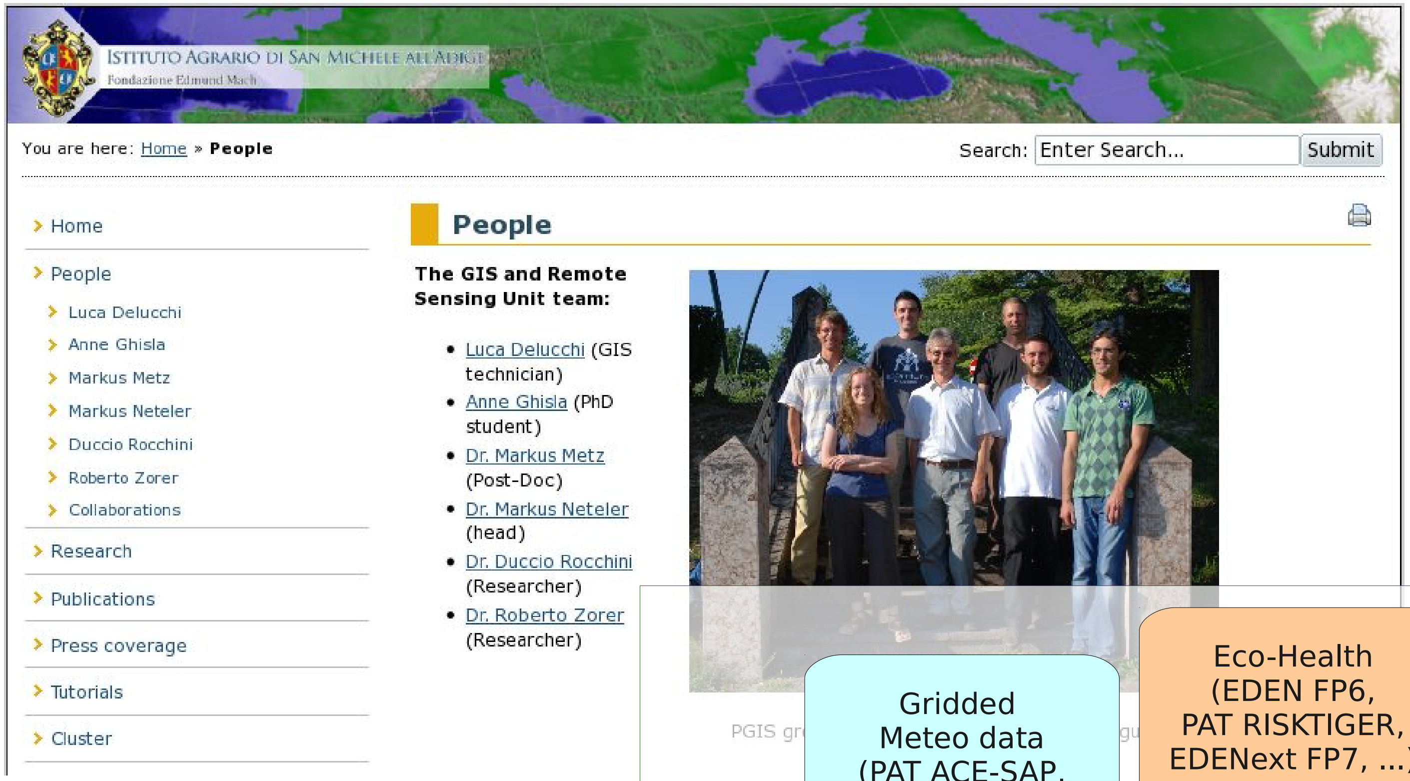
Markus Neteler & Markus Metz
Fondazione E. Mach – CRI, Italy
http://gis.cri.fmach.it

