. If no off-time reports are included in the analysis, no advection will be necessary.

REMAPPING: The Barnes Objective Analysis Technique (1) is employed for remapping the irregularly spaced input values to the uniform 2-D Cartesian grid. At each destination grid location all input values, no matter how distant, are included in the calculation of the estimate. The weight W assigned to any datum at distance D from the destination Cartesian coordinate location is given by the following gaussian function:

$$\mathrm{W} = \mathrm{EXP}(\ln(0.1) \times \mathrm{D}^2/\mathrm{RINF}^2)$$

where RINF is the distance (in kilometers) where the gaussian weighting function will be equal to 0.1. RINF may be a single user specified value or a combination of two different radii; one (RADKM) for the dense network and the other (RADSPR) for sparse regions. Every input value is multiplied by its calculated weight, all weighted values are accumulated and a final normalized estimate is assigned to the grid location in question. RINF controls the response of the gaussian weighting function. Satisfactory results are usually attained with RINF set approximately equal to the Surface Mesonet station spacing.

An iterative correction technique for reducing the Root Mean Square (RMS) difference between the original input values and the nearest Cartesian estimates may also be invoked. If NPASS (in the ANALYZE command) is set greater than 1, the residual between each original datum and the Cartesian field estimate is computed immediately following the first pass (described above) of the objective analysis procedure. Using the set of residuals as input, the objective analysis procedure is invoked and the resultant field of gridded residuals is used to adjust the current grid of Cartesian estimates. This operation is repeated until NPASS iterations have been performed. Experience with this feature suggests a value for NPASS of 2 for Surface Mesonet analyses.

Additional weighting of the time series reports using the same gaussian weighting function (with the response radius expressed in minutes) may be performed as part of the remapping procedure. This optional feature is only meaningful when off-time reports are included in the analysis. By default all advected reports receive equal weight in temporal space. Two options are available. The reports can be time weighted AND advected or a weighted estimate of the time series can be computed and assigned to the associated station location for input to the spatial remapping as described by Doswell (2). When assigning weights as a function of time, care should be taken NOT to make the weights so small that their contribution becomes negligible. The default value computed for RADTIM is generally a good estimate for the first time user of this feature.

2-D FILTERING: The capability for 2-D filtering of the remapped Cartesian estimates using Leise's Multi-dimensional Telescoped Filter (3) is also available. Each iteration of the filter will reduce the scales retained by a factor of two. 2-D filtering of the Cartesian space estimates should NOT be necessary if all preceeding computational steps have been properly parameterized.

It should be evident from the preceeding discussion that a wide variety of alternatives can be explored when generating two-dimensional datasets from Surface Mesonet information. Parameterization may vary considerably from one analysis to the next depending upon any number of circumstances. The graphical output produced by GEMINI is designed to assist the analyst in fine tuning each individual remapping. Be aware that this algorithm has NO controls to prevent data from being extrapolated into regions for which there are no original mesonet reports. The user must assume responsibility for selecting destination grids that are compatible with the Surface Mesonet. In the interests of efficiency output tapes should NOT be generated until satisfactory parameterization has been determined for all the analysis times that are to be processed.

References:

1) Barnes, S.L., 1973: Mesoscale objective map analysis using weighted time series observations. *NOAA Tech. Memo* ERL NSSL-62, 60 pp.

2) Doswell, C.A. III, 1977: Obtaining meteorologically significant divergence fields through the filtering property of objective analysis. *Mon. Wea. Review,* **105**, No. 7 (July), 885-892.

3) Leise, J.A., 1981: A multidimensional scale-telescoped filter and data extension package. *NOAA Tech. Memo* ERL WPL-82, 20 pp.

4) Fankhauser, J.C., and C.G. Mohr, 1979: Influence of surface wind kinematics on thunderstorm evolution. Preprints 11th Conf. on Severe Local Storms, Kansas City, Mo. Amer. Meteor. Soc., 415-420.

