

Image display procedures using GRASS

**Northwest Pacific Region Environmental Cooperation Center
version 1.0**

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1. Introduction

This manual describes the GRASS operating procedures for displaying images from MODIS Chlorophyll-a data, which can be obtained from the Marine Environmental Watch System.

(1) Data format

GRASS supports only a limited number of formats. Therefore, the data format supported by GRASS will need to be ordered from the Marine Environmental Watch System. This manual covers the MODIS Chlorophyll-a data parameters and image display procedures using GRASS, based on the file formats, as shown in Fig. 1-1.

Table .1-1 Formats used

File format	BSQ	
Center Coordinates	North Lat.35°, East Long.132.5°	
Coordinates of 4 corners	50N/115 E	50N/150 E
	20N/115 E	20N/150 E
Resolution	1.0 k m	
Projection	Rectangular	

(2) Data used

For example purposes, this manual uses the following data, as shown below.

- Data ID : MCHLA_20050708013300
- Product : MODIS/Terra Chlorophyll-a
- Observation Starting date/time : 2005/07/08 10:33:00 (JST)

(3) GRASS version

This manual is based on the GRASS 6.0 version.

(4) Operating System

Operating System used for this manual was Fedora Core 4.

2. Order of MODIS Chlorophyll-a Data

First, search for the MODIS - CHLA or SST data from the Marine Environmental Watch System. Next, open the Order window, as shown in Fig. 2-1. Next, click on "Change" to change the setting's contents.

http://www.nowpap3.go.jp - Marine Environmental Protection of Northwest Pacific Region - Microsoft Internet Explorer

Marine Environmental Watch Project - Ministry of the Environment Japan and CEARAC -
Order List

Please return to "Search" window to add order data before choosing order conditions.
After choosing the order conditions, click "Order" button.
An order confirmation mail is sent to the following address.
Your E-Mail address :

Settings

1		Data ID	MCHLA_20050722045900	Selected criteria of detail	Center of generating Latitude :30.000,Longitude:130.000
		Dataset	MODIS/Chlorophyll-a		Resolution 1.00
		Satellite	AQUA		Number of lines 3592
		Receive Date	2005/07/22 13:59 (JST) 2005/07/22 13:59 (JST)		Number of samples 3047
		Selected criteria of output			Gridline 2degrees (white)
		Output format	jpeg		Coastline 4Km (white)
		Map method of projections	rectangular		

A max size of data to be made 10.94 Mbyte (1)

① Click on "Change."

Execute Order

インターネット

Fig. 2-1 Order Window

Formatting the data to be ordered, as shown in Fig. 2-2.

First, select "BSQ" for data output and "rectangular" for projection. Different values for center latitude and longitude, resolution, number of lines, and number of samples, from the ones as shown in Fig. 2-2, can be set. However, if different values are entered, then the GRASS parameters will also need to be changed in order to read the data.

The screenshot shows the 'Order Setting Window' for MODIS/Chlorophyll-a data. The window is titled 'Marine Environmental Watch Project - Ministry of the Environment Japan and CEARAC -' and 'Order Criteria'. It contains several sections: 'Output Format criteria', 'Area criteria', 'Image size', and 'Other criteria'. Red circles and arrows highlight specific fields and buttons, with numbered callouts explaining the required settings.

- ① Select "BSQ" for data output.
- ② Select "rectangular" for projection.
- ③ Input 35 for Center latitude, and 132.5 for Center longitude.
- ④ Input 1.00 for Resolution, 3140 for Lines and 3000 for Samples.
- ⑤ Click on "Set Order Criteria."

Fig.2-2 Order Setting Window

After clicking on the "Set Order Criteria", the Order List Window will then be displayed. Here, enter the E-mail address where the order confirmation should be sent to, as shown in Fig. 2-3. After verifying the order in the window, click on "Execute Order"

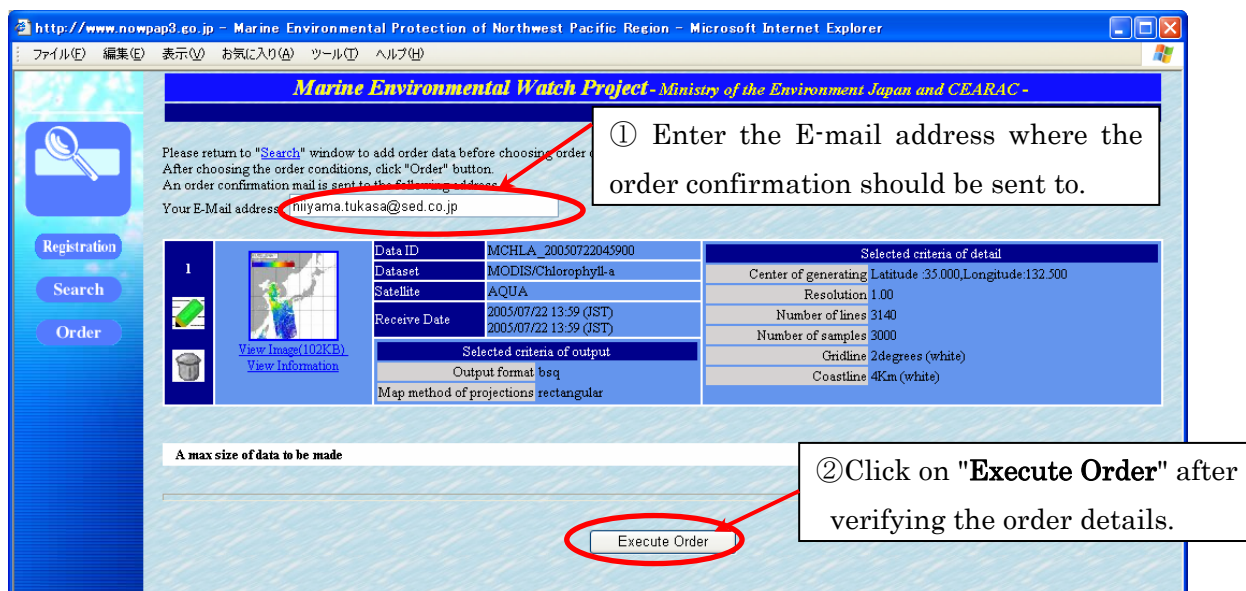


Fig. 2-3 Order List Window

After clicking on "Execute Order," an Order Confirmation E-mail will be sent to you. Further, an Order Completion E-mail will also be sent after the order entry process is completed. The FTP download address will be included in the Order Completion E-mail.

3. Image Display using GRASS

(1) Starting GRASS

Enter the following command, as shown below, on the command line.