GRASS GIS news

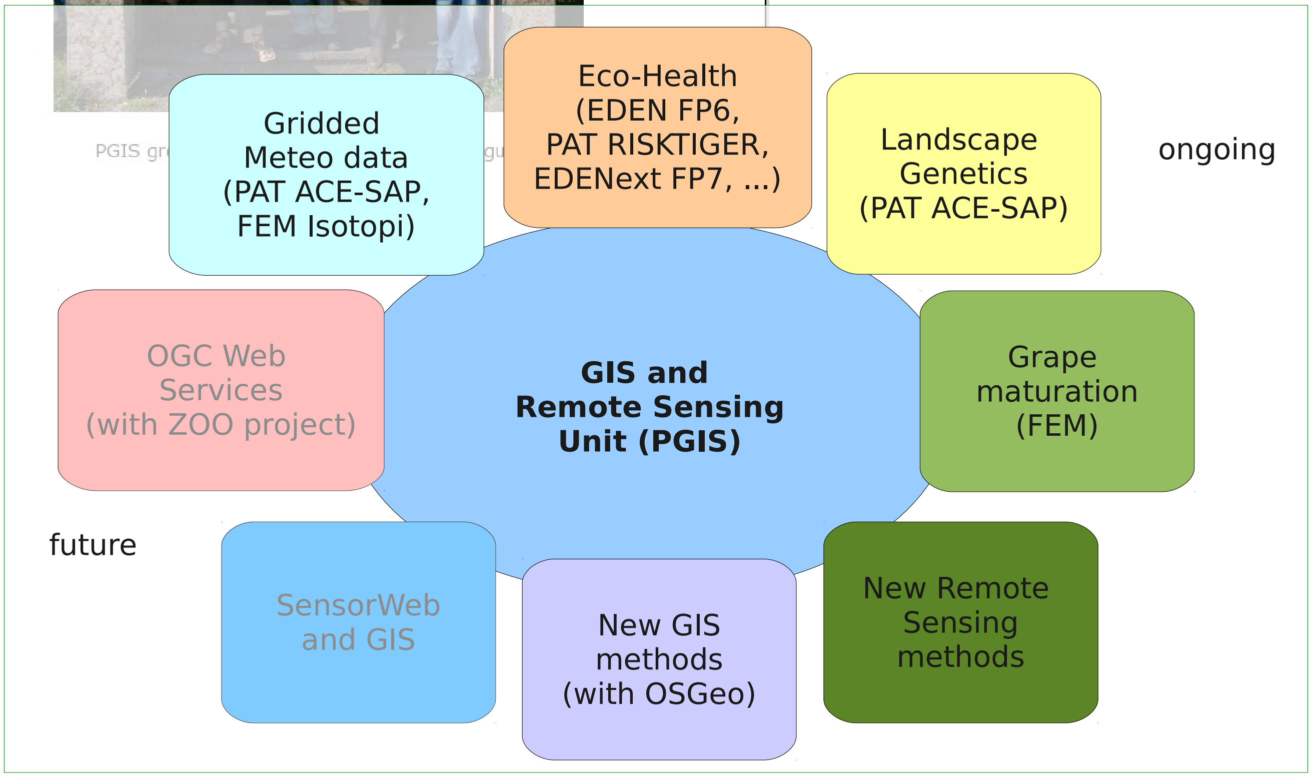
GEOSTAT 2012
Münster, Germany

PGIS unit @ Fondazione Edmund Mach, Trento



http://gis.cri.fmach.it/

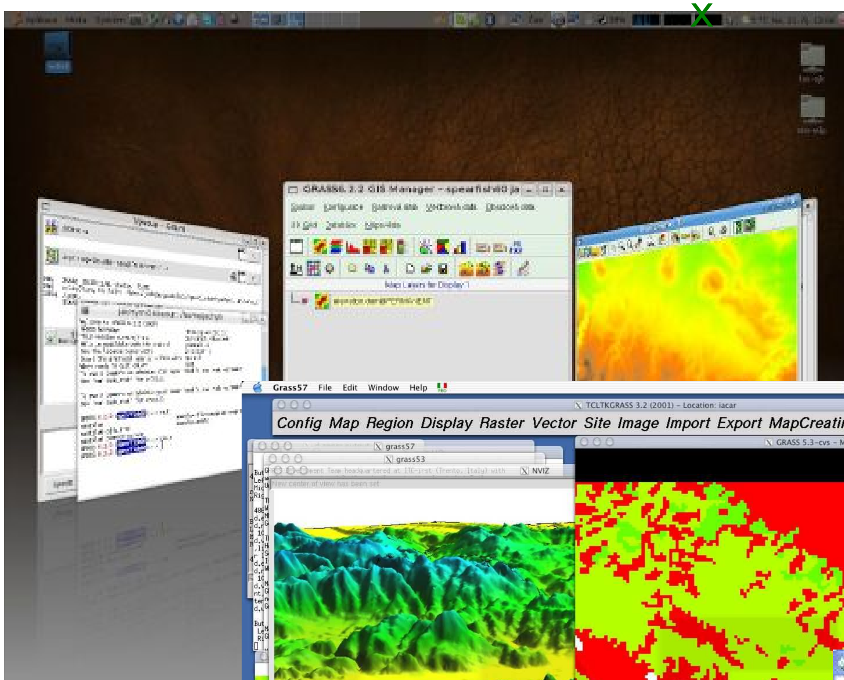
Research Topics



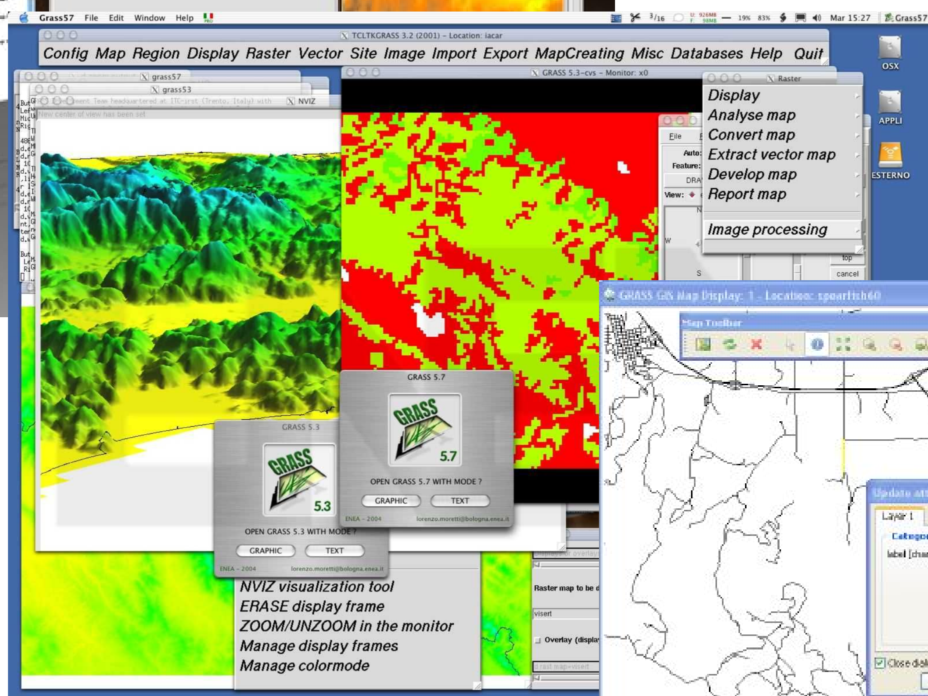
GRASS: a portable GIS

