

VI.5.3C-SYSTEM-MARO-TECH PROGRAM FCST FUNCTION MARO HCL TECHNIQUES

This Section describes the Hydrologic Command Language (HCL) Techniques used by the Operational Forecast Program by Function MARO.

A detailed description of each Technique is in Section VI.5.3D [[Hyperlink](#)].

The Techniques used by Function ESP can be categorized as those:

- o often used
- o not often used
- o not used for forecasting

Technique   Notes   Description

**Techniques Often Used**

Techniques to specify the run period:

STARTRUN	<u>1/</u> <u>2/</u>	Set time for start of run
ENDRUN	<u>1/</u> <u>2/</u>	Set time for end of run
LSTCMPDY	<u>1/</u> <u>2/</u>	Set time for end of computational (observed data) period
LSTALLOW	<u>1/</u> <u>2/</u>	Set future time limit for Technique LSTALLOW

The value for Technique ENDRUN must be exactly one day later than the value of Technique STARTRUN. Both times must also be 12Z.

Techniques to specify the MARO computational options:

CONVEC	<u>1/</u> <u>2/</u>	Specify if convective option is to be used and set convective radius
ESTFTW	<u>2/</u>	Specifies type of Ft. Worth estimation scheme to be used to estimate missing grid point precipitation from surrounding grid points
FTWMDRDS	<u>2/</u>	Specifies if MDR can be used to determine six 6 hour distribution percentages
MDREST6	<u>1/</u> <u>2/</u>	Specifies if MDR data are to be used to distribute daily amounts at grid points containing missing values of less than 24 hour precipitation
MDREST24	<u>1/</u> <u>2/</u>	Specifies if and how MDR data are to be used to estimate missing 24 hour precipitation at certain grid points in the grid system
MDRTABLE	<u>2/</u>	Specifies the MDR-to-precipitation probability level conversion table to use when converting a 6

<u>Technique</u>	<u>Notes</u>	<u>Description</u>
		hour MDR sum to an equivalent precipitation amount
PP24MAX	<u>1/</u> <u>2/</u>	Specifies the maximum 24 hour precipitation amount that is to be considered valid
PP24TIME	<u>1/</u> <u>2/</u>	Specifies if only reports for the entire run period should be used or partial day reports should be used as daily totals
WTEST24	<u>1/</u> <u>2/</u>	Specifies whether estimated precipitation values for all grid points will be written to the PPDB

### **Techniques Not Often Used**

MARO Function display control Techniques:

PRTPP24	<u>1/</u> <u>2/</u>	Specifies what values are to be printed out in the list of 24 hour precipitation reports from the named network stations
PRTPP6	<u>1/</u> <u>2/</u>	Specifies if a table of 6 hour precipitation reports are to be displayed
PRTPPZRO	<u>2/</u>	Specifies if zero amounts are to be included with the displays generated by Techniques PRTPP24 and PRTPP6
PRTMDR	<u>1/</u> <u>2/</u>	Specifies if a summary of the MDR-to-precipitation calibration results and the MDR-to-precipitation table are to be displayed
PRTMDR6	<u>1/</u> <u>2/</u>	Specifies if comparisons between observed 6 hour precipitation and MDR 6 hour accumulations are to be made
PRTMARO	<u>2/</u>	Specifies if a table of MARO, MAPG and MAPI values for each MARO area are to be displayed
PGSZMARO	<u>2/</u>	Specifies the maximum number of MARO areas that can appear on a single page of the table generated by the PRTMARO Technique
PLOTPP24	<u>1/</u> <u>2/</u>	Specifies if an AFOS graphics product is to be generated to plot daily precipitation values
BOXDUMP	<u>2/</u>	Specifies grid box(es) for which grid point hydrologic data is to be displayed on a grid box background
BOXDKEY	<u>2/</u>	Specifies the four character data type codes of the hydrologic data variables to be displayed by the BOXDUMP Technique

Technique   Notes   Description

General display control Techniques:

METRIC      1/ 2/      Sets English/metric units switch for display output

PAGESIZE    1/ 2/      Specifies how many lines are to be printed per page

Timing control/specification codes:

NOUTZ        1/ 2/      Sets the time zone number code

NOUTDS      1/ 2/      Indicates if daylight savings time is in effect

Computational control Techniques:

FTWQPF      2/          Specifies if a QPF run is to be made and specifies 6 hour distribution factors to be applied to the precipitation

APIMAX      2/          Specifies upper limit of computed API values

APIMIN      2/          Specifies lower limit of computed API values

APIRCMIN    2/          Specifies minimum value for which to compute tomorrow's API with recession multiplication constant

APIREC      2/          Specifies value of the API recession multiplication constant

APISCON     2/          Specifies value of the API subtraction constant (used when API is less than APIRCMIN)

DUR          2/          Specifies precipitation duration factor used in computation of the grid point runoff

WKLAG       2/          Specifies week of year where runoff production is most efficient (used in API recession computations)

NOEST6HR    1/ 2/      Specifies whether missing 6 hour sums should ever be estimated from surrounding grid points

NUMQDT      2/          Specifies maximum number of precipitation reports per quadrant to use when computing precipitation estimates

Runtime MOD options:

MODTZC      1/ 2/      Specifies default time zone code to be associated with a runtime MOD

<u>Technique</u>	<u>Notes</u>	<u>Description</u>
MODUNITS	<u>1</u> / <u>2</u> /	Specifies if English or metric units are to be used as input to most MOD commands
MODWARN	<u>1</u> / <u>2</u> /	Specifies if warning messages will be issued from the MOD subroutines

### **Techniques not used operationally**

Debug control Techniques:

PPDEBUG	<u>1</u> / <u>2</u> /	Sets Preprocessor system debug codes
PPTRACE	<u>1</u> / <u>2</u> /	Sets Preprocessor trace level
RWWARN	<u>1</u> / <u>2</u> /	Specifies whether warning messages will be issued from the read/write subroutines
BOXDEBUG	<u>2</u> /	Specifies grid box(es) for which certain grid-box-dependent debug codes are to be in effect

Notes:

- 1/ The Technique is used by other Functions and will apply to all Functions unless changed between COMPUTE commands.
- 2/ Techniques are either Universal or Nonuniversal depending on whether their values can be changed during the COMPUTE of a Function. Universal Techniques are assigned a single value for the COMPUTE of a Function. Nonuniversal Techniques can be changed within the COMPUTE of a Function.

All Techniques are Universal.

The Techniques MDREST6, PRTMDR6, PLOTPP24, MODTZC, MODUNITS, MODWARN, RWWARN, PUNCH are not yet implemented in MARO. While one may specify them, they will have no effect on the outcome of the MARO Function.

There are also four Techniques whose value is hard-wired in by the MARO program. For the time being, the value of these Techniques below will not be allowed to vary from their permanently assigned value. These Techniques are:

1. CONVEC - permanently assigned a value of 1 (YES)
2. METRIC - permanently assigned a value of 0 (NO)
3. NOEST6HR - permanently assigned a value of 1 (YES)
4. WTEST24 - permanently assigned a value of 1 (YES)

### Discussion of Specific MARO Techniques

A discussion of each of the Techniques that are used to specify options for Function MARO follows. Included is a brief description of what each one does and some guidelines for their use. Details of the

form and content of each Technique can be found in section VI.5.3D-TECH.

**Techniques which affect the computational algorithms:**

1. CONVEC

Description: This Technique determines if a convective radius will be used to limit the stations that are used to estimate daily amounts at a grid point with missing data. All estimators in each quadrant beyond the specified radius are ignored. The MARO Function hard wires the Technique value to 1 (ON). The argument, convective radius, must be between 12 and 70 miles. If it is outside this range, it is set to the closest limit. The global default for the convective radius is zero.

Guidelines: The CONVEC Technique is most effective in those situations where the precipitation is highly variable over short distances. The more variable the precipitation, the shorter the convective radius should be. However, care should be taken to not set the radius so small that very few observations will be used in making precipitation estimations. It is a good idea to set a local default for the convective radius using the HCL command SETLDFLT.

2. ESTFTW

Description: The value of this Technique determines when to divide by the sums of the distance weights when computing estimations of grid point precipitation. The options are:

- a. Divide by the sum of the weights, unless there is observed precipitation in only one quadrant.
- b. Divide by the sum of the weights only when there is observed precipitation in two non-adjacent quadrants, three quadrants or four quadrants.
- c. Divide by the sum of the weights only if there is observed precipitation in three or four quadrants (global default).