`%grass60`

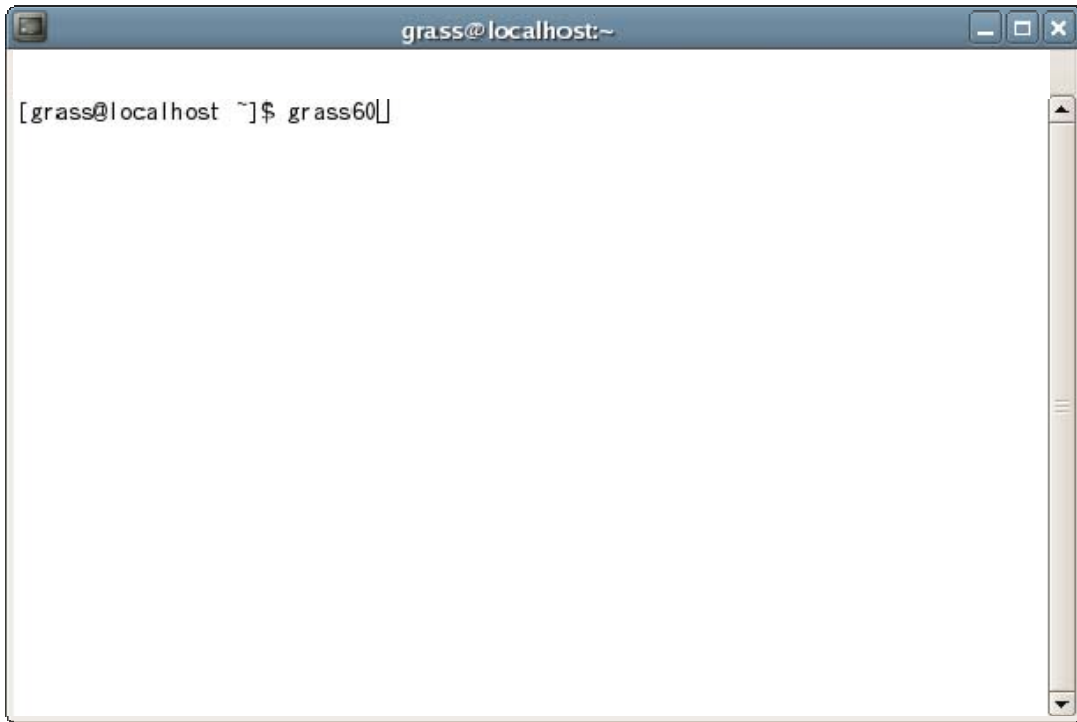


Fig.3-1 Terminal window

(2) Initial Database settings

When GRASS is started, a startup window, as shown in Fig.3-2, is displayed. In this window, 3 variables will need to be set.

- LOCATION
- MAPSET
- DATABASE

These 3 variables correspond to the GRASS data structure, as shown in Fig.3-3. In this example, the following directory is created.

/home/grass/database/nihonkai/permanent

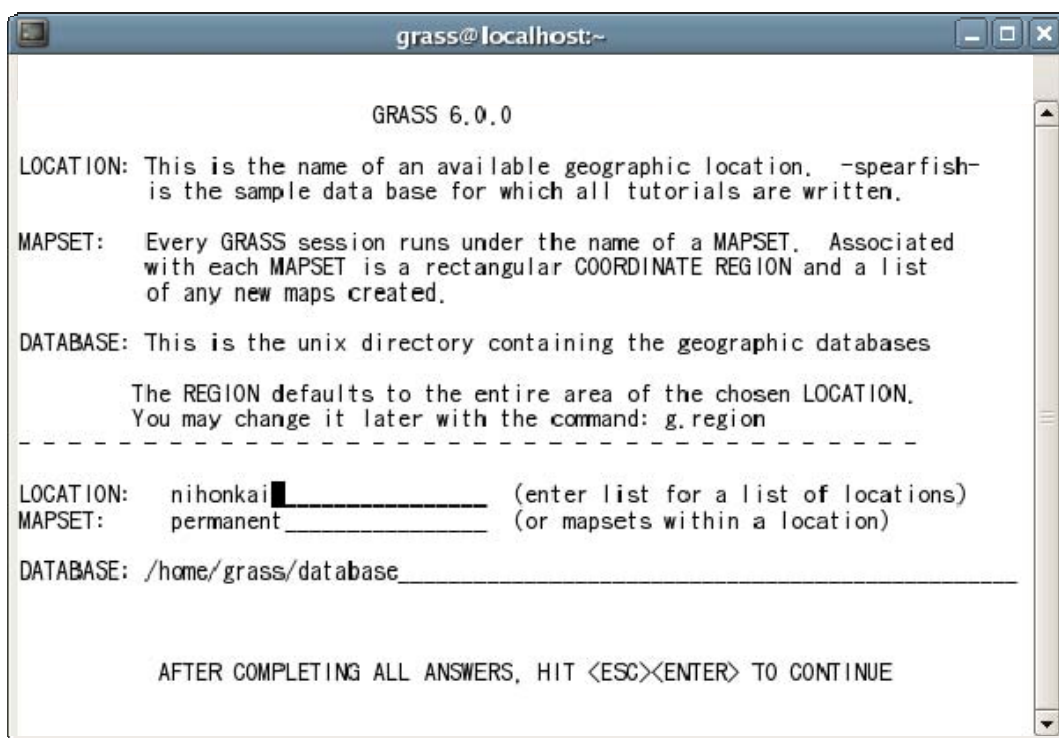


Fig. 3-2 GRASS Startup Window

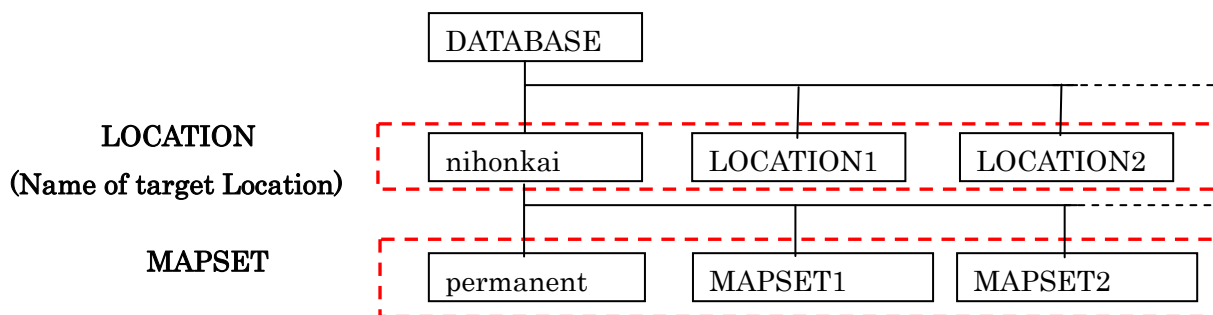


Fig.3-3 GRASS Data structure

The following 3 files will be created in the MAPSET directory.

- DEFAULT_WIND : 4 LOCATION coordinates (north, south, east and west)
PROJ_INFO : Projection Information (UTM, longitude-latitude, etc.)
- PROJ_UNIT : Projection Units (°, m, etc.)

Information for these 3 files will be applied to other MAPSET for the same LOCATION, unless they are specifically modified.

After the data structure is determined, Hit [Esc][Enter] to continue. The window, as shown in Fig. 3-4, is then displayed. Enter "y" in the box to create a location. (In Fig.3-4, the example shown is based on the nihonkai7 LOCATION.)

