GRASS GIS 7 workshop

GRASS GIS 7 raster intro

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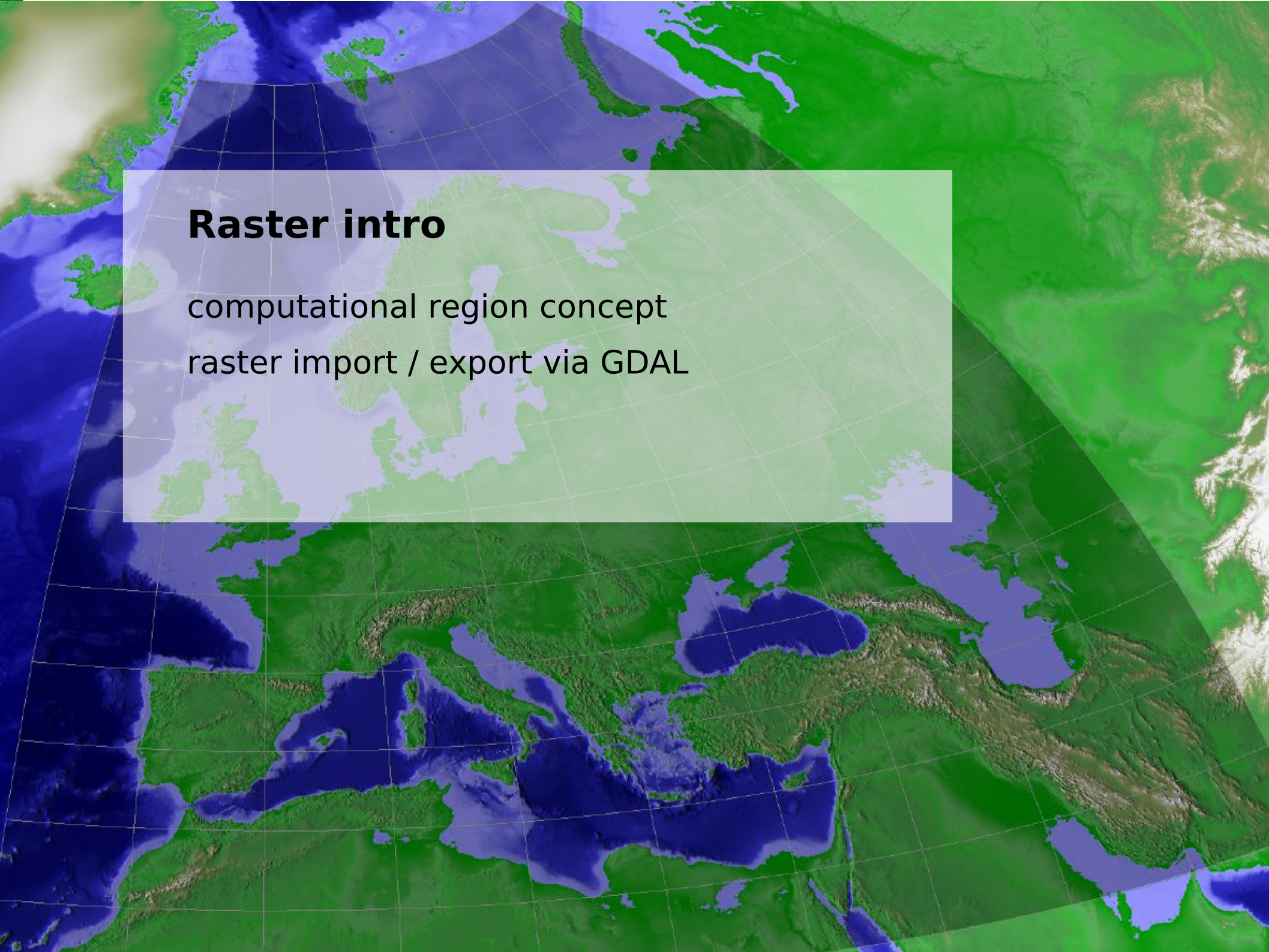
Session Objectives

- GRASS GIS raster processing concepts
- Import of a GeoTIFF (DEM)
- Applying a color table to the DEM
- Raster: NULL values and MASK
- Working with the computational region
- Region and raster map import/export
- Raster map export
- Simple hydrological modelling
- Raster capabilities in GRASS GIS

