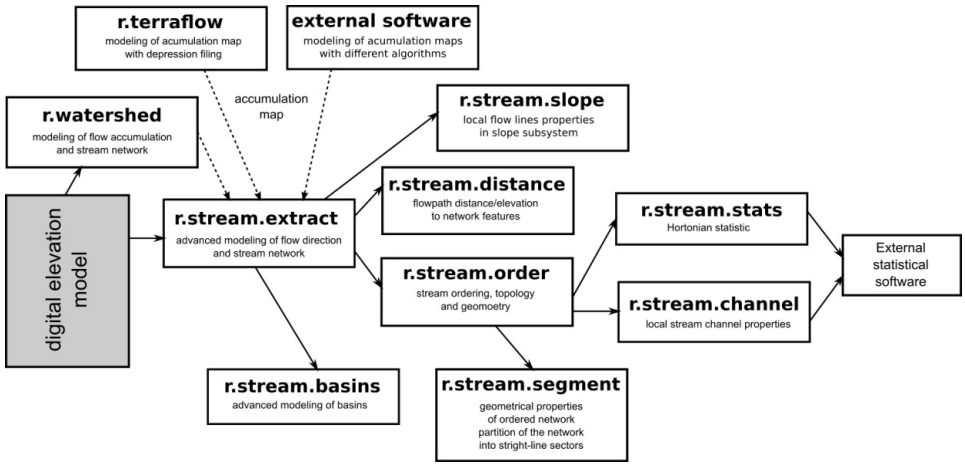
COURSE DESCRIPTION

r stream is a comprehensive and flexible hydro-geomorphological modeling tool written as an extension for GRASS GIS. The toolbox is optimized to work with really huge datasets (of hundreds of millions and even billions cells) and is really fast. Most of modules are easy to use in its basic form hoverer for advanced users offer numerous additional options.

r stream prives following possibillites:

- advanced stream network modeling
- cooperation with different accumulation algorithms (import form SAGA)
- advanced and quick basins delineation
- modeling the internal structure of watershed
- stream ordering and Horton's statistics
- input data correction (snapping to pour points)
- advanced analysis of stream properties including directional analysis
- easy and quick fuzzy approach to stream network modeling (with GRASS scripting)



Workshop takes 2 hours of intensive training and 2 hour comprehensive practice exercise. The training part consists of 5 exercises (approx: 15 - 30 min each):

Exercise 1:
Modeling stream network using slope/accumulation threshold and different stream initiation map

Exercise 2:
Import and use different type of accumulation maps from SAGA GIS. How GRASS can cooperate with SAGA

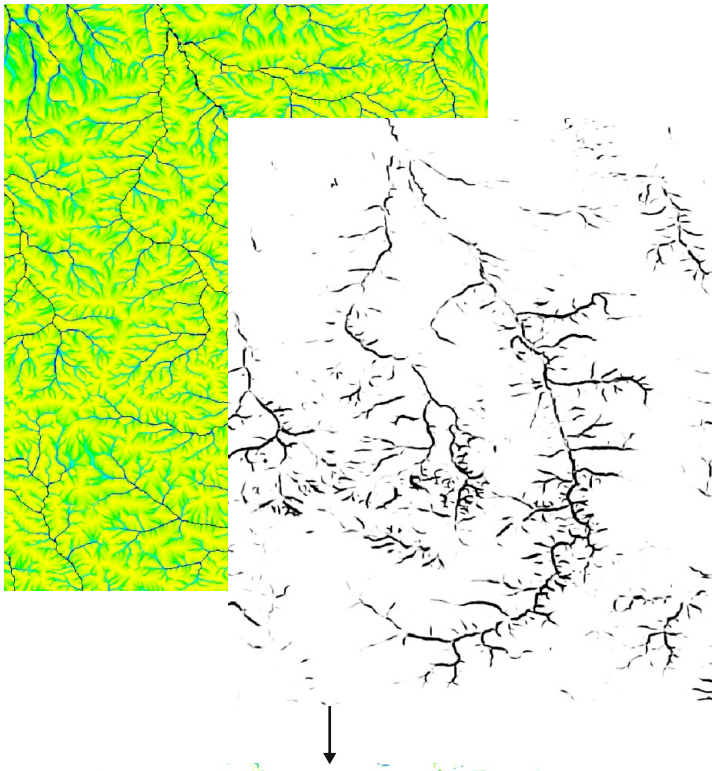
Exercise 3:
- advanced basin's delineation using different methods of outlet definition: by (points, lines and areas); snapping streams outlets and heads to pour point