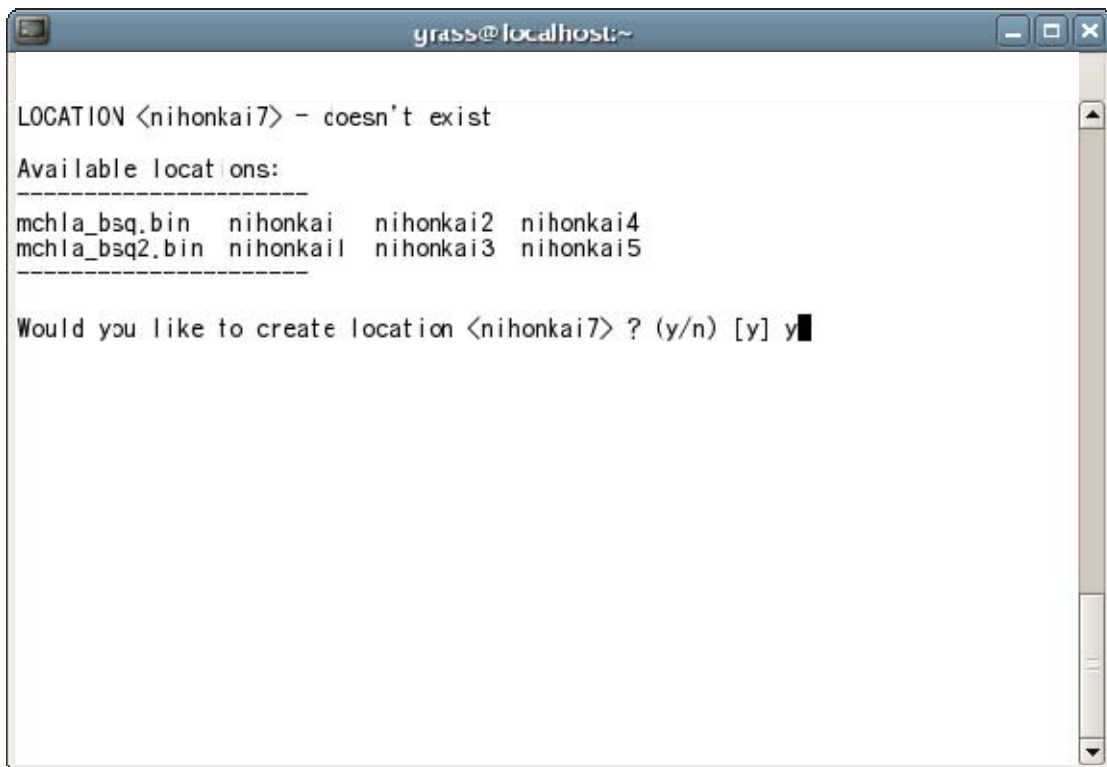


Fig. 3-4 GRASS initial setting Window (1)

Next, the window, as shown in Fig. 3-5, is displayed. Enter "y" here.

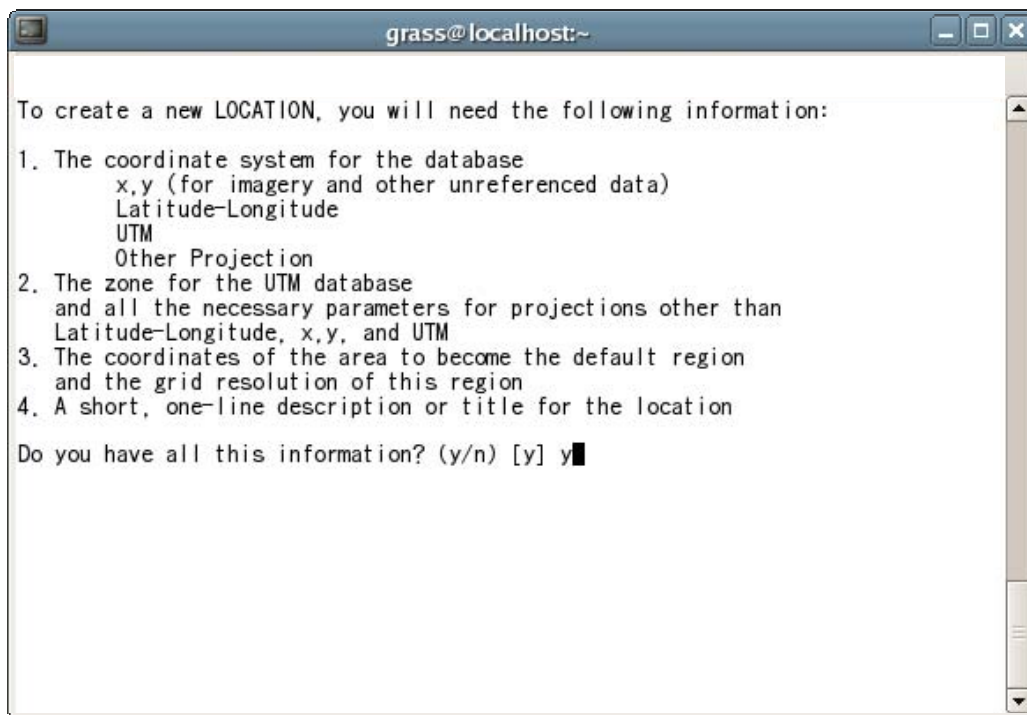


Fig.3-5 GRASS initial setting Window (2)

Screen showing the 4 Projection selection options. Enter "A" here.

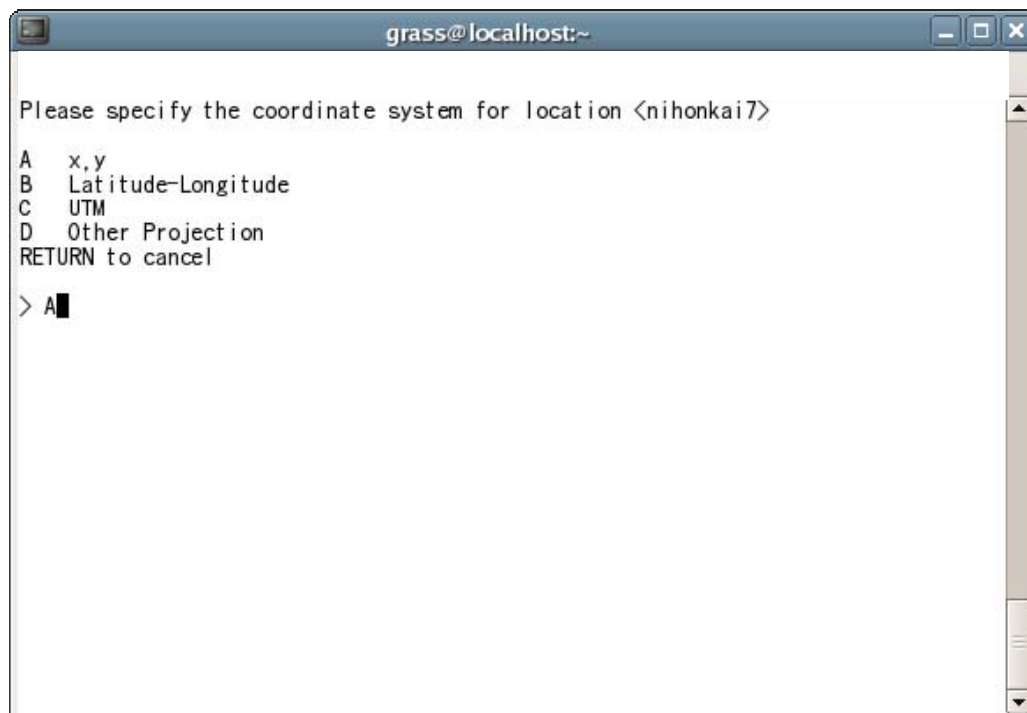


Fig.3-6 GRASS initial setting Window (3)

Should the "x, y coordinate system be specified? (y/n)." Enter "y" here.