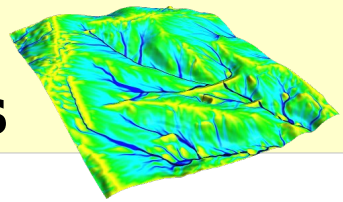


Raster intro

computational region concept

raster import / export via GDAL

Some GRASS raster processing concepts



Computational region

- defined by region extent and raster resolution
- applies to raster operations

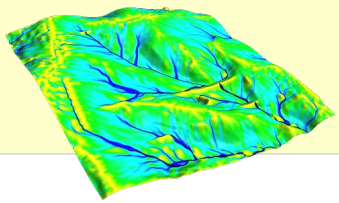
Raster map region

- defined by map extents and map resolution
- each raster map has its own values
- computational region overrides raster region

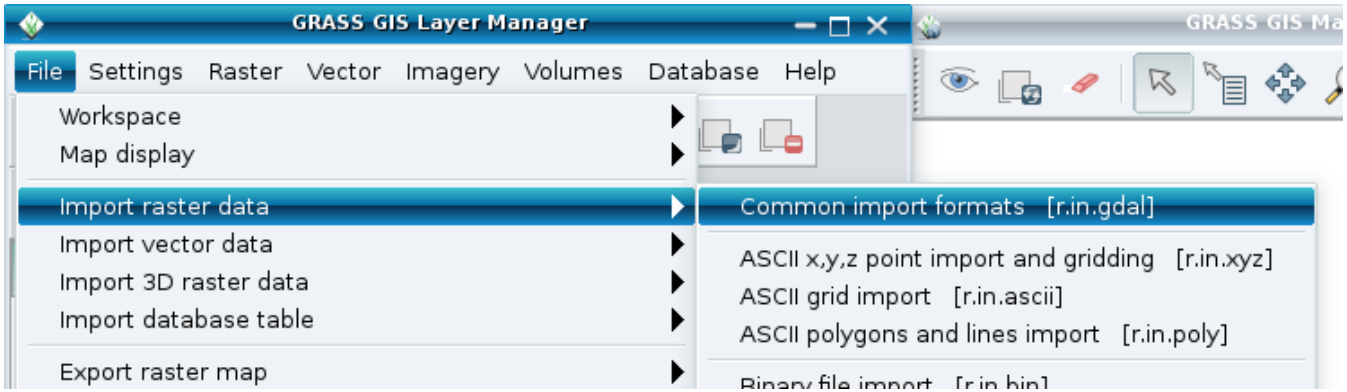
Display region

- extents of the current map display
- independent of the current computational region and the raster region
- user can set the current computational region from display region

Exercise – Import of a GeoTIFF (DEM)

