

**PCA-5017**

**INTRODUÇÃO AOS SISTEMAS DE INFORMAÇÃO  
GEOGRÁFICA EM SOFTWARE LIVRE**

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**GRASS**

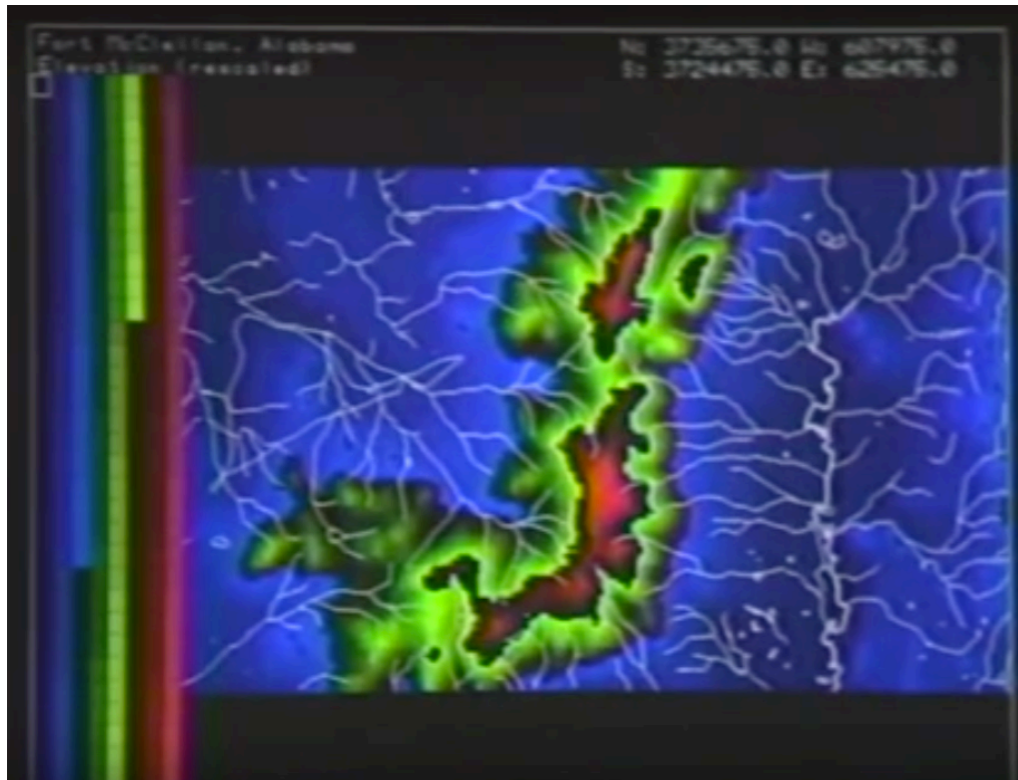
# GRASS – HISTÓRICO

- ▶ Geographic Resources Analysis Support System
- ▶ 1982 Fort Hood Information System (FHIS) (Vax11/780)
- ▶ 1983 Installation Geographic Information System (IGIS) (SUN-1)
- ▶ 1984 GRASS (SUN-1 and Masscomp)
- ▶ 1985 GRASS 1.0
- ▶ 1987 GRASS 2.0
- ▶ 1988 GRASS 3.0
- ▶ 1991 GRASS 4.0
- ▶ 1997 GRASS 4.2 Baylor University
- ▶ 1998 GRASS 4.2.1 Markus Neteler, University of Hannover, Germany
- ▶ 1999 GRASS 5.0 Baylor University and Markus Neteler

# GRASS – HISTÓRICO

- ▶ 2001 The GRASS Development Team
- ▶ 2002 GRASS 5.0 stable
- ▶ 2004 GRASS 5.4.0
- ▶ 2005 GRASS 6.0
- ▶ 2006 GRASS 6.1
- ▶ 2006/7 GRASS 6.2
- ▶ 2007/8 GRASS 6.3
- ▶ 2008 GRASS 6.4 (+ WinGRASS)
- ▶ 2012 GRASS 6.4.2
- ▶ GRASS 6.5 - bugfix + testing
- ▶ GRASS 7.0 - new stuff

# GRASS - HISTÓRICO - VERSÃO 2.0



```

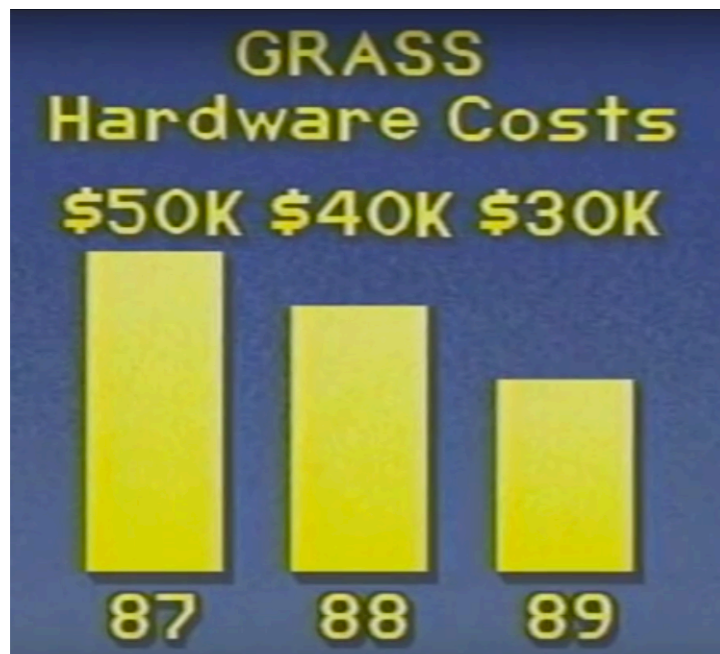
PLEASE SET GIS SESSION INFORMATION

LOCATION: This is the name of an available geographic location. -spearfish-
is the sample data base for which all tutorials are written.

MAPSET: Every GIS session runs under the name of a MAPSET. Associated
with each MAPSET is a rectangular COORDINATE WINDOW and a list
of any new maps created.

The WINDOW defaults to the entire area of the chosen LOCATION.
You may change it later with the command: window
-----
LOCATION:..... hood.....
MAPSET:..... Johnson.....

AFTER COMPLETING ALL ANSWERS, HIT (ESC) TO CONTINUE
(OB INTERRUPT TO CANCEL)
    
```



# GRASS - HISTÓRICO - VERSÃO 4.3

The screenshot displays the GRASS 4.3 desktop environment. On the left, a terminal window titled 'Konsole - Konsole' shows the following text:

```
Enter the name of an existing vect file
Enter 'list' for a list of existing vect files
Hit RETURN to cancel request
> list
<list>
-----
vect files available in mapset PERMANENT:
Fields      t.9961.100      t.9961.300.bks  t.hydr
quads       t.9961.100.all  t.9961.400      t.powe
railroads   t.9961.100.bks  t.9961.400.all  t.rail
roads       t.9961.200      t.9961.400.bks  t.road
struct.areas t.9961.200.all  t.9961.500      t.road
sections    t.9961.200.bks  t.9961.500.all  t.road
soils       t.9961.300      t.9961.500.bks  t.road
streams     t.9961.300.all  t.county        t.trac
-----
Enter the name of an existing vect file
Enter 'list' for a list of existing vect files
Hit RETURN to cancel request
> █
```

On the right, a window titled 'GRASS 4.3 - Monitor: x0' displays a map of Spearfish, SD. The map is overlaid with a grid and shows various geological features. The legend on the left side of the monitor window lists the following categories:

- metamorphic transition
- igneous
- sediments
- limestones
- shale
- sandy shale
- clay sand
- sand

The monitor window also displays the following information:

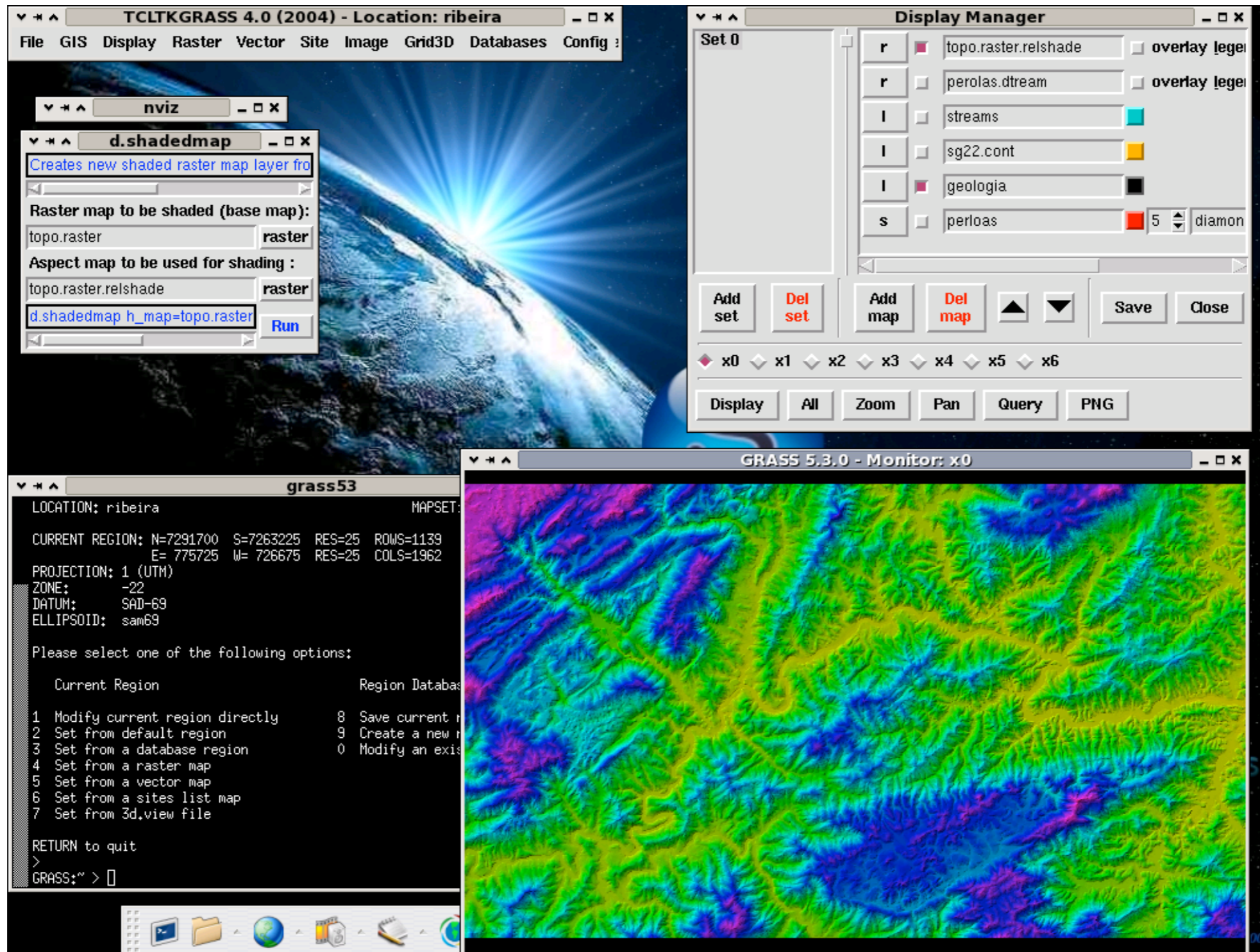
Spearfish, SD

REGION  
S: 4914000 N: 80000  
E: 4928000 E: 809000

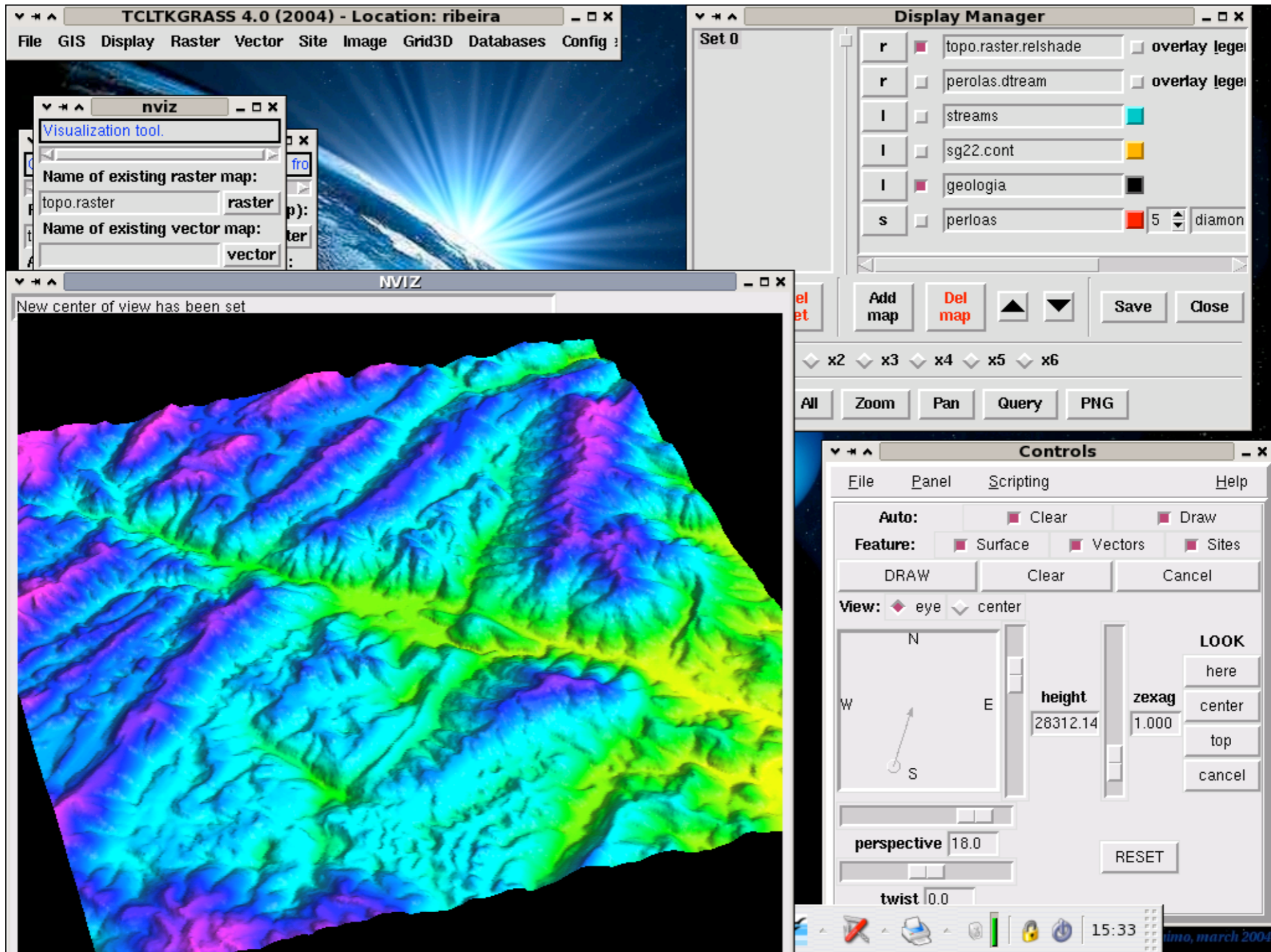
CELL-SIZE  
row col 20 20

At the bottom left of the monitor window, the GRASS logo is visible.

# GRASS - HISTÓRICO - VERSÃO 5.3



# GRASS - HISTÓRICO - VERSÃO 5.3



# GRASS - HISTÓRICO - VERSÃO 6.2

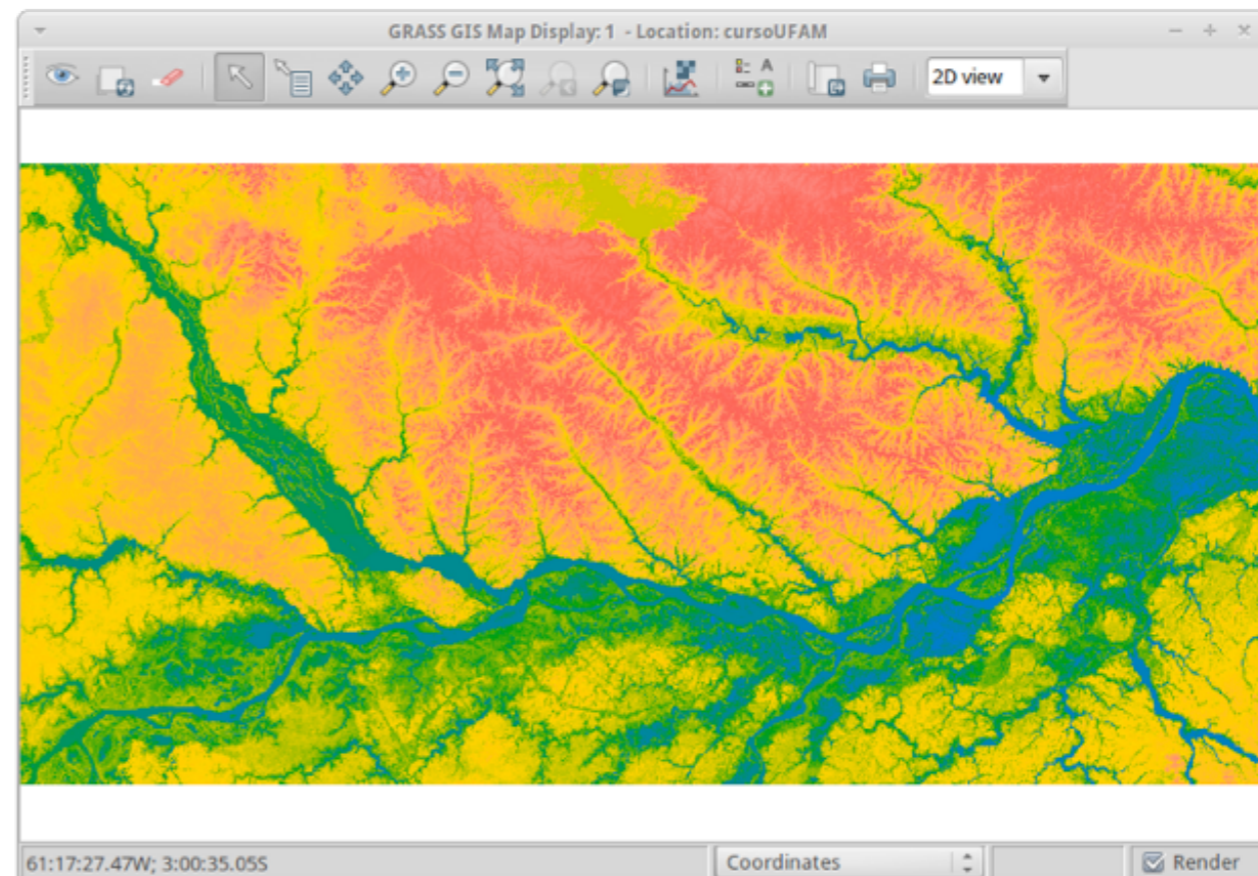
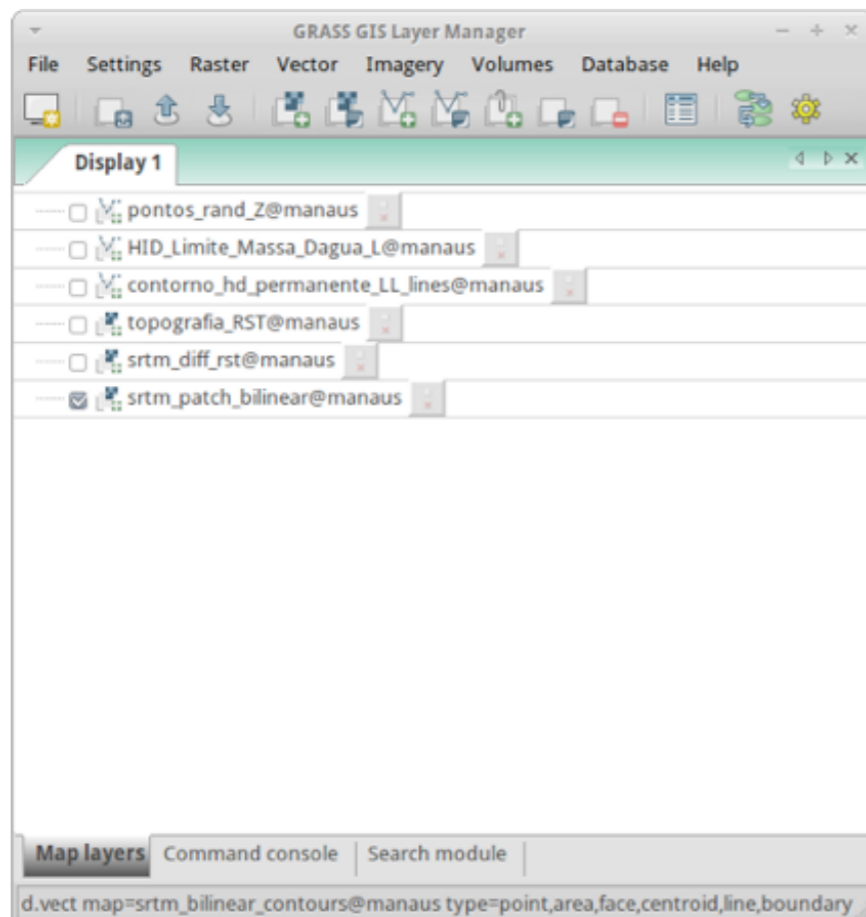
The image displays the GRASS GIS 6.2 interface, which is a graphical user interface for geographic information system (GIS) processing. The interface is divided into several windows:

- GRASS6.3.svn GIS Manager - podecarda tf\_lampiao**: This window shows the main menu (File, Config, Raster, Vector, Imagery, Volumes, Databases, Help) and a toolbar with various icons for map management. Below the toolbar, there is a section titled "Map Layers for Display 1" with a list of layers, including "topo\_fp@tf\_lampiao". A "values to display" field and a "drape map" field are also visible, along with a "drape map brightness adjustment" slider.
- Map Display 1**: This window displays a 3D topographic map of a terrain, showing elevation and color shading. The map is rendered in a perspective view, with a color scale ranging from blue (low elevation) to red (high elevation).
- grass63**: This is a terminal window showing the GRASS 6.3.svn (2008) logo and a welcome message. It provides information about the GRASS homepage (<http://grass.osgeo.org/>), the current shell (Bash Shell), and various commands for help and configuration. The terminal prompt is "GRASS 6.3.svn (podecarda):>".
- Output - GIS.m**: This window shows the command line for the "g.pnmcomp" process, which is used for color relief map generation. The command is: `g.pnmcomp in=7442.2.ppm mask=7442.2.pgm opacity=1.0 background=255:255:255 width=521 height=459 output=7442.1.ppm`. The window includes "Save" and "Clear" buttons, and a "Run" section with buttons for "Run", "Run (background)", "Run (GUI)", and "Run (in Xterm)".

The system tray at the bottom of the screen shows the date and time: "Sunday, February 10 - 18:49".



# GRASS - HISTÓRICO - VERSÃO 6.4 + 7.0



The screenshot shows the GRASS GIS terminal window. The title bar reads "Terminal". The terminal displays the GRASS GIS logo and the following text:

```
Welcome to GRASS 6.4.1 (2011)
GRASS homepage:          http://grass.osgeo.org/
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
If required, restart the GUI with: g.gui wxpython
When ready to quit enter: exit

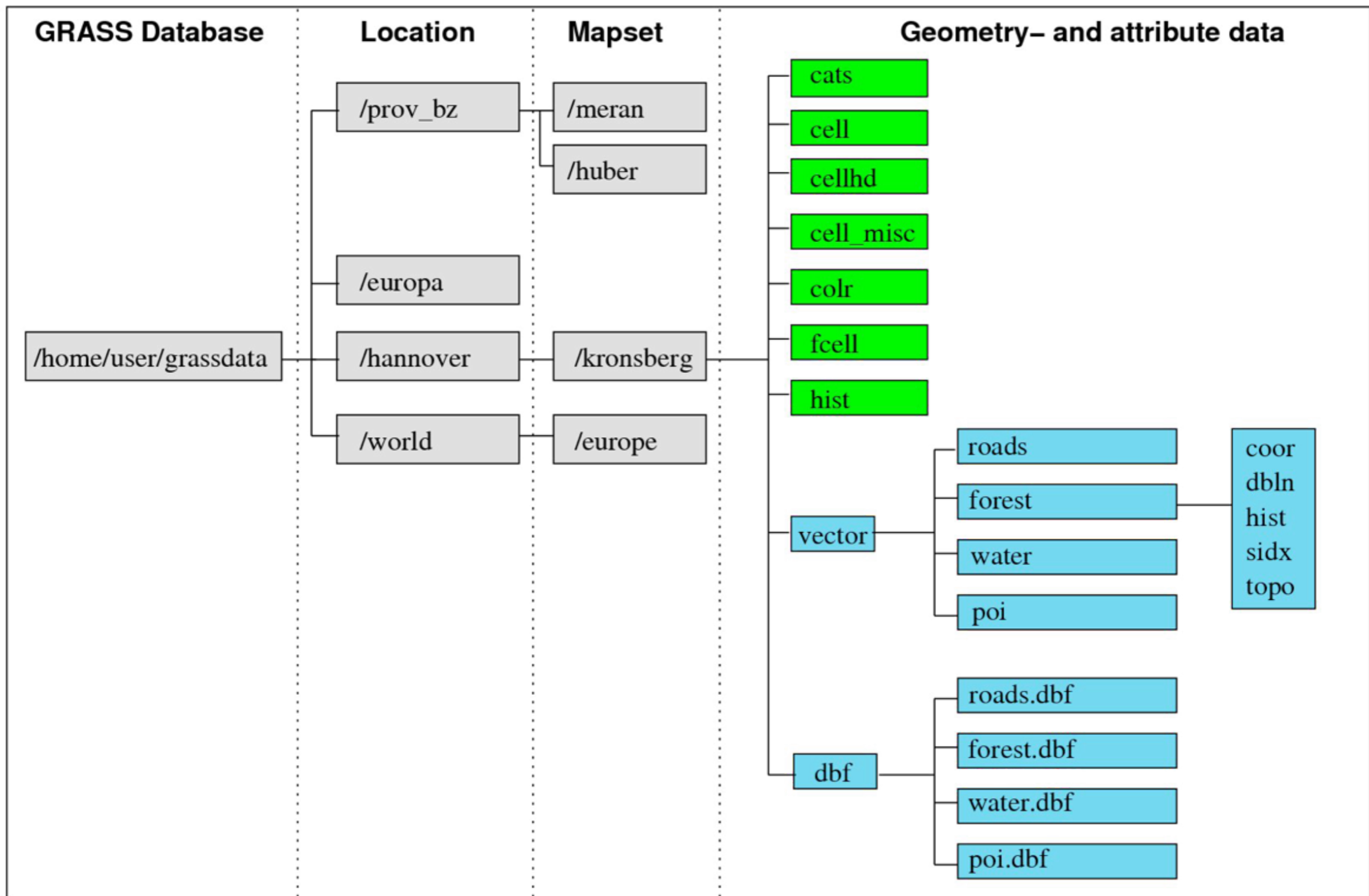
To run a command as administrator (user "root"), use "sudo <command>".
See "man sudo_root" for details.

GRASS 6.4.1 (cursoUFAM):- >
```

# ORGANIZAÇÃO DOS PROJETOS

- ▶ Hierarquia baseada em **Locations** e **mapsets**
- ▶ A **Location** compreende toda a área de trabalho (p.ex., **America\_do\_Sul**)
- ▶ O **mapset** é a porção ativa e utilizada para análise, que pode ser do mesmo tamanho ou menor que a location (p.ex., **Sao\_Paulo**, **area\_mestrado**, etc)
- ▶ Vários mapsets podem ser definidos para a mesma location.
- ▶ Dados de interesse comum (tais como modelos de relevo, imagens de satélite etc) podem ser armazenados em um mapset especial ao qual todos os usuários têm acesso, chamado de PERMANENT, que é criado automaticamente ao se criar uma nova Location

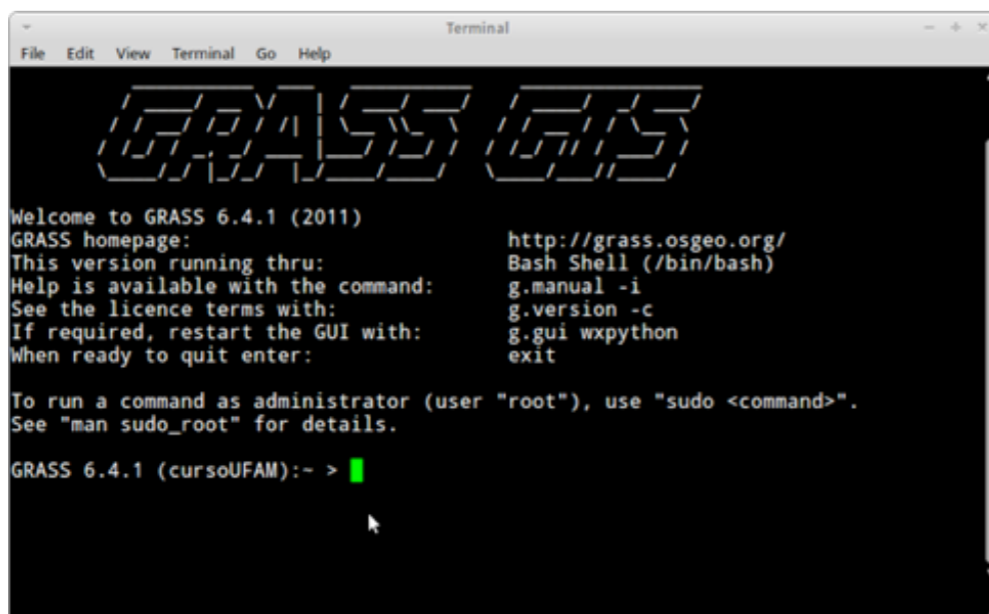
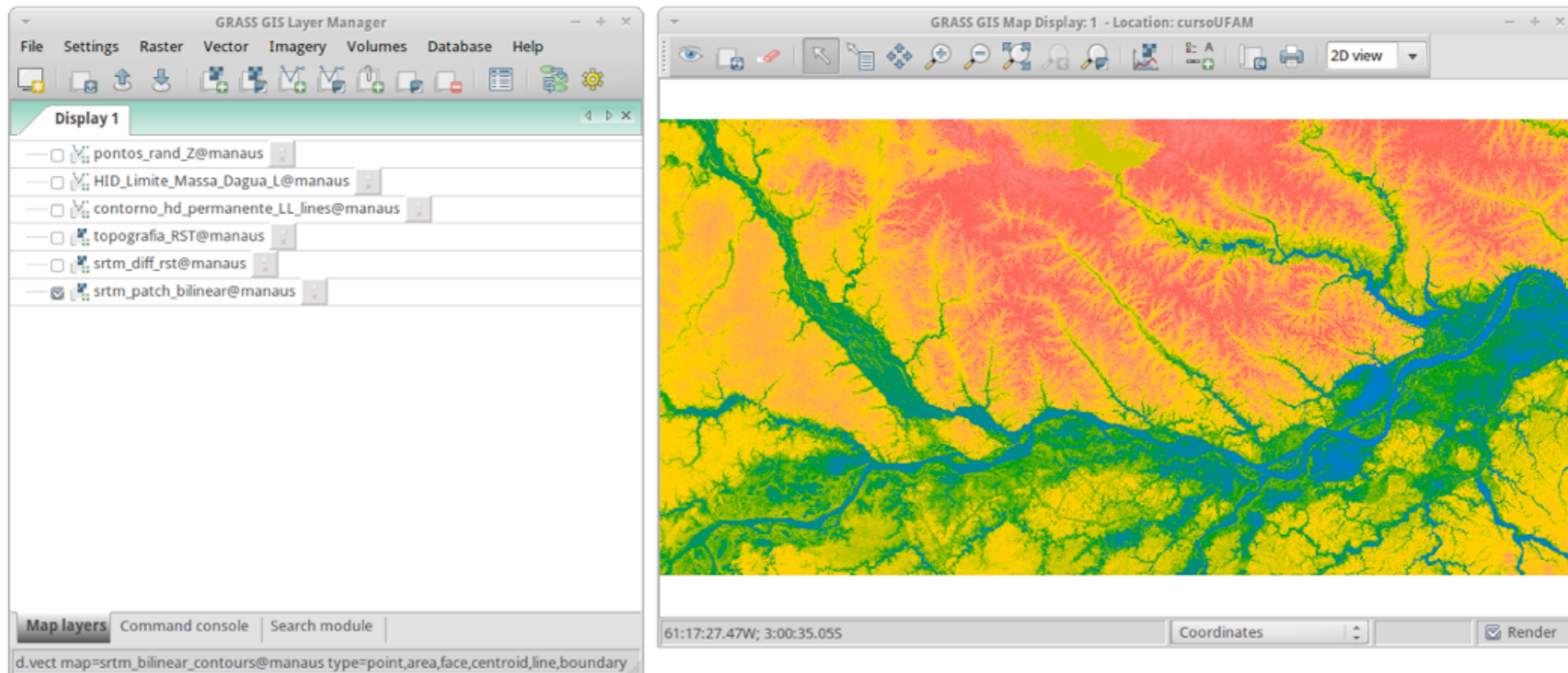
# ORGANIZAÇÃO DOS PROJETOS



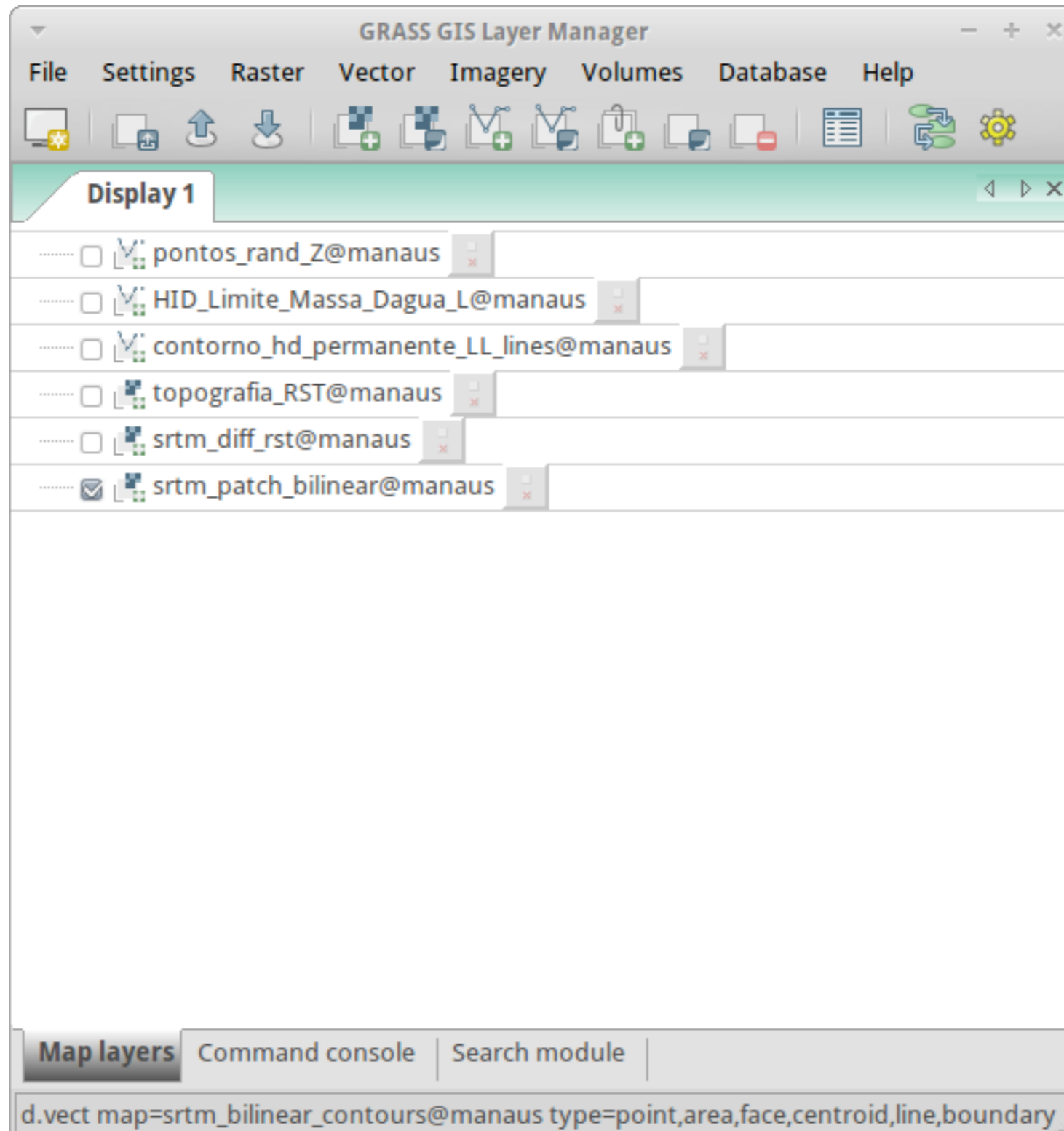
## REGION

- ▶ Um conceito importante dentro do GRASS é o de **region**, que define, dentro do mapset, a área de interesse e a resolução espacial dos mapas raster. Tanto a resolução espacial quanto as coordenadas do retângulo envolvente da region podem ser facilmente alteradas sem a necessidade de reinicialização do sistema ou a criação de novos projetos; é possível salvar as configurações da region para acessá-la facilmente quando necessário.
- ▶ É preciso frisar que todas as análises envolvendo mapas raster (análise de terreno, álgebra de mapas, interpolação de superfícies etc) são efetuadas de acordo com as configurações da region ativa, e que esta não necessariamente corresponde com as configurações do Display.