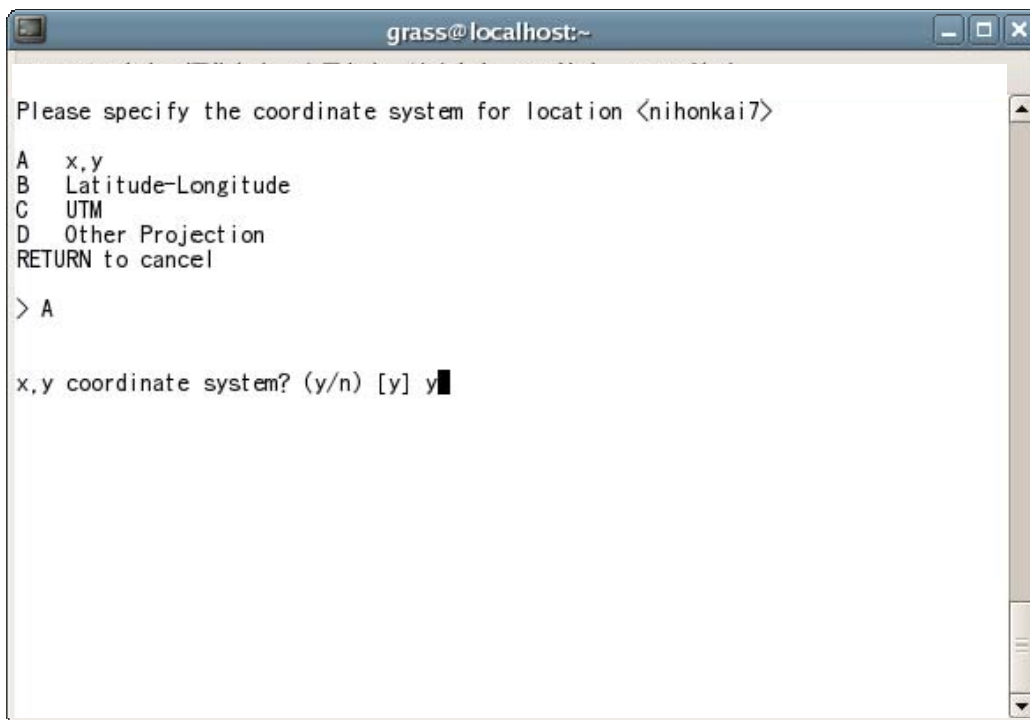


Fig.3-7 GRASS initial setting Window (4)

Next, Enter the name of the target location (e.g., toyama).

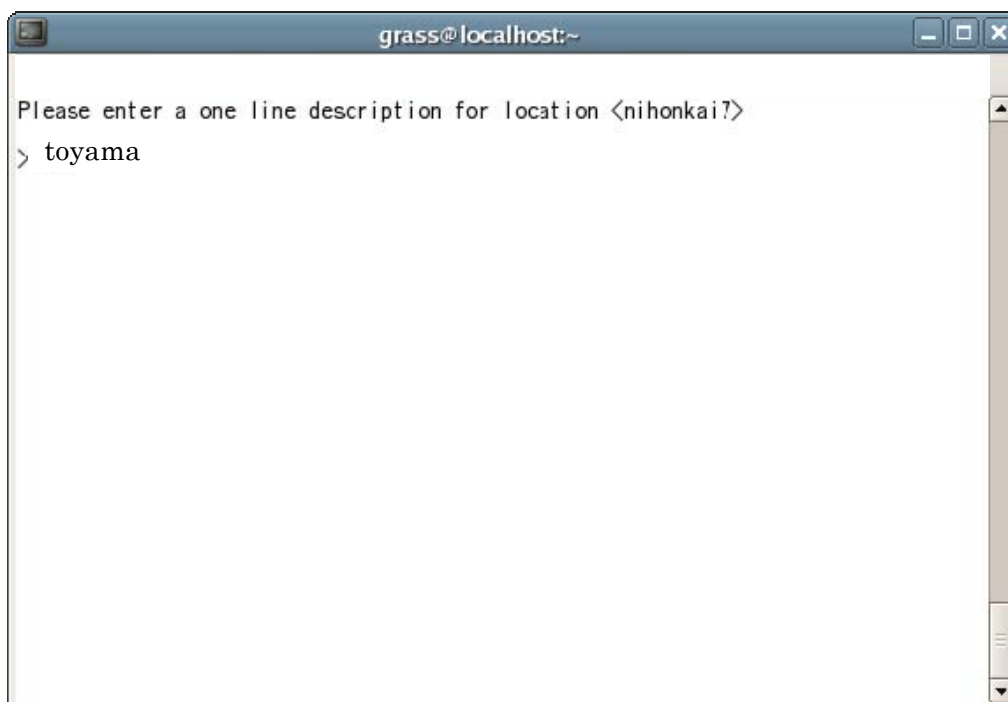


Fig.3-8 GRASS initial setting Window (5)

Confirm the location's name and Enter "y."



```
grass@localhost:~  
Please enter a one line description for location <nihonkai7>  
> toyama  
=====  
toyama  
=====  
ok? (y/r) [y] y
```

Fig.3-9 GRASS initial setting Window (6)

For north, south, east, and west entry information, refer to the 4 corner's data, as shown below, contained in a Word file, which is included as part of the downloaded data. (The name of the data file (Word format) is "20050708013300_mchla_chla.doc")

```
upper_left_lat : 49.1035
upper_left_lon : 116.0504
upper_right_lat : 49.1035
upper_right_lon : 148.9496
lower_left_lat : 20.8965
lower_left_lon : 116.0504
lower_right_lat : 20.8965
lower_right_lon : 148.9496
```

Enter a size of 1 pixel for "GRID RESOLUTION." If you use this data, the calculation will be performed as follows:

East-West : $(148.9496 - 116.0504) / 3000 \neq 0.0109664$

North-South: $(49.1035 - 20.8965) / 3140 \neq 0.00898312$

After Entry, Hit [Esc][Enter] to continue.