http://grass.osgeo.org

GNU/Linux



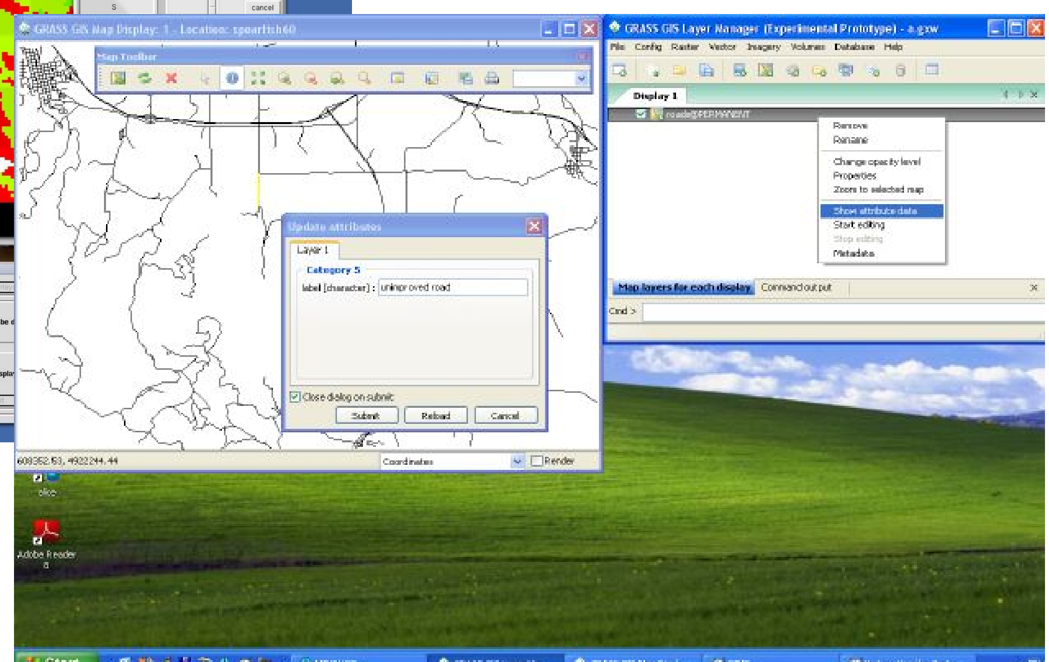
MacOSX



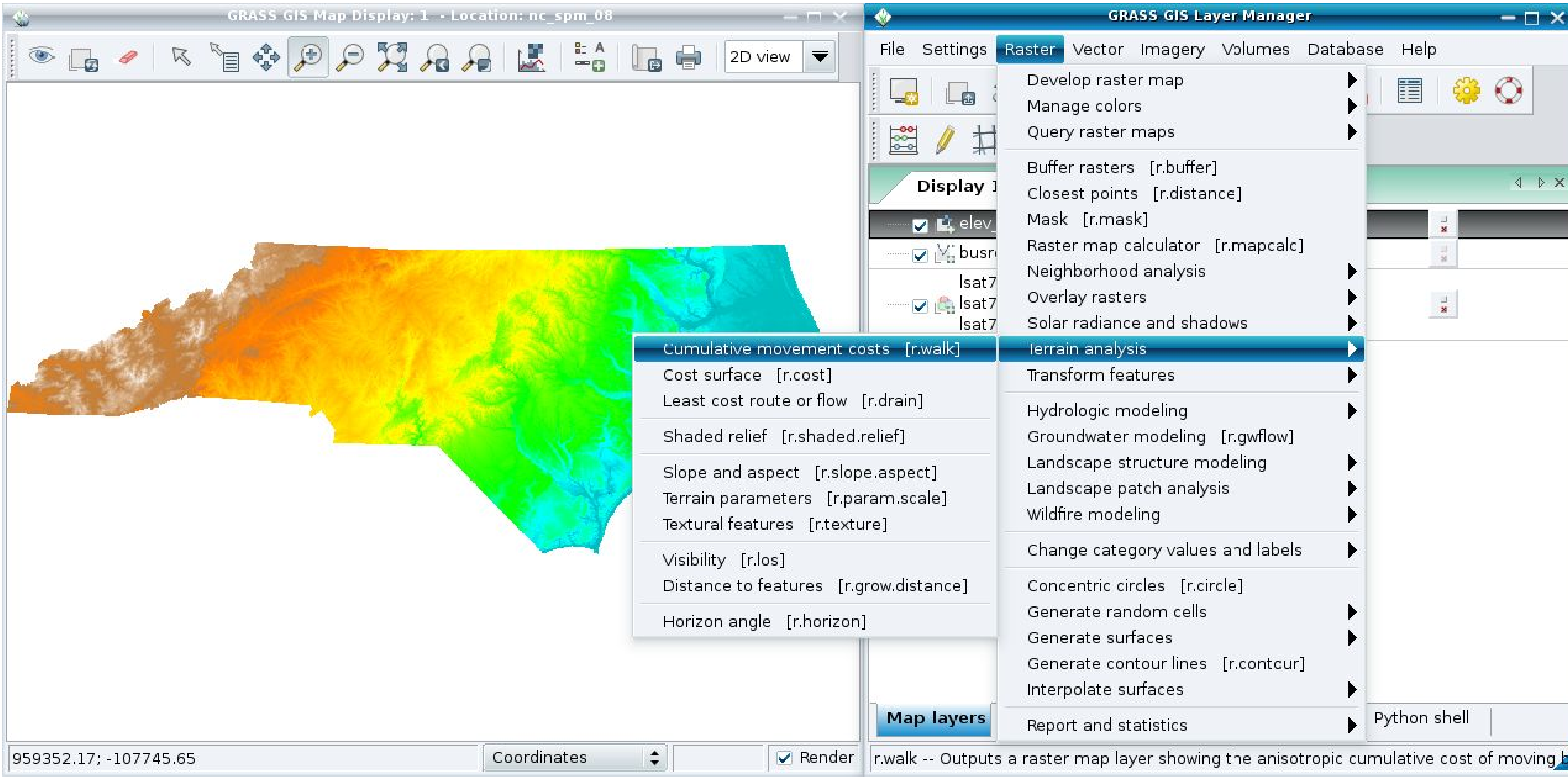
Project Cost Calculator	GRASS 6 - 6/2011
Include	All Code
Codebase	583,001 lines
Effort (est.)	157 person-years
Average Salary	$ 55000 per year
Estimated Cost	**$ 8,641,329**