Guidelines: Option c works best in highly convective situations and where there is a sharp cut-off of the precipitation, such as a squall line. Under convective conditions, the other options tend to overestimate precipitation and spokes of what might be abnormally high precipitation estimates may appear. If the precipitation is not so convective in nature and there are many observations, option b may be permissible.

3. FTWMDRDS

Description: When this Technique is turned on, the percentage 6 hour distribution factors may be determined with MDR data, as well as first order observed precipitation. The precipitation derived from the MDR accumulations will be determined by the MDR-to-precipitation conversion table, whose value is input by the user or

determined by calibration of first order precipitation. The global default value of this Technique is zero (OFF).

Guidelines: This Technique would likely be quite useful where vast areas with no nearby first order precipitation data exist. With recent closings of more first order stations, this feature would be utilized more frequently.

#### 4. MDREST24

Description: This Technique governs the use of MDR derived precipitation for estimating missing precipitation amounts at the MDR centroid grid points. These grid points, which number about 700 in the WGRFC area, are those grid points located nearest the center of an MDR square. The 6 hour MDR accumulation for the square is converted to an equivalent 6 hour precipitation using the MDR probability table specified. The 6 hour precipitation amounts are summed to compute a 24 hour precipitation. This value is placed at the grid point address of the centroid grid point assigned to the MDR square. These estimates are treated as observed values. There are three levels of MDR usage:

- a. use MDR data to fill in zero amounts,
- b. use MDR to estimate precipitation up to a specified amount and
- c. use MDR to estimate any amount.

The global default value of this Technique is zero (OFF).

Guidelines: To use MDR to estimate zero precipitation amounts appears to be quite promising where the precipitation observations are few in number. To use MDR to estimate precipitation other than zero could be questionable, because of the lack of a consistently good correlation between MDR derived precipitation and observed precipitation. The use of a MDR table derived from observed first order station data may remove some of the bias. Nevertheless, use of option c should be limited to those times that one must make a MARO run with very little observed data, such as at night. Use of option b may be feasible, provided the precipitation threshold is small.

#### 5. MDRTABLE

Description: A MDR-to-precipitation probability level conversion table, which is used to generate an equivalent 6 hour precipitation from MDR sums, is specified with this Technique. Otherwise, a table is determined from calibration of the first order precipitation data. The global default value of this Technique is zero (no specific table is specified).

Guidelines: The impact this feature has on MAPG and MARO computations is determined by the MDR usage level Technique, MDREST24. The lack of a consistently good correlation between precipitation and MDR inhibits the utility of any of these tables.

Using the first order precipitation data would tend to (hopefully) pick the most rational overall precipitation estimates. In a highly convective situation with only a sparse amount of first order precipitation data, it would probably be best to use a 50 or 70 percent level to estimate precipitation.

#### 6. PP24MAX

Description: This Technique specifies the maximum precipitation total for this particular MARO run. It applies to full day totals, partial day totals and 6 hour totals. If the Technique is on, any amount exceeding the maximum value given in the argument is set to missing and a warning message is issued. The global default value of this Technique is zero (no maximum value is set).

Guidelines: This Technique does provide some measure of quality control to the precipitation input data and should be used to remove invalid reports. However, one must be careful to specify the proper upper limit and carefully monitor each run to ensure that valid excessive precipitation amounts are not discarded.

#### 7. PP24TIME

Description: This Technique determines if precipitation totals that do not correspond exactly to the period being run are used. Normally, only totals that represent the exact time period being run are used (e.g., only full day reports are used for a full day run and only 12 hour sums are used for a 12 hour partial day run). If this Technique is off, there is no check as to the period represented by the precipitation report (e.g., a 12 hour report would be treated as a daily total for a full day run).

Guidelines: This Technique should be on (global default) if additional rain could have occurred after a partial day report was made. In this case, partial reports are not used and the values for these stations are estimated (the estimate could be less than the partial report.) The Technique should be off, if in the vast majority of cases, little or no precipitation occurs after a partial total is reported (i.e., if full-day totals are only reported when additional rain occurs and thus partial reports represent full-day totals if they are not updated).

#### 8. FTWQPF

Description: This Technique specifies if the run of the MARO Function is a QPF run. Up to four arguments can be specified with this Technique. These arguments are 6 hour distribution factors, which are normalized to produce 6 hour distribution percentages. The global default value of this Technique is zero (no QPF run is specified).