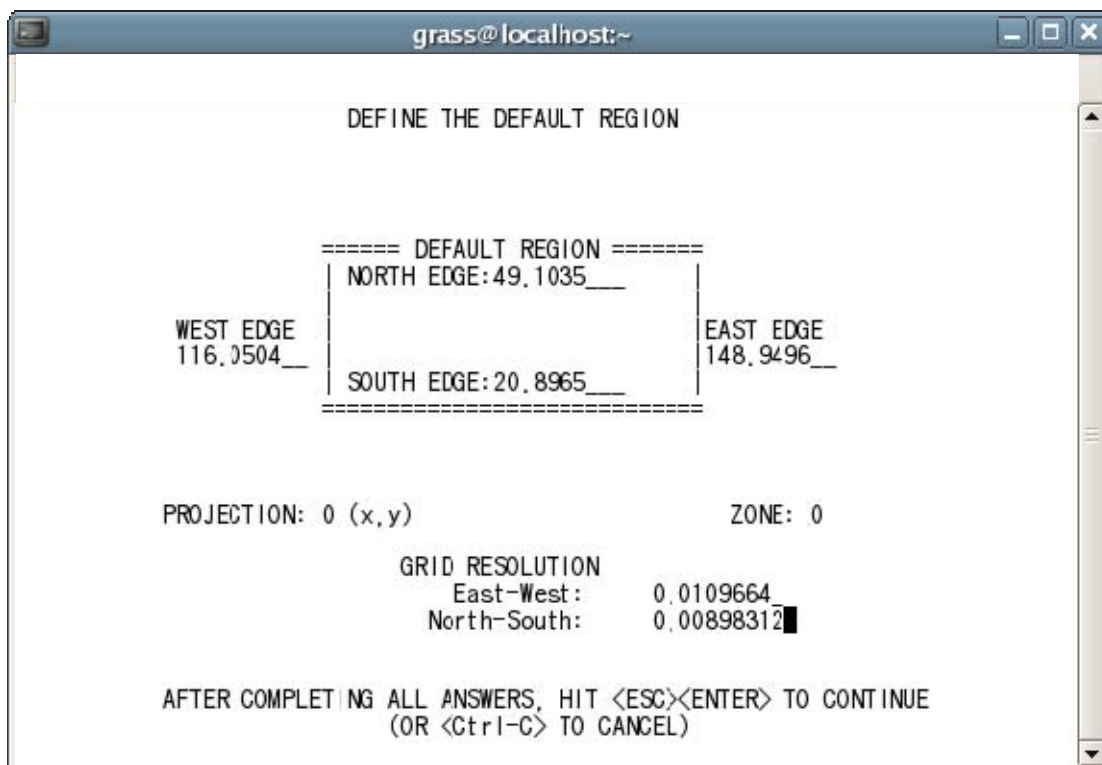
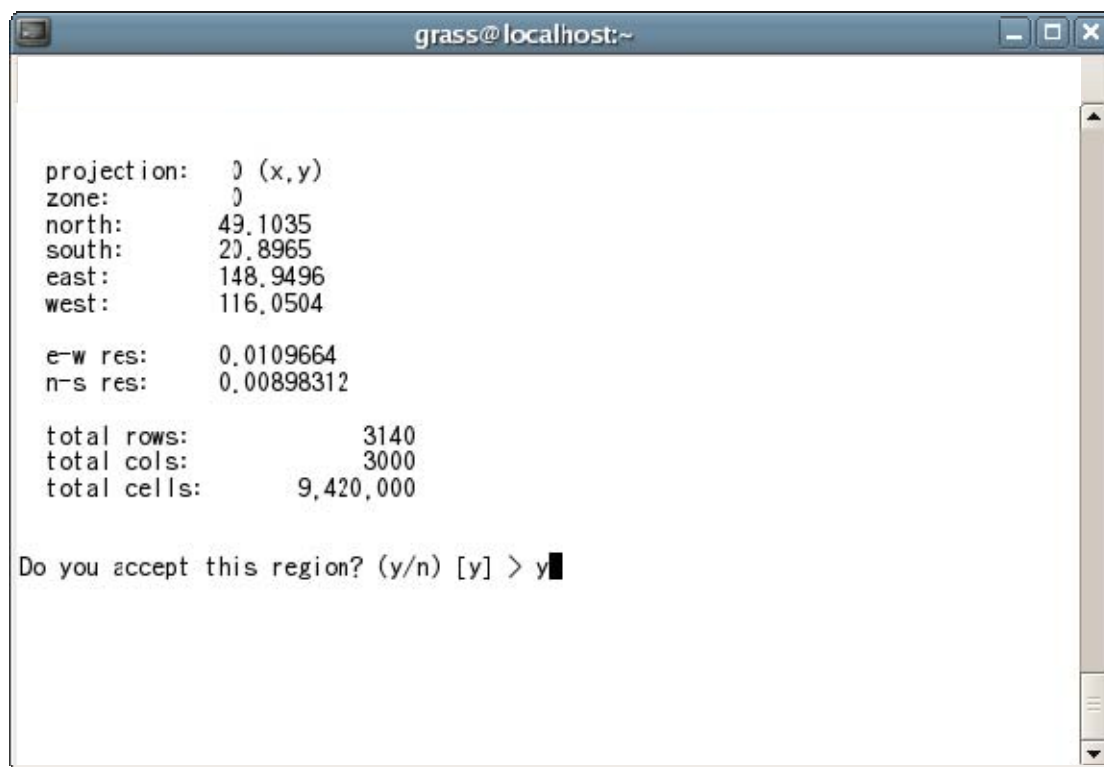


Fig.3-10 GRASS initial setting Window (7)

A confirmation window will be displayed, as shown in Fig.3-11.

If all the values are correct, Enter "y" .



```
grass@localhost:~  
  
projection:  () (x,y)  
zone:      ()  
north:    49.1035  
south:    20.8965  
east:     148.9496  
west:     116.0504  
  
e-w res:  0.0109664  
n-s res:  0.00898312  
  
total rows:      3140  
total cols:      3000  
total cells:    9,420,000  
  
Do you accept this region? (y/n) [y] > y
```

Fig.3-11 GRASS initial setting Window (8)

(3) Data display

As shown in Fig.3-12, data is read by the command below.

```
> r.in.bin input=/home/grass/database/mchla_bsq.bin output=mchla_grass.dat
```

(↑ Input file name)

(↑ GRASS file name)

```
bytes=1 north=49.1035 south=20.8965 west=116.0504 east=148.9496
```

(↑ number of bytes) (↑ Target Location's Lat. & Long. for north, south, east and west)

```
r=3140 c=3000 null=0 -b
```

(↑ number of lines)

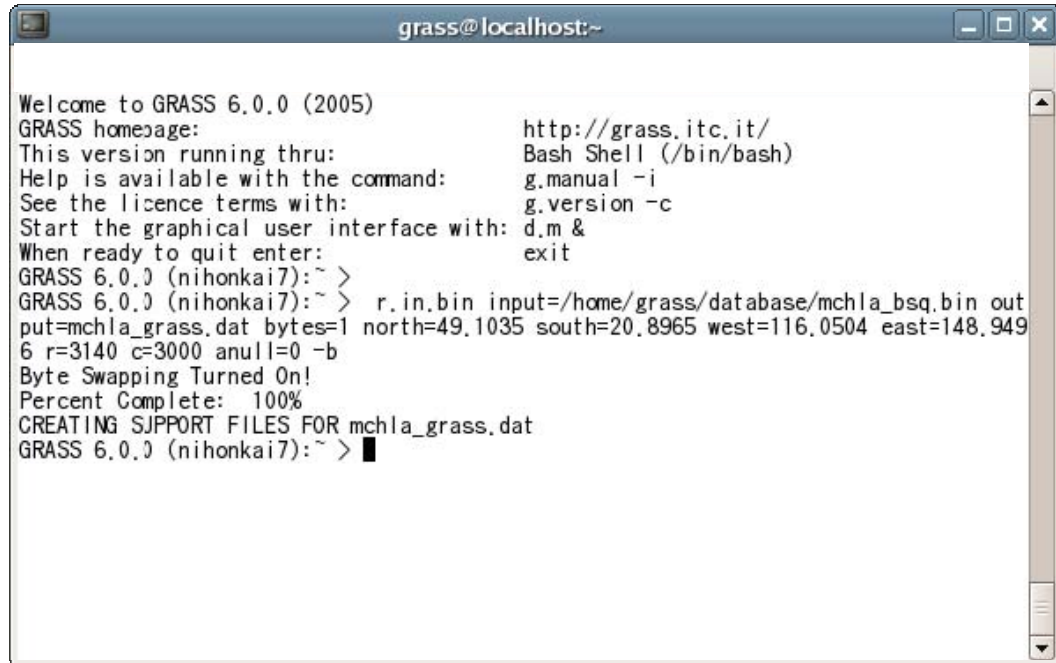
(↑ number of columns)



```
grass@localhost:~  
Welcome to GRASS 6.0.0 (2005)  
GRASS homepage: http://grass.itc.it/  
This version running thru: Bash Shell (/bin/bash)  
Help is available with the command: g.manual -i  
See the license terms with: g.version -c  
Start the graphical user interface with: d.m &  
When ready to quit enter: exit  
GRASS 6.0.0 (nihonkai7):~ >  
GRASS 6.0.0 (nihonkai7):~ > r.in.bin input=/home/grass/database/mchla_bsq.bin out  
put=mchla_grass.dat bytes=1 north=49.1035 south=20.8965 west=116.0504 east=148.949  
6 r=3140 c=3000 anull=0 -b
```

Fig.3-12 Data reading (1)