Exercise 4:
Ordering network using different ordering algorithms (Horton, Strahler, Gravelius itp) and Horton's statistics; dividing streams into straight line blocks

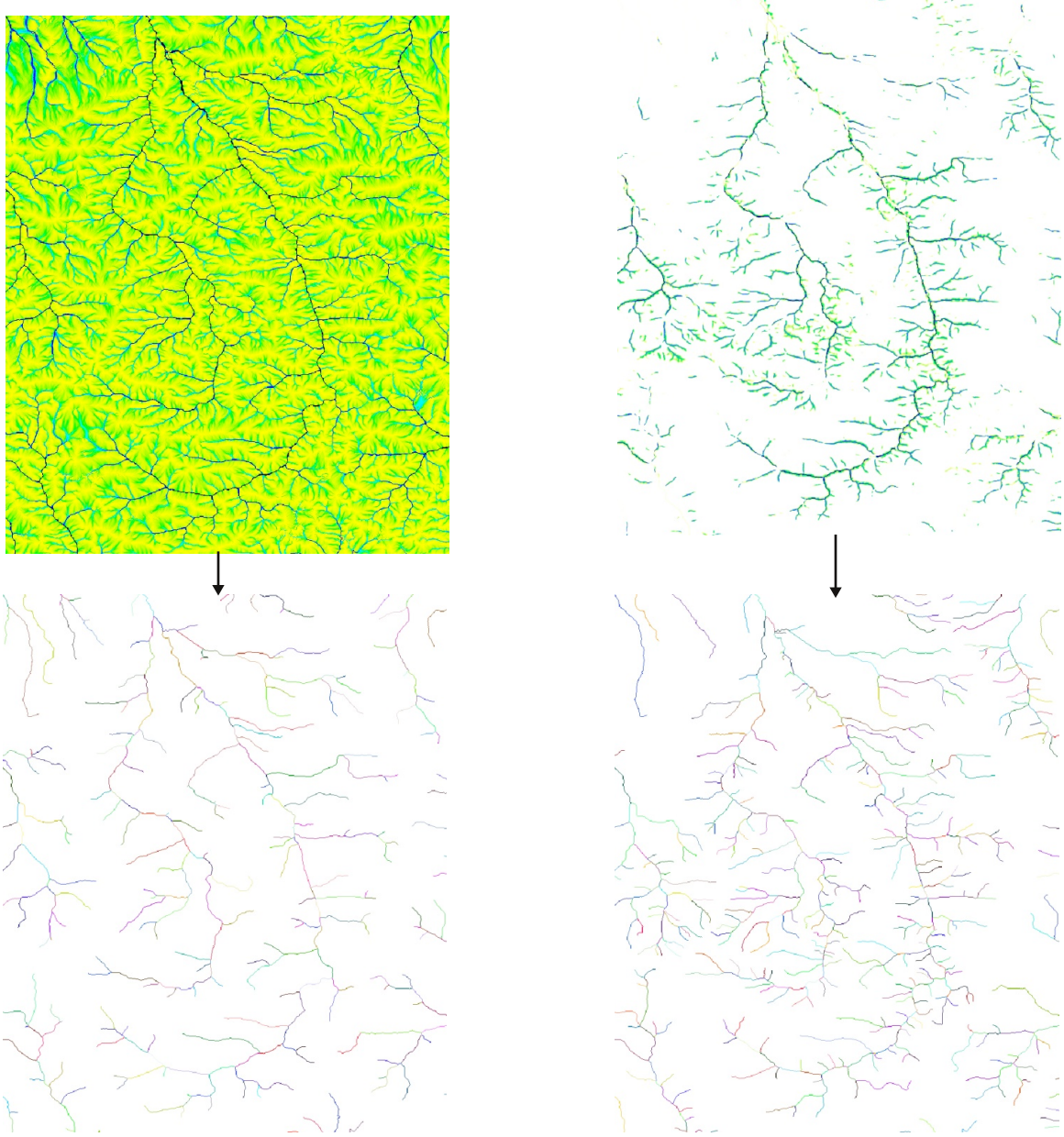
Exercise 5:
modeling of watershed structure (distance, elevation, local slope properties)