Guidelines: Use this Technique when forecast (QPF) precipitation as input to the MARO Function is desired. There are seven rules that must be followed when a QPF run of the MARO Function is made.

- a. The ending runtime (specified by Technique ENDRUN) of the MARO Function must be 12Z for the next hydrologic day (Recall, MARO can only be run for one day in the future).
- b. The starting runtime (specified by Technique STARTRUN) must be 24 hours prior to the ending runtime.
- c. The beginning time of the forecast data within the runtime period of the MARO Function is the time given in LSTCMPDY.
- d. A QPF run may accept a mix of observed partial-day precipitation totals and forecast precipitation totals. The time period of the observed precipitation, if any is available, begins at time STARTRUN and ends at time LSTCMPDY. Forecast precipitation begins at time LSTCMPDY and ends at time ENDRUN.
- e. Any QPF data must be entered in grid point precipitation format in a runtime MOD (Refer to section VI.5.3C-MARO-MOD for the format).
- f. Any observed precipitation data available will be used, unless it is overwritten in the runtime MOD.
- g. If less than four 6 hour distribution factors are given in the argument list, those missing factors will be assigned a value of zero and will apply to the earlier 6 hour periods during the forecast. If no argument list is submitted, a uniform distribution over the number of 6 hour periods in the forecast time slice will be assumed.

## 9. APIMAX

Description: This Technique retrieves a single argument that specifies an upper limit of all grid point API values that are computed in this run. Any grid point API value that exceeds this upper limit is set to the upper limit value. The global default of this upper limit is 5.00 inches.

Guidelines: As there is a limit to the amount of surface and sub-surface moisture that can be retained, it is rational to put an upper limit on the API. Since many rainfall-runoff relations are based on empirical relations, the solutions become more suspect as extremes are approached. To put a limit on the soil moisture would tend to remove the extreme values. In general, an upper limit of about 5.00 inches to 10.00 inches is advisable. This Technique could also be used to re-set APIs, but since it operates on the entire grid point network, it should be used carefully.

## 10. APIMIN

Description: This Technique retrieves a single argument that specifies a lower limit of all grid point API values that are computed in this run. Any grid point API value that falls below this lower limit is set to the lower limit value. The global

default of this lower limit is -1.00 inches.

Guidelines: As there likely is a lower limit to the amount of soil moisture deficit that can be accumulated, it is rational to put a lower limit on the API. Since many rainfall-runoff relations are based on empirical relations, the solutions become more suspect as extremes are approached. To put a limit on the soil moisture would tend to remove the extreme values. In general, a lower limit of about 0.00 inches to -5.00 inches is advisable. This Technique could also be used to re-set APIs, but since it operates on the entire grid point network, it should be used carefully.

#### 11. APIRCMIN

Description: This Technique retrieves a single argument that specifies the minimum API value for which tomorrow's API will be computed using the API recession constant. The global default of this minimum API value is 0.30 inches.

Guidelines: Normally, API recession is computed by the formula:

Tomorrow's API = today's API \* API recession constant.

As API decreases in absolute magnitude, the amount of daily recession also decreases. Eventually, a point is reached where API doesn't recess at all. If the minimum API value desired is zero, then this formula will work in all cases. However, if negative values of API are desired, another method must be used as API approaches zero. By specifying a value of APIRCMIN, this ensures continued recession. When API goes below APIRCMIN, the multiplication process is abandoned and a new formula is used:

Tomorrow's API = today's API - API subtraction constant.

When APIs go below the default value, recession by the subtraction formula begins.

#### 12. APIREC

Description: This Technique retrieves a single argument which sets the value of the API recession constant used in the multiplication process. The global default value of the argument is zero. When the argument is zero, a seasonally varying API recession, varying between 0.86 (summer) and 0.94 (winter) is used.

Guidelines: The closer the value is to 1.00, the slower the recession. Normally, a recession constant around 0.90 is used.

#### 13. APISCON

Description: This Technique retrieves a single argument which sets the value of the API subtraction constant used in the subtraction process. The global default value of the subtraction constant is 0.01 inches.

Guidelines: The value one chooses depends on how fast one wishes the APIs to decrease when they approach zero and go negative.