https://www.ohloh.net/p/grass_gis

MS-Windows



New GRASS GIS User interface

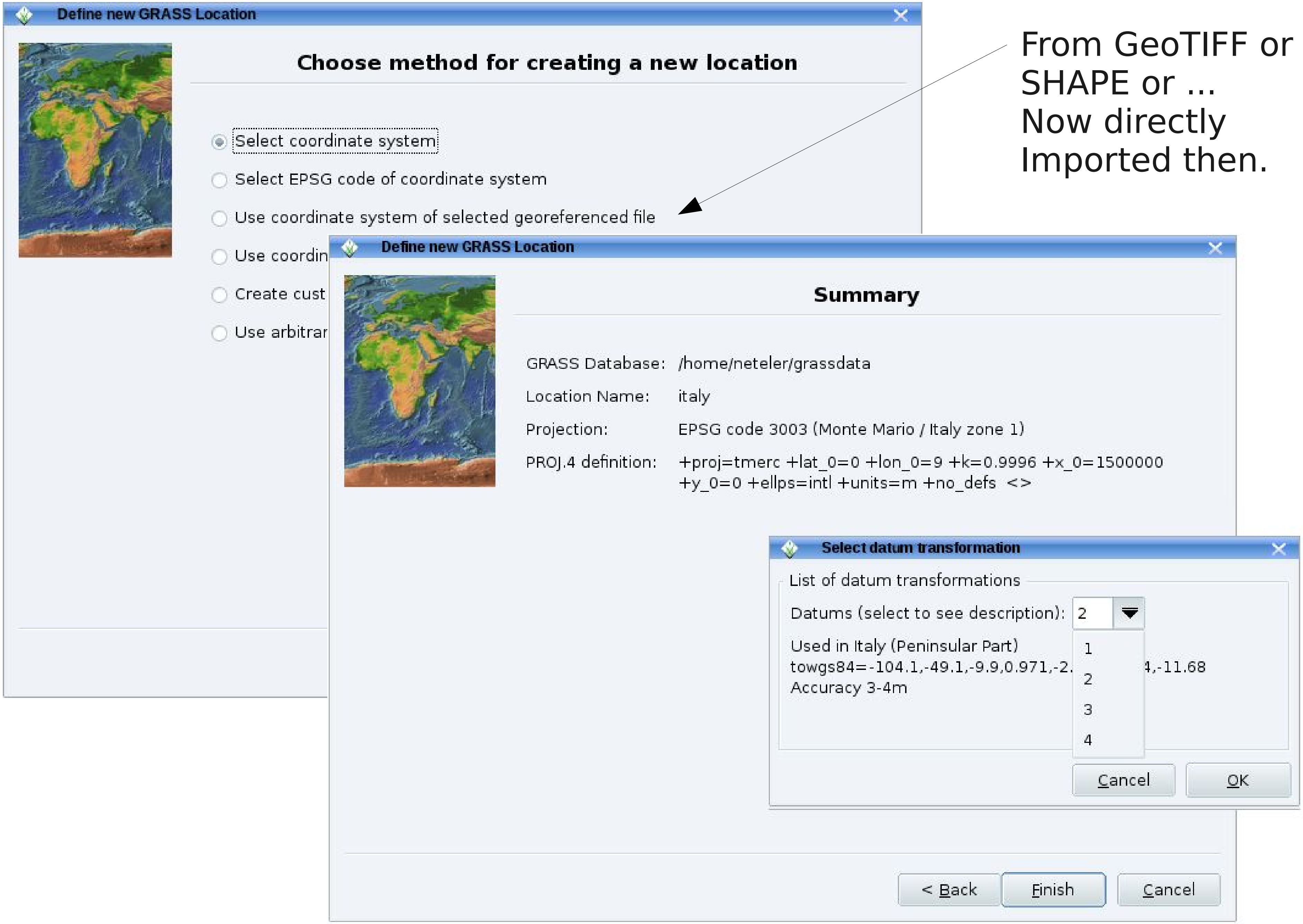


DE

JA

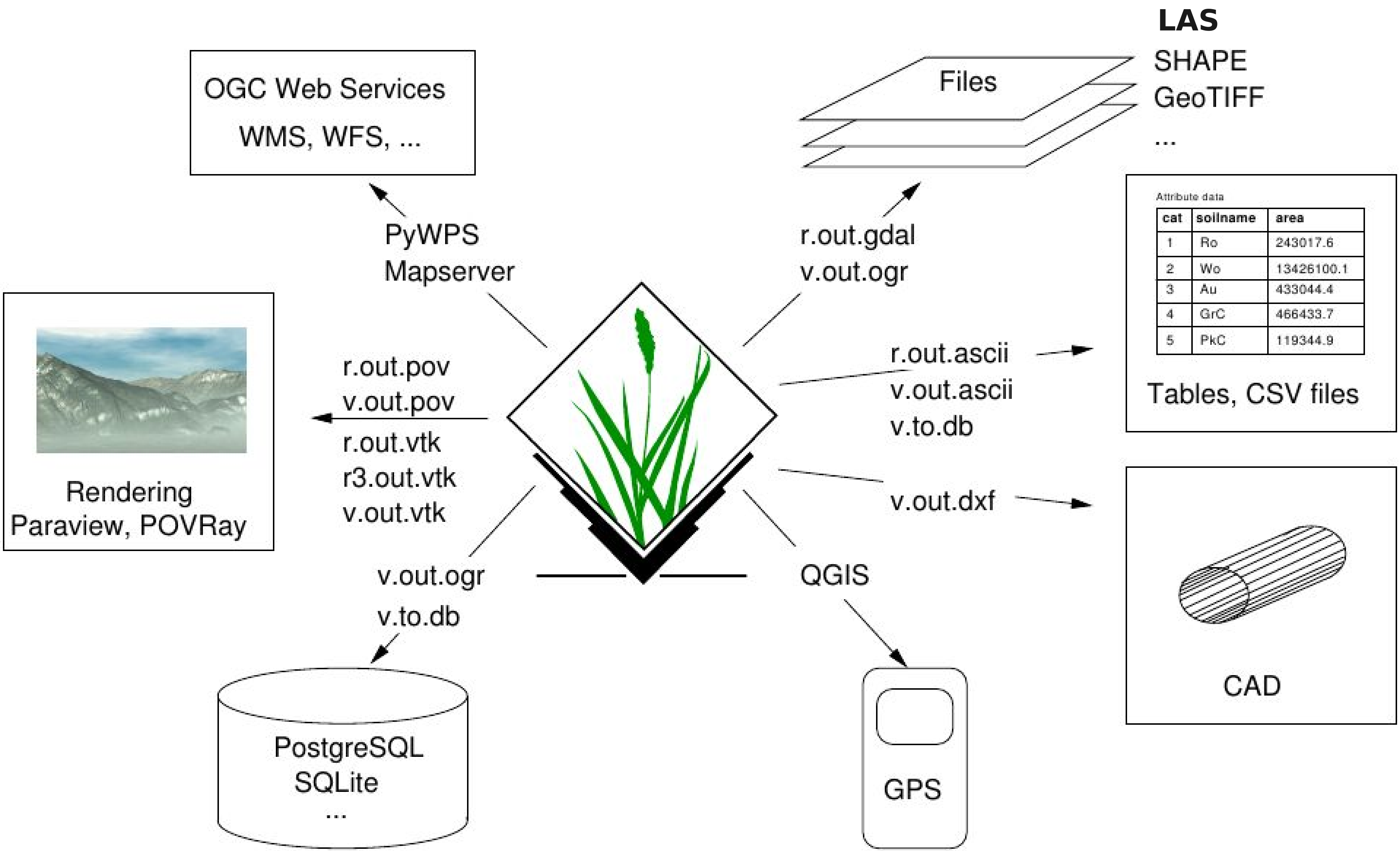
PL

GRASS: Project database (Location) wizard

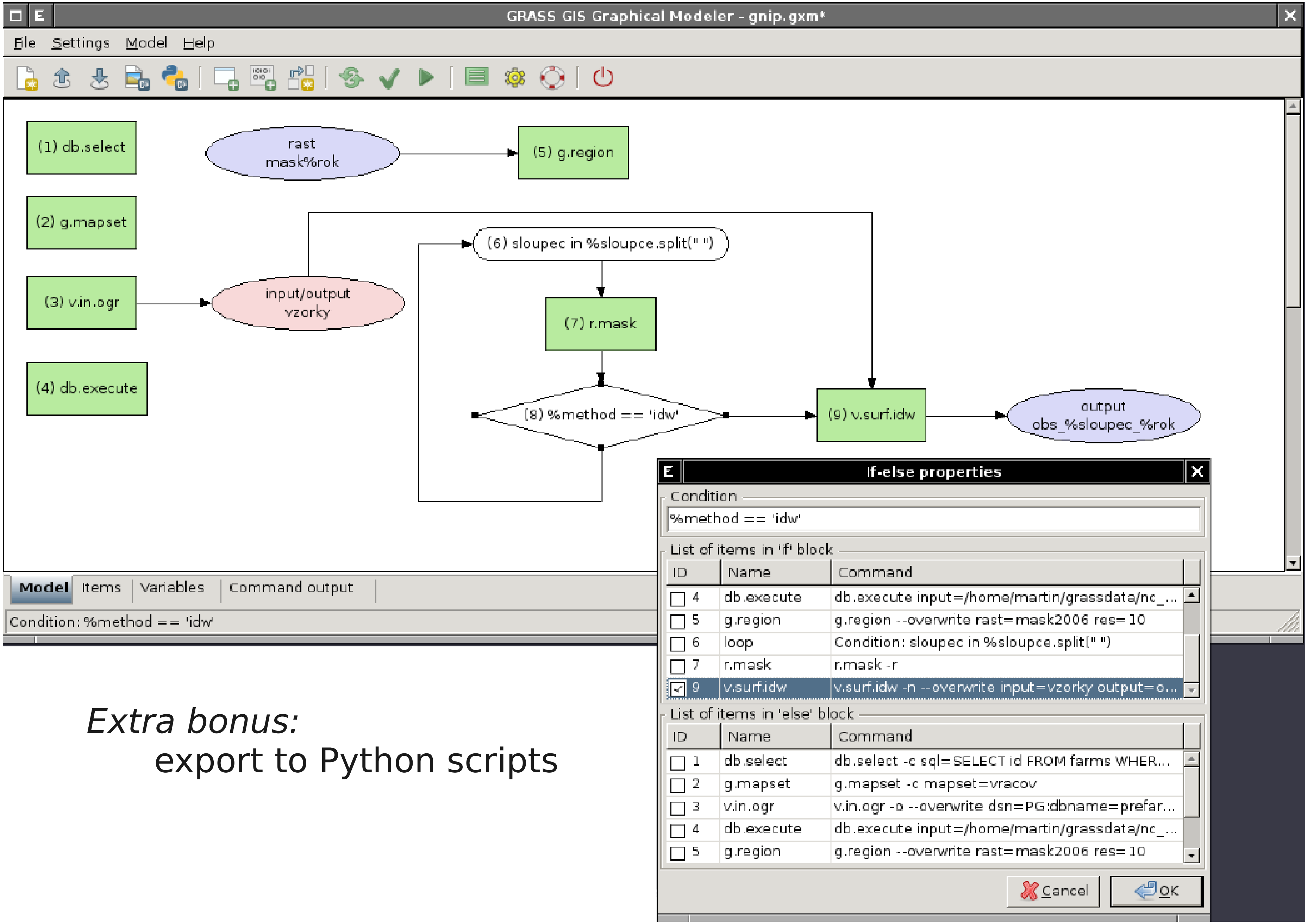


From GeoTIFF or SHAPE or ...
