

GRASS GIS 7: A theoretical and practical course

Session 1 – GRASS GIS 7 raster intro

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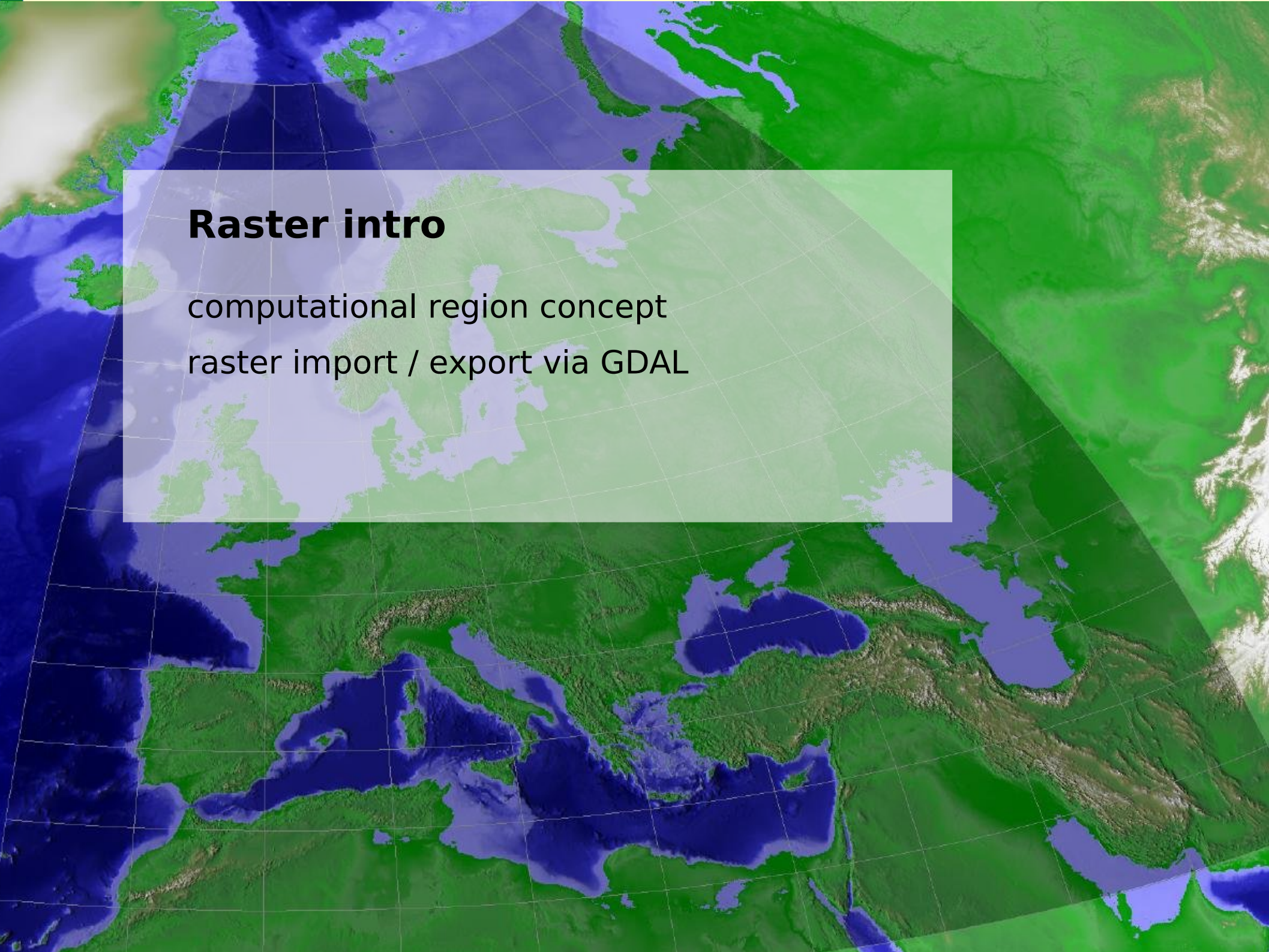
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<http://www.mundialis.de>