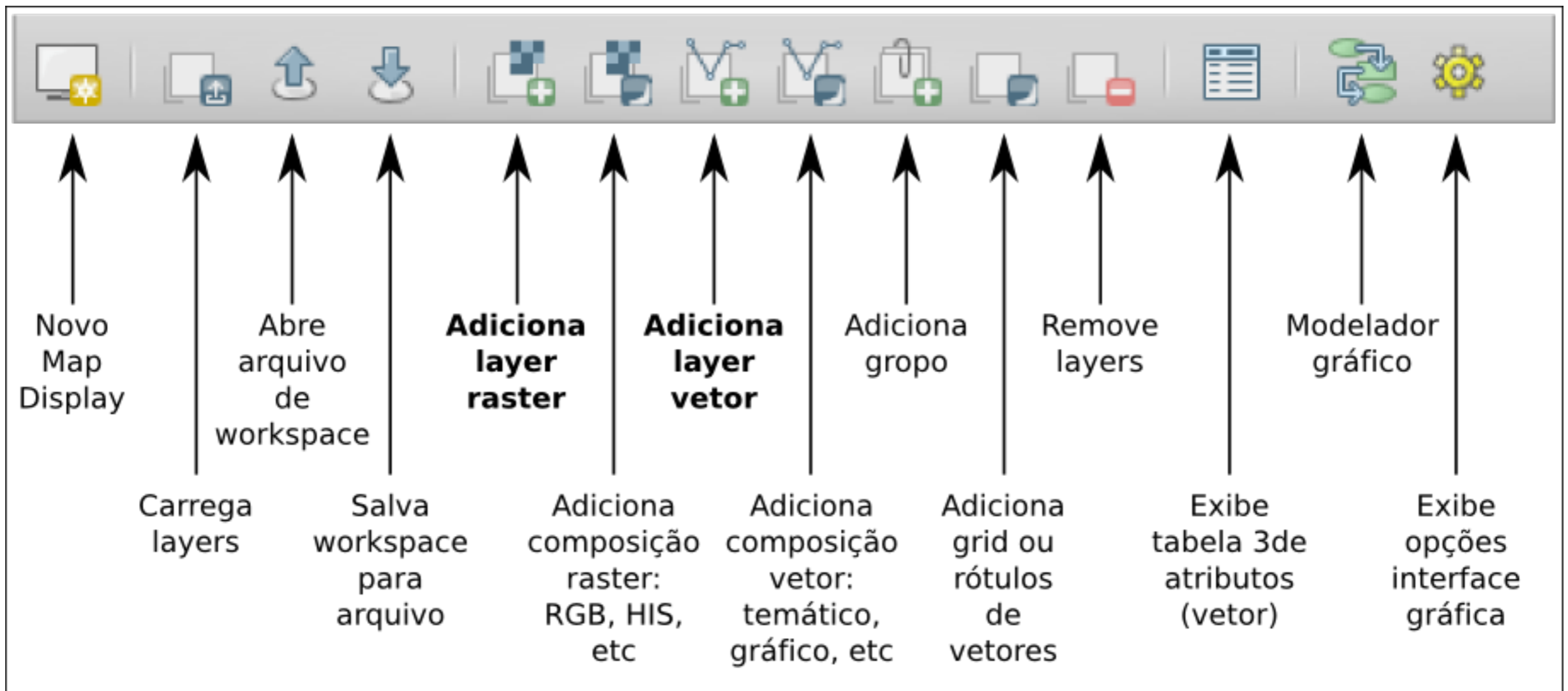
# INTERFACE GRÁFICA



# LAYER MANAGER



# FERRAMENTAS GISM



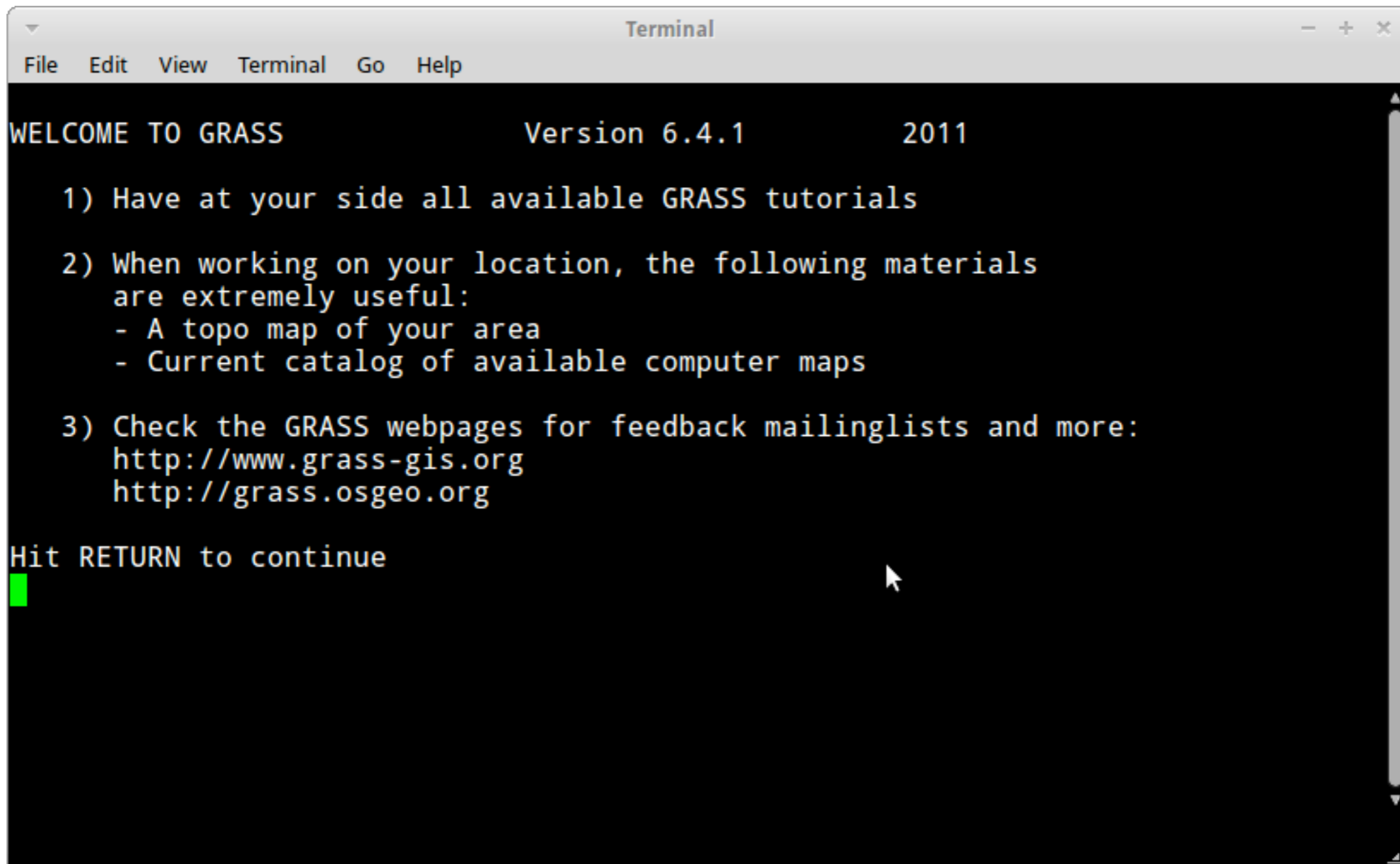
# FERRAMENTAS MAPDISPLAY

The image shows a software toolbar with 17 icons. Below each icon is a label in Portuguese, and below that is a label in English. Arrows point from the English labels up to the icons.

Portuguese Label	English Label
Desenha layers ativos	Redesenha layers
Apaga display	Apontador
Questão layers raster/vetor	Pan
Zoom In	Zoom Out
Zoom to selected layer(s)	Zoom anterior
Opções de zoom	Análise
Adiciona elementos no mapa	Exporta display para arquivo gráfico
Imprime display	Modo de display 2D / 3D



# WELCOME!

A screenshot of a terminal window titled "Terminal". The window has a menu bar with "File", "Edit", "View", "Terminal", "Go", and "Help". The terminal content displays a welcome message for GRASS Version 6.4.1, dated 2011. The message includes three numbered instructions: 1) Have at your side all available GRASS tutorials; 2) When working on your location, the following materials are extremely useful: - A topo map of your area; - Current catalog of available computer maps; 3) Check the GRASS webpages for feedback mailinglists and more: http://www.grass-gis.org and http://grass.osgeo.org. The terminal ends with "Hit RETURN to continue" and a green cursor. A mouse cursor is visible over the terminal area.

```
Terminal
File Edit View Terminal Go Help
WELCOME TO GRASS                Version 6.4.1                2011

  1) Have at your side all available GRASS tutorials


  2) When working on your location, the following materials
     are extremely useful:
     - A topo map of your area
     - Current catalog of available computer maps

  3) Check the GRASS webpages for feedback mailinglists and more:
     http://www.grass-gis.org
     http://grass.osgeo.org

Hit RETURN to continue
█
```

# WELCOME!

GRASS GIS 7.2.1 startup



# GRASS GIS

Bringing advanced geospatial technologies to the world

1. Select GRASS GIS database directory

GRASS GIS database directory contains Locations.

No GRASS Location found in '/Users/guano/Desktop'. Create a new Location or choose different GRASS database directory.

2. Select GRASS Location

All data in one Location is in the same coordinate reference system (projection). One Location can be one project. Location contains Mapsets.

3. Select GRASS Mapset

Mapset contains GIS data related to one project, task within one project, subregion or user.

# CRIAR LOCATION E MAPSET

Define new GRASS Location

**Define GRASS Database and Location Name**

GIS Data Directory:

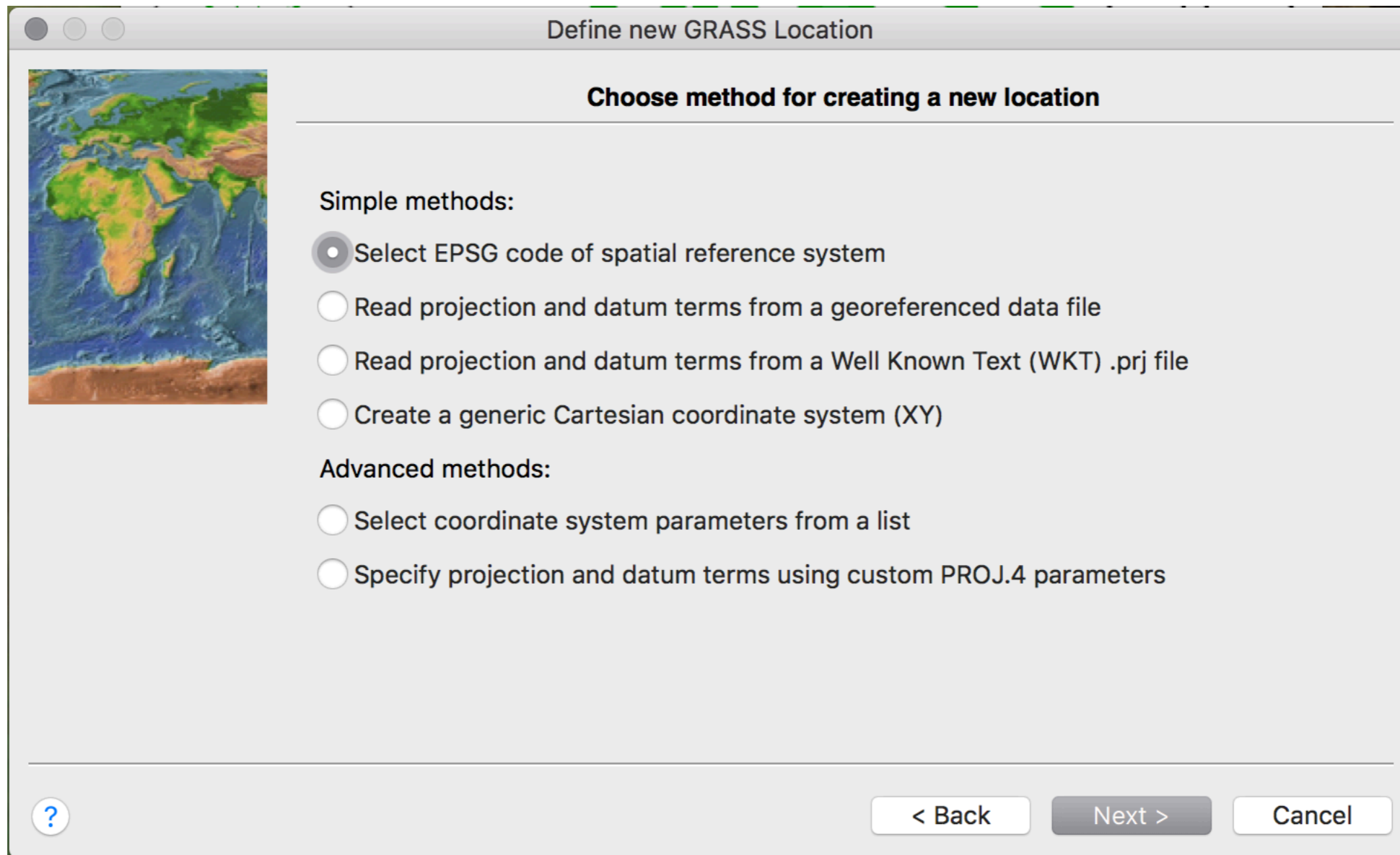
Project Location:

Location Title:

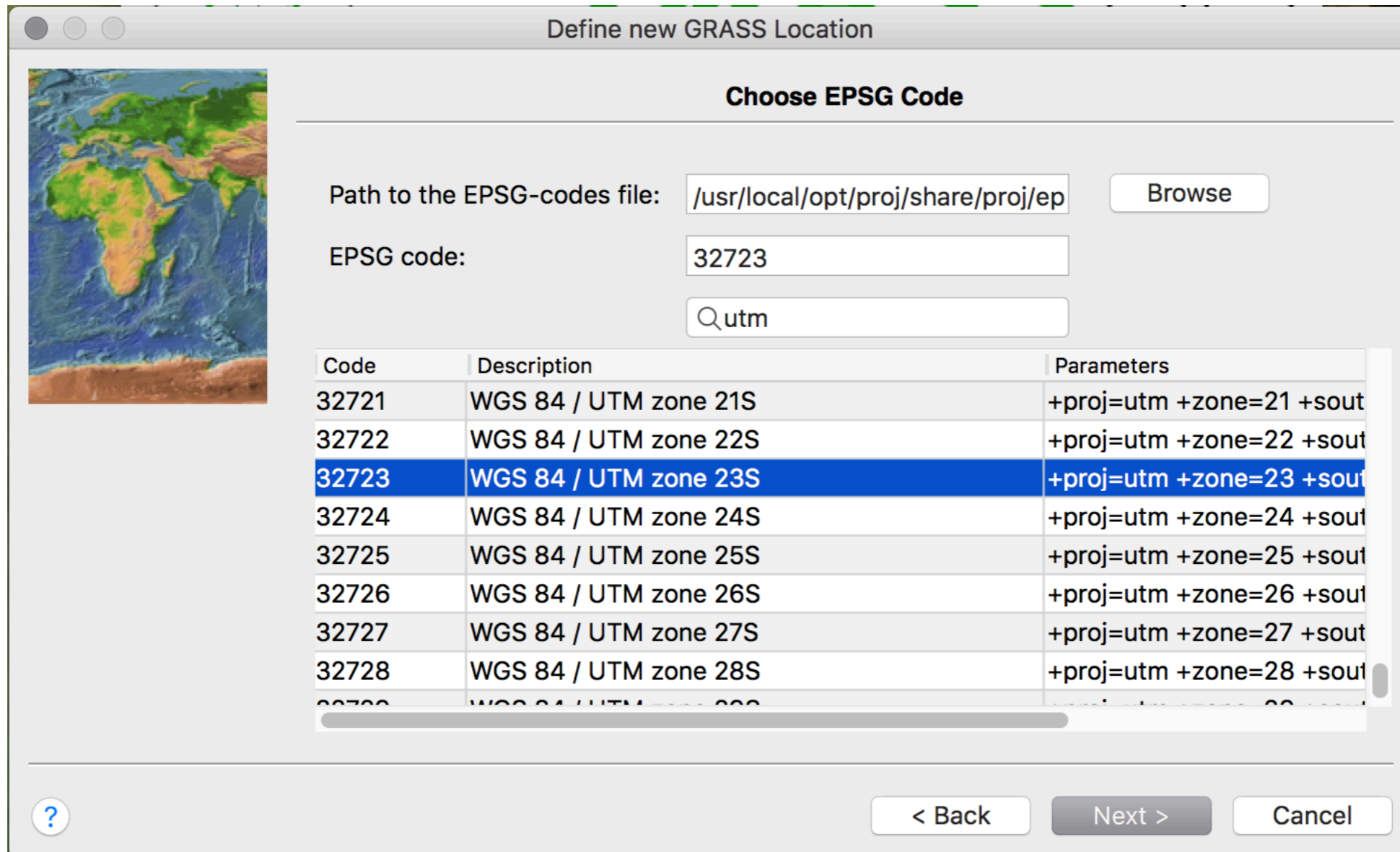
Set default region extent and resolution

Create user mapset

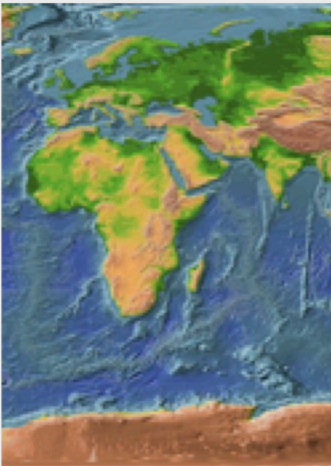
# CRIAR LOCATION E MAPSET



# CRIAR LOCATION E MAPSET



# CRIAR LOCATION E MAPSET



Define new GRASS Location

Choose

Path to the EPSG-codes file:

EPSG code:

Code	Description	Parameters
32721	WGS 84 / UTM zone 21S	+proj=utm +zone=21 +sout
32722	WGS 84 / UTM zone 22S	+proj=utm +zone=22 +sout
32723	WGS 84 / UTM zone 23S	+proj=utm +zone=23 +sout
32724	WGS 84 / UTM zone 24S	+proj=utm +zone=24 +sout
32725	WGS 84 / UTM zone 25S	+proj=utm +zone=25 +sout
32726	WGS 84 / UTM zone 26S	+proj=utm +zone=26 +sout
32727	WGS 84 / UTM zone 27S	+proj=utm +zone=27 +sout
32728	WGS 84 / UTM zone 28S	+proj=utm +zone=28 +sout