#### 14. DUR

Description: This Technique retrieves a single argument which sets the value of the precipitation duration factor used in the MARO rainfall-runoff computations. The global default value of this argument is zero. When the argument is zero, a seasonally varying duration factor ranging in value from 1.0 (summer) hours to 6.0 (winter) hours is used.

Guidelines: As the duration factor decreases, the amount of runoff generated with a constant precipitation increases. In general, this factor can be anywhere in the range from 1.0 hours to 24.0 hours.

#### 15. WKLAG

Description: This Technique specifies the week number where the precipitation duration is the longest and the API recession is the slowest. This is the middle of the winter week. The global default value of this Technique is 4.

Guidelines: The value one assigns to this Technique depends on the general climate of the RFC area. In general, the week number should closely correspond to the week when temperatures are the lowest and precipitation tends to be the least convective. In and around Texas, that time appears to be about the end of January or the first part of February. Thus, the default is set to the value of 4.

#### 16. NUMQDT

Description: This Technique specifies the maximum number of precipitation reports per quadrant to use when computing precipitation estimates. The search continues through each quadrant until the convective distance is reached or until NUMQDT precipitation reports are found. The global default value of this Technique is 1.

Guidelines: Intuitively, the more observations that can be used to form an estimation from, the less biased the estimation should be. However, in convective precipitation situations, that may not be the case. More observations also increases search time for each grid point and can significantly increase total CPU time needed for a MARO run. Because primarily of the time situation, the value of NUMQDT specified should not exceed 5.

### **Techniques which affect the MARO output:**

#### 1. BOXDEBUG

Description: This Technique specifies which grid boxes that the grid box dependent debug codes apply to. Technique PPDEBUG must specify the appropriate debug codes for this Technique to work properly. Up to 20 grid box numbers may appear in the argument list

of this Technique. The global default value of this Technique is zero (OFF) and the global default value of the argument list is 20 zeroes.

Guidelines: This Technique applies only when one or more of the special grid box dependent debug codes is given the Technique PPDEBUG argument list. A list of the debug codes appears with the discussion of the PPDEBUG Technique. One should keep the number of grid boxes to a minimum, because the debug codes that apply to this Technique generate a considerable amount of output, even for only one grid box.

## 2. PPDEBUG

Description: One uses this Technique to create extra debug output to track calculations of certain interim variables or to display certain working arrays, parametric arrays or contents of specified NWSRFS Data Bases. An argument list containing up to 20 four-character debug codes appears with this Technique. Each argument is a mnemonic for those elements selected for debug output. The global default value of this Technique is zero (OFF) and the global default value of the argument list is 20 4-character blank codes.

Guidelines: This is used in a non-operational mode to track computational algorithms of the MARO Function or display data or parametric arrays when execution of the MARO Function yields errors, warnings or suspect output. The debug options can generate considerable output and increase CPU time requirements of the MARO Function. There are 36 debug codes available within MARO and two of the debug codes generate output only when the computations involve grid boxes given in the BOXDEBUG Technique. Debug output should be specified only for those parts of the program where the problems are expected to be occurring in and only within those grid boxes where grid point computations need to be individually tracked.

The following list of the MARO debug codes available provides a brief explanation of the debug output generated by each of the codes:

- o APIG - Dump out values of the APIG array.
- o GADR - Dump out the starting addresses...array sizes...and data types of working temporary data and parametric arrays being loaded into the APIG array during the precipitation and MDR data transfer processes. The APIG array is the temporary holding location for several data and parametric arrays that are simultaneously being kept in the MARO Function.
- o GAPI - Dump MAPI computations. Also dump the APIG data array read by subroutine RPDDLY.
- o GBOX - Dump the GBOX parametric array.
- o GCOM - Dump Function MARO common blocks.

- o GCPU - Perform a CPU time check and display the amount of CPU time used since the last time check.
- o GDPP - Dump out the computations involved in moving the daily precipitation from its temporary storage locations in the PP24 array to its permanent location in the PG24 array.
- o GDRC - Dump out the API recession constant and the precipitation duration factor.
- o GDST - Dump the distribution variables determined in subroutine GDIST6.
- o GDTM - Dump date-time variables determined in the timing subroutine GSETTM.
- o GENL - Dump the GENL station parametric array.
- o GEST - Dump precipitation estimation results in the precipitation estimation routines.
- o GMDR - Dump the GMDR parametric array.
- o GMPG - Dump mean areal precipitation computations.
- o GMRO - Dump mean areal runoff computations.
- o GOPT - Dump out a detailed list of options from subroutine GTITLE.
- o GP6 - Dump out the non-zero elements of the GP6 data array.
- o GP24 - Dump the GP24 parametric array.
- o GPDB - Dump out the type and status code for each access to the PDB.
- o GPXP - Dump the precipitation written with the '.GRIDPX' command.
- o GRNF - Dump grid point rainfall/runoff computations.  
  