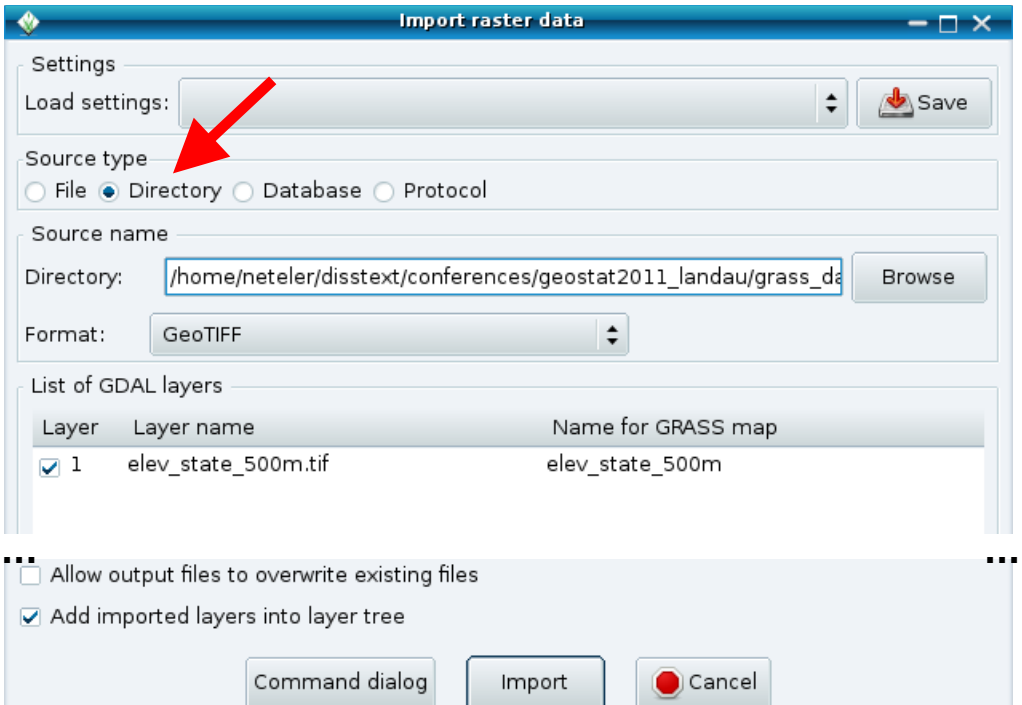


Since GRASS handles data in its own format, GIS files need to be imported (r.in.gdal/r.import) or just registered (r.external):



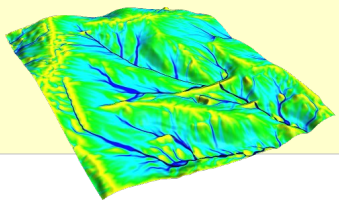
http://data.neteler.org/geostat2015/north_carolina/elev_ncstate_500m_tif.zip