STREAM NETWORK MODELING

r stream offers offers unlimited methods of network initiation and tracing. All aviailable with simple GRASS map algebra. Here streams are traced using MFD accumulation map and are initialised by product of accumulation and fuzzy valley detection based on minimum curvature. Toolbox can use accumulation map of any source and moddified with any terrain features. No limits except the imagination... everything with simple map algebra...



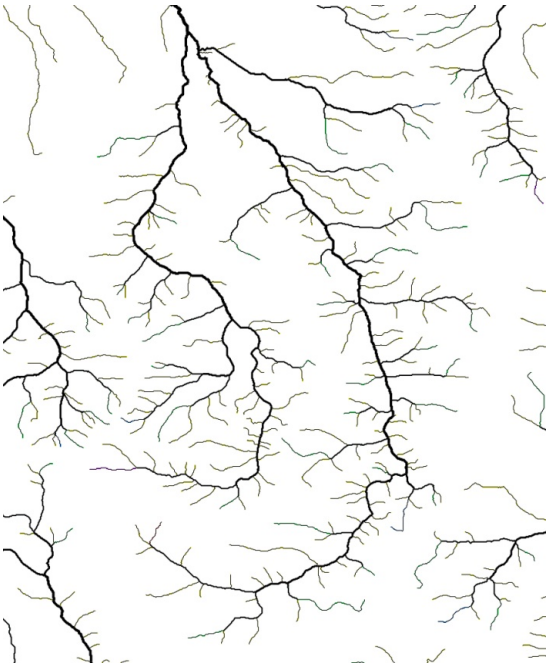
THRESHOLD-BASED MODEL



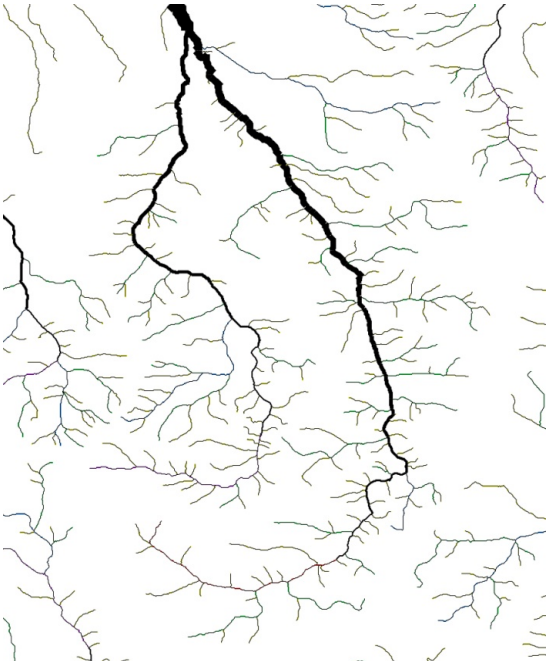
NETWORK ORDERING

r stream toolbox offers 7 methods of network ordering: Strahler and Horton (original) stream order, Shreve (Scheidegger) stream magnitude , Gravelius (Hack) stream hierarchy, topological distance to outlet and unique Drwal's streams order. All orders can be modeled with one simple GRASS command...