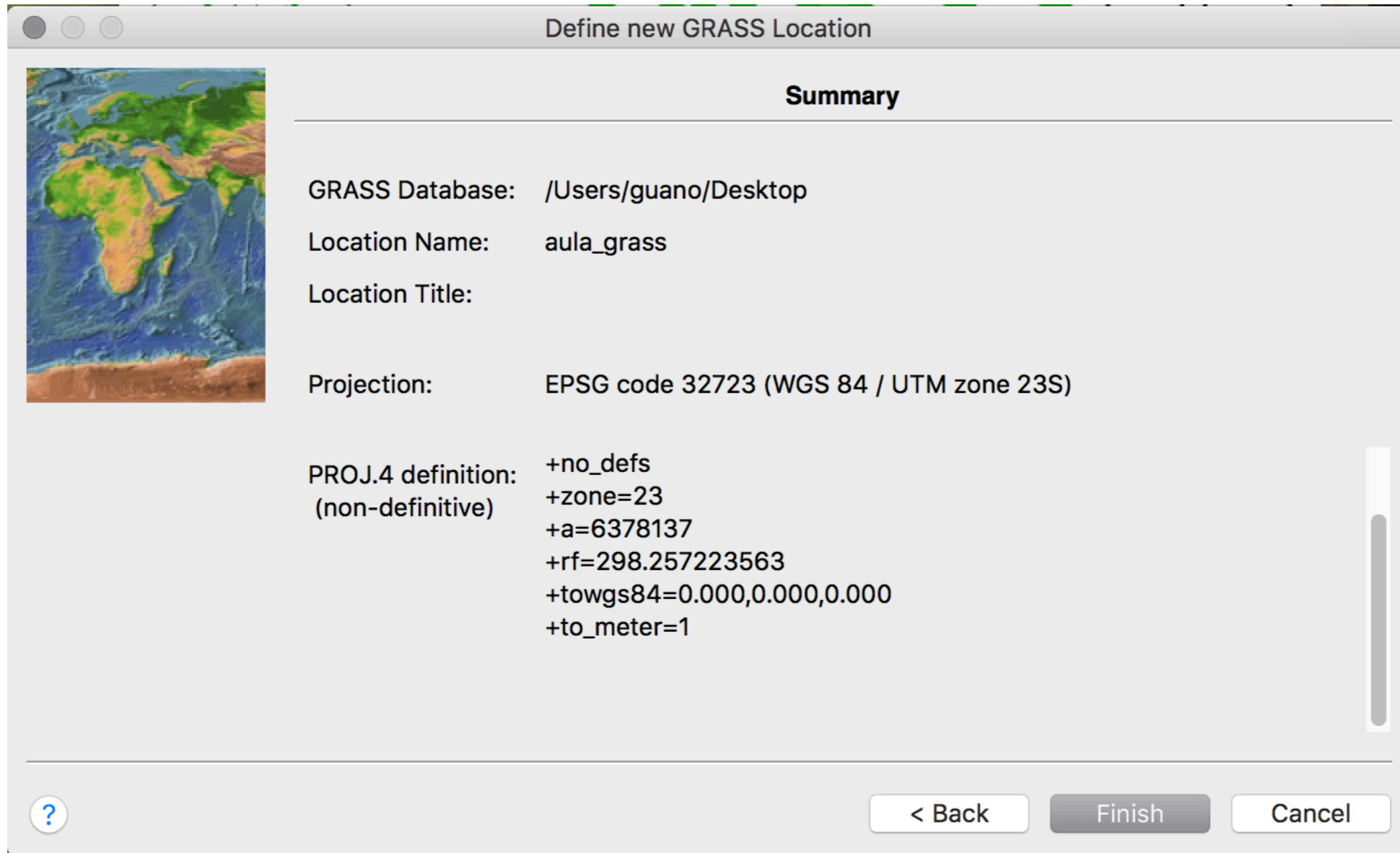
Select datum transformation

Select from list of datum transformations

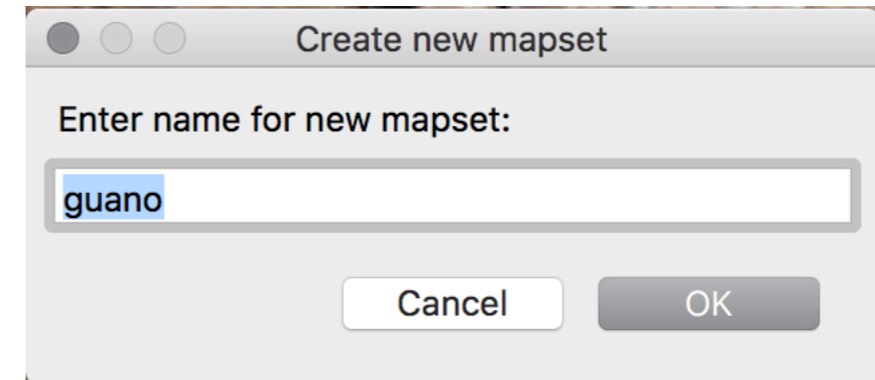
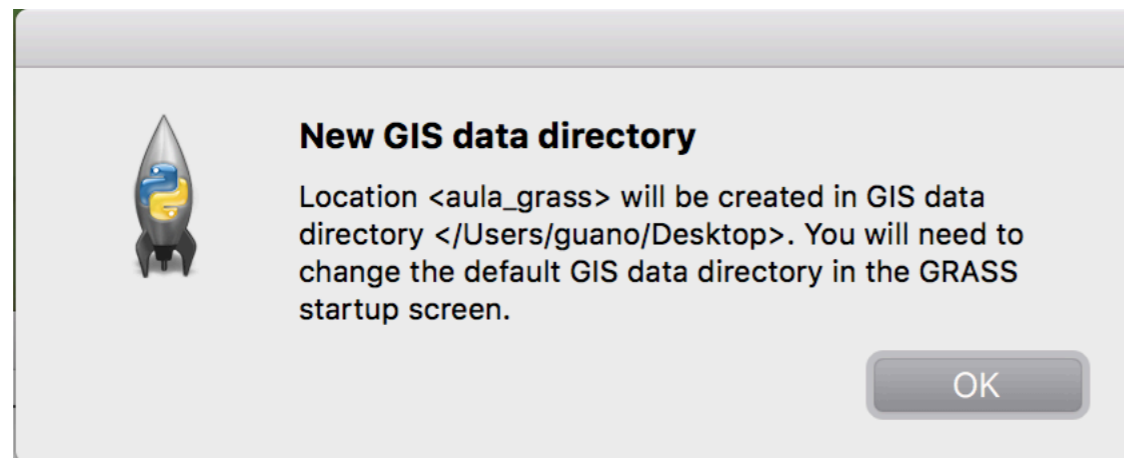
0  
Do not apply any datum transformations

1  
Used in whole wgs84 region  
towgs84=0.000,0.000,0.000  
Default 3-Parameter Transformation (May not be optimum for old

# CRIAR LOCATION E MAPSET






# CRIAR LOCATION E MAPSET

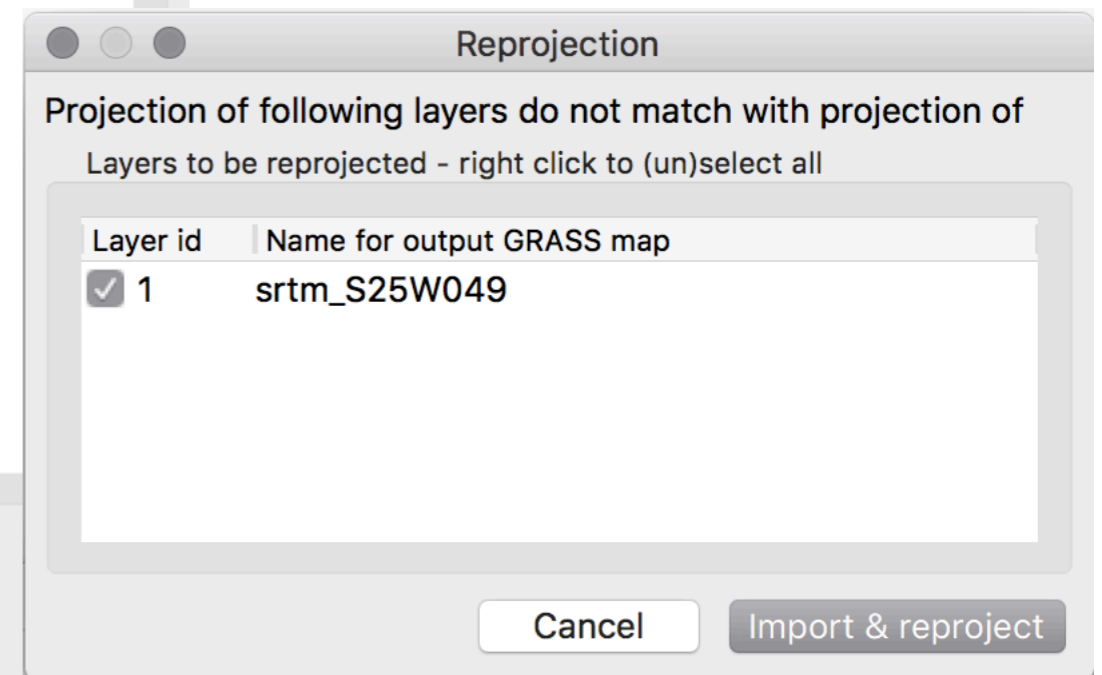
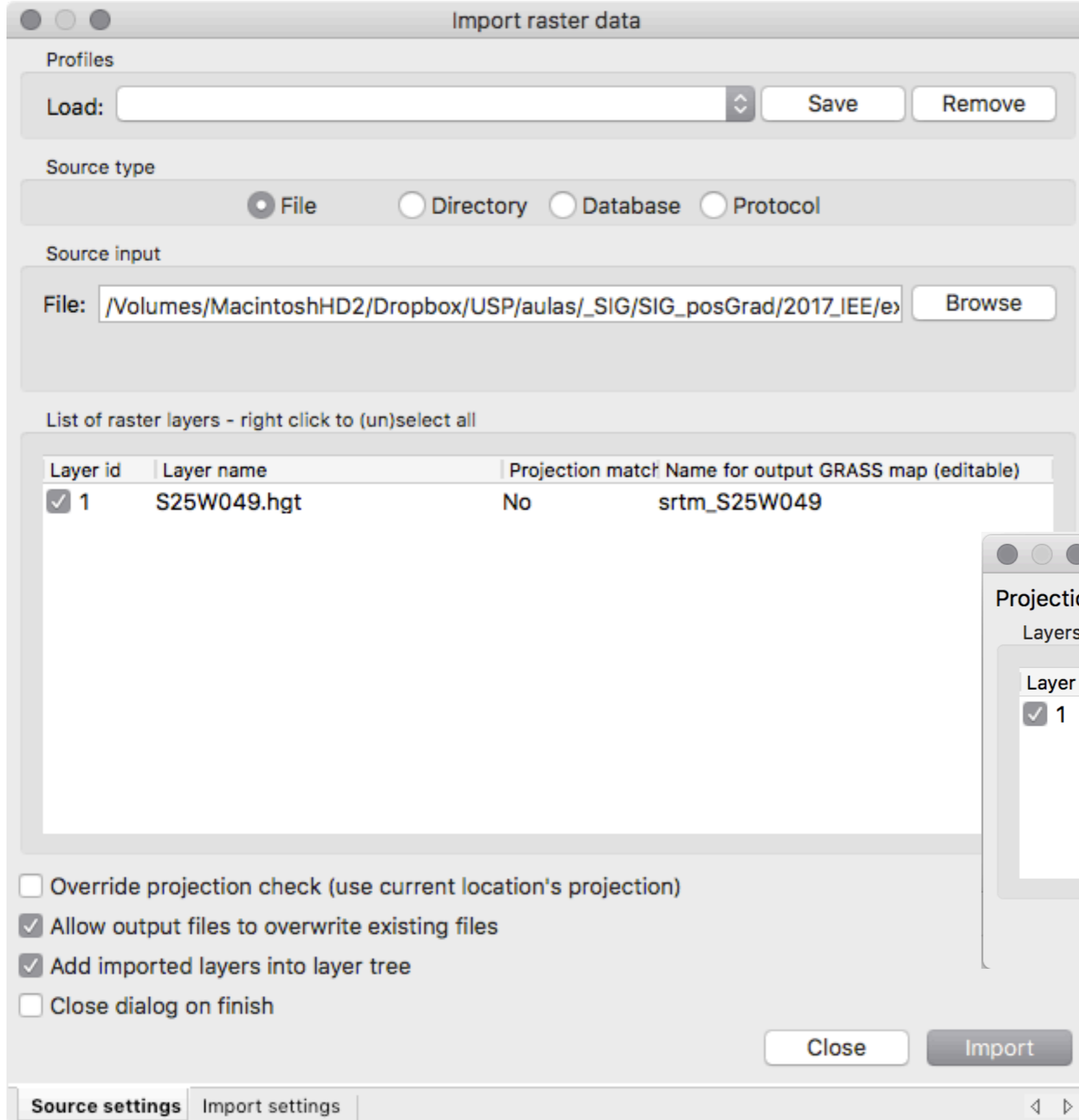




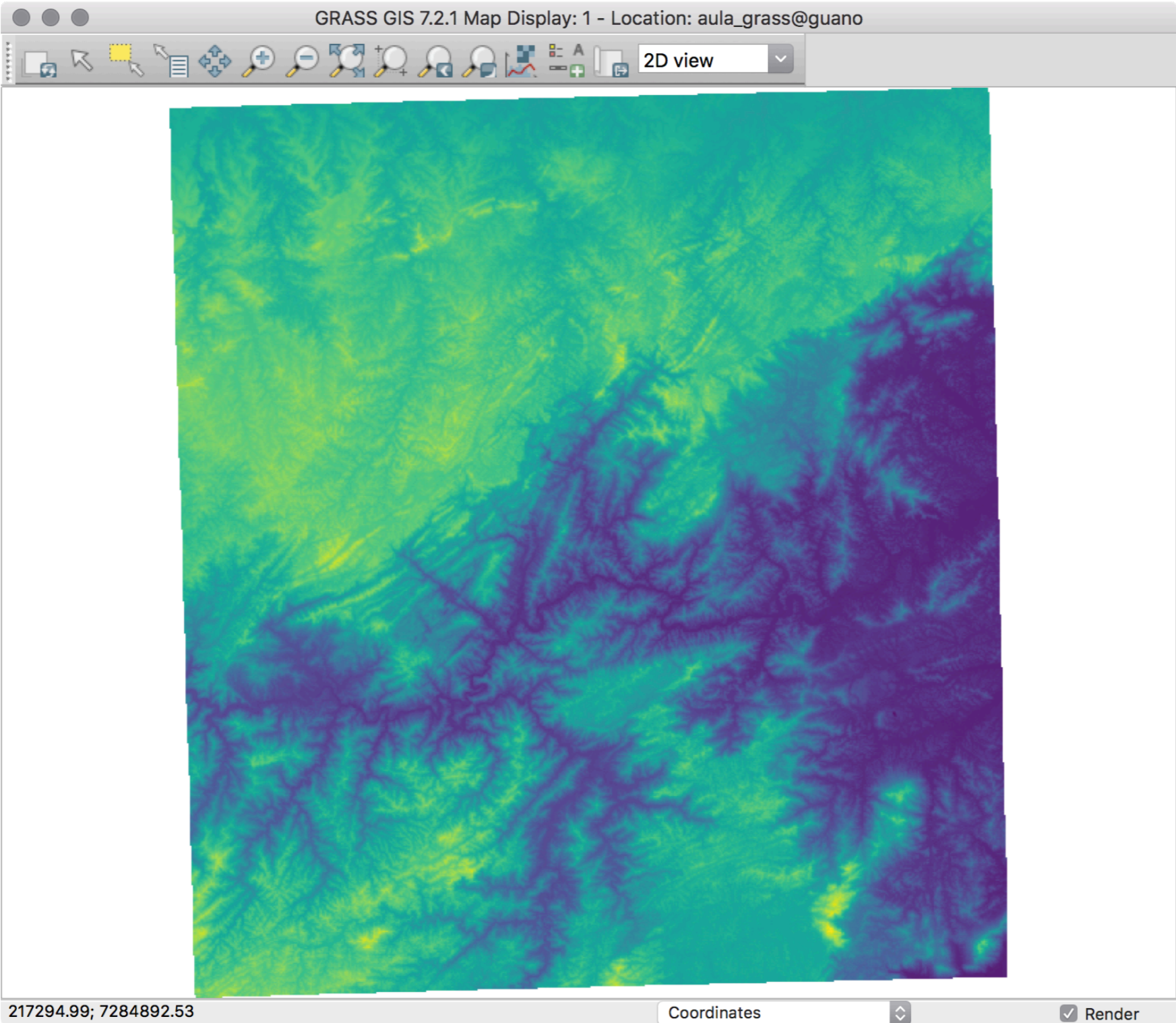
# IMPORTAR SRTM

Workspace	▶
Map display	▶
<b>Import raster data</b>	▶
Import vector data	▶
Import 3D raster data	▶
Import database table	▶
Export raster map	▶
Export vector map	▶
Export 3D raster maps	▶
Export database table	▶
Link external data	▶
Manage maps	▶
Map type conversions	▶
 Georectify [g.gui.gcp]	
 Graphical modeler [g.gui.gmodeler]	
Run model	
3D image rendering [m.nviz.image]	
Animation tool [g.gui.animation]	
Bearing/distance to coordinates [m.cogo]	
 Cartographic Composer [g.gui.psmmap]	
Map Swipe [g.gui.mapswipe]	
Launch script	
Close GUI	⌘W