Session Objectives

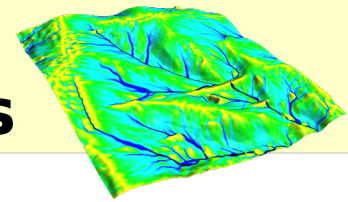
- GRASS GIS raster processing concepts
- Import of a GeoTIFF (DEM)
- Applying a color table to the DEM
- Raster: NULL values and MASK
- Working with the computational region
- Region and raster map import/export
- Raster map export
- Simple hydrological modelling
- Raster capabilities in GRASS GIS



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

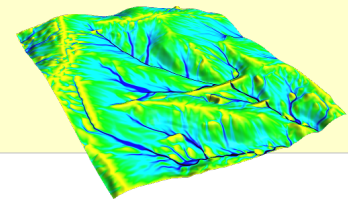
Display region

extents of the current map display

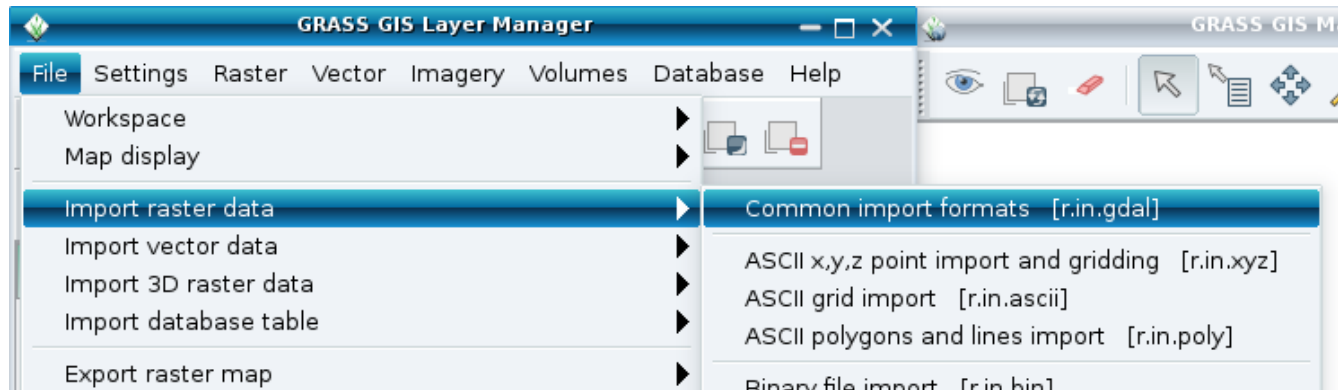
independent of the current computational region
and the raster region

user can set the current computational region from display region

Exercise – Import of a GeoTIFF (DEM)