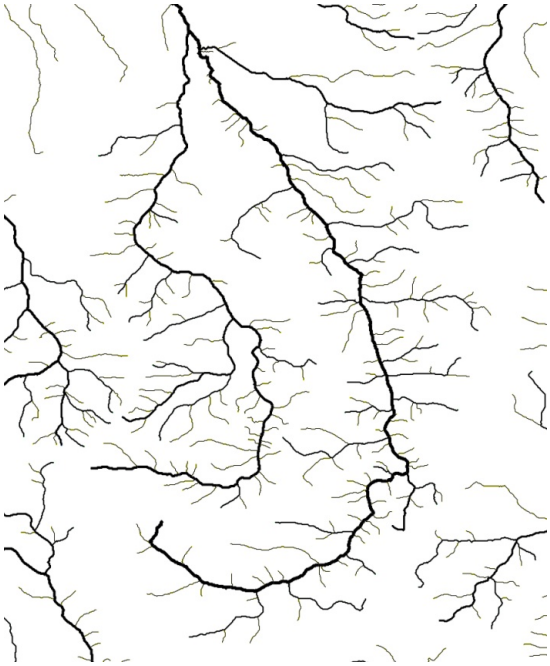
STRAHLER



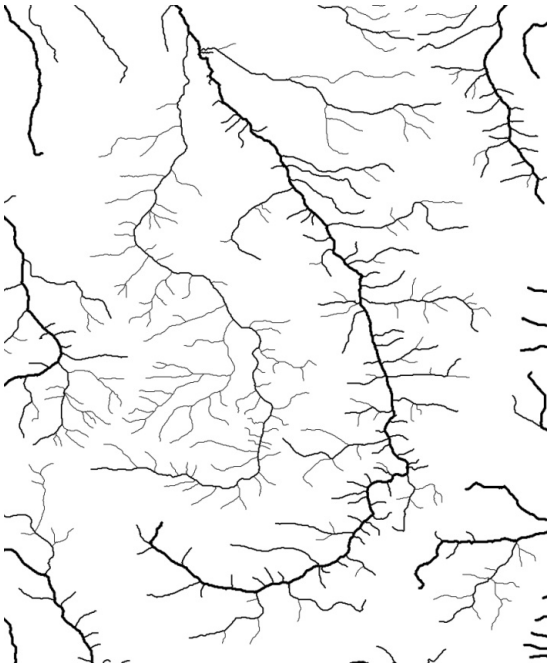
SHREEVE



HORTON

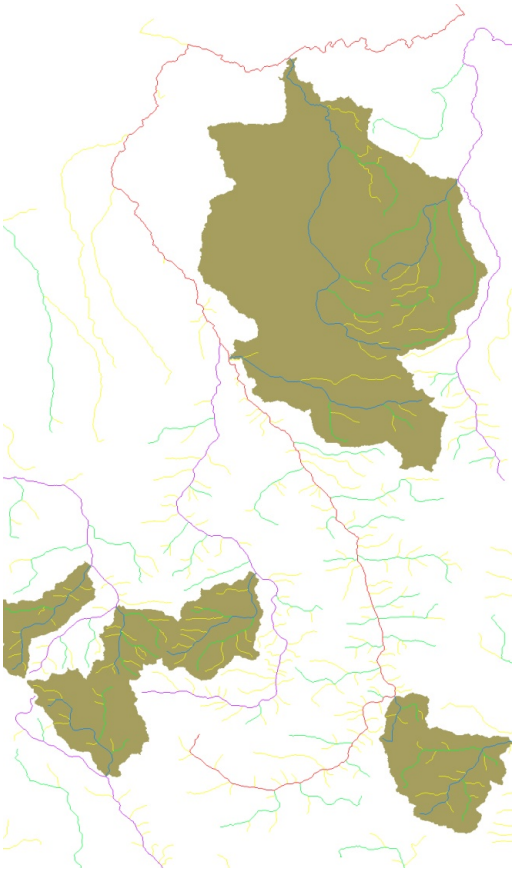


MAIN STREAMS



ADVANCED BASIN DELINEATION

3rd ORDER BASINS



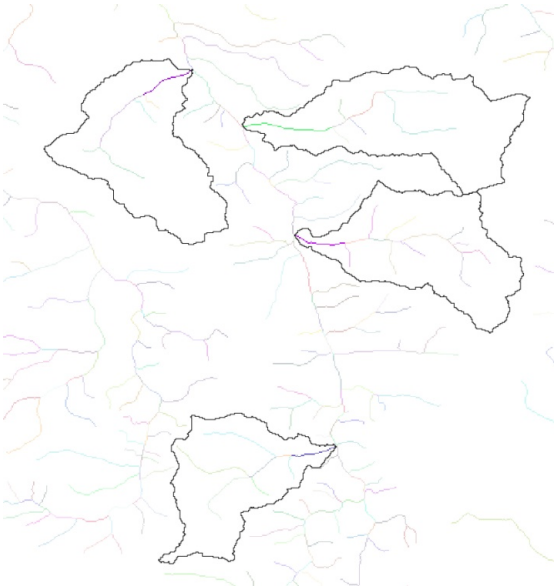
Basin delineation module is one of the most powerful tool of r.stream package. It allow to model basins using:

- multipoints (outlets, gauges etc.)
- multilines (streams, coastlines)
- areas (lakes, marshes etc)

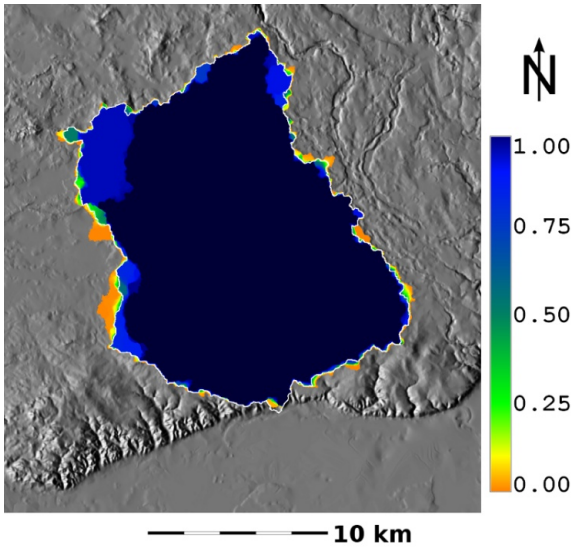
