Evaluation of gvSIG and SEXTANTE Tools for Hydrological Analysis

Hochschule für Technik Stuttgart

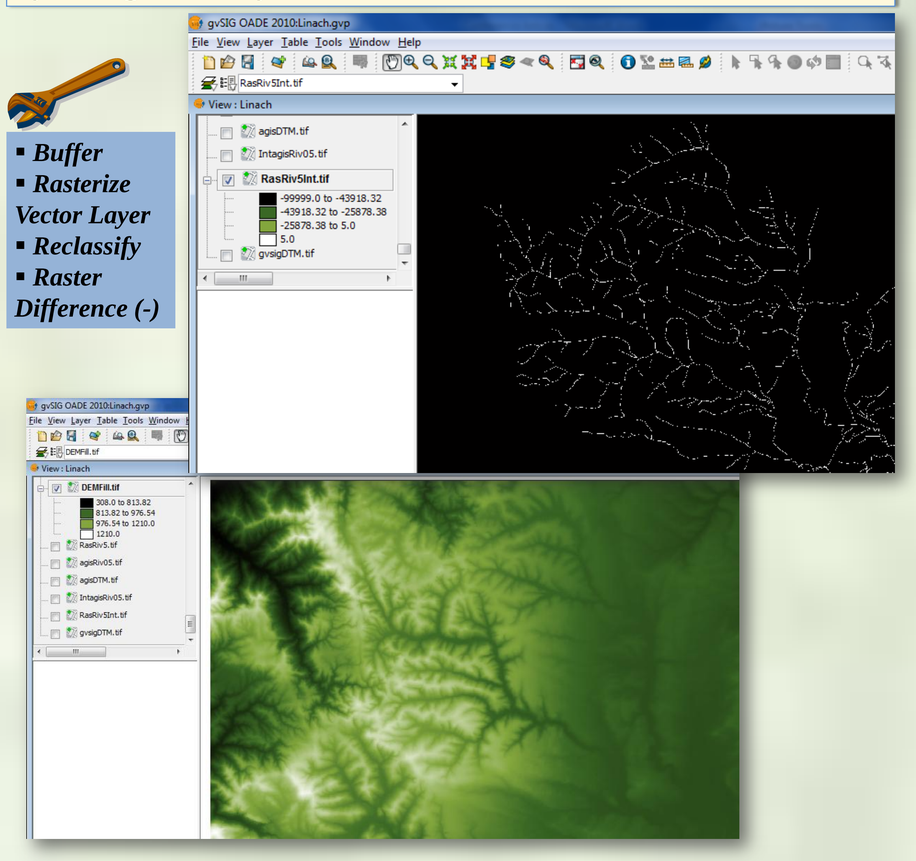
Schröder Dietrich[a], Mudogah Hildah[b] and Franz David[b]

Department of Photogrammetry and Geo-informatics, Stuttgart University of Applied Sciences, GERMANY

dietrich.schroeder@hft-stuttgart.de

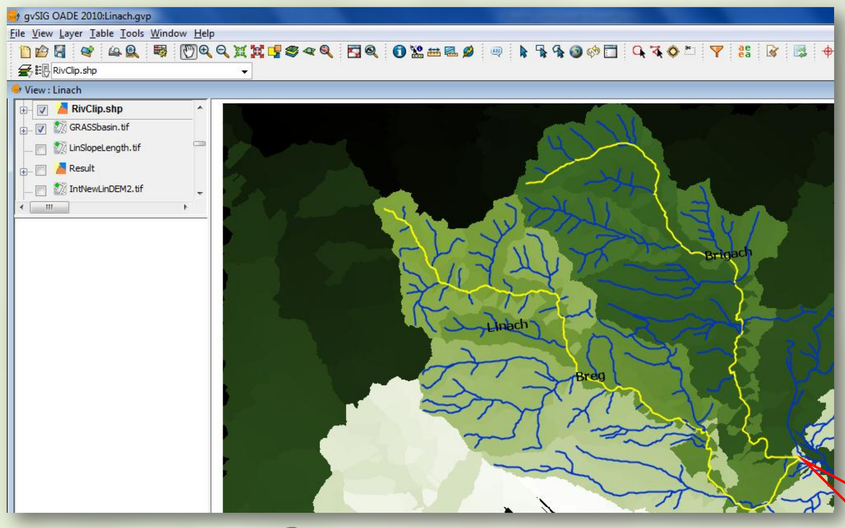
6th International gvSIG Conference, Valencia, SPAIN