APPENDIX F

SURFACE MESONET FIELD NAMES

The following 4 character field names are recognized by the GEneral Mesonet INterpolation Interface (GEMINI). There are 3 categories of fields:

1. Display/Analysis fields: Fields in this category represent measurements that are either directly available from the surface mesonet or are easily calculated from the original reports. Information from these fields may be digitized on a map background (DIGPLT), listed out (LIST), subjected to objective analysis (FIELD), or plotted against time (TIME).
2. Display-ONLY fields: Fields in this category represent site characteristics which remain constant at all times throughout the duration of the experiment. Information from these fields may be digitized on a map background (DIGPLT) and listed out (LIST). These fields may NOT be subjected to objective analysis (FIELD).
3. Analysis-ONLY fields: Fields in this category represent quantities which can only be derived after objective analysis has been performed on measurements directly obtainable from the surface mesonet. All the necessary steps required to generate this type of field are performed automatically whenever a field name in this category is encountered on a FIELD command. Since these quantities exist only in a 2-Dimensional gridded format they can NOT be digitized on a background of site locations (DIGPLT) nor can they be listed out (LIST) as input surface mesonet reports.

The following page contains the complete list of valid field names recognizable by GEMINI. All names are grouped according to the categories described above.

DISPLAY/ANALYSIS FIELDS:

Name:	Units:	Description:
PRES	MB	Station pressure.
TEMP	DEG C	Dry bulb temperature.
RELH	PERCENT	Relative Humidity.
U	M/S	U component of the wind.
V	M/S	V component of the wind.
WETB	DEG C	Wet bulb temperarure.
PRED	MB	Station pressure reduced to reference elevation.
MIXR	G/KG	Mixing ratio.
DWPT	DEG C	Dewpoint temperature.
PLCL	MB	Pressure at the lifted condensation level.
TLCL	DEG C	Temperature at the lifted condensation level.
EPOT	DEG K	Equivalent potential temperature.
POT	DEG K	Potential temperature.
DEPR	DEG C	Dewpoint depression (TEMP – DWPT).
TVIR	DEG C	Virtual temperature.
VPOT	DEG K	Virtual potential temperature.
RNAB	MM	Absolute rainfall reported by station.
RNRL	MM	Accumulated rainfall; see RAIN command.

DISPLAY ONLY FIELDS.

Name:	Units:	Description:
LAT	DEG N	Station latitude (Degrees North +).
LON	DEG W	Station longitude (Degrees West -).
ELEV	METERS	Station elevation above mean sea level.
XSTA	KM	Station distance E-W from project origin.
YSTA	KM	Station distance N-S from project origin.
SPD	M/S	Wind speed.
DIR	DEG	Wind direction.
WMAX	M/S	Maximum (gust) wind speed.

ANALYSIS ONLY FIELDS.

Name:	Units:	Description:
ISOT	M/S	Isotach field.
MASS	1E-3/SEC	Mass divergence.
MOIS	1E-3/SEC	Moisture divergence.

VORT	1E-3/SEC	Vorticity field.
TOPO	M	Surface topography, if available.
GRAD	DEG/KM	Magnitude of gradient of temperature.
HADV	DEG/HR	Horizontal advection of temperature.

APPENDIX J

GEMINI DECK SETUP

In order to use GEMINI, the user must construct an input file that contains any Unix shell commands to setup the environment for Gemini (e.g., link or copy needed data files into the working directory) and that also contains a list of the Gemini commands to be executed. The following page contains a template for setting up a GEMINI run. Please refer to it for the remainder of this discussion. The discussion applies for running on the Cray or the workstations though the details will be slightly different for each environment.

Sample deck # 1

Examine CCOPE Surface Mesonet data for a particular date and time period.

The following deck accesses data from a single day during the CCOPE experiment. One output listing (of 5 possible) and one digital plot (of 8 possible) of user specified measurements will be produced for EACH 5 minute map period within the time interval on the PROCESS command. NO objective analysis is performed in this example.