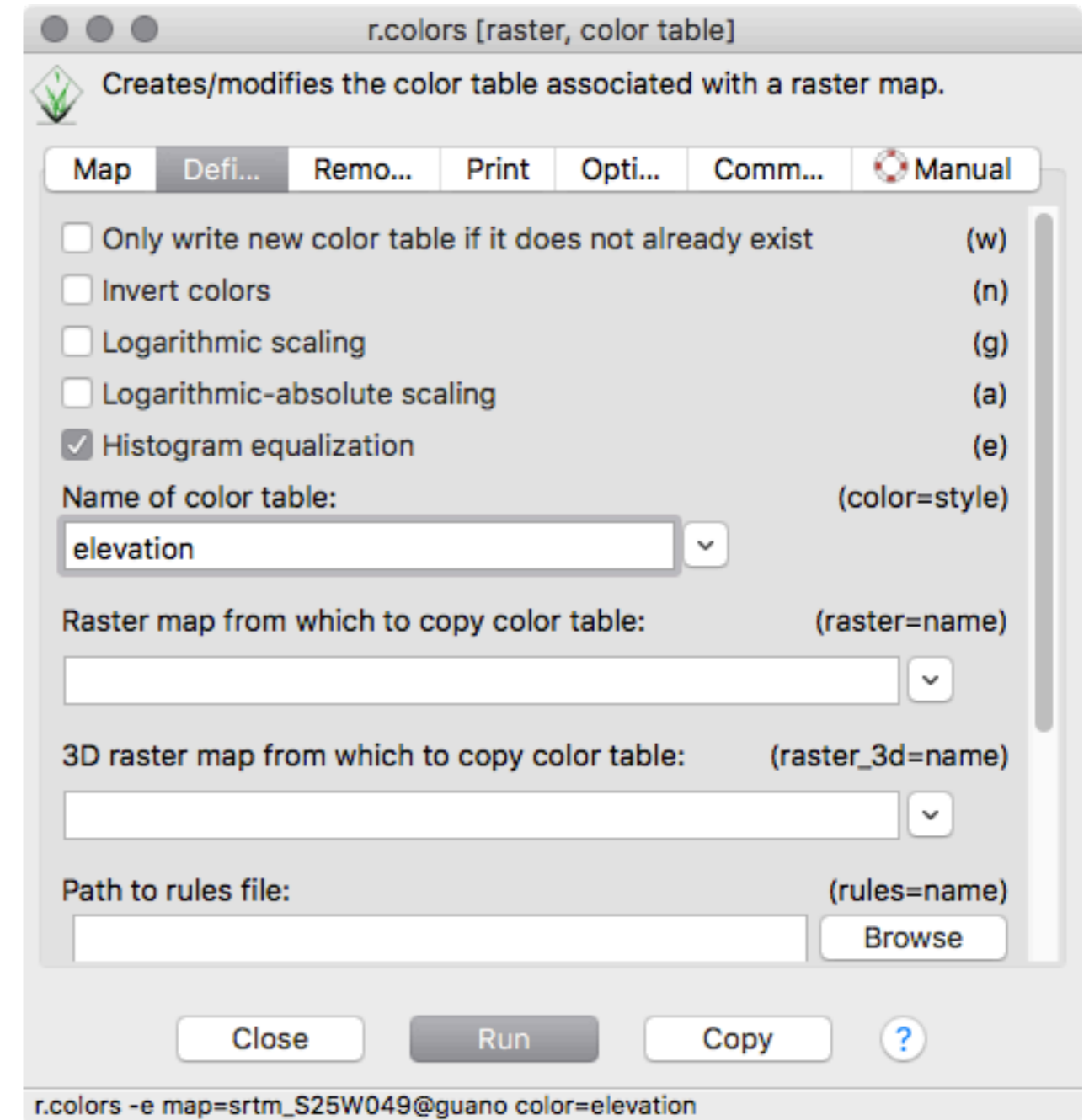
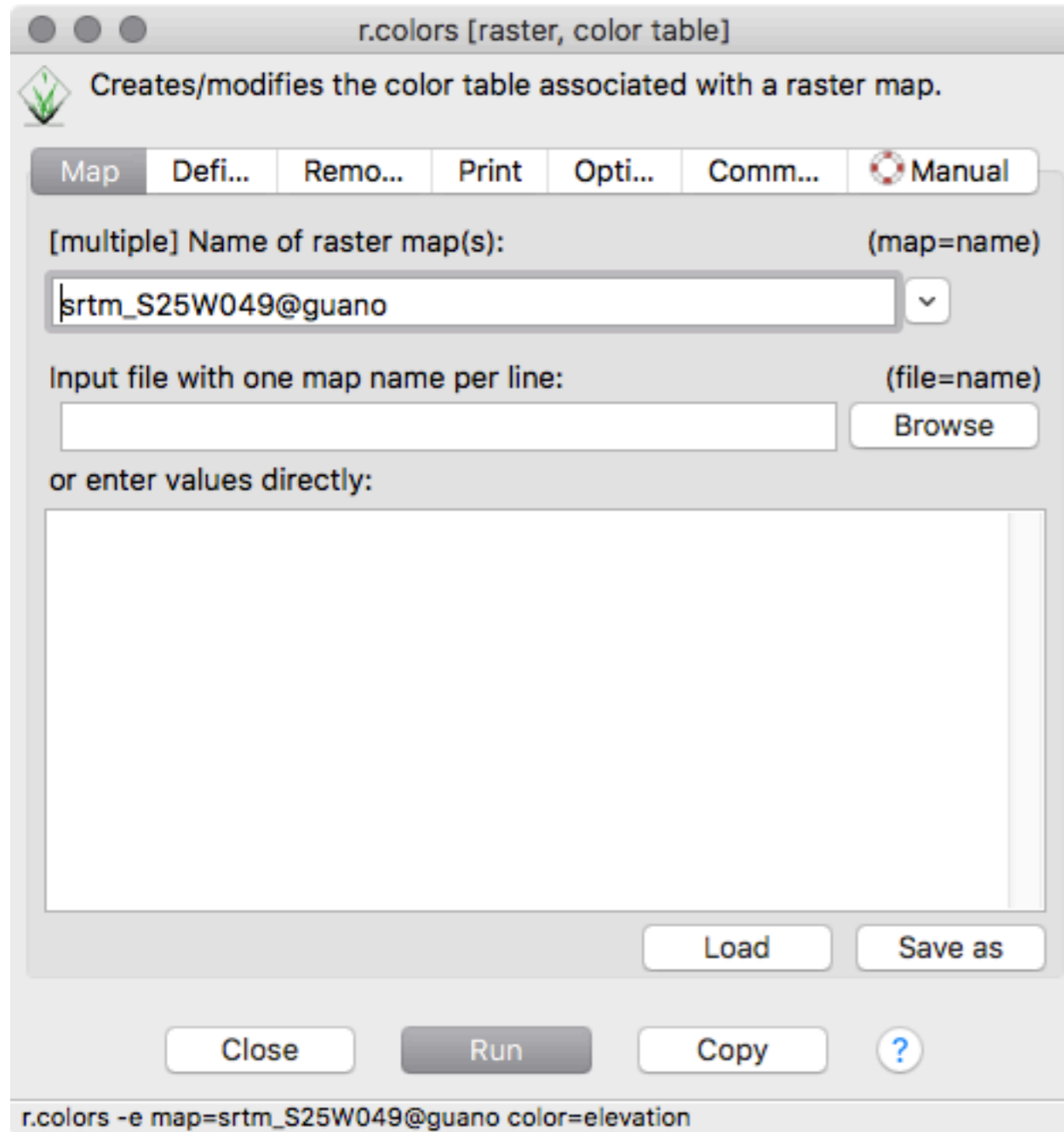
<b>Common formats import [r.in.gdal]</b>
Import of common formats with reprojection [r.import]
ASCII x,y,z point import and gridding [r.in.xyz]
ASCII grid import [r.in.ascii]
ASCII polygons, lines, and point import [r.in.poly]
Raw binary array import [r.in.bin]
GRIDATB.FOR import [r.in.gridatb]
Matlab 2D array import [r.in.mat]
PNG import [r.in.png]
SPOT NDVI import [i.in.spotvgt]
SRTM HGT import [r.in.srtm]
Terra ASTER HDF import [r.in.aster]
LAS LiDAR points import [r.in.lidar]
Unpack raster map [r.unpack]
Reproject raster map from different GRASS location [r.proj]



# DISPLAY RASTER



# ALTERAR CORES (RASTER - MANAGE COLORS - R.COLORS)



# ACERTAR REGION

- Region ▶
- GRASS working environment ▶
- Map projections ▶
- Addons extensions ▶

Display region [g.region -p]

Set region [g.region]

g.region [general, settings, computational region, extent, resolution, level1]

Manages the boundary definitions for the geographic region.

Existing Bounds Reso... Effects Print Optional Comm... Manual

Set from default region (d)

Save as default region (s)

Set current region from named region: (region=name)

[multiple] Set region to match raster map(s): (raster=name)

Set region to match 3D raster map(s) (both 2D and 3D values): (raster\_3d=name)

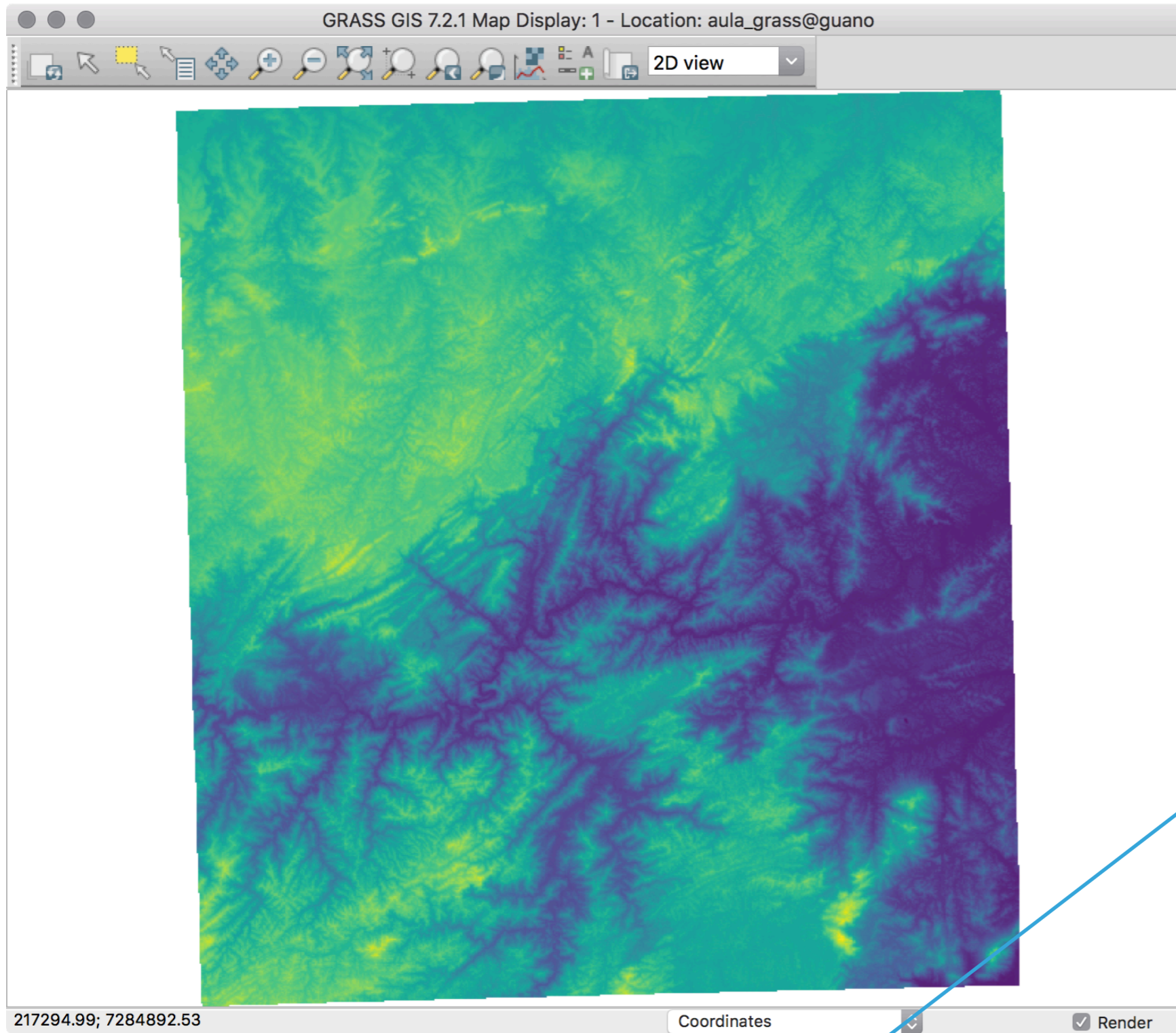
[multiple] Set region to match vector map(s): (vector=name)

Close Run Copy ?

Close dialog on finish

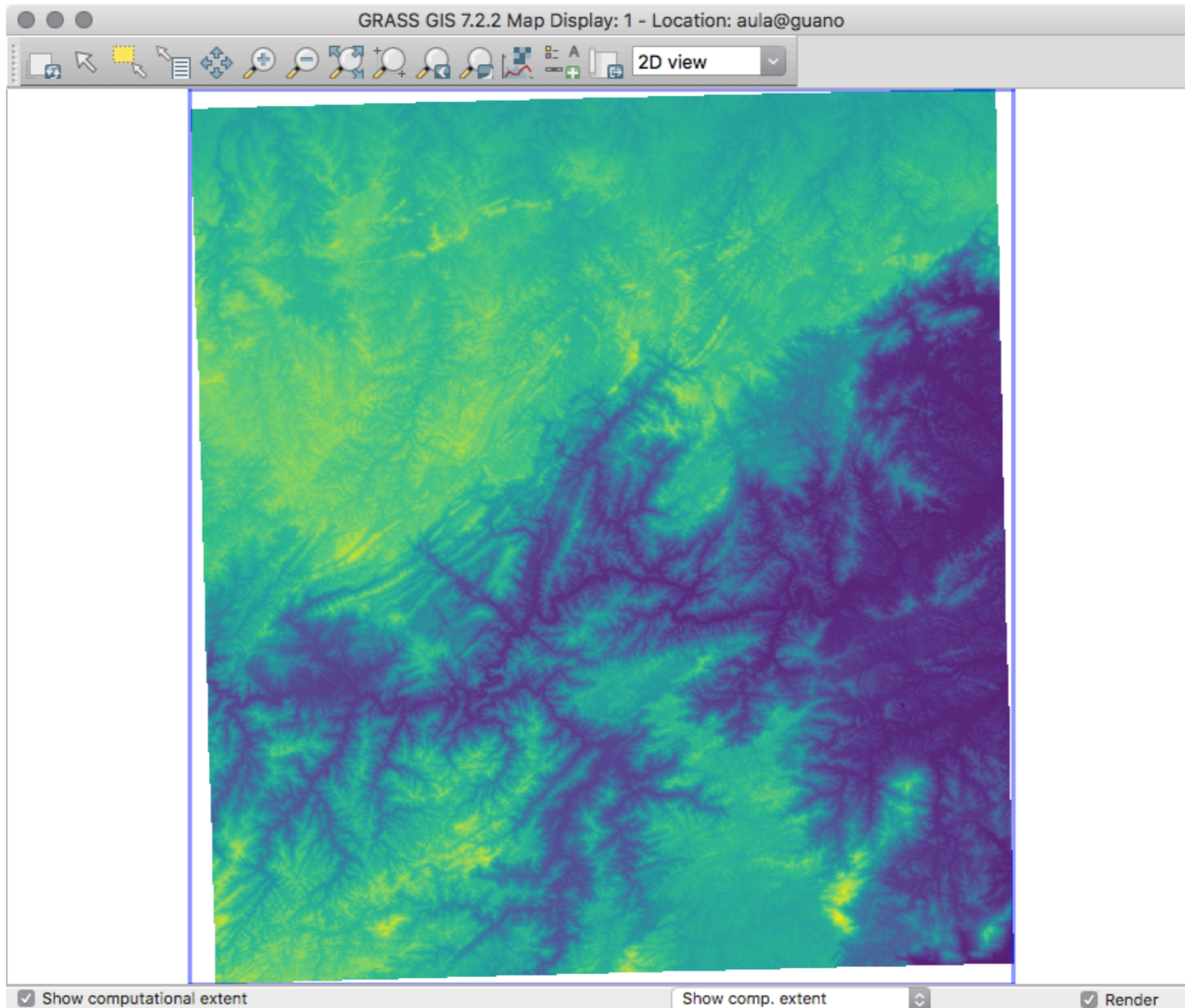
g.region --overwrite raster=srtm\_S25W049@guano

# VER REGION NO MAP DISPLAY

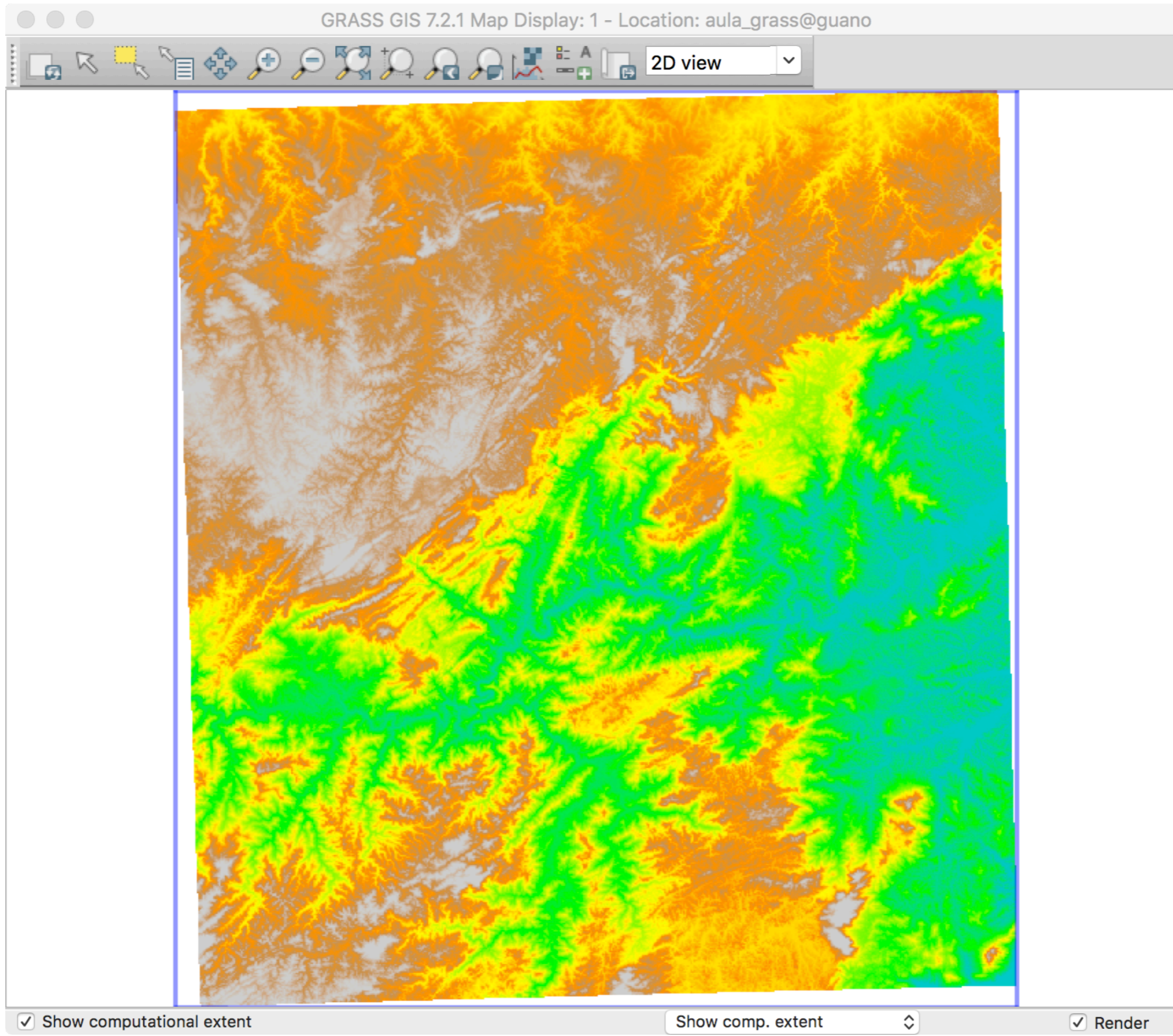


- ✓ Coordinates
- Extent
- Computational region
- Show comp. extent**
- Display mode
- Display resolution
- Display geometry
- Map scale
- Go to
- Projection

# VER REGION NO MAP DISPLAY



# ESCALA DE CORES (FUNCIONANDO)





# RELEVO SOMBREADO

Develop raster map ▶	
Manage colors ▶	
Query raster maps ▶	
Map type conversions ▶	
Raster buffers and distance ▶	
Mask [r.mask]	
Raster map calculator [r.mapcalc]	
Neighborhood analysis ▶	
Overlay rasters ▶	
Solar radiance and shadows ▶	
<b>Terrain analysis ▶</b>	<b>Generate contour lines [r.contour]</b>
Transform features ▶	Cost surface [r.cost]
	Cumulative movement costs [r.walk]
	Least cost route or flow [r.drain]
	<b>Compute shaded relief [r.relief]</b>
	Apply shade to raster [r.shade]
Hydrologic modeling ▶	Slope and aspect [r.slope.aspect]
Groundwater modeling ▶	Terrain parameters [r.param.scale]
Landscape patch analysis ▶	Textural features [r.texture]
Wildfire modeling ▶	
	Visibility [r.viewshed]
Change category values and labels ▶	Distance to features [r.grow.distance]
Generate random cells ▶	Horizon angle [r.horizon]
Generate surfaces ▶	
Interpolate surfaces ▶	
Reports and statistics ▶	

## RELEVO SOMBREADO

- ▶ 1) zoom em uma área pequena
- ▶ 2) MapDisplay - set region to display

Zoom to default region  
Zoom to saved region

**Set computational region extent from display**  
Set computational region extent interactively  
Set computational region from named region

Save display geometry to named region  
Save computational region to named region

# RELEVO SOMBREADO

r.relief [raster, elevation, relief, terrain, hillshade]

Creates shaded relief map from an elevation map (DEM).