Vector rivers are rasterized and used in the 'Burn-in' approach which involves reducing the DEM along the river trenches by a defined value and using the output as the basis of the hydrological analysis.



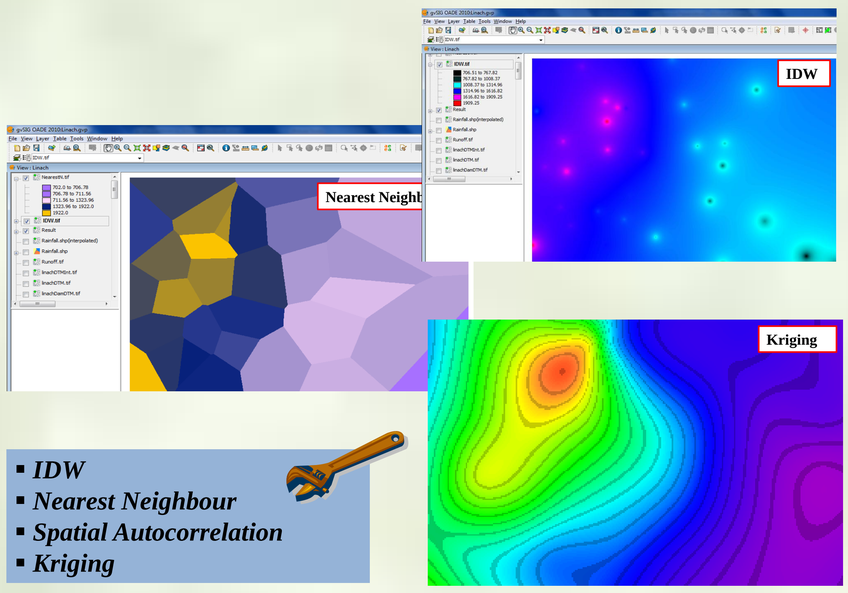
- ***Buffer***
- ***Rasterize Vector Layer***
- ***Reclassify***
- ***Raster Difference (-)***

Watershed delineation done using ***r.watershed*** tool from the GRASS interface with SEXTANTE as the front end.



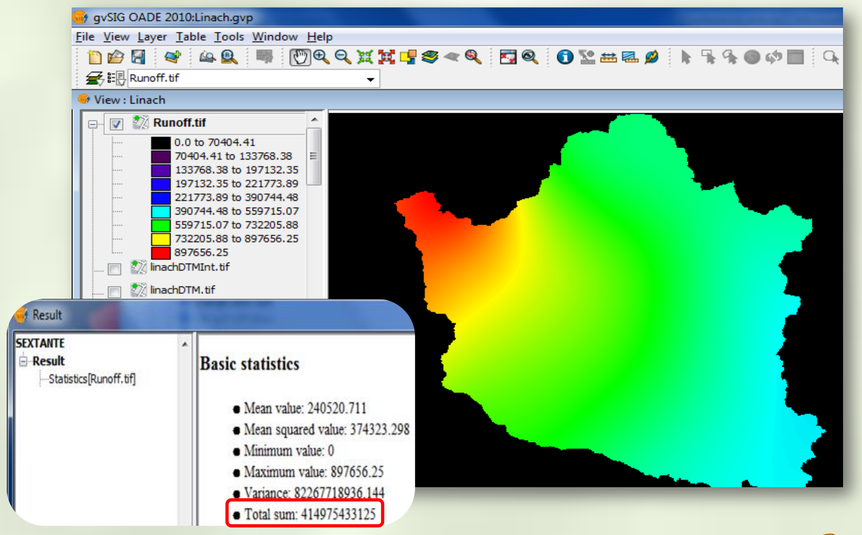
- ***r.watershed***

Interpolation of rainfall data tested using various techniques. Kriging shows a much smoother result.