This is the first deck that should be run by anyone using GEMINI for the first time since it is an excellent way to familiarize oneself with the required CRAY JCL and basic display capabilities without getting involved with the more elaborate objective analysis facilities. In this example a 60 by 60 km analysis/display grid is specified; GRID is a MANDATORY command in any GEMINI deck set up, as is PROJECT. The fields to be LISTed are: ELEV (Station elevation), U (U-component), V (V-component), PRES (Pressure), TEMP (Dry bulb), DWPT (Dewpoint), POT (Theta) and EPOT (Theta-E). The same 8 fields will also be digitized on a plotted display corresponding to the 60 by 60 km area specified in the GRID command. Although a maximum of 6 fields may be digitized per plot, the (U,V) components may be depicted as wind vectors on these displays if desired. The information following the QUIT command can be used as a positioning guide when supplying the parameterization required by GEMINI commands, since any card images following the QUIT command are ignored.

```
PROJECT CCOPE
C     THIS IS A USER SUPPLIED COMMENT !!!
*     SO IS THIS -THE GRID COMMAND DEFINES THE AREA OF INTEREST
GRID    20.0    80.0    10.0    70.0    1.0
C
C     THE FOLLOWING SET OF FIELDS WILL BE LISTED OUT ON THE PRINTER IN
C     THE SAME ORDER AS THEY APPEAR ON THE CARD IMAGE IMMEDIATELY FOLLOWING
C     THE LIST COMMAND.  BE SURE TO SPECIFY THAT THE SITES TO BE LISTED
C     CORRESPOND DIRECTLY TO THOSE WITHIN THE ANALYSIS GRID DEFINED ABOVE.
C
LIST    PRINT   ANALYSIS
ELEV    U       V       PRES    TEMP    DWPT    POT     EPOT
C
C     THE SAME INFORMATION WILL ALSO BE PLOTTED ON A BACKGROUND CORRESPONDING
C     TO THE AREA DESIGNATED ON THE GRID COMMAND.  INCLUDE THE WIND VECTORS.
C
DIGPLT  ELEV    PRES    TEMP    DWPT    POT     EPOT    ANALYS  VECTOR  2.5
C
C     DATE, BEGINNING AND ENDING TIME OF THE SEGMENT TO ANALYZE.  USE
C           DEFAULT VALUES OF 5 MINUTE AVERAGING AT 5 MINUTE INTERVALS.
C
PROCESS 810801. 1600.   1700.
C
C     ALWAYS INCLUDE A QUIT COMMAND TO ENSURE COMPLETION OF ALL PROCEDURES.
C
QUIT
1.......2.......3.......4.......5.......6.......7.......8.......9.......+.......
12345678901234567890123456789012345678901234567890123456789012345678901234567890
         1         2         3         4         5         6         7         8
```

Sample deck # 2

Perform an objective analysis on some of the surface mesonet fields.

The following deck is an expansion of Sample deck # 1. In this example objective analyses will be performed explicitly and contour plots generated for 3 of the fields in the earlier example: PRES, TEMP and DWPT. In addition since a request has been made for ARROW and STREAMline plots on the WINDS command, objectively analyzed wind fields will also be produced for display purposes. The ANALYZE command contains the remapping parameters and indicates that all sites within 10 km of the analysis grid are to be used for input. General advection criteria are specified on the STMSPD command and the PROCESS command has been modified to include 2 maps on either side of the analysis time; resulting in a total of 5 input reports from each site. Note also that the LIST and DIGPLT commands have been altered to include all the sites contributing reports to the objective analysis procedure.

```
PROJECT CCOPE
GRID    20.0    80.0    10.0    70.0    1.0
C
C     10,25 KM RAD. INFLUENCE, 2 PASSES, 10 KM GRID EXTENSION, NO FILTERING.
C
ANALYZE 10.0    25.0    2.0     10.0    0.0
C
C     STORM MOTION IS 300 DEG AT 14.5 M/S
C           USE LOCAL WIND REPORTS UNLESS TWO CONSECUTIVE INPUT WINDS
C           DIFFER BY MORE THAN 20 DEG.
C
STMSPD  GLOBAL  300.    14.5    20.0
C
C     GENERATE ALL GRAPHICAL PRODUCTS RELATED TO ADVECTION AND WIND FIELDS.
C
WINDS   U       V       BOTH    BOTH
C
C     THE FOLLOWING FIELDS WILL BE OBJECTIVELY ANALYZED AND PLOTTED
C
FIELD   PRES    0.0     CONT
FIELD   TEMP    0.0     CONT
FIELD   DWPT    0.0     CONT
C
LIST    PRINT   INPUT
ELEV    U       V       PRES    TEMP    DWPT    POT     EPOT
DIGPLT  ELEV    PRES    TEMP    DWPT    POT     EPOT    INPUT   VECTOR  2.5
C
C     SAME PROCESSING COMMAND AS BEFORE- INCLUDE REPORTS FROM THE TWO MAPS
C           BEFORE AND AFTER THE ANALYSIS TIME AS WELL.  PRODUCE A SITE MAP
C           AND PRINT STATISTICS FOR EACH FIELD TO BE ANALYZED.
C                    (Site map will have map background)
C
PROCESS 810801. 1600.   1700.   5.0     5.0     2.0     ENTIRE  MAP     STATS
QUIT
1.......2.......3.......4.......5.......6.......7.......8.......9.......+.......
12345678901234567890123456789012345678901234567890123456789012345678901234567890
         1         2         3         4         5         6         7         8
```