Now directly Imported then.

GRASS GIS: Interoperability



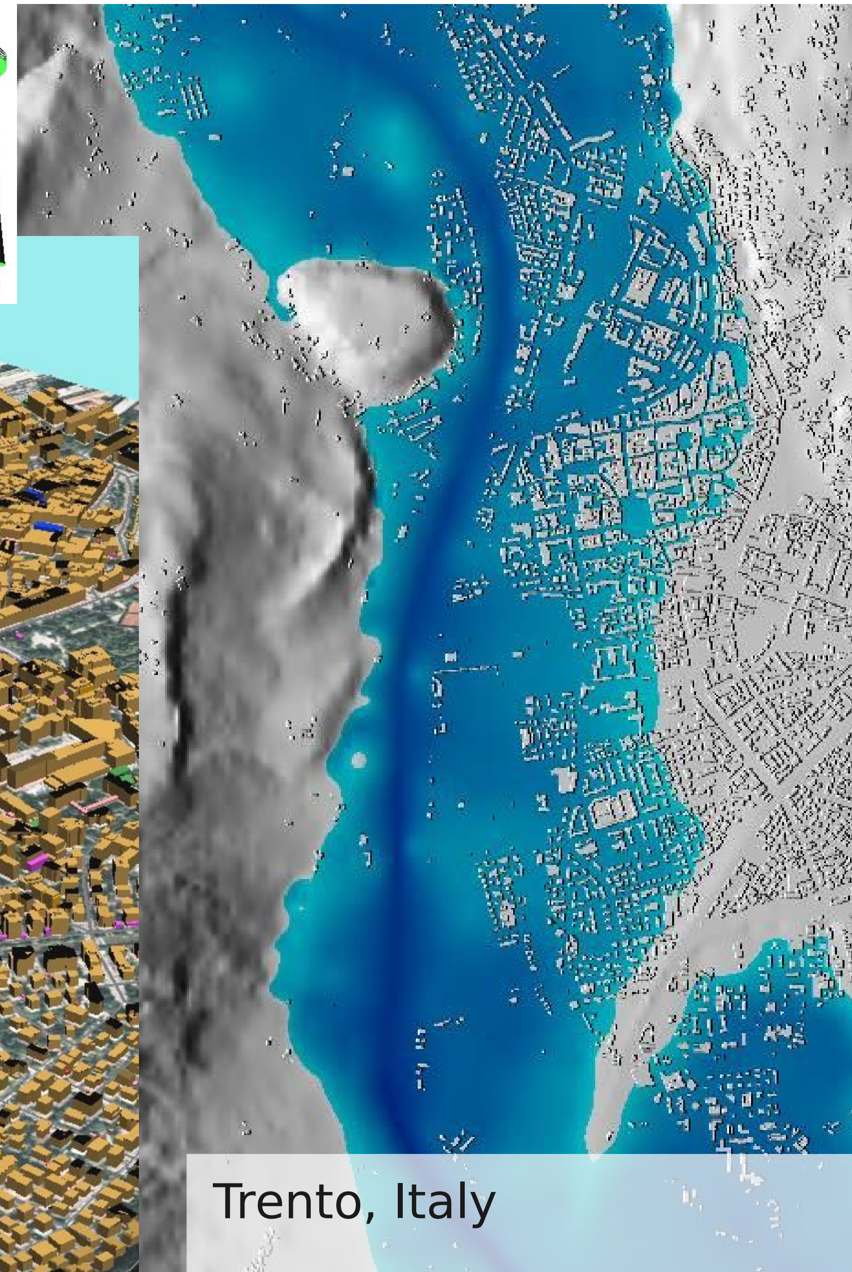
GRASS: New Geospatial Modeller



Extra bonus:
export to Python scripts

Raster and 3D vector

Elevation model combined with extruded 3D buildings; also true 3D vector supported