- ***IDW***
- ***Nearest Neighbour***
- ***Spatial Autocorrelation***
- ***Kriging***

Total annual surface runoff within the watershed calculated using precipitation data.



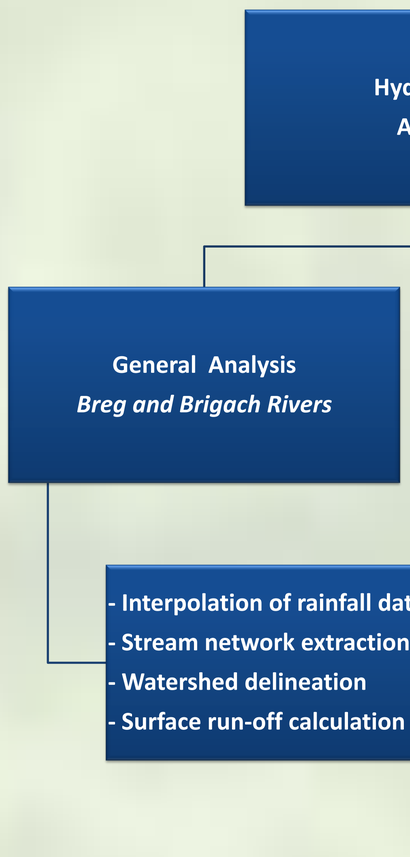
Ref: 410, 835 m³
gvSIG: 414, 975 m³

- ***Raster Calculator***
- ***Basic Statistics***

Linach Dam is located in a small valley of the Black Forest in South-West Germany. The dam was built in the 1920's for hydro-electricity production but was shut down in the 1960's. Plans to revive the dam are underway. A hydrological analysis of the dam project is thus done using gvSIG and SEXTANTE tools.

First a coarse and simplified hydrological modelling is done in order to get a general overview of the hydrological characteristics of the whole region. Then a more detailed analysis is done on a much smaller sub basin based on a tributary named *Linach*.

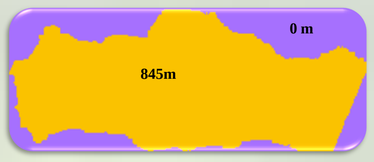
Linach Dam before restoration, Image taken from :
http://lh5.ggpht.com/_T_0gBySQ9ik/RxJUmeiRcAI/AAAAAAAABBo/gEGiaupwpGY/DSCF2104.jpg

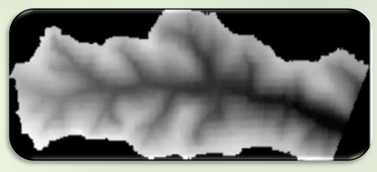


Donaueschingen where Breg and Brigach rivers meet to form River Danube, **Image taken from:**
http://www.the-english-guest-house.com/thedanube.htm

Dam Analysis

Dam capacity is calculated using the DEM and constant grids with free board height values.

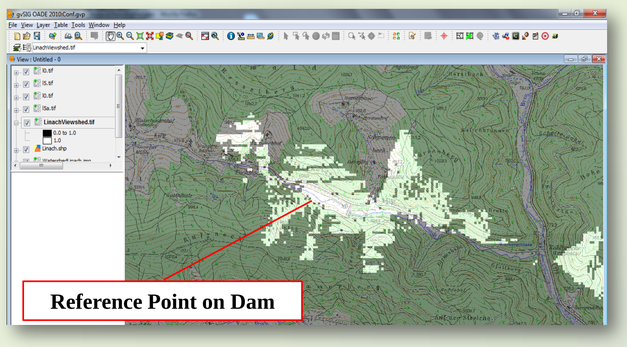




- ***Constant Grid***
- ***Volume Between layers***

Ref: 1,655,925,131 m³
gvSIG: 1,655,929,566 m³

Finally a viewshed analysis is done to establish the location of control points for surveying the dam. The control point is taken as the centre on top of the free board.