Module is quick and efficiet. The easiest way is just to give stream network and list streams for which basins are required. Software do the rest.

Fuzzy basin delination is also possible and takes no more than few minutes depending on number of iteration, dataset size and resolution. it Rrequires some basic scripting (no more than 10 lines of simple python code)

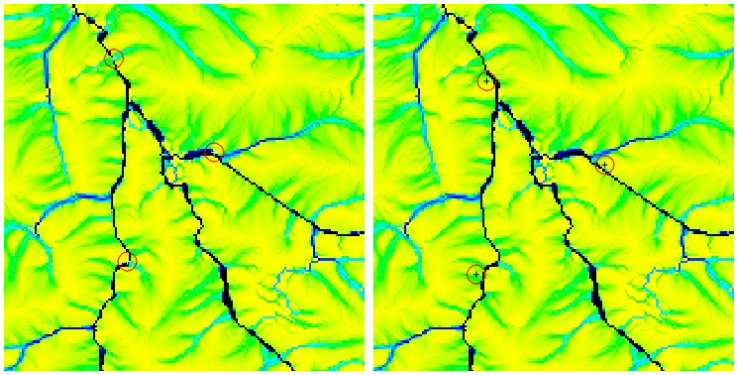
UNIQUE BASINS IN ONE STEP



FUZZY BOUNDARIES



Snap to pour points is useful data correction tool. ussualy data gathered in the field does not fit to the modeled data. This tool allow to correct it in seconds...