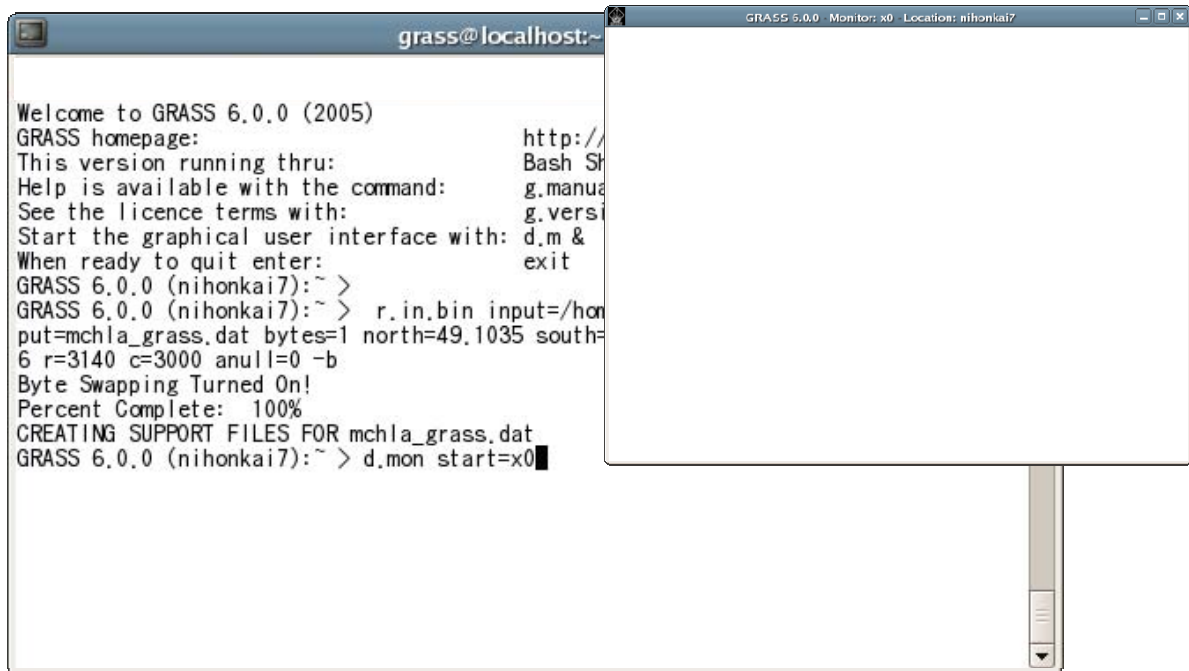
After data reading is complete, the message “CREATING SUPPORT FILE FOR mchla_grass.dat”, will appear in the window, as shown in Fig.3-13



```
grass@localhost:~  
  
Welcome to GRASS 6.0.0 (2005)  
GRASS homepage:                http://grass.itc.it/  
This version running thru:      Bash Shell (/bin/bash)  
Help is available with the command: g.manual -i  
See the licence terms with:     g.version -c  
Start the graphical user interface with: d.m &  
When ready to quit enter:       exit  
GRASS 6.0.0 (nihonkai7):~ >  
GRASS 6.0.0 (nihonkai7):~ > r.in.bin input=/home/grass/database/mchla_bsq.bin out  
put=mchla_grass.dat bytes=1 north=49.1035 south=20.8965 west=116.0504 east=148.949  
6 r=3140 c=3000 anull=0 -b  
Byte Swapping Turned On!  
Percent Complete: 100%  
CREATING SUPPORT FILES FOR mchla_grass.dat  
GRASS 6.0.0 (nihonkai7):~ > █
```

Fig.3-13 Reading data (2)

Enter the command: d.mon start=x0. Another window will open on the right side.



```
grass@localhost:~  
  
Welcome to GRASS 6.0.0 (2005)  
GRASS homepage:                http://  
This version running thru:      Bash S  
Help is available with the command: g.manua  
See the licence terms with:     g.versi  
Start the graphical user interface with: d.m &  
When ready to quit enter:       exit  
GRASS 6.0.0 (nihonkai7):~ >  
GRASS 6.0.0 (nihonkai7):~ > r.in.bin input=/hom  
put=mchla_grass.dat bytes=1 north=49.1035 south=  
6 r=3140 c=3000 anull=0 -b  
Byte Swapping Turned On!  
Percent Complete: 100%  
CREATING SUPPORT FILES FOR mchla_grass.dat  
GRASS 6.0.0 (nihonkai7):~ > d.mon start=x0 █
```

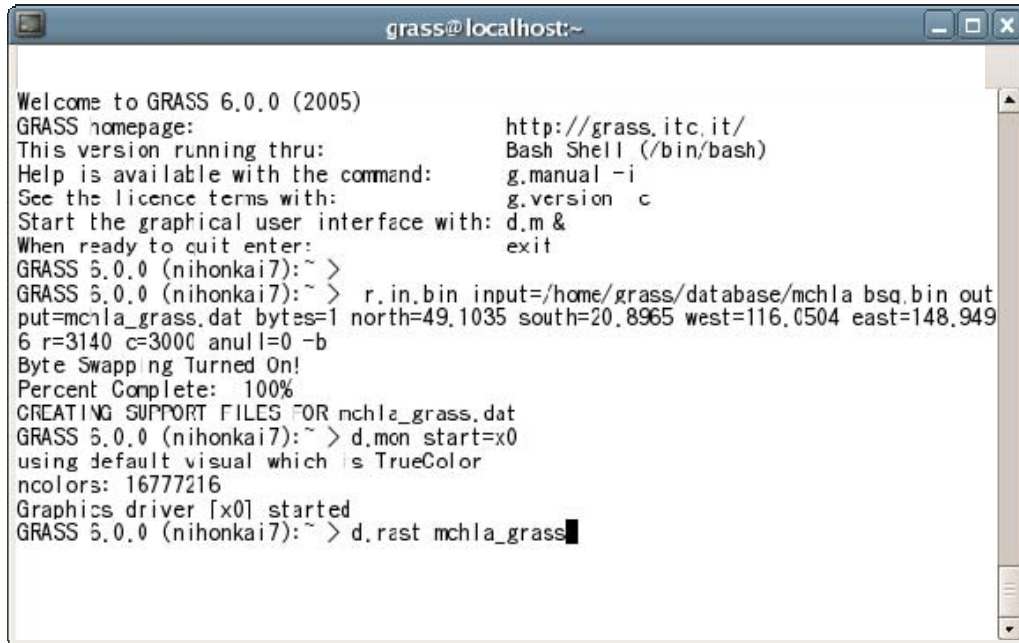
GRASS 6.0.0 Monitor: x0 Location: nihonkai7

Fig.3-14 Startup Display Window

Enter the following command, as shown in Fig.3-15, to display the readings.

> d.rast mchla_grass.dat

(↑GRASS file loaded)



```
grass@localhost:~  
Welcome to GRASS 6.0.0 (2005)  
GRASS homepage: http://grass.itc.it/  
This version running thru: Bash Shell (/bin/bash)  
Help is available with the command: g.manual -i  
See the licence terms with: g.version c  
Start the graphical user interface with: d.m &  
When ready to quit enter: exit  
GRASS 6.0.0 (nihonkai7):~ >  
GRASS 6.0.0 (nihonkai7):~ > r.in.bin input=/home/grass/database/mchla bsq.bin out  
put=mchla_grass.dat bytes=1 north=49.1035 south=20.8965 west=116.0504 east=148.949  
6 r=3140 c=3000 anull=0 -b  
Byte Swapping Turned On!  
Percent Complete: 100%  
CREATING SUPPORT FILES FOR mchla_grass.dat  
GRASS 6.0.0 (nihonkai7):~ > d.mon start=x0  
using default visual which is TrueColor  
ncolors: 16777216  
Graphics driver [x0] started  
GRASS 6.0.0 (nihonkai7):~ > d.rast mchla_grass
```

Fig.3-15 Image Data Display (1)

Fig.3-16 shows the image Data Display.