Sample deck # 3

Perform objective analyses with modifications to certain sites.

The following deck performs the same objective analyses as designated in Sample deck # 2 with modifications included for certain stations. One alteration involves the specification of advection criteria applicable to site MSU only (overriding that on the STMSPD command); the other fix eliminates data from site P21 from consideration in the objective analysis. Another FIELD (MIXR -Mixing Ratio) has been added; any data values more than 3.5 standard deviations from the mean of that field will be automatically discarded. The LIST command is getting to be a bore so we punt that. Another digital plot is added and the TEMP field plot will contain a vector overlay.

```
PROJECT CCOPE
GRID    20.0    80.0    10.0    70.0    1.0
ANALYZE 10.0    25.0     2.0    10.0    0.0
STMSPD  GLOBAL  300.    14.5    20.0
C
C     SPECIFY INDIVIDUAL ADVECTION CRITERIA FOR MSU, IGNORE DATA FROM P21.
C
STATION MSU     USE     USER    325.    12.0    10.0
STATION P21     IGNORE
C
C     GENERATE ALL GRAPHICAL PRODUCTS RELATED TO ADVECTION AND WIND FIELDS.
C           CUSTOMIZE THE VECTOR AND STREAMLINE PLOTS SOMEWHAT.
C
WINDS   U       V       BOTH    BOTH    5.0     -1.     PRO     3.0
C
C     THE FOLLOWING FIELDS WILL BE OBJECTIVELY ANALYZED AND PLOTTED.
C           USER SUPPLIES CONTOUR LEVELS FOR PRESSURE FIELD ONLY.
C           GEMINI GENERATES CONTOUR LEVELS FOR THE OTHERS.
C           (U,V) VECTOR PLOT WILL BE OVERLAYED ONTO TEMP CONTOURS.
C
FIELD   PRES    0.0     CONT            900.    925.    5.0
FIELD   TEMP    0.0     CONT    10101020
FIELD   DWPT    0.0     CONT
FIELD   MIXR    3.5     CONT
C
DIGPLT  ELEV    PRES    TEMP    DWPT    POT     EPOT    INPUT   VECTOR  2.5
DIGPLT  PRED    TLCL                    WETB    MIXR    ANALYSIS
C
C     SAME PROCESSING COMMAND AS BEFORE- THIS TIME WE USE 3 MAP REPORTS
C           BEFORE AND AFTER THE ANALYSIS TIME AS WELL.  PRODUCE A SITE MAP
C           AND PRINT STATISTICS FOR EACH FIELD TO BE ANALYZED.
C
PROCESS 810801. 1600.   1700.   5.0     5.0     3.0     ENTIRE  SITE    STATS
QUIT
1.......2.......3.......4.......5.......6.......7.......8.......9.......+.......
12345678901234567890123456789012345678901234567890123456789012345678901234567890
         1         2         3         4         5         6         7         8
```

Sample deck # 4

Saving objectively analyzed fields for subsequent analysis in CEDRIC.