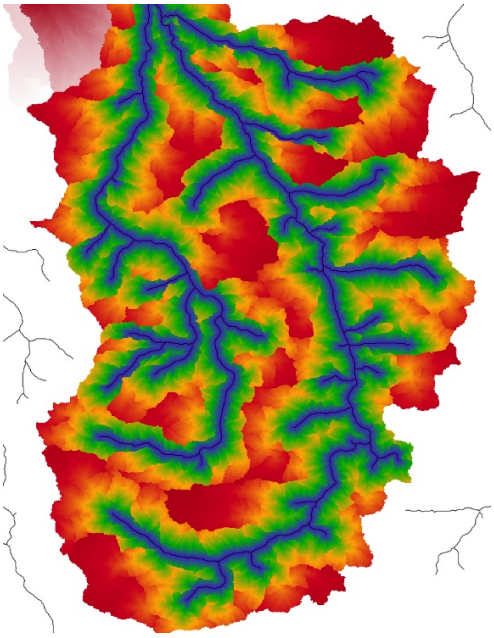


R STREAM A GRASS GIS TOOLBOX FOR ADVANCED HYDROGEOMORPHOLOGICAL MODELING

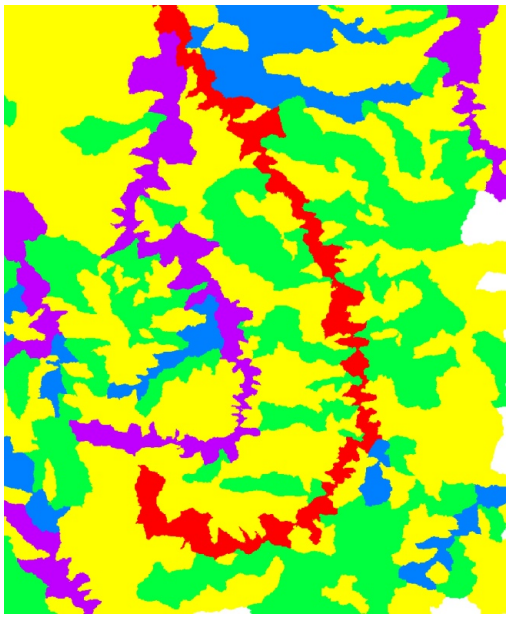
MODELING THE STRUCTURE OF WATERSHED

The toolbox offers advanced method of modeling internal structure of watershed. Watercouse elevation/distance to streams is the simplest and most popular tool. Many other features including properites of channel and slope subsystems are available. Modeling watershed's structure of more complex objects like lakes or shorelines is also possible.