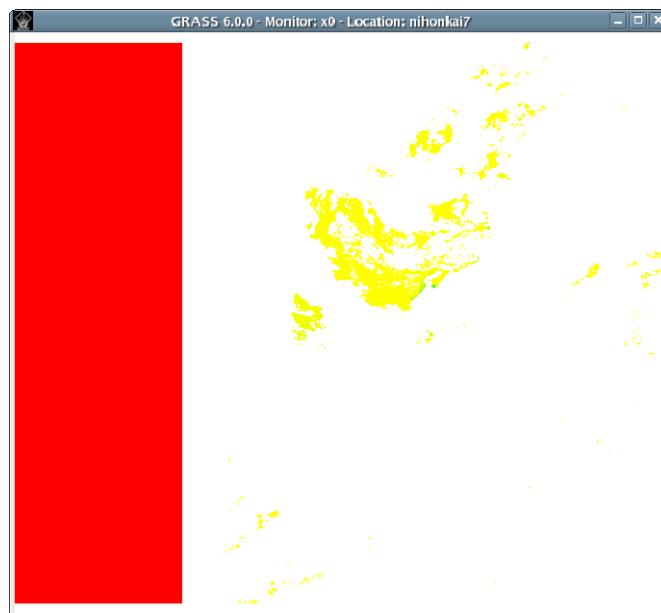


Fig.3-16 Image Data Display (2)

To change the Image's color type, use the command below.

You can select the color types from the list and enter them in the "***" field.
Refer to Fig. 3-18 for the color table.

```
> r.colors map= muhla_grass.dat color= * * *
```

(↑GRASS file loaded)

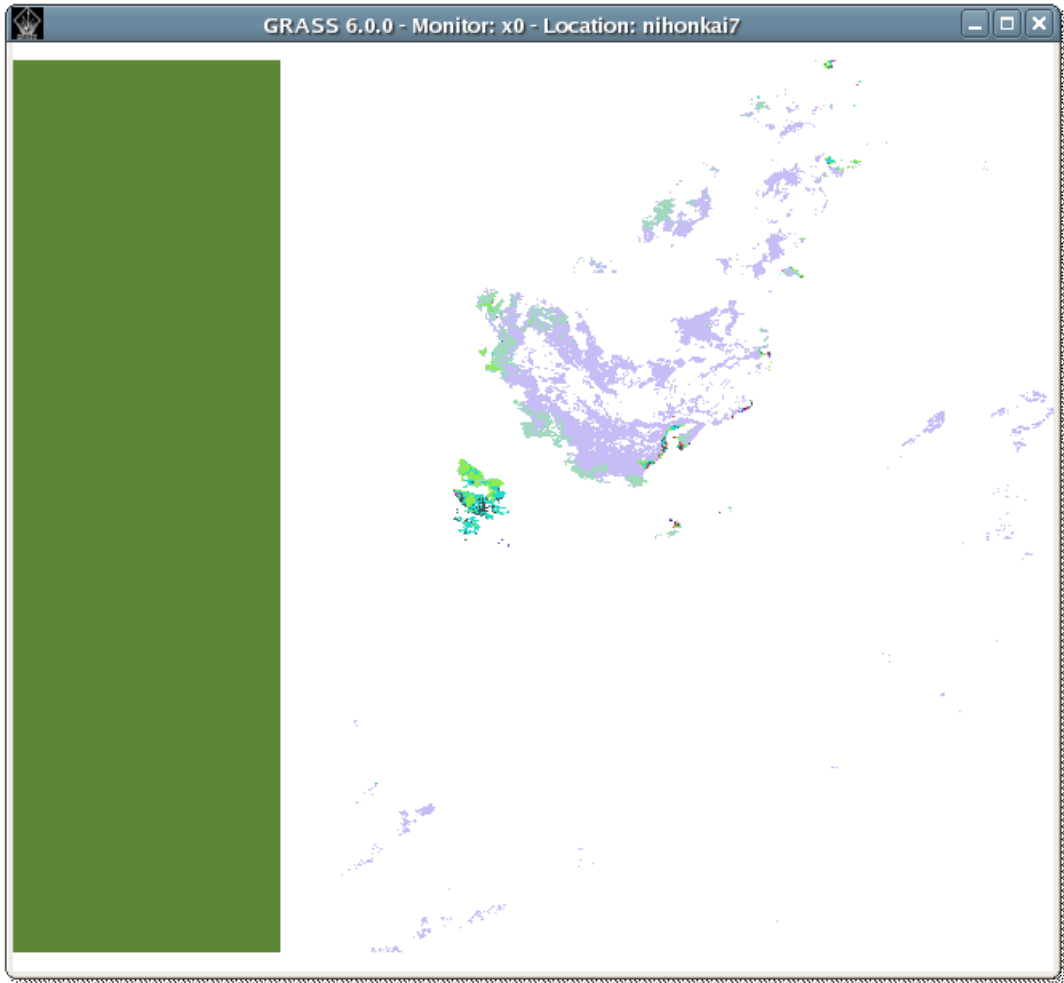


Fig.3-17 Image Data Display (3)