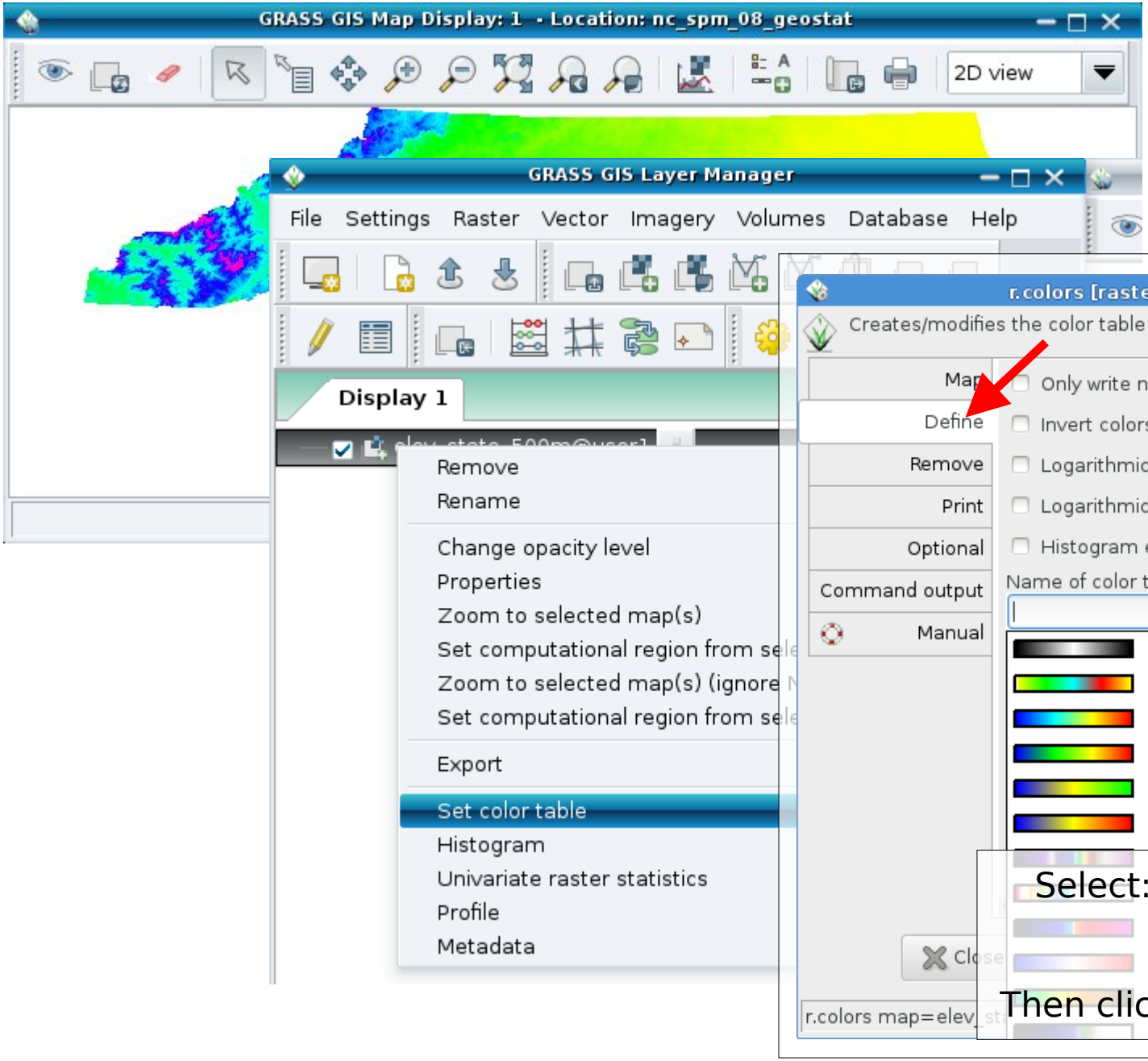
`elev_ncstate_500m.tif`



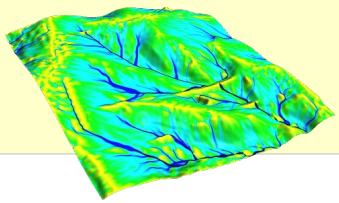
After import, activate the map in the map tree to display it

Exercise – Applying a color table to DEM





Raster: NULL values and MASK

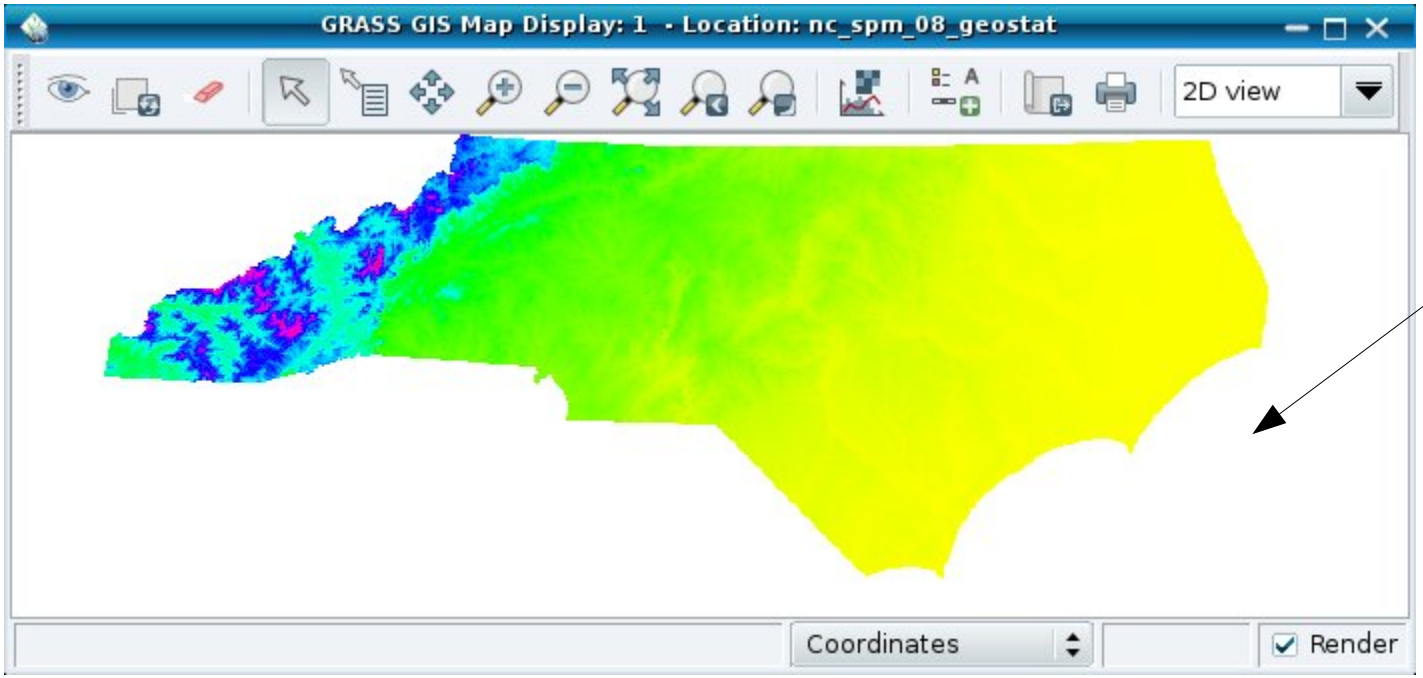


NULL values: no value – e.g. gaps in DEM

MASK (i.e., a raster map with this name, capital letters):