Required Sun position Optional Command output Manual

Name of input raster map: \* (input=name)  
srtm\_S25W049@guano

Name for output shaded relief map: \* (output=name)  
srtm\_S25W049\_shade\_315\_25

Close Run Copy ?

Add created map(s) into layer tree  
 Close dialog on finish

```
r.relief --overwrite input=srtm_S25W049@guano output=srtm_S25W049_shade_315_25 altitude=25 azimuth=315
```

r.relief [raster, elevation, relief, terrain, hillshade]

Creates shaded relief map from an elevation map (DEM).

Required Sun position Optional Command output Manual

Altitude of the sun in degrees above the horizon (valid range 0-90): (altitude=float)  
25

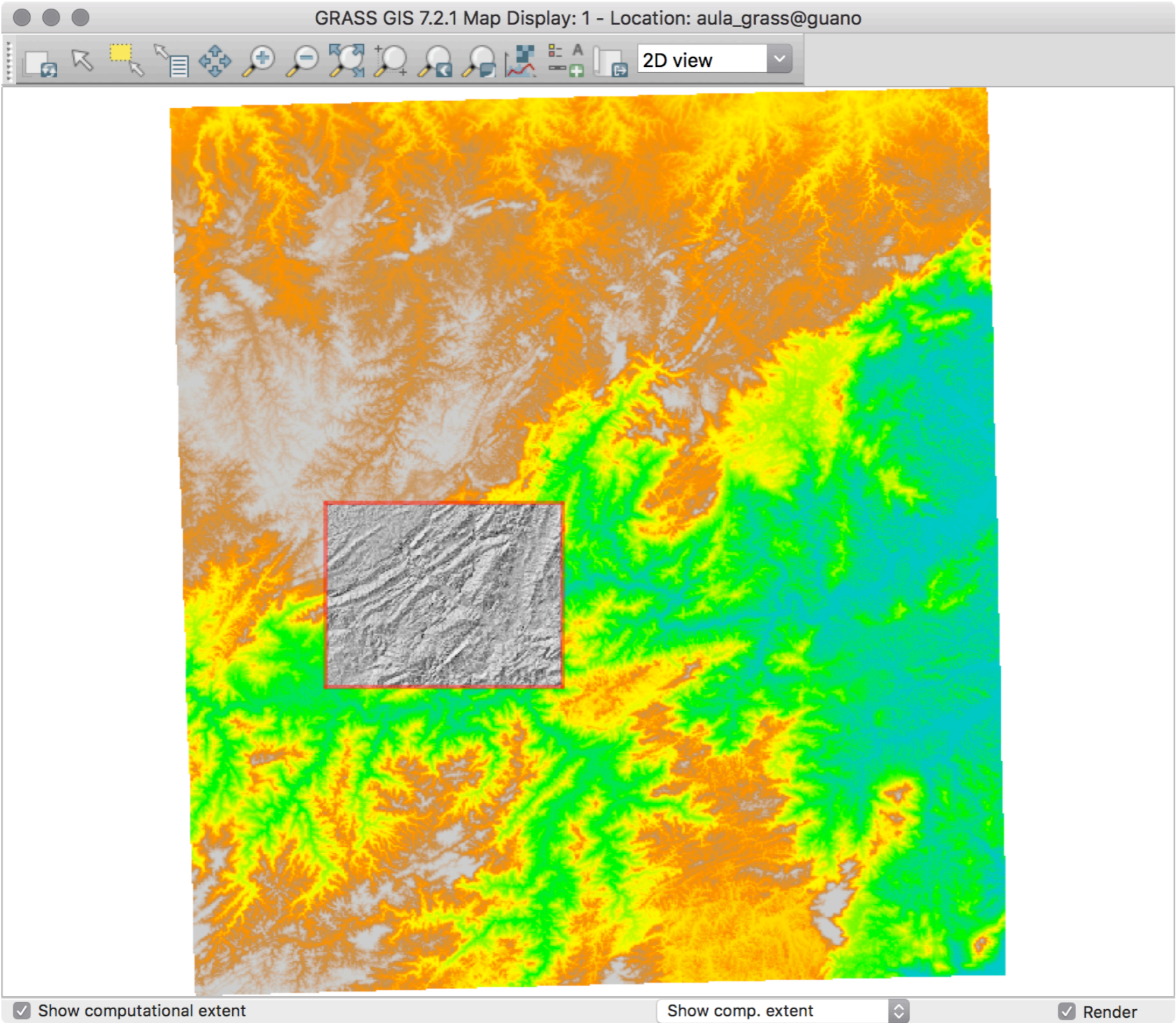
Azimuth of the sun in degrees to the east of north (valid range 0-360): (azimuth=float)  
315

Close Run Copy ?

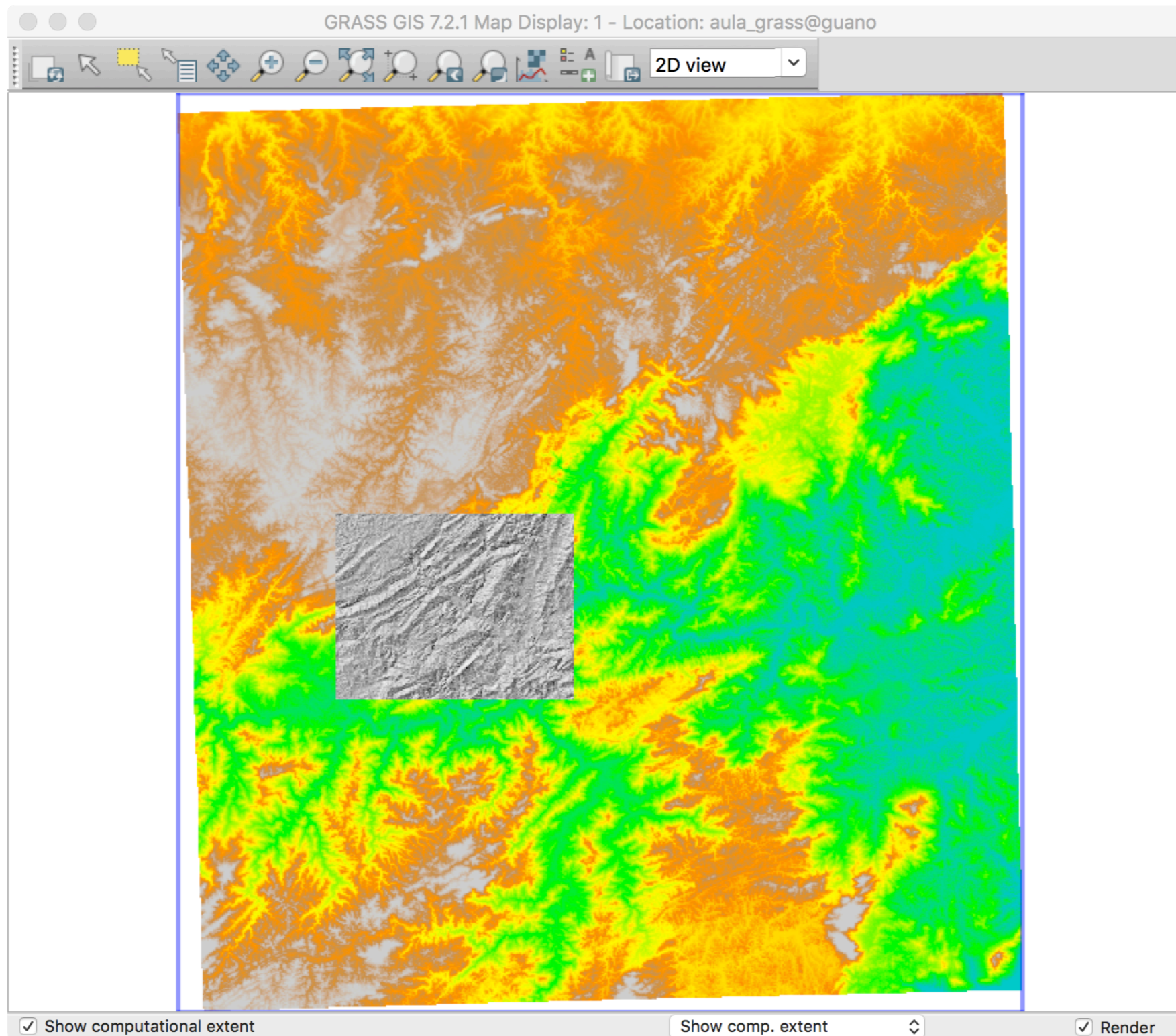
Add created map(s) into layer tree  
 Close dialog on finish

```
r.relief --overwrite input=srtm_S25W049@guano output=srtm_S25W049_shade_315_25 altitude=25 azimuth=315
```

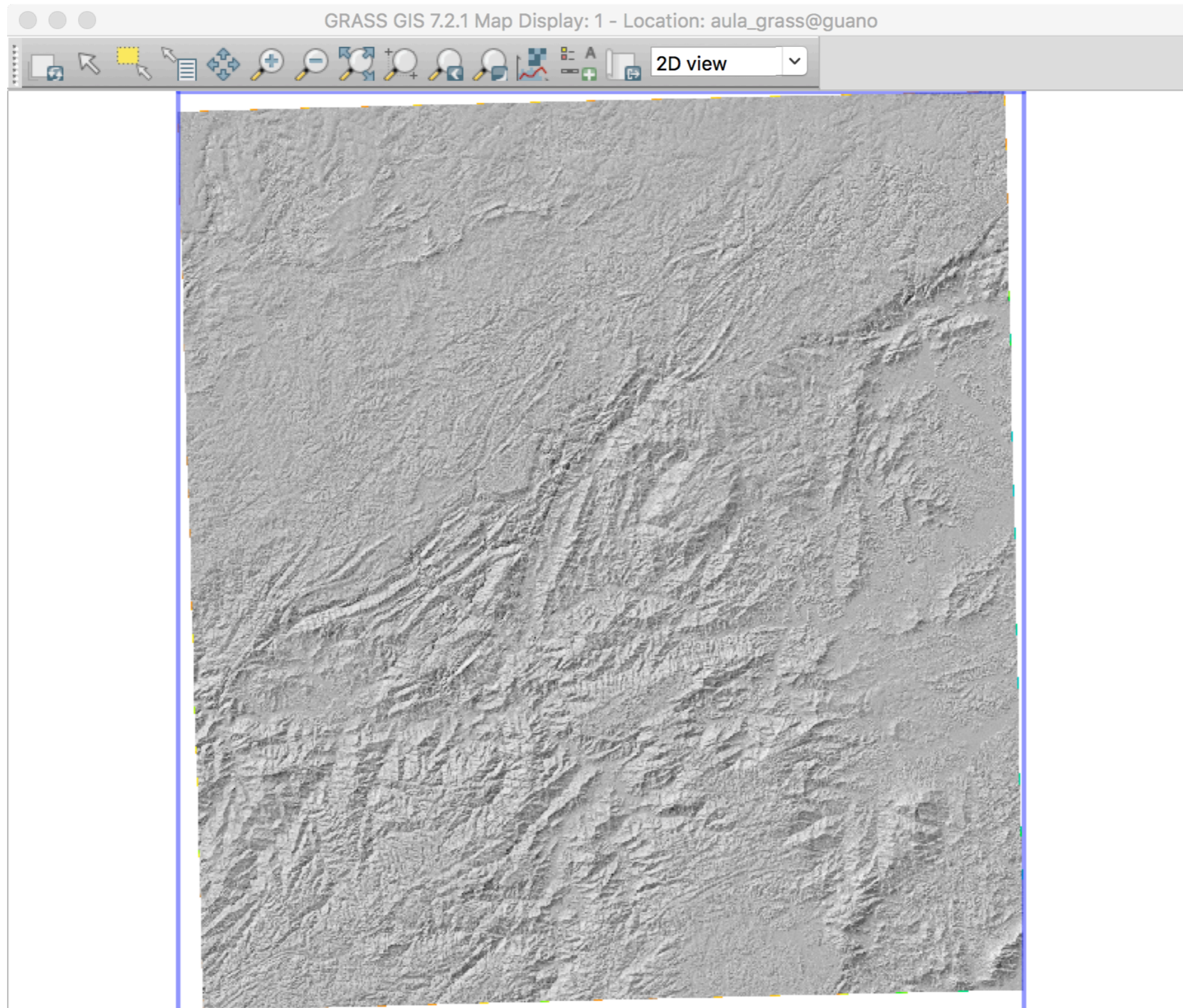
# RELEVO SOMBREADO



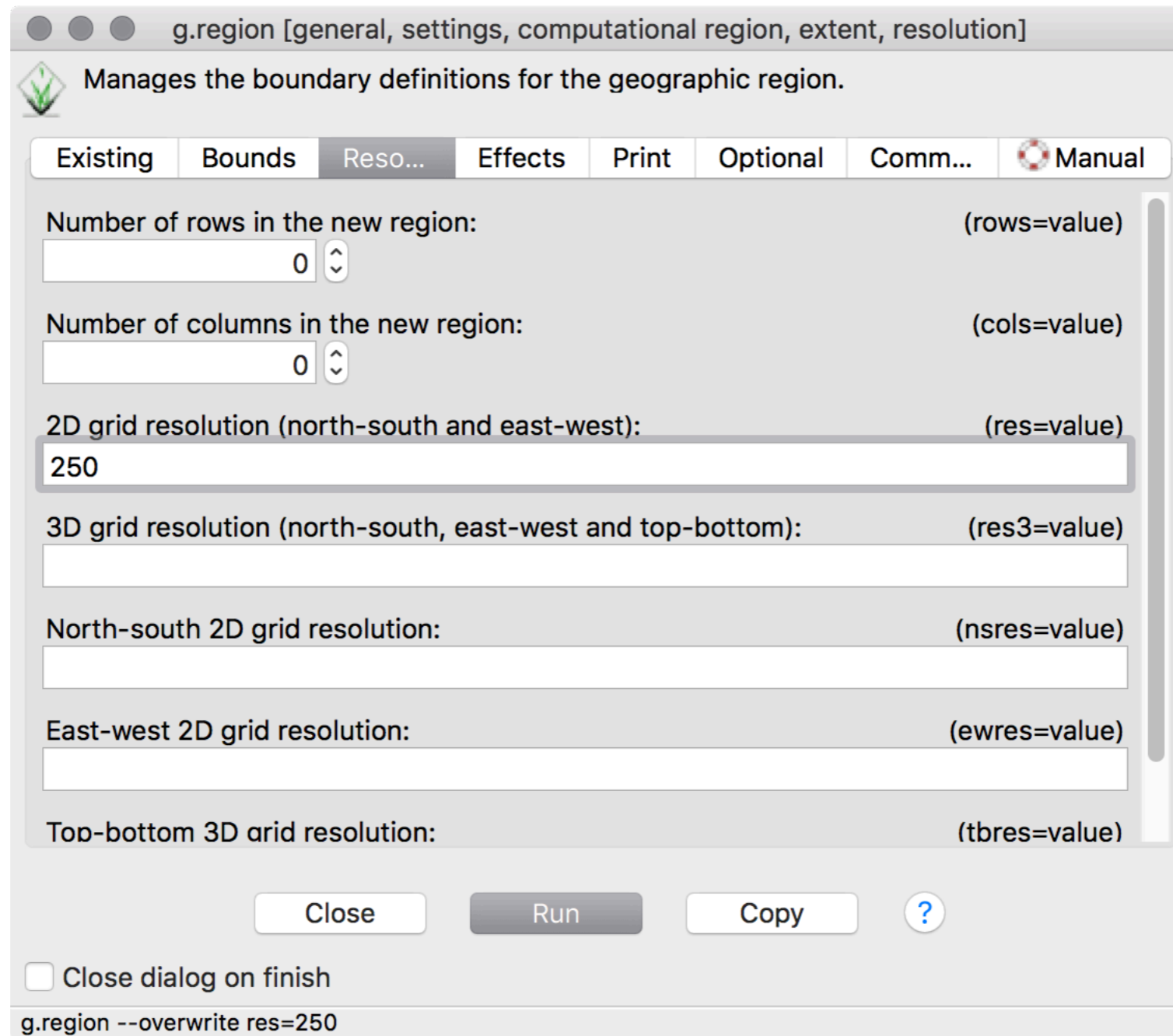
# RELEVO SOMBREADO – DEFINIR REGION PARA LAYER