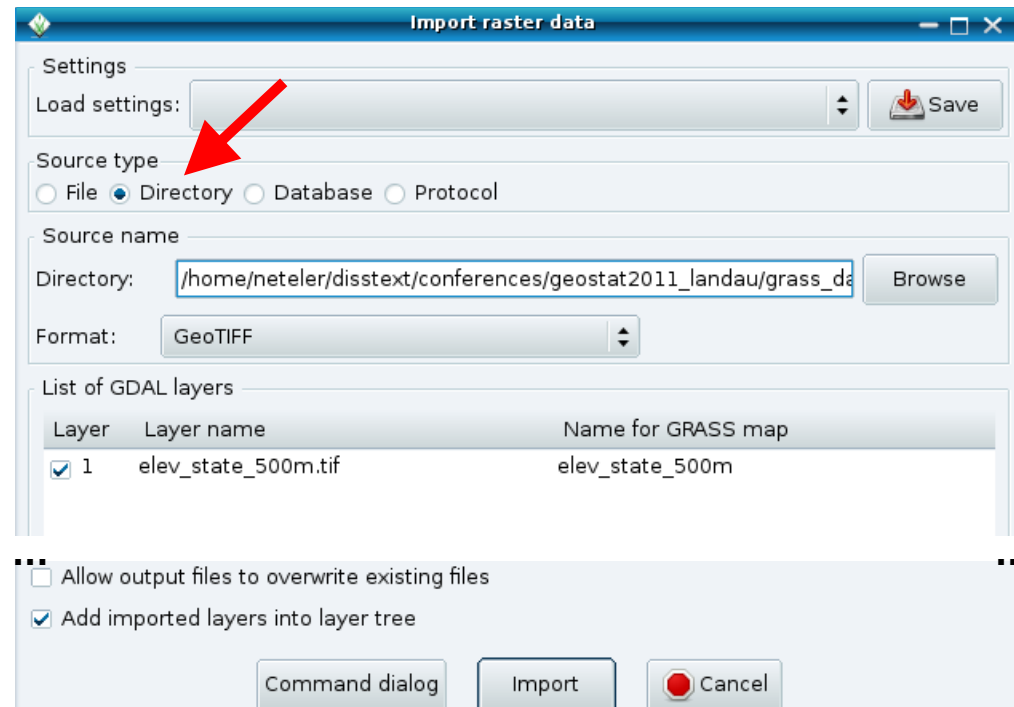
Since GRASS handles data in its own format, GIS files need to be imported (r.in.gdal/r.import) or just registered (r.external):



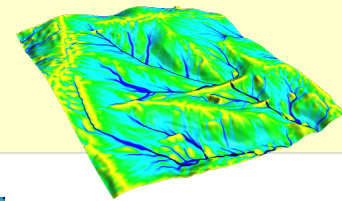
http://data.neteler.org/geostat2015/north_carolina/elev_ncstate_500m.tif.zip

elev_ncstate_500m.tif

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



Exercise – Applying a color table to DEM



GRASS GIS Map Display: 1 - Location: nc_spm_08_geostat

GRASS GIS Layer Manager

Display 1

Remove
Rename
Change opacity level
Properties
Zoom to selected map(s)
Set computational region from selected map(s)
Zoom to selected map(s) (ignore NODATA)
Set computational region from selected map(s)
Export
Set color table
Histogram
Univariate raster statistics
Profile
Metadata

r.colors [raster, color table]

Creates/modifies the color table associated with a raster map.

Map ☐ Only write new color table if one doesn't already exist
Define ☐ Invert colors
Remove ☐ Logarithmic scaling
Print ☐ Logarithmic-absolute scaling
Optional ☐ Histogram equalization
Command output
Manual

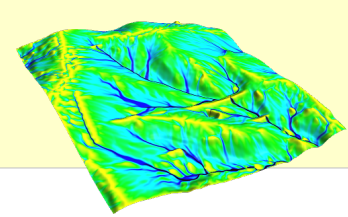
Name of color table: (color=st)

aspect
aspectcolr
bcyr
bgyr
byg
byr
celsius
color
differences
etopo2

Select: elevation or terrain or srtm or ...