Optional: KML export for virtual globes

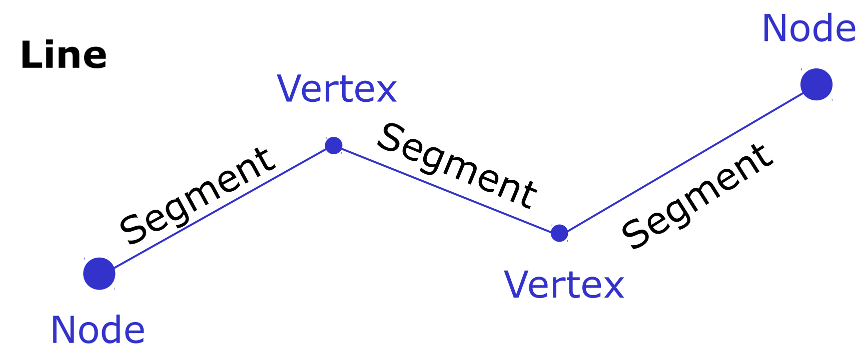
GRASS Topological 2D/3D Vector model

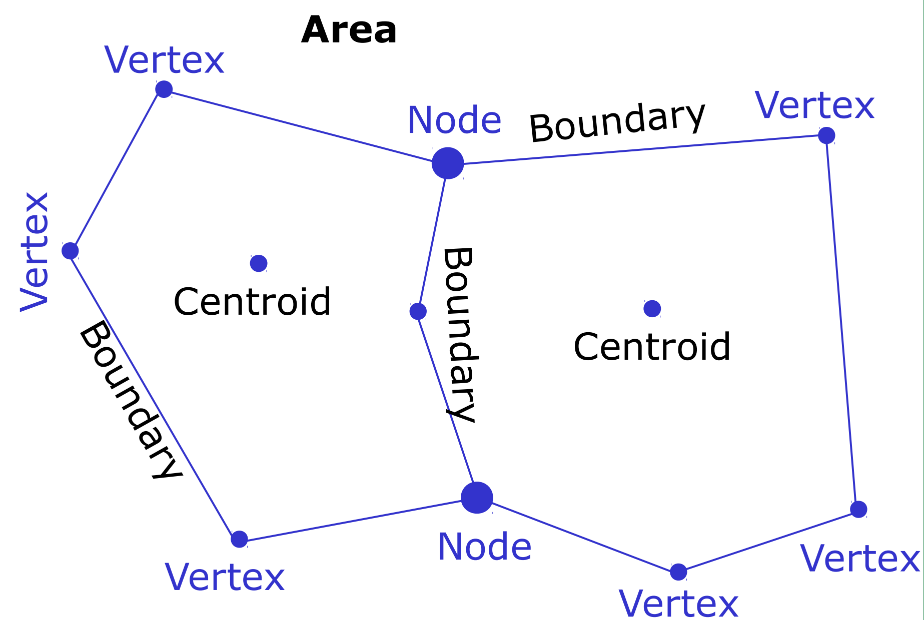
Vector geometry types

- Point
- Centroid
- Line
- Boundary
- Area (boundary + centroid)
- face (3D area)
- [kernel (3D centroid)]
- [volumes (faces + kernel)]

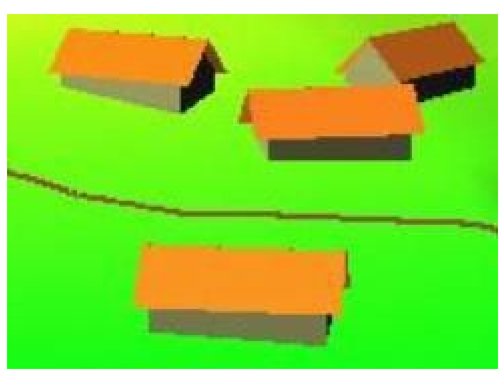
not in all GIS!