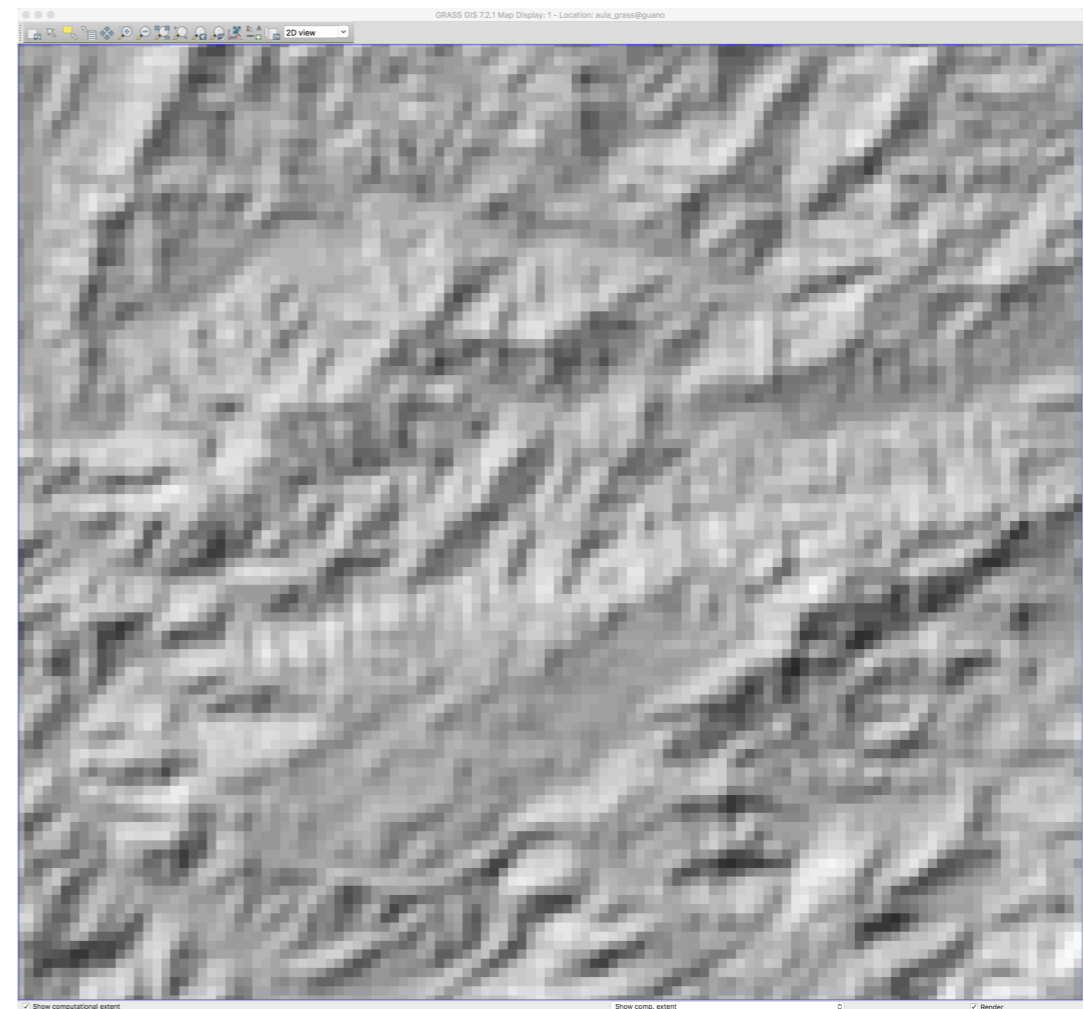
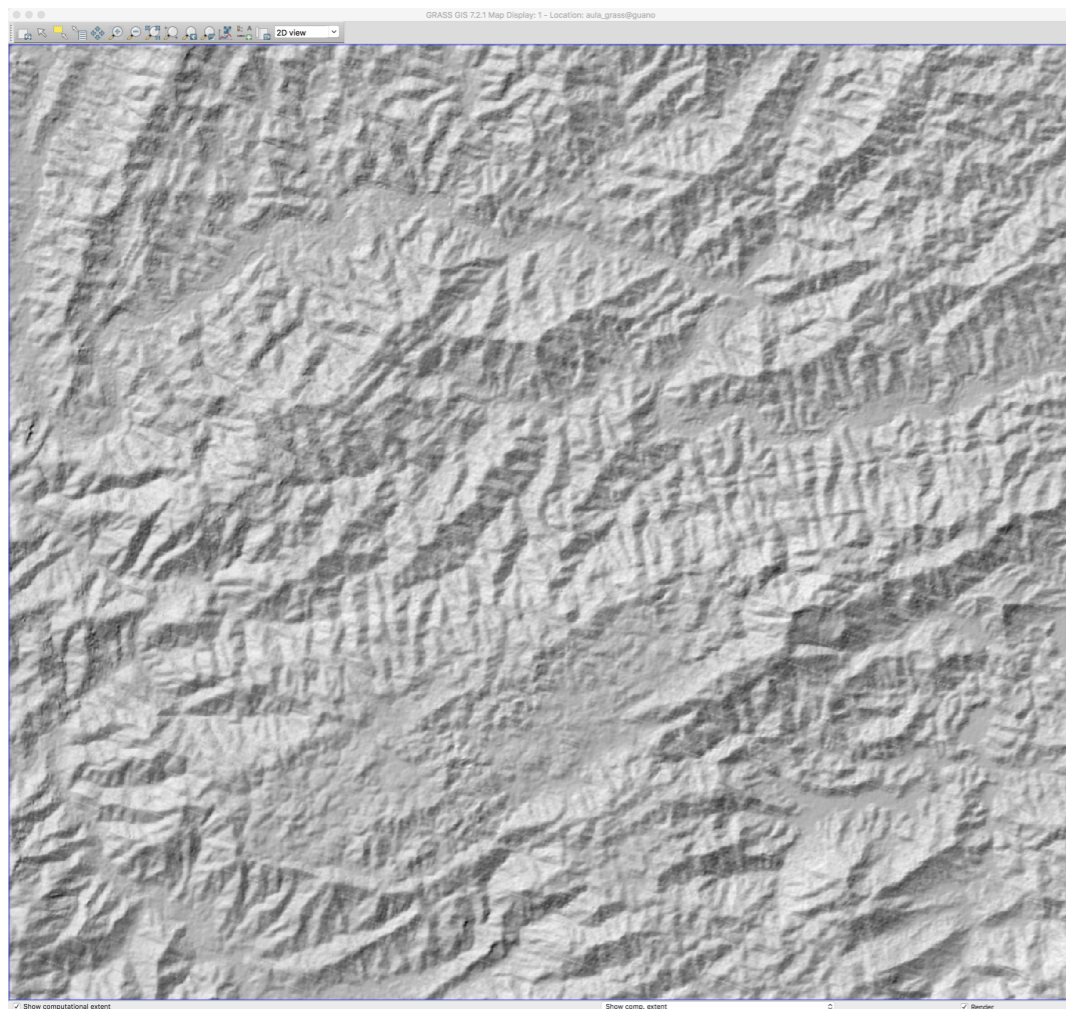
# RELEVO SOMBREADO



# REGION – MUDAR RESOLUÇÃO PARA 250M






# CRIAR LOCATION E MAPSET





# IMPORTAR VETOR (PONTOS – DAVIS.DAT)

Workspace	▶
Map display	▶
Import raster data	▶
Import vector data	▶
Import 3D raster data	▶
Import database table	▶
Export raster map	▶
Export vector map	▶
Export 3D raster maps	▶
Export database table	▶
Link external data	▶
Manage maps	▶
Map type conversions	▶
 Georectify [g.gui.gcp]	
 Graphical modeler [g.gui.gmodeler]	
Run model	
3D image rendering [m.nviz.image]	
Animation tool [g.gui.animation]	
Bearing/distance to coordinates [m.cogo]	
 Cartographic Composer [g.gui.psmmap]	
Map Swipe [g.gui.mapswipe]	
Launch script	
Close GUI	⌘W

Common import formats [v.in.ogr]
Import of common formats with reprojection [v.import]
ASCII points or GRASS ASCII format [v.in.ascii]
ASCII points as a vector lines [v.in.lines]
DXF import [v.in.dxf]
WFS [v.in.wfs]
ESRI e00 import [v.in.e00]
Geonames import [v.in.geonames]
Matlab array or Mapgen format import [v.in.mapgen]
LAS LiDAR points import [v.in.lidar]
Unpack vector map [v.unpack]
Reproject vector map from different GRASS location [v.proj]

# IMPORTAR VETOR

v.in.ascii [vector, import, ASCII]

Creates a vector map from an ASCII points file or ASCII vector file.

Required Input format Points Optional Command output Manual

Name of input file to be imported: \* (input=name)  
 Browse

or enter values directly:

Load Save as

Name for output vector map: \* (output=name)

Close Run Copy ?

Add created map(s) into layer tree  
 Close dialog on finish

v.in.ascii --overwrite input=/Volumes/MacintoshHD2/Dropbox/USP/aulas/\_SIG/SIG\_posGrad/2017\_IEE/exe

v.in.ascii [vector, import, ASCII]

Creates a vector map from an ASCII points file or ASCII vector file.

Required Input format Points Optional Command output Manual

Do not expect a header when reading in standard format (n)

Input file format: (format=string)

Field separator: (separator=character)

Text delimiter: (text=character)


Close Run Copy ?


Add created map(s) into layer tree  
 Close dialog on finish

v.in.ascii --overwrite input=/Volumes/MacintoshHD2/Dropbox/USP/aulas/\_SIG/SIG\_posGrad/2017\_IEE/exe

# IMPORTAR VETOR

v.in.ascii [vector, import, ASCII]

 Creates a vector map from an ASCII points file or ASCII vector file.

Required   Input format   **Points**   Optional   Command output    Manual

Do not create table in points mode (t)

Do not build topology (b)

Only import points falling within current region (points mode) (r)

Ignore broken line(s) in points mode (i)

Number of header lines to skip at top of input file (points mode): (skip=integer)

Column definition in SQL style (points mode): (columns=string)

Number of column used as x coordinate (points mode): (x=integer)

Number of column used as y coordinate (points mode): (y=integer)

Number of column used as z coordinate (points mode): (z=integer)

Number of column used as category (points mode): (cat=integer)

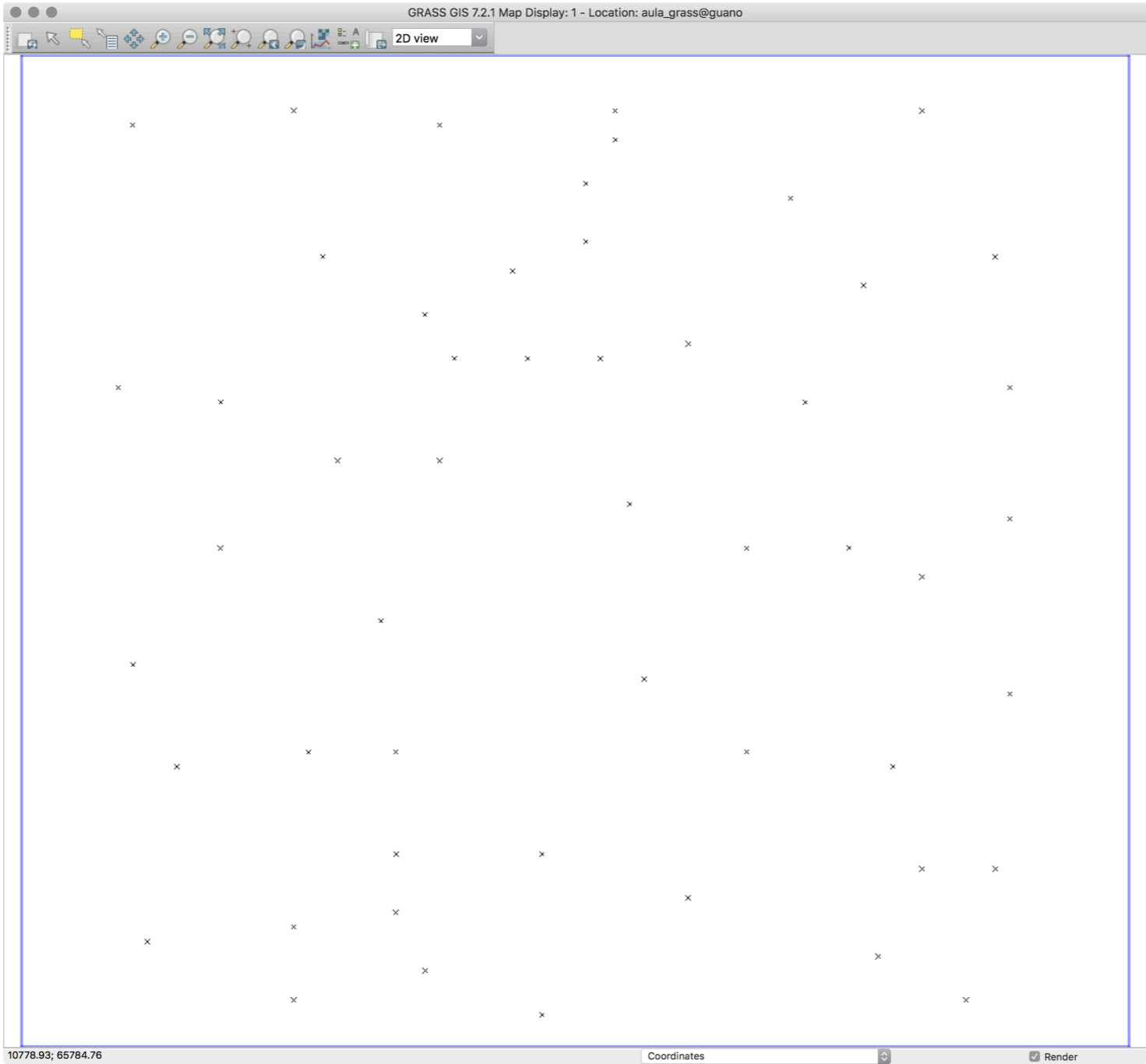
Close   Run   Copy   ?

Add created map(s) into layer tree

Close dialog on finish

v.in.ascii -b --overwrite input=/Volumes/MacintoshHD2/Dropbox/USP/aulas/\_SIG/SIG\_posGrad/2017\_IEE/€

# VETOR



# INTERPOLAR SUPERFICIE

- Develop raster map ▶
- Manage colors ▶
- Query raster maps ▶
- Map type conversions ▶
- Raster buffers and distance ▶
- Mask [r.mask]
- Raster map calculator [r.mapcalc]
- Neighborhood analysis ▶
- Overlay rasters ▶
- Solar radiance and shadows ▶
- Terrain analysis ▶
- Transform features ▶
- Hydrologic modeling ▶
- Groundwater modeling ▶
- Landscape patch analysis ▶
- Wildfire modeling ▶
- Change category values and labels ▶
- Generate random cells ▶
- Generate surfaces ▶
- Interpolate surfaces ▶
- Reports and statistics ▶

- Bilinear and bicubic from vector points [v.surf.bspline]
- IDW from raster points [r.surf.idw]
- IDW from vector points [v.surf.idw]
- Raster contours [r.surf.contour]
- Regularized spline tension [v.surf.rst]
- Raster series interpolation [r.series.interp]
- Fill NULL cells [r.fillnulls]

# INTERPOLAR SUPERFICIE

v.surf.rst [vector, surface, interpolation, 3D]

Performs surface interpolation from vector points map by splines. Spatial approximation and topographic analysis from given point or isoline data in vector format to floating point raster form using regularized spline with tension.

Required Selection **Parameters** Outputs Optional Command out... Manual

Perform cross-validation procedure without raster approximation (c)

Use scale dependent tension (t)

Name of the attribute column with values to be used for approximation: (zcolumn=name)

Name of raster map used as mask: (mask=name)

Tension parameter: (tension=float)

40.

Smoothing parameter: (smooth=float)

Name of the attribute column with smoothing parameters: (smooth\_column=string)

Maximum number of points in a segment: (segmax=integer)

40

Minimum number of points for approximation in a segment (>segmax): (npmin=integer)

300

Minimum distance between points (to remove almost identical points): (dmin=float)

Maximum distance between points on isoline (to insert additional points): (dmax=float)

Conversion factor for values used for approximation: (zscale=float)

1.0

Anisotropy angle (in degrees counterclockwise from East): (theta=float)

Anisotropy scaling factor: (scalex=float)

Close Run Copy ?

Add created map(s) into layer tree

Close dialog on finish

v.surf.rst --overwrite input=davis@guano elevation=davis\_dem

v.surf.rst [vector, surface, interpolation, 3D]

Performs surface interpolation from vector points map by splines. Spatial approximation and topographic analysis from given point or isoline data in vector format to floating point raster form using regularized spline with tension.

Required Selection Parameters **Outputs** Optional Command out... Manual

Output partial derivatives instead of topographic parameters (d)

Name for output surface elevation raster map: (elevation=name)

davis\_dem

Name for output slope raster map: (slope=name)

Name for output aspect raster map: (aspect=name)

Name for output profile curvature raster map: (pcurvature=name)

Name for output tangential curvature raster map: (tcurvature=name)

Name for output mean curvature raster map: (mcurvature=name)

Name for output deviations vector point map: (deviations=name)

Name for output cross-validation errors vector point map: (cvdev=name)

Name for output vector map showing quadtree segmentation: (treeseg=name)

Name for output vector map showing overlapping windows: (overwin=name)

Close Run Copy ?

Add created map(s) into layer tree

Close dialog on finish

v.surf.rst --overwrite input=davis@guano elevation=davis\_dem

# GERAR CURVAS DE NIVEL

r.contour [raster, surface, contours, vector]

Produces a vector map of specified contours from a raster map.

Required Contour levels Optional Command output Manual

Name of input raster map: \* (input=name)  
davis\_dem@guano

Name for output vector map: \* (output=name)  
davis\_dem\_r50m\_c10m

Close Run Copy ?

Add created map(s) into layer tree  
 Close dialog on finish

```
r.contour --overwrite input=davis_dem@guano output=davis_dem_r50m_c10m step=10
```

r.contour [raster, surface, contours, vector]

Produces a vector map of specified contours from a raster map.