Then click on the "Run" button

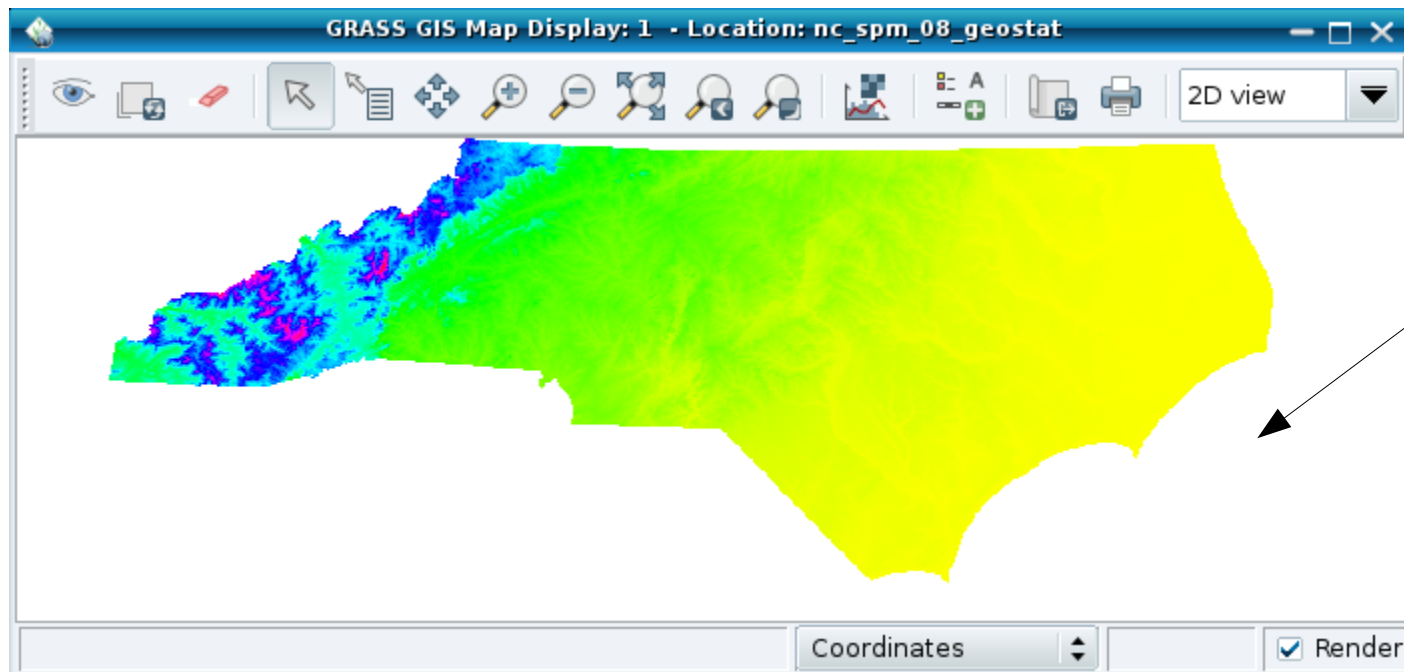
Raster: NULL values and MASK



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

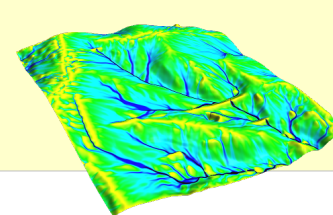
MASK (i.e., a raster map with this name, capital letters):

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):

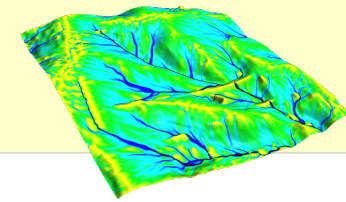
```
r.mask raster=zipcodes maskcats=27605
```