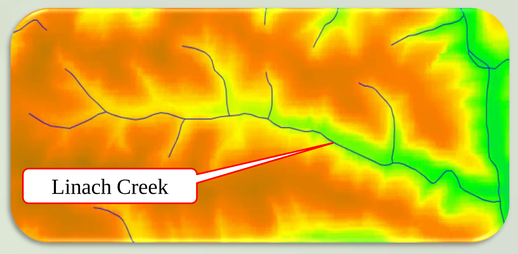


Summary

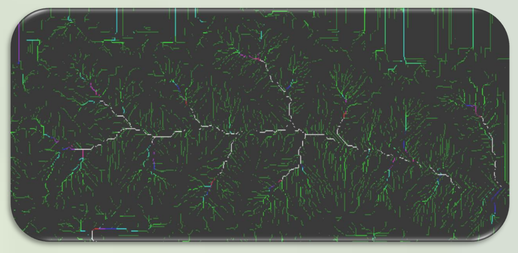
About 80% of all the tools tested worked well whereas only 15% either gave wrong results or reported an error. The remainder accounts for cases where no specific tool was found and workarounds were used.

Contours, digitized from topographic raster maps are used to create a more detailed DEM which forms the basis for the hydrological modelling of the *Linach* watershed.

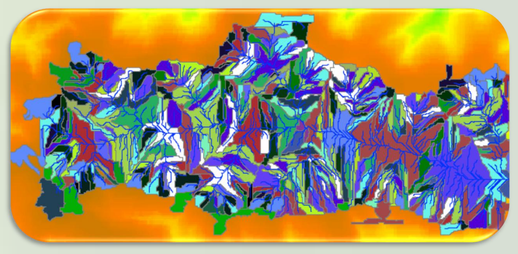
Sink-filled DEM overlaid with rivers



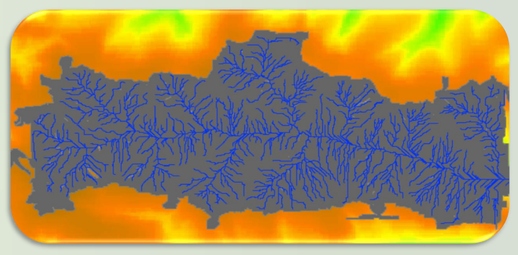
Flow accumulation



Watersheds

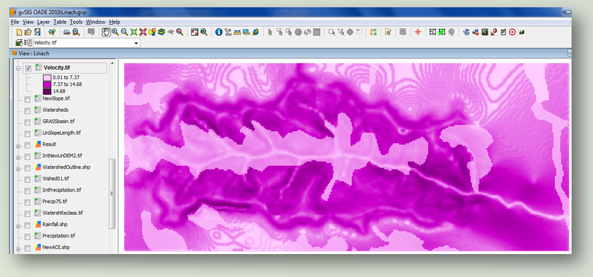


Merged watersheds and stream network

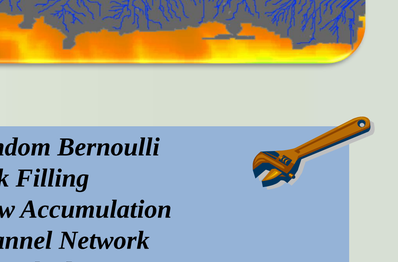


- ***Random Bernoulli***
- ***Sink Filling***
- ***Flow Accumulation***
- ***Channel Network***
- ***Watershed***
- ***gvSIG Geo-processing Toolbox***

Velocity map calculated using Manning Stricker equation with landcover as the obstacle layer.



Flow Time Map and time-area diagram calculation



- ***Slope***
- ***Time to Outlet***
- ***Class Statistics***
- ***Reclassify***
- ***Volume Between layers***
- ***Geomorphological Instantaneous Unit Hydrograph***