Required Contour levels Optional Command output Manual

Increment between contour levels: (step=float)  
10

[multiple] List of contour levels: (levels=float)

Minimum contour level: (minlevel=float)

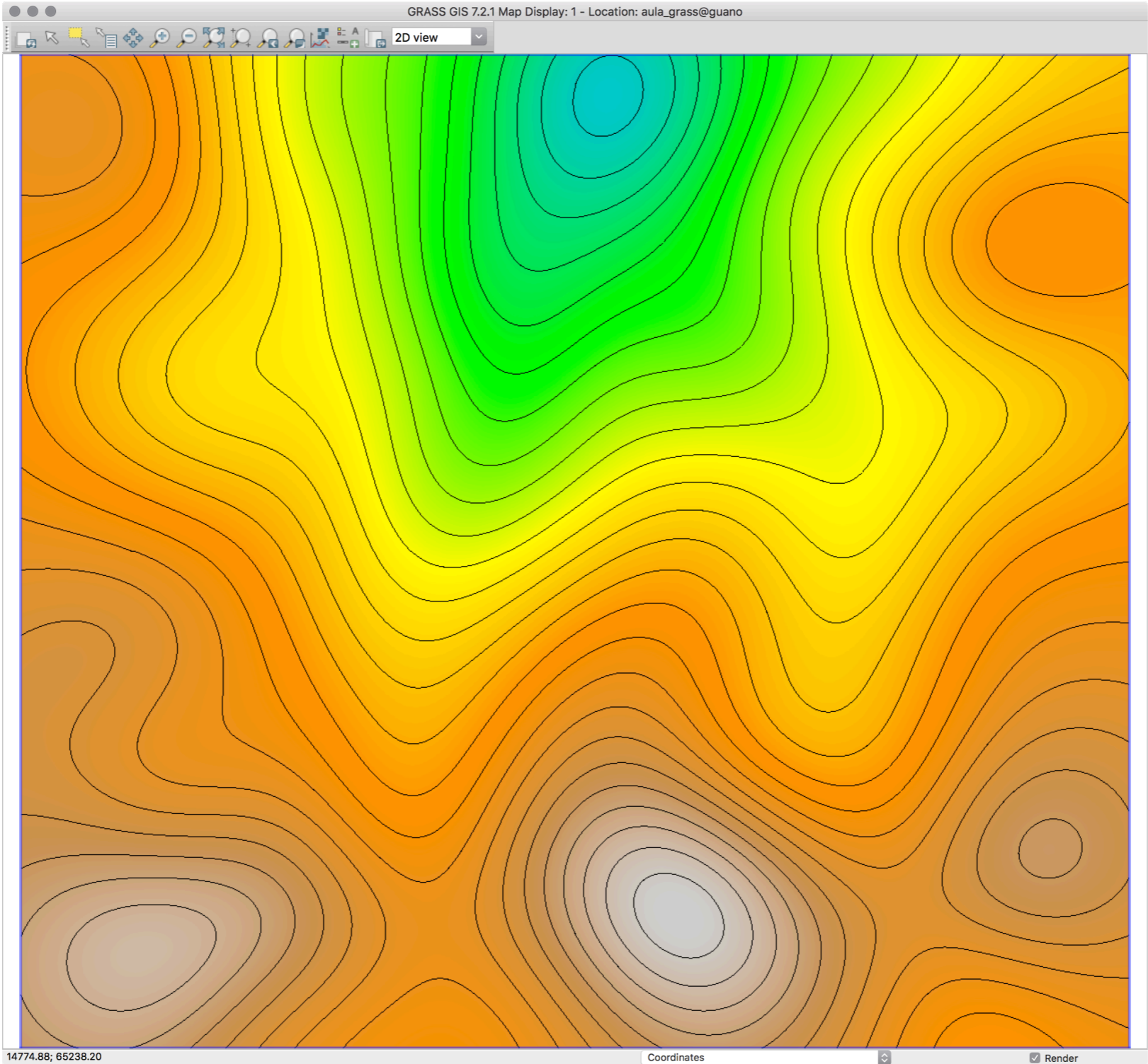
Maximum contour level: (maxlevel=float)

Close Run Copy ?

Add created map(s) into layer tree  
 Close dialog on finish

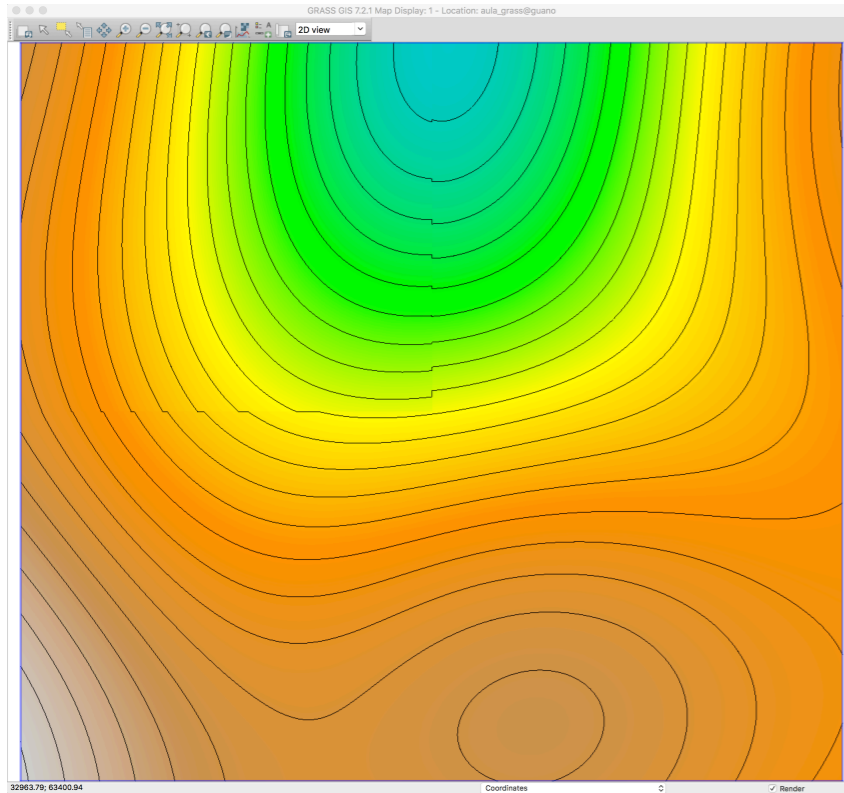
```
r.contour --overwrite input=davis_dem@guano output=davis_dem_r50m_c10m step=10
```

# DEM + CURVAS DE NIVEL

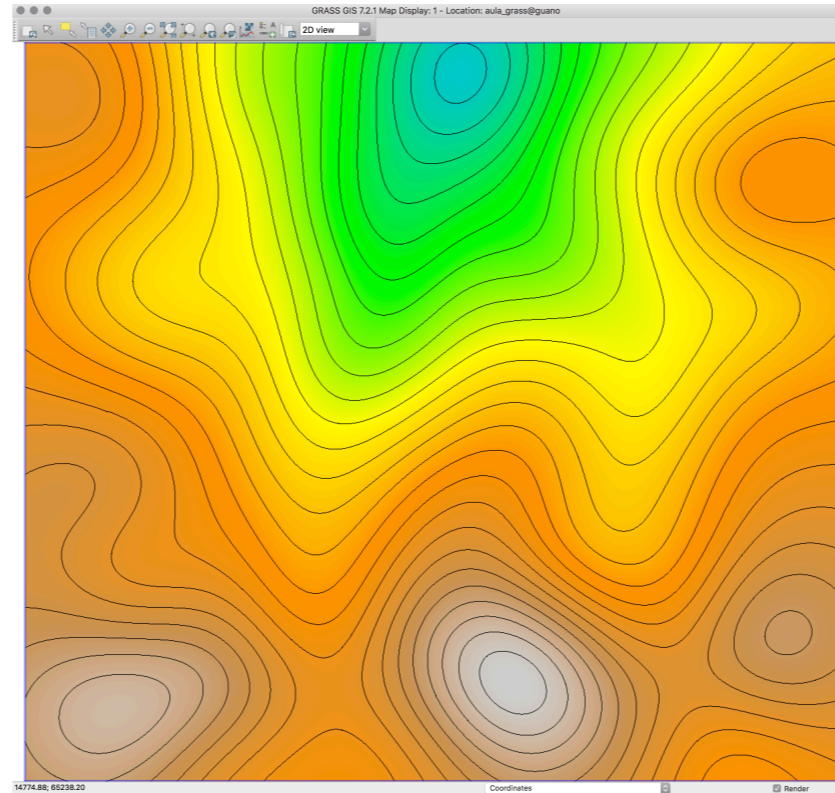




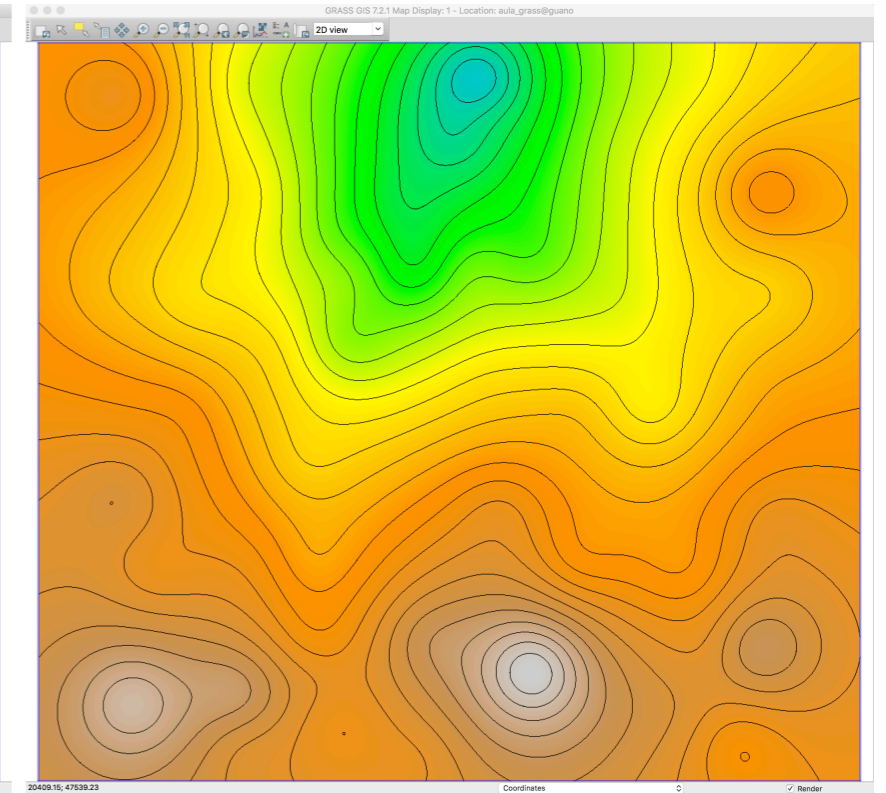
# DEM + CURVAS DE NIVEL



T=10



T=40



T=100

# INTERPOLAR SUPERFICIE + DERIVADAS

v.surf.rst [vector, surface, interpolation, 3D]

Performs surface interpolation from vector points map by splines. Spatial approximation and topographic analysis from given point or isoline data in vector format to floating point raster form using regularized spline with tension.

Required Selection Parameters **Outputs** Optional Command out... Manual

Output partial derivatives instead of topographic parameters (d)

Name for output surface elevation raster map: (elevation=name)  
davis\_dem\_t40

Name for output slope raster map: (slope=name)  
davis\_dem\_t40\_slope

Name for output aspect raster map: (aspect=name)  
davis\_dem\_t40\_aspect

Name for output profile curvature raster map: (pcurvature=name)  
davis\_dem\_t40\_pcurv

Name for output tangential curvature raster map: (tcurvature=name)  
davis\_dem\_t40\_tcurv

Name for output mean curvature raster map: (mcurvature=name)

Name for output deviations vector point map: (deviations=name)

Name for output cross-validation errors vector point map: (cvdev=name)

Name for output vector map showing quadtree segmentation: (treeseq=name)

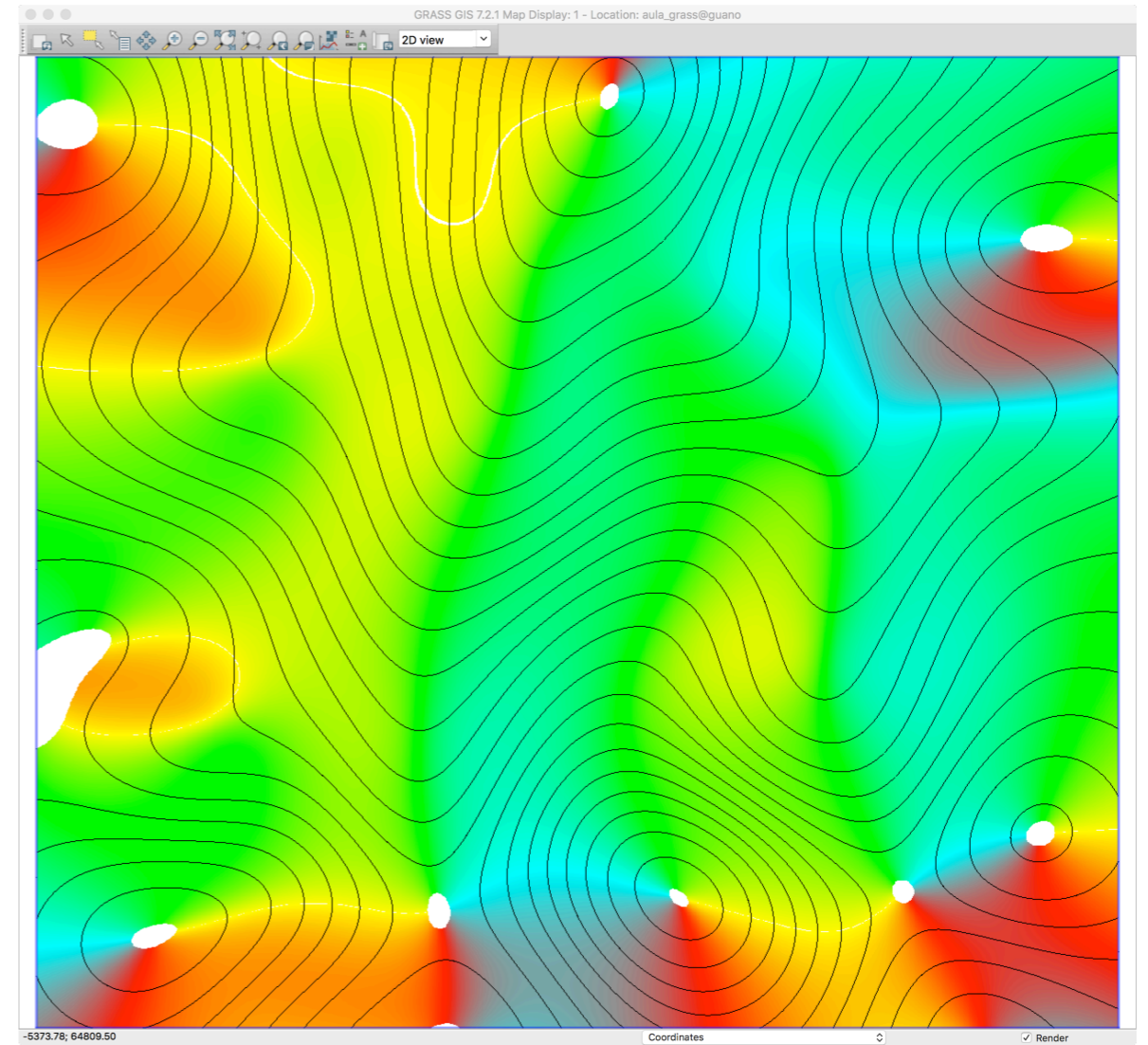
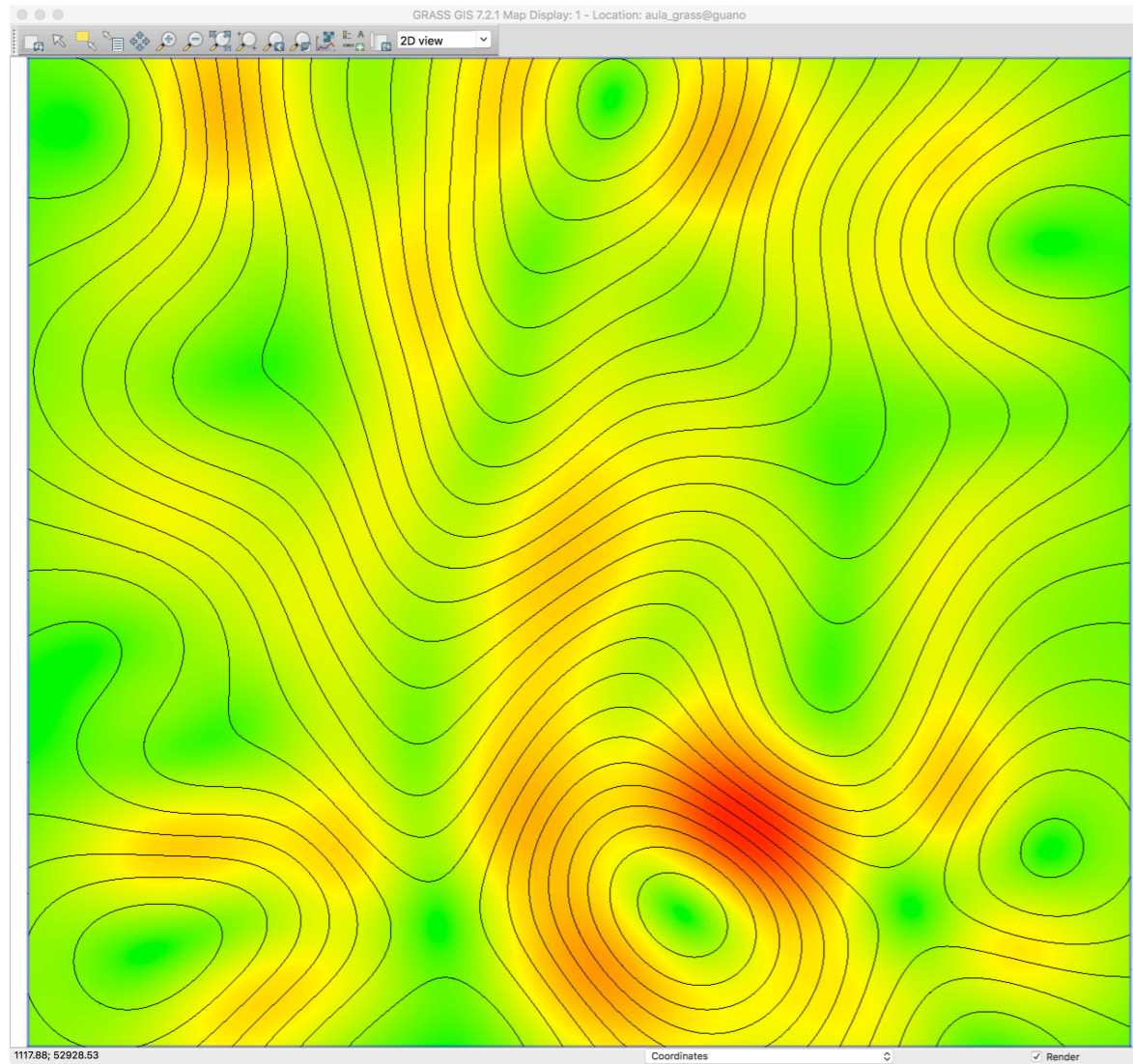
Name for output vector map showing overlapping windows: (overwin=name)

Close Run Copy ?

Add created map(s) into layer tree  
 Close dialog on finish

v.surf.rst --overwrite input=davis@guano elevation=davis\_dem\_t40 slope=davis\_dem\_t40\_slope aspect=davis\_dem\_t

# DECLIVIDADE / ASPECTO



# CURVATURAS