Geometry is **true** 3D when: x, y, z



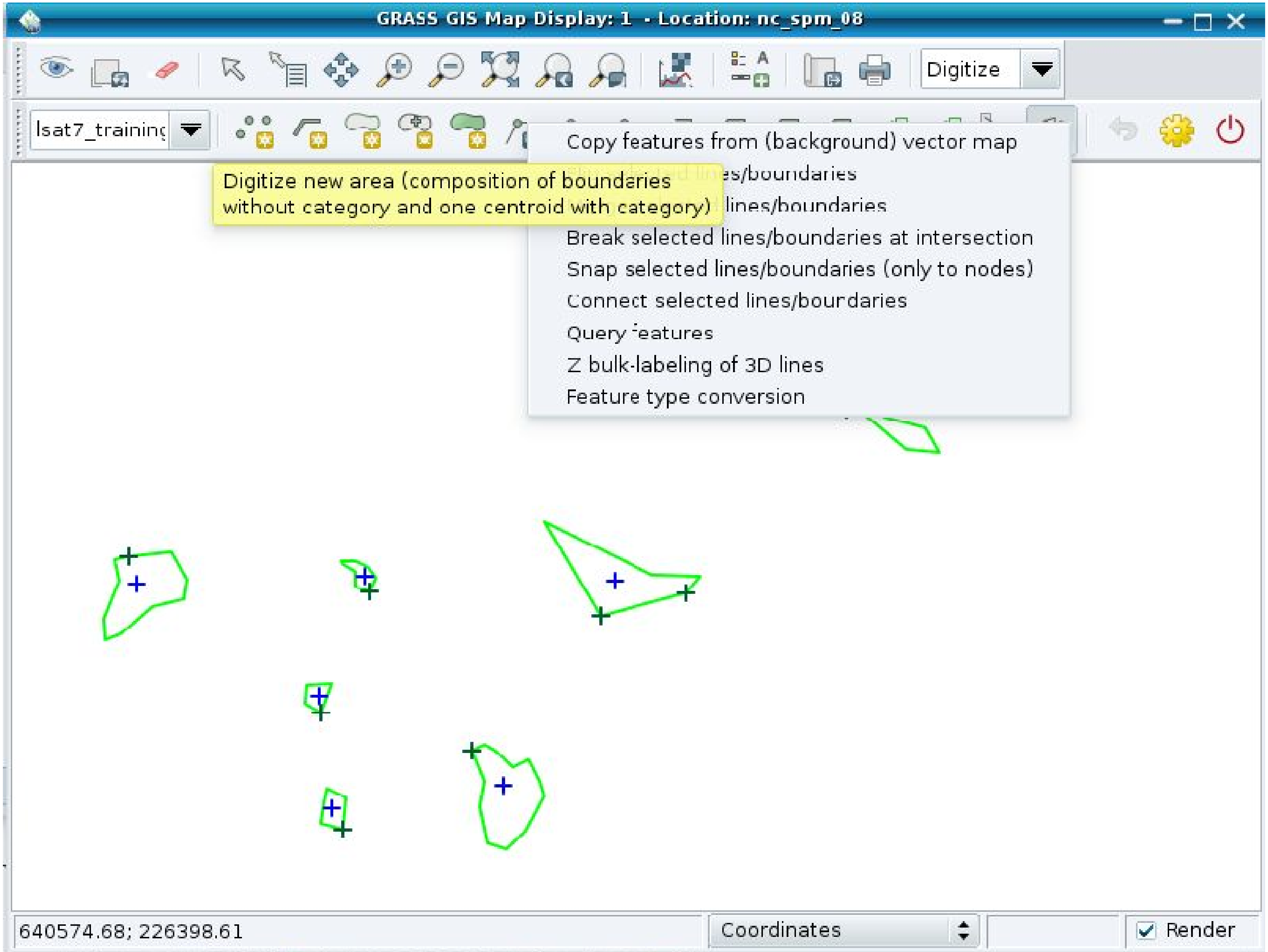


Face
s



Use of Spatial Index

GRASS Topological Vector Digitizer



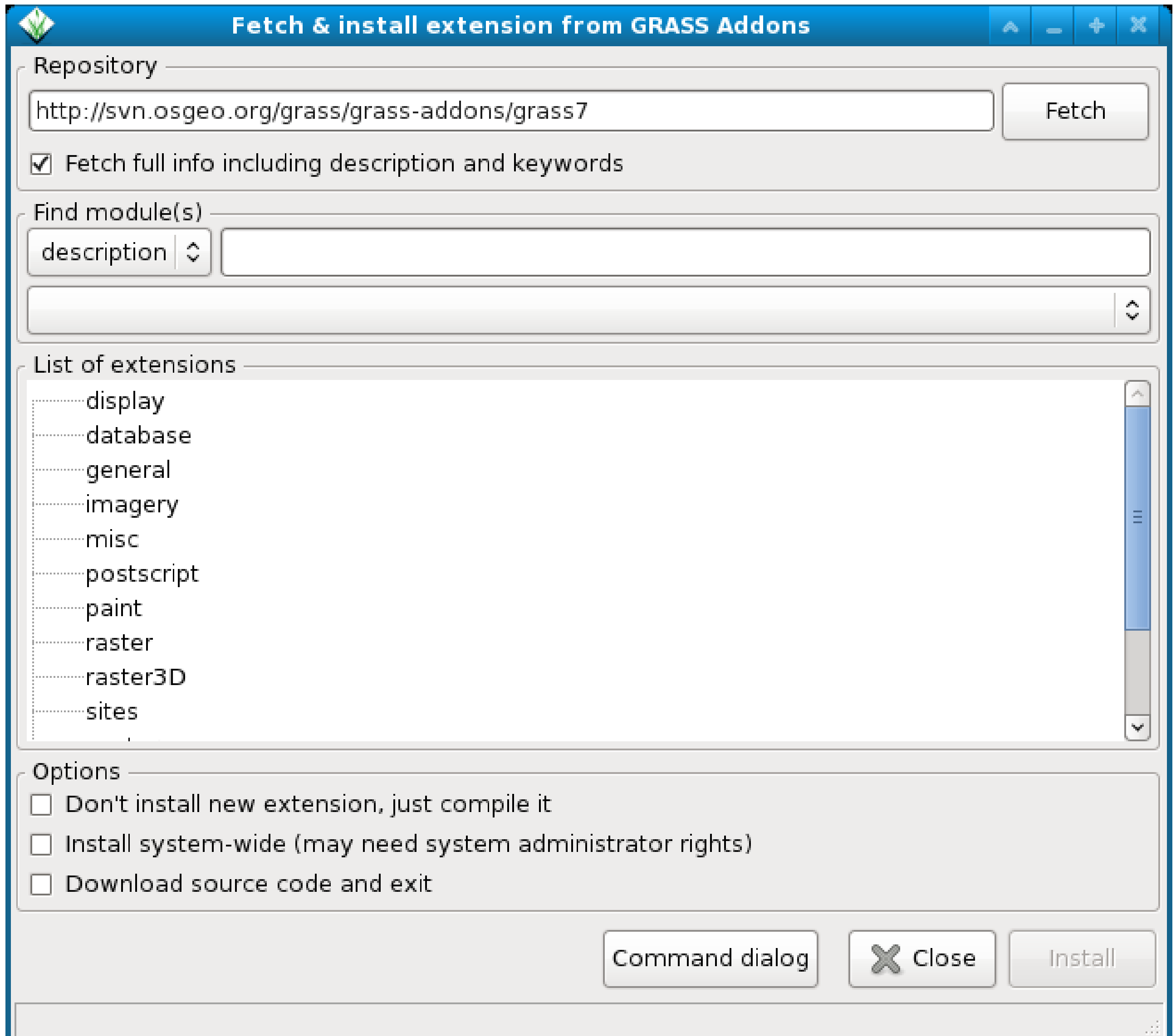
GRASS Addons: User contributed extensions

The Addons repository is SVN based:
User can easily obtain **write** access to develop new functionality

http://grass.osgeo.org/wiki/Addons

Installation with extension manager

Increasing inflow of Python scripts



Support for massive spatial datasets in GRASS GIS

GRASS 7 raster processing

Raster resampling

Standard

nearest neighbour, linear, cubic, lanczos

Spline based

Regularized Spline Tension (RST), bspline

Statistical

average, median, mode, min, max, sum, variance, stddev, quantile

Filtering window

Bartlett, gauss, hermite, sinc, lanczos1, lanczos2, lanczos3, hann, hamming, blackman and any combination thereof