- 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`

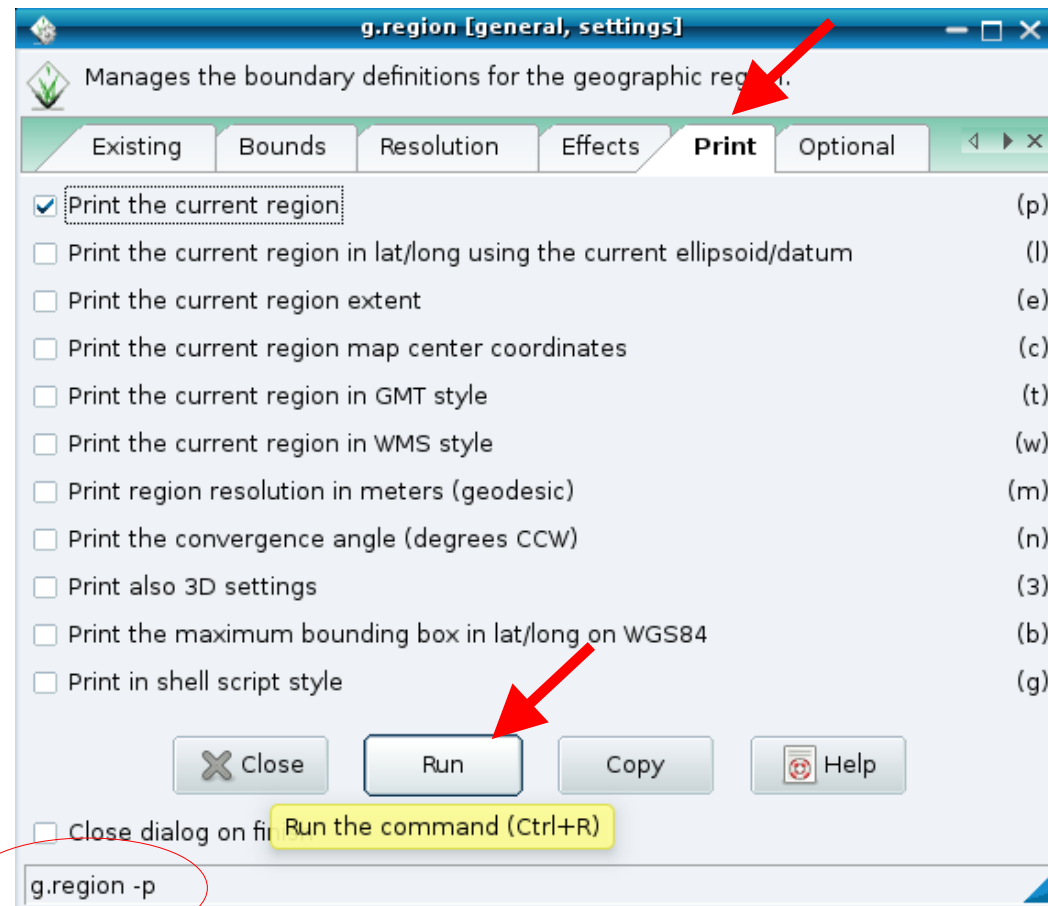
Exercise – Working with the region



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

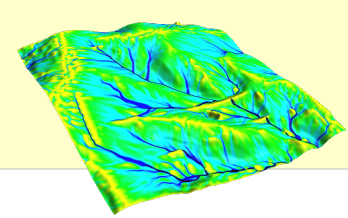
command: `g.region -p`

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

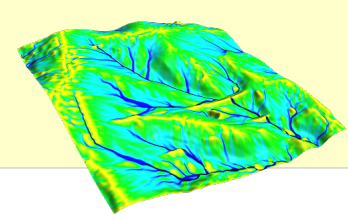
r.out.* modules

**!! 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`

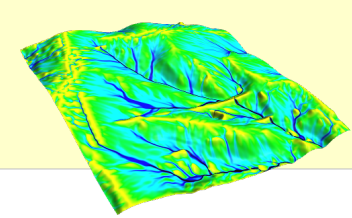
Change to HOME:

```
> cd
```

```
> pwd
```

Note: White space in path needs quoting with “**C:\PATH TO\...**”

Exercise – Hydrological modelling



Flow accumulation with Multiple Flow Direction:

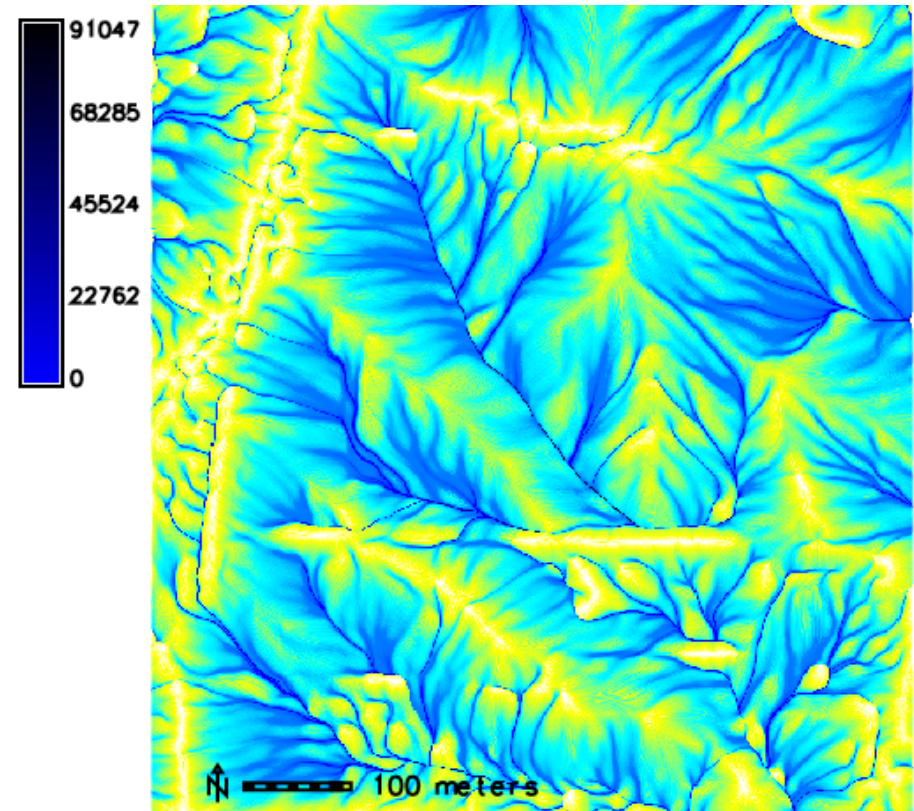
```
# set computational region to map (using map metadata)
g.region raster=elev_lid792_1m -p

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

# check map list
g.list raster

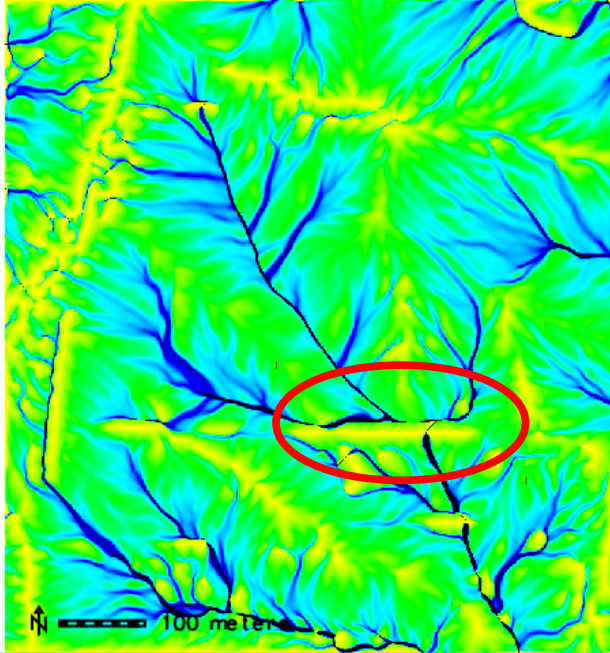
# show metadata
r.info flowacc

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



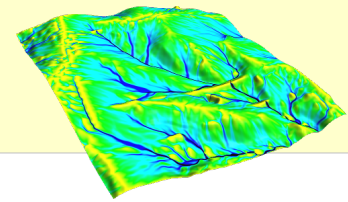