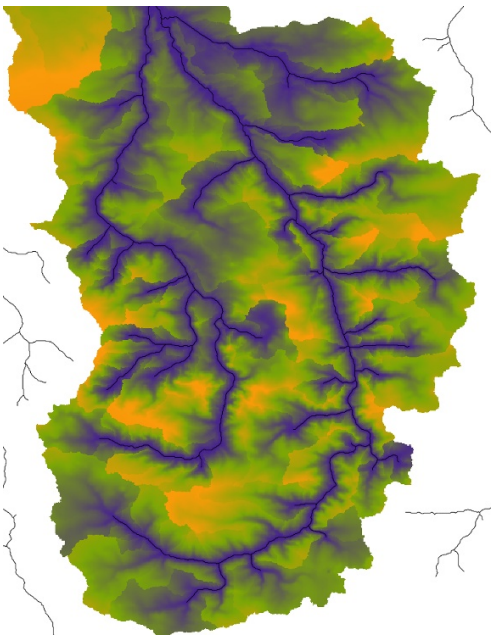
WATERCOURSE DISTANCE



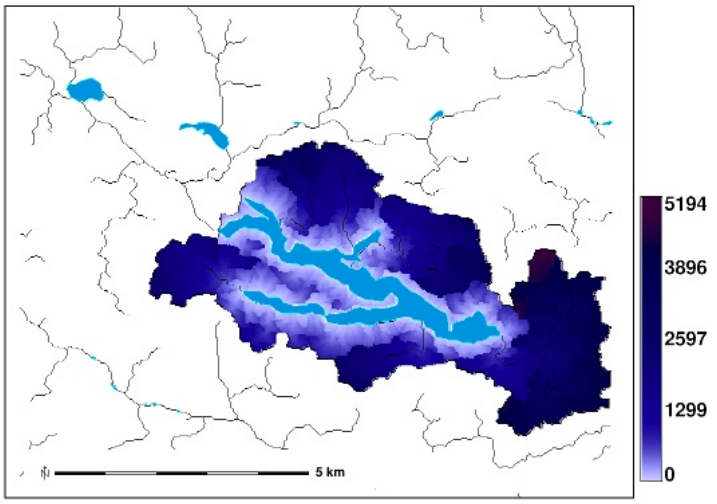
SUPPLY AREA OF DIFFERENT ORDER



WATERCOURSE ELEVATION

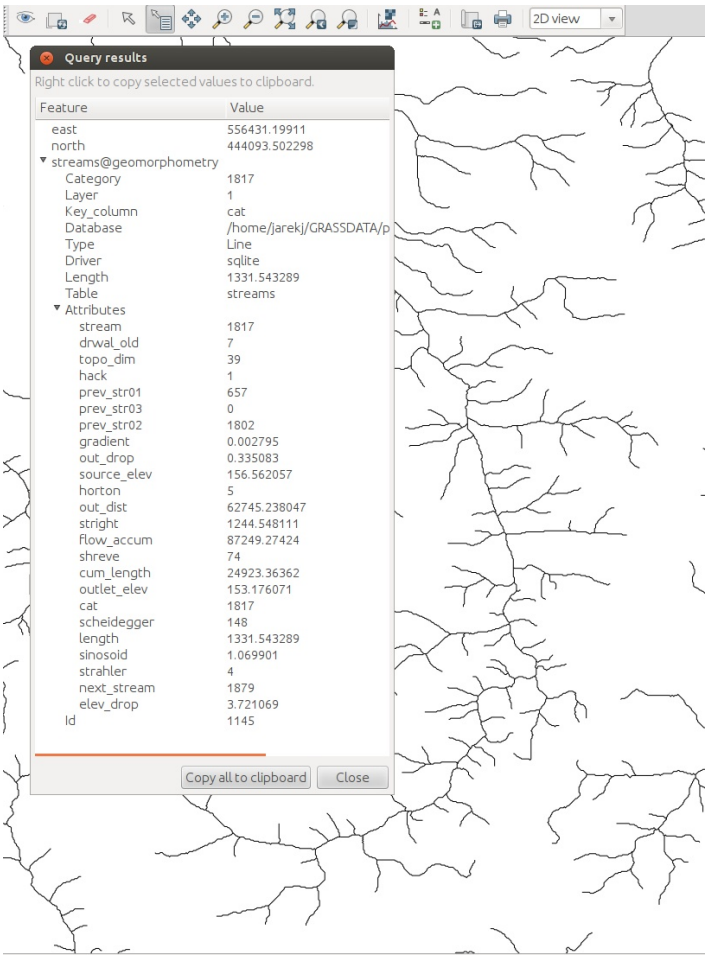


1st AND 2nd ORDER BASINS



ADVANCED APROACH TO NETWORK ANALYSIS

Network analysis offers numerous parameters calculated during analysis: more than 20 topological and geometrical parameters of stream segments, direcional analysis, network segmentation and many more...