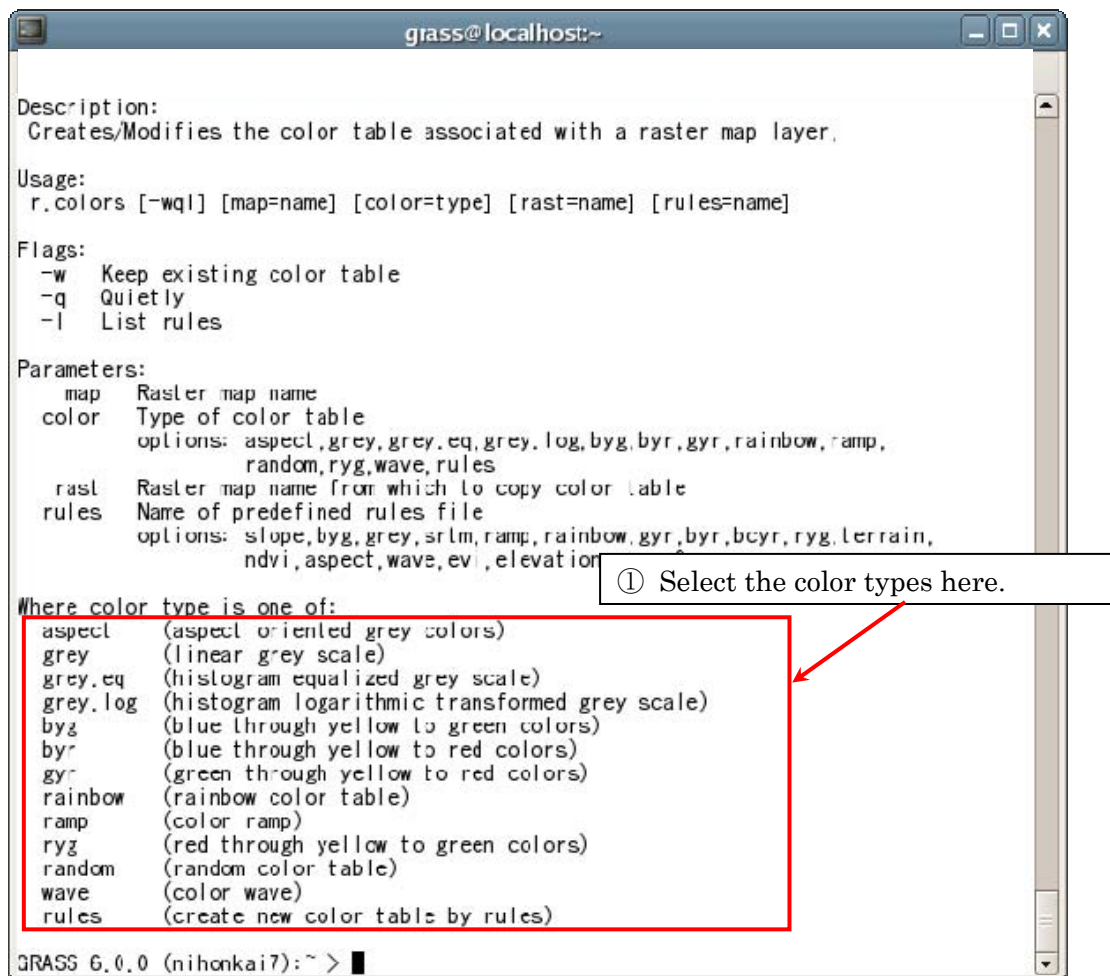


Fig.3-18 List of color types

In addition, if “rules” are selected, a new color table can be generated. For example, “0” can be specified for blue, “2” for cyan, “4” for green, “6” for yellow, “8” for orange, “10” for red, in a format, as shown in Figure 3-19. Figure 3-20 shows the image using the new color table.

```
grass@localhost:~  
ファイル(E) 編集(E) 表示(V) 端末(I) タブ(T) ヘルプ(H)  
GRASS 6.0.0 (nihonkai7):~ > r.colors map=mchla_grass.dat color=rules  
Enter rules, "end" when done, "help" if you need it.  
Data range is 1 to 255  
> help  
Enter a rule in one of these formats:  
val color  
r% color  
nv color  
default color  
color can be one of:  
white black red green blue yellow magenta cyan aqua grey gray orange brown  
purple violet indigo  
or an R:G:B triplet, e.g.: 0:127:255  
> 0 blue  
> 2 cyan  
> 4 green  
> 6 yellow  
> 8 orange  
> 10 red  
> end  
WARNING: Your color rules do not cover the whole range of data!  
Color table for [mchla_grass.dat] set to rules  
GRASS 6.0.0 (nihonkai7):~ > d.rast mchla_grass.dat  
100%  
GRASS 6.0.0 (nihonkai7):~ > █
```

Fig 3-19 User defined new color table

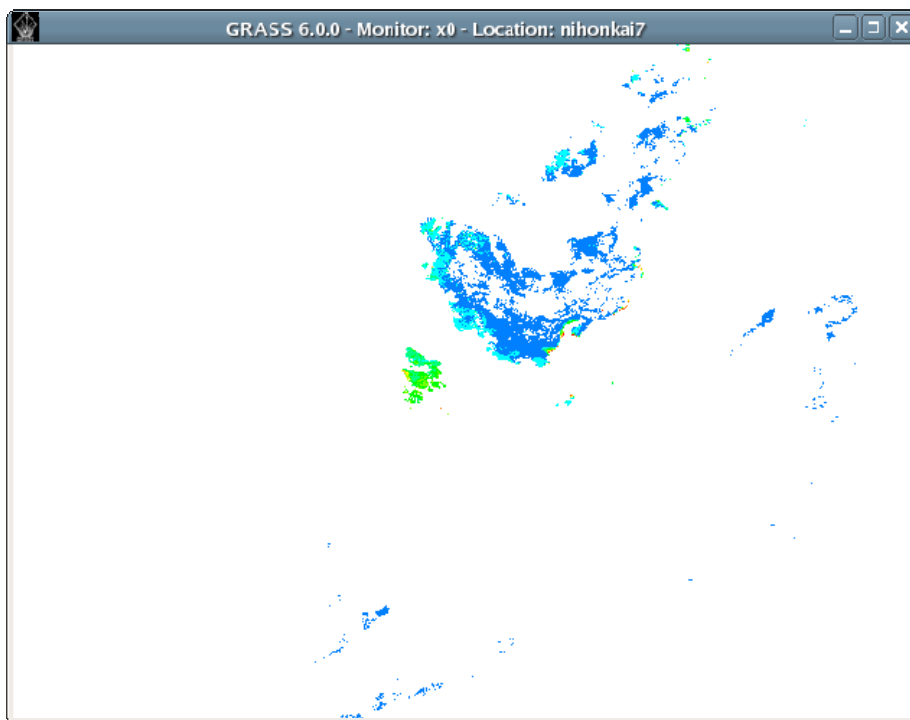


Fig 3-20 Image displayed using the new color table

(4) Physical Quantity Display

To display the physical quantity, use the following command, as shown below.

```
d.what.rast mchla_grass.dat
```

(↑GRASS file containing the data)

Move the cursor on the screen and left-click on the pixel you wish to confirm.

The longitude, latitude and physical quantity will be displayed, as shown in Fig.3-21.

Right-click to close the window.

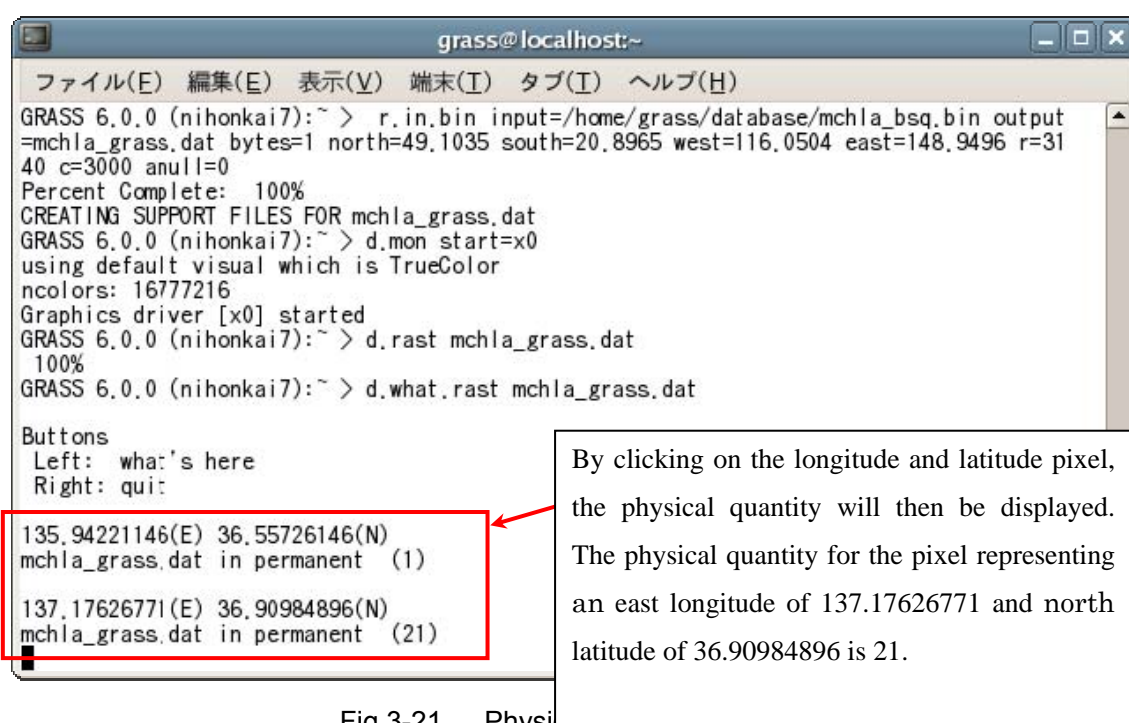


Fig.3-21 Physical Quantity Display

To calculate the physical quantity from the BSQ file, multiply the count value by 0.125.(Please refer to the description of the temp step value of 0.125 in the meta data file. The physical quantity can be calculated by multiplying the temp step value by other data format's count value).

The above unit is described in the meta data file.