Exercise – Hydrological analysis: reality check



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

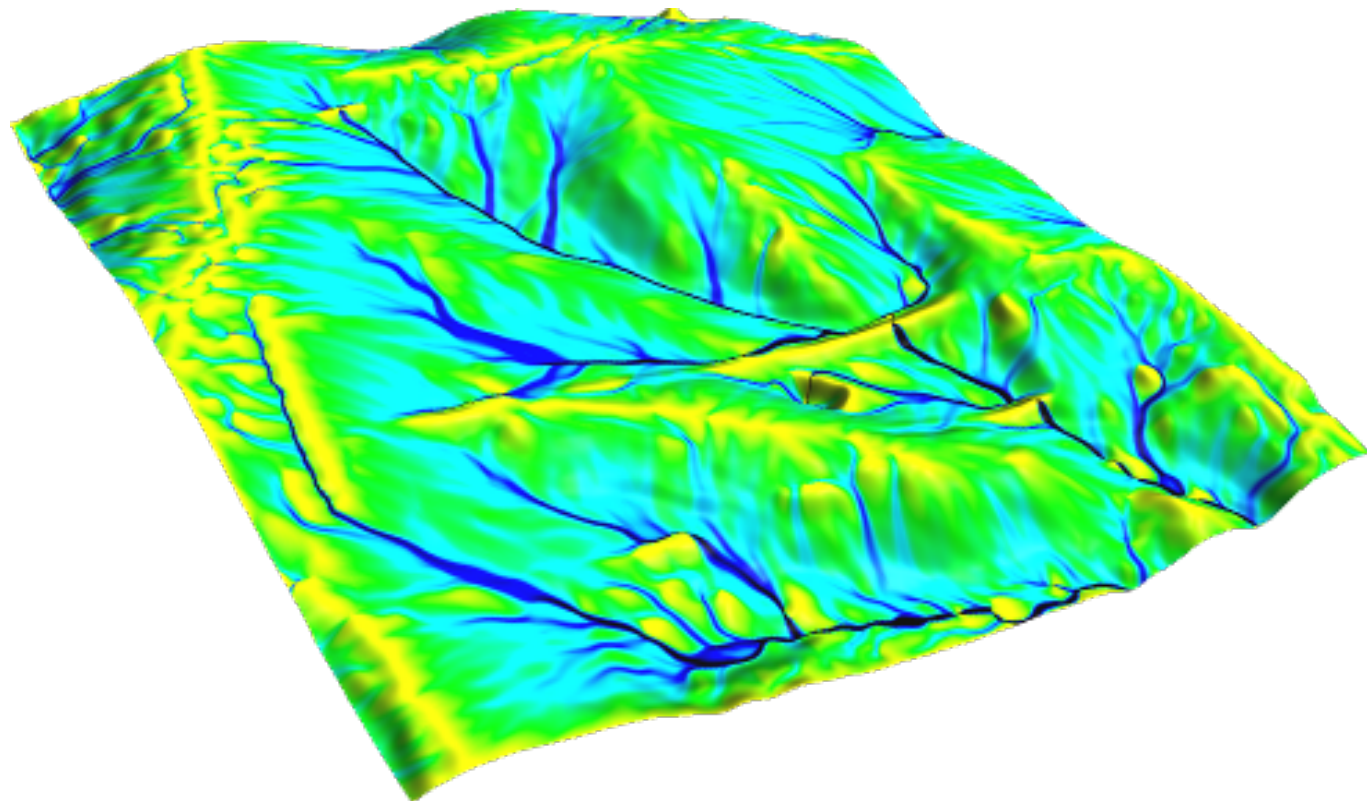
Exercise – Hydrological modelling



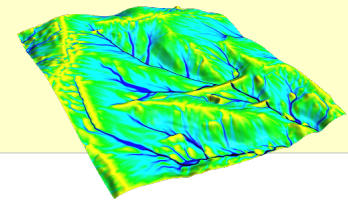
Perspective view of flow accumulation:

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

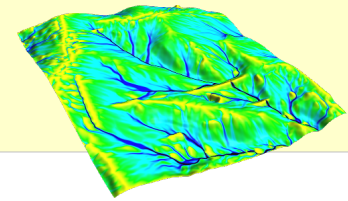
Hydrologic modeling

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/>