GRASS 7 raster processing

Raster surface interpolation from raster or vector points

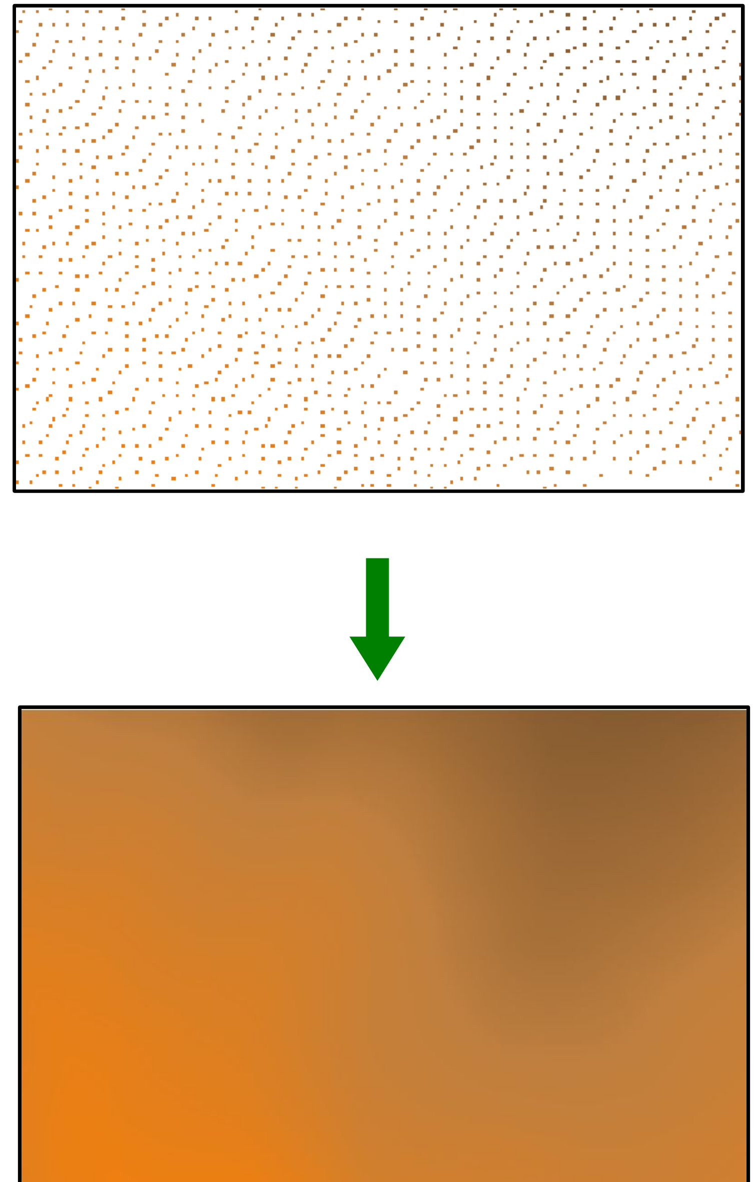
Inverse Distance Weighing (IDW)

Regularized Spline Tension (RST)

Bspline (Tykhonov regularization)

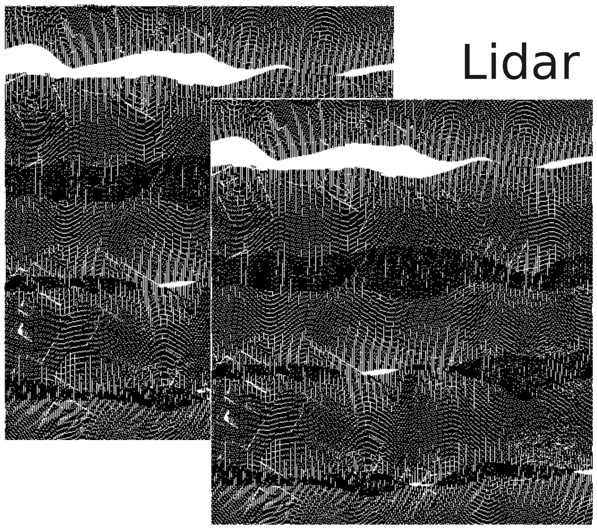
Ordinary kriging

Filtering window

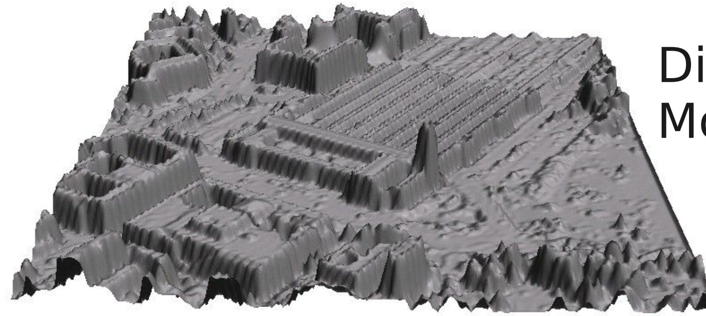


Processing of LiDAR data: laser scanning of the terrain

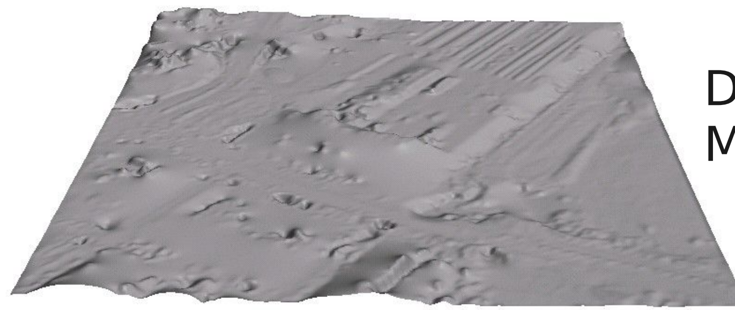
M. Brovelli and R. Antolín
H. Mitasova



Lidar First pulse
Last pulse

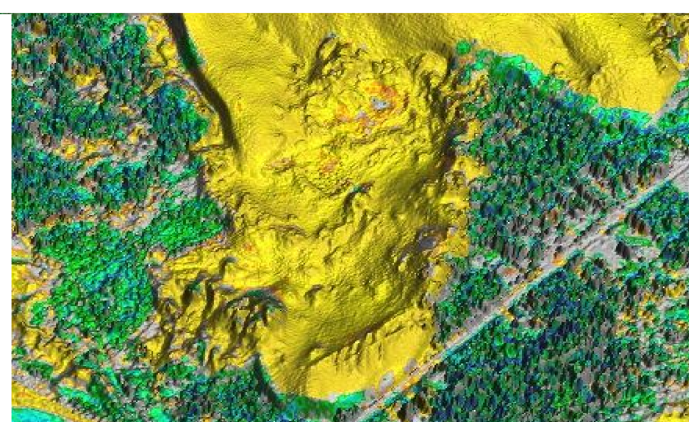


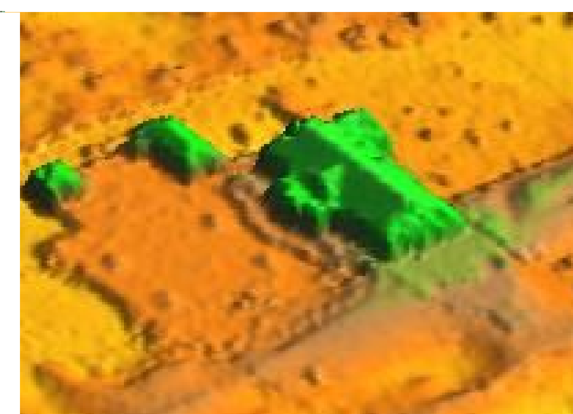
Digital Situation Model (DSM)



Digital Terrain Model (DTM)

Processing 500 Million points....





Processing of LiDAR data: laser scanning of the terrain

New in GRASS 7: direct import of LiDAR LAS