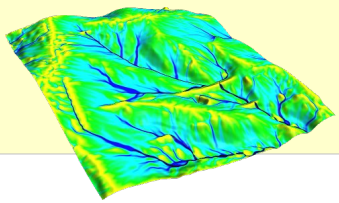
MASK'ed cells are read as NULL cells -> usually skipped

(also all areas outside the computation region)



NULL
(perhaps due
to a MASK)

Exercise – Working with MASKs



Load the “zipcodes” raster map into the Layer Manager and display it.

Set the computational region to the map (via right mouse button) or with

```
g.region raster=zipcodes -p
```

Now we want to pick only one ZIP code and restrict subsequent calculations to only that part.

- List raster attributes (or use query tool on map):
  `r.category zipcodes`
- Set the MASK (here: using a raster map, also vector maps are supported – an inverse mask can be set adding the `-i` flag):

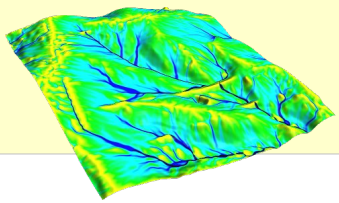
  ```
  r.mask raster=zipcodes maskcats=27605
  ```

- Now display the map again (“Render map” icon) to see only that particular area of the “zipcodes” map

Note: the computational region is not updated by that.

MASK removal: `r.mask -r`

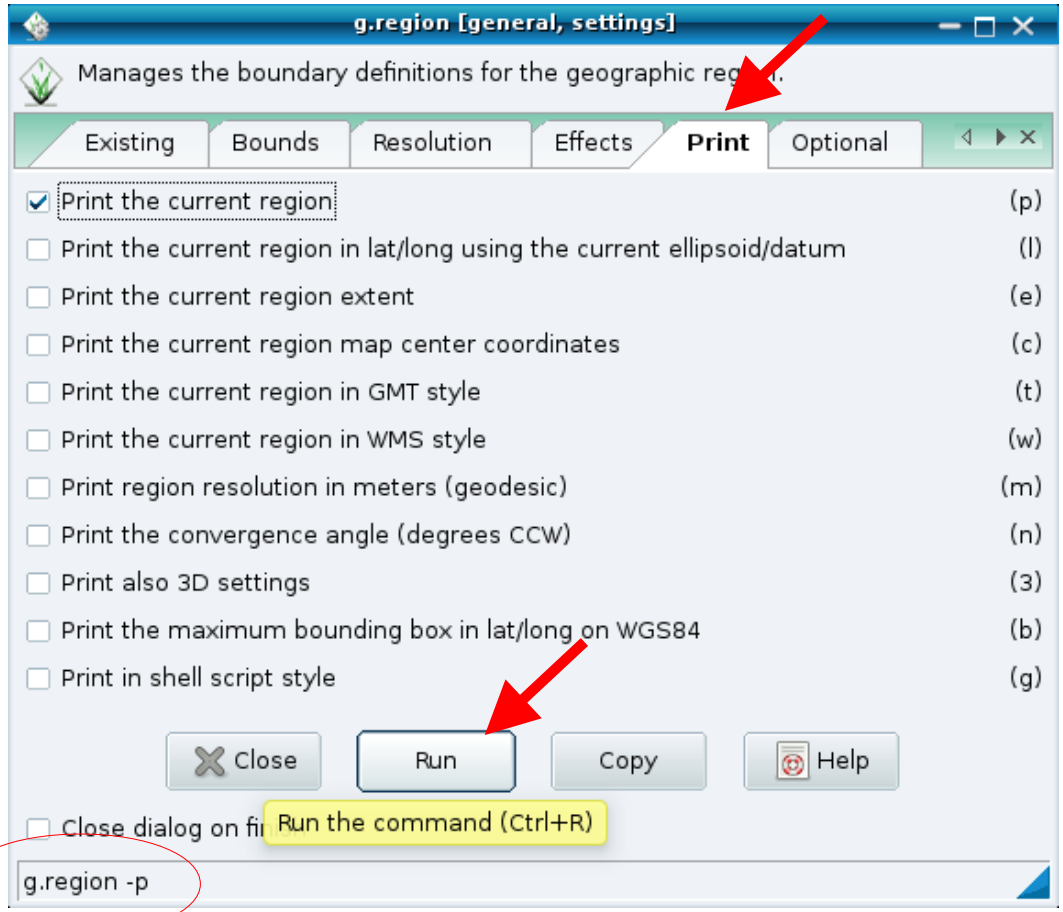
Exercise – Working with the region



Print values of computational region (valid for the active MAPSET)