This is performed only on grid boxes specified with the BOXDEBUG Technique.
- o GSIX - Dump out the results of the computations to place the 6 hour percentage distributions in the W6 array. Also dump out the 6 hour related computations in subroutine GDATSV.
- o GTRN - Dump array transfer data in subroutine GTRNS.
- o MARO - Dump the MARO parametric array.

- o MDRF - Dump the MDR-to-precipitation estimation results determined in subroutine GMDRRF.
- o MDRZ - Print out MDR estimated precipitation (even if zero). Used when MDR6 is specified.
- o MDR6 - Dump the MDR6 data array.
- o OG24 - Dump the OG24 parametric array.
- o PG24 - Dump out the non-missing elements of the PG24 data array.
- o PP24 - Dump the PP24 data and pointer array.
- o PPVR - Dump the PPVR data and pointer array.
- o PVRX - Dump individual PPVR data values and associated addresses (used mainly in subroutines GLST6, GSIXFL and GCTRL).
- o QUAD - Dump the quadrant estimation results in the precipitation estimation algorithms.  
  
This is performed only on grid boxes specified with the BOXDEBUG Technique.
- o RFRO - Dump the RFRO parametric array.
- o SPLS - Dump the sorted precipitation list determination results. This is determined in subroutine GSPFIL.
- o USER - Dump the contents of the USER parametric array.

### 3. BOXDKEY

Description: This Technique is used to specify 4-character codes for hydrologic variables that may be displayed on a grid box background with the BOXDUMP Technique. Those permissible 4-character codes are as follows:

- a. APIG - display grid point API values and
- b. PG24 - display grid point values of precipitation, including estimations.

The global default value of the Technique is zero (OFF) and the global default value of the argument list is three 4-character blank codes.

Guidelines: Use the 4-character code of the hydrologic variable you wish to display. You may specify one or both. The specific grid box numbers to display the grid point data for is determined in the BOXDUMP Technique.

#### 4. BOXDUMP

Description: This Technique specifies the actual grid boxes for which to display the hydrologic data specified by BOXDKEY. Up to 20 grid box numbers can be specified. The global default value of this Technique is zero (OFF) and the global default value of the argument list is 20 zeroes.

Guidelines: One must use this Technique in conjunction with Technique BOXDKEY. The grid box number is the number of the grid box whose data you wish to display. Because the effect of an observation in the grid point network makes itself felt in surrounding grid boxes, the Technique will also display surrounding grid boxes in addition to the specified grid box.

When a grid box is specified for display, a 4X4 matrix of that grid box and the surrounding grid boxes is generated for output. The display matrix contains the northernmost tier of grid boxes in the first (top) row and the westernmost column of grid boxes in the first (left-hand) column. The grid box listed will be located in the second row, second column of the display matrix.

For example, suppose one wished to display grid point hydrologic data in the WGRFC grid box 15. A printer display of grid box 15 and its surrounding boxes would be generated, as illustrated in figure 1 below:

```
I----I----I----I----I
I 09 I 10 I 11 I 98 I
I----I----I----I----I
I 14 I 15 I 16 I 17 I
I----I----I----I----I
I 24 I 25 I 26 I 27 I
I----I----I----I----I
I 38 I 39 I 40 I 41 I
I----I----I----I----I
```

Figure 1. Grid Box Display Matrix for WGRFC Grid Box 15.

Displays of four grid boxes each would appear on a single sheet of standard 11"X14" printer paper. Grid boxes 9, 10, 14 and 15 would appear on the first sheet; grid boxes 11, 98, 16 and 17 would appear on the second sheet; grid boxes 24, 25, 38 and 39 would appear on the third sheet; and grid boxes 26, 27, 40 and 41 would appear on the fourth sheet.

This output method makes it possible to display a rather large area with just a few grid box numbers.