Fast fuzzy analysis of stream network. With simple script...

Full Horton's statistics for entire area or for selected basins in user's or script friendly mode....

```
Reading map <strahler_basin@geomorphometry>
Reading map <dirs@geomorphometry>
Reading map <DEM@geomorphometry>
Summary:
Max order | Tot.N.str. | Tot.str.len. | Tot.area. | Dr.dens. | Str.freq.
   (num)  |    (num)   |      (km)    |    (km2)  | (km/km2) | (num/km2)
        5 |        253 |     442.0637 |  493.5006 |   0.8958 |   0.5127
Stream ratios based on regresion coefficient:
 Bif.rt. | Len.rt. | Area.rt. | Slo.rt. | Grd.rt.
  3.8792 |  2.2414 |   4.4687 |  1.9320 |  2.0014
Avaraged stream ratios with standard deviations:
 Bif.rt. | Len.rt. | Area.rt. | Slo.rt. | Grd.rt.
  4.3750 |  2.2711 |   3.7627 |  1.9175 |  1.9792
  2.4958 |  1.1258 |   2.6135 |  0.2132 |  0.2507
Order | Avg.len |  Avg.ar  |  Avg.sl |  Avg.grad. | Avg.el.dif
 num  |   (km)  |  (km2)   |  (m/m)  |    (m/m)   |     (m)
    1 |  1.3077 |   1.5148 |  0.0202 |     0.0190 | 19.0181
    2 |  1.9809 |   6.1848 |  0.0100 |     0.0095 | 16.2252
    3 |  6.8350 |  36.3321 |  0.0050 |     0.0046 | 22.3005
    4 | 20.4695 | 185.0571 |  0.0024 |     0.0021 | 41.7859
    5 | 23.0110 | 493.5006 |  0.0015 |     0.0013 | 29.1810
Order | Std.len |  Std.ar  |  Std.sl |  Std.grad. | Std.el.dif
 num  |   (km)  |  (km2)   |  (m/m)  |    (m/m)   |     (m)
    1 |  1.5996 |   3.1182 |  0.0111 |     0.0100 |  9.4113
    2 |  1.4761 |   5.1842 |  0.0042 |     0.0039 |  9.5532
    3 |  4.2174 |  27.0118 |  0.0031 |     0.0028 | 10.0295
    4 |  5.4695 |  93.8812 |  0.0001 |     0.0002 |  7.6165
    5 | -0.0000 |   0.0000 |  0.0000 |     0.0000 |  0.0000
Order | N.streams | Tot.len (km) | Tot.area (km2)
    1 |       210 |     274.6068 | 318.1113
    2 |        35 |      69.3317 | 216.4689
    3 |         5 |      34.1751 | 181.6605
    4 |         2 |      40.9390 | 370.1142
    5 |         1 |      23.0110 | 493.5006
Order | Bif.rt. | Len.rt. | Area.rt. | Slo.rt. | Grd.rt. | d.dens. | str.freq.
    1 |  6.0000 |  1.5149 |   0.0000 |  2.0071 |  1.9921 |  0.8632 |  0.6601
    2 |  7.0000 |  3.4505 |   4.0829 |  2.0049 |  2.0832 |  0.3203 |  0.1617
    3 |  2.5000 |  2.9948 |   5.8744 |  2.0582 |  2.2130 |  0.1881 |  0.0275
    4 |  2.0000 |  1.1242 |   5.0935 |  1.5999 |  1.6287 |  0.1106 |  0.0054
    5 |  0.0000 |  0.0000 |   2.6667 |  0.0000 |  0.0000 |  0.0466 |  0.0020
(Tue Jun 25 10:58:43 2013) Command finished (0 sec)
```

Analysis of lineamnets...