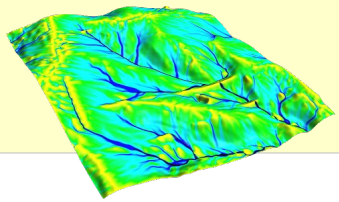
command: `g.region -p`

wxGUI: Settings -> Region -> Set region



Indeed, command line:

Raster map import/export



Import of raster maps

r.in.* modules

r.import (it also offers reprojection on the fly)!

Always the full maps are imported.

Export of raster maps

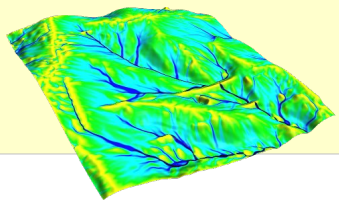
r.out.* modules

!! Raster export adheres to computational region (and respects also a MASK if present)

r.out.gdal for export

GDAL supports > 140 raster formats.

Exercise – Raster map export



Raster export via GDAL

command: r.out.gdal

wxGUI: File -> Export raster map -> Common export formats

Exercise:

Set region to some raster map

```
> g.region -p raster=<raster>
```

export this raster with `r.out.gdal`

```
> r.out.gdal input=<raster> output=<raster>.tif
```

Now display this raster map, zoom in, set region from display (icon)

export again with `r.out.gdal`

compare size of the two exported raster maps

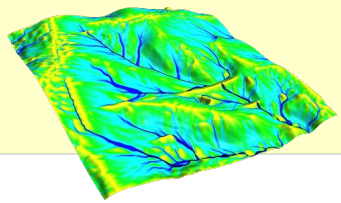
compare output of gdalinfo

Change to HOME:

```
> cd
> pwd
```

Note: White space in path needs quoting with "C:\PATH TO\..."

Exercise – Hydrological modelling



Flow accumulation with Multiple Flow Direction:

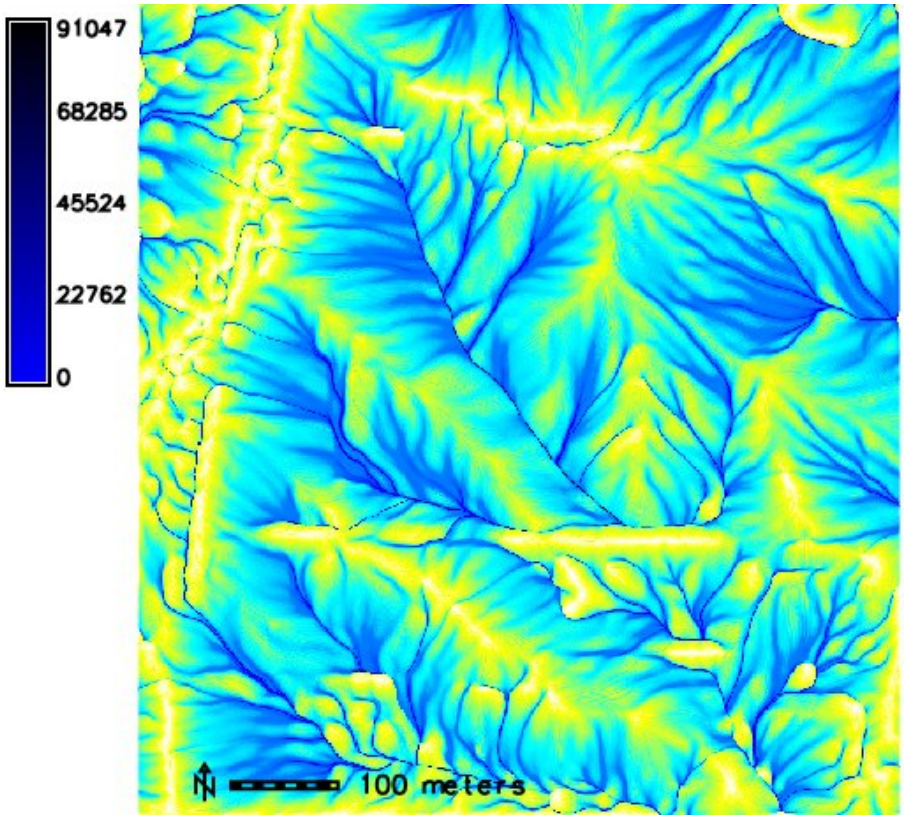
```
# set computational region to map (using map metadata)
g.region raster=elev_lid792_1m -p

# flow accumulation with MFD
r.watershed elevation=elev_lid792_1m accumulation=flowacc

# check map list
g.list raster

# show metadata
r.info flowacc

# now look at map in
# map display
```



Exercise – Hydrological analysis: reality check

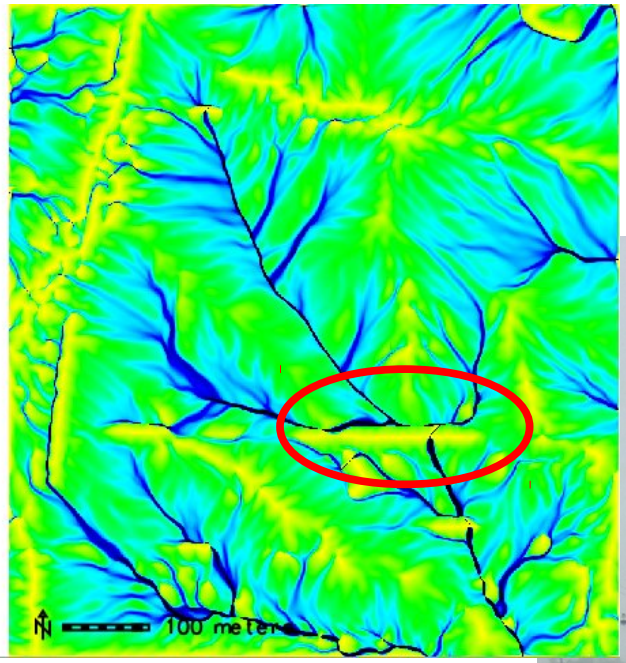
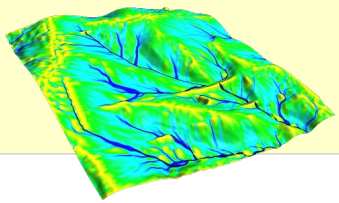


Photo view

Credit:
Helena Mitasova, NCSU
(source: author,
citation: http://www4.ncsu.edu/~lgtateos/download/tvcg.10.pdf)

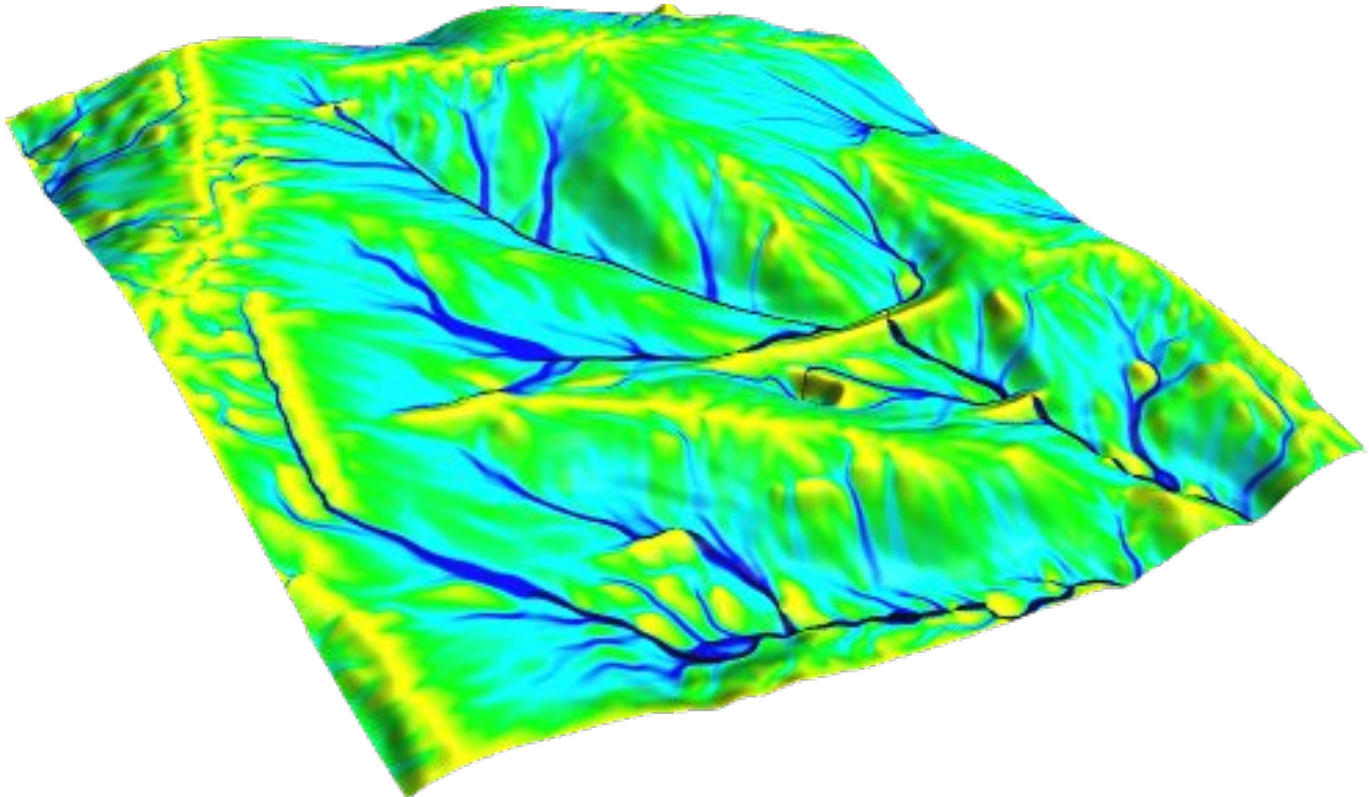
Exercise – Hydrological modelling



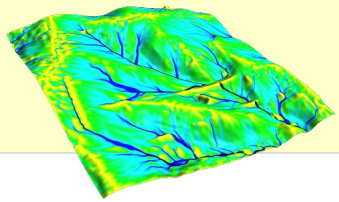
Perspective view of flow accumulation:

Create a nice perspective view

- Load and highlight the “elev_lid792_1m” raster map in the layer manager
- In the map display, switch to “3D view” – in the upper right corner
- In wxNVIZ's “Data” tab, load “`flowacc`” as “Surface attrib./Color”
- Increase the shown map resolution in “Fine mode”: reduce the value



Raster capabilities in GRASS GIS



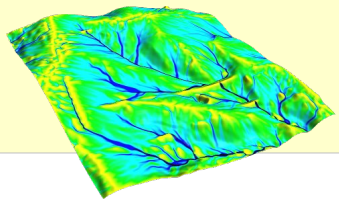
Example raster module groups

- resampling
- Reprojection/georectification
- map calculator
- Terrain analysis
- Hydrologic modeling
- Reports and statistics

Raster maps: DEMs, land cover, climatic maps …

Imagery maps: Landsat, MODIS, SPOT, QuickBird …

Raster data analysis: further methods



- Additional DEM analysis modules:
  - depression areas can be filled with **r.fill.dir**
  - flowlines can be calculated with **r.flow**
  - trace a flow through a DEM: **r.drain**
  - watershed analysis can be done with **r.watershed** and **r.terraflow**
  - cost surfaces: **r.cost, r.walk**
- Energy:
  - cast shadows, astronomical calculations of sun position: **r.sunmask**
  - energy budget: **r.sun**
- Line of sight:
  - viewsheds can be generated with: **r.viewshed**
- Interpolation methods
  - 2D inverse distance weighted: **v.surf.idw**
  - 2D from contour lines: **r.surf.contour**
  - 2D bilinear: **r.resamp.interp**
  - 2D regularized splines with tension (with cross validation): **v.surf.rst**
  - 3D regularized splines with tension (with cross validation): **v.vol.rst**
  - 2D/3D kernel densities: **v.kernel**

  ... and much more!

https://grass.osgeo.org/grass72/manuals/