The following deck is a slight modification of Sample deck # 3. In this example the analysis results have been so gratifying that after some minor editing we have decided to permanently save the analyzed fields in a CEDRIC format. In order to preserve the winds it is necessary to explicitly analyze the U and V components as separate fields. Many of the peripheral displays have been deactivated. Analysis results will be saved on the output dataset called V12345 which has been assigned to FORTRAN logical unit 35.

```
C     SAVE OBJECTIVELY ANALYZED FIELDS ON V12345.
C
OUTTAPE 35.0    V12345  BEG     0.0     0.0     CWADE   COPE
PROJECT CCOPE
C
GRID    20.0    80.0    10.0    70.0    1.0
ANALYZE 10.0    25.0     2.0    10.0    0.0
STMSPD  GLOBAL  300.    14.5    20.0
C
C     SPECIFY INDIVIDUAL ADVECTION CRITERIA FOR MSU, IGNORE DATA FROM P21.
C
STATION MSU     USE     USER    325.    12.0    10.0
STATION P21     IGNORE
C
WINDS   U       V       NONE    BOTH    5.0     -1.     PRO     3.0
C
C     THE FOLLOWING FIELDS WILL BE OBJECTIVELY ANALYZED.  U AND V HAVE
C           BEEN ADDED TO THE LIST BUT WILL NOT BE PLOTTED AS SCALAR FIELDS.
C
C
FIELD   PRES    0.0     CONT            900.    925.    5.0
FIELD   TEMP    0.0     CONT    10101020
FIELD   DWPT    0.0     CONT
FIELD   MIXR    3.5     CONT
FIELD   U       0.0
FIELD   V       0.0
C
C     MODIFY SELECTED PARAMETERS AT SITES MLS AND MQK
C
EDIT    MLS     1615.   1630.   PRES    =925.0  TEMP    +1.2
EDIT    MQK     1650.   1700.   TEMP    -0.4    U       =10.6   V       =2.5
C
PROCESS 810801. 1600.   1700.   5.0     5.0     3.0     ENTIRE  SITE    STATS
QUIT
1.......2.......3.......4.......5.......6.......7.......8.......9.......+.......
12345678901234567890123456789012345678901234567890123456789012345678901234567890
         1         2         3         4         5         6         7         8
```

Sample deck # 5

Features new to GEMINI.

The following deck is a departure from the preceding samples; it demonstrates the analysis of a project other than CCOPE, as well as giving an example of the TIME analog plot command and the addition of map backgrounds to certain displays.

```
PROJECT CINDE
GRID    -35.0   65.     -50.0   50.0    1.0
C
* Do field displays with map backgrounds.
FIELD   PRES    0.0     CONT    10100001900.    925.    5.0
FIELD   TEMP    0.0     HAFT    10101021
FIELD   DWPT    0.0     CONT    10101001
* Here's one with no background.
FIELD   MIXR    3.5     CONT    10101000
* Set analysis time for relative rainfall calculations, activate the
* deglitching algorithm, and deactivate normalization; then activate the field.
RAIN    5.0     YES     YES
FIELD   RNRL    0.0     CONT    10100001
* Set up analog plots.
TIME    ANALYSIS                3.0
        TEMP    0.0     20.0    0.0     1.0
        PRED    990.0   1010.0  0.0     1.0
        MIXR    2.0     12.0    0.0     1.0
        DIR     0.0     360.0   0.0     1.0
        SPD     0.0     20.0    0.0     1.0
        U   V   -20.0   20.0    0.0     1.0
END
C
* Process 6 hours at one-minute resolution, all networks; no site map
PROCESS 870711. 1200.   1800.   1.0     1.0     0.0     ENTIRE  NONE
* With same parameters, process 48 hours at five-minute resolution.
* Note that such a long time period with FIELD analyses will take a fairly
* large amount of processor time.  Deleting the FIELD commands will
* speed up the program dramatically.
PROCESS 870712  0000.   4800.   5.      5.      0.      ENTIRE  NONE
QUIT
1.......2.......3.......4.......5.......6.......7.......8.......9.......+.......
12345678901234567890123456789012345678901234567890123456789012345678901234567890
         1         2         3         4         5         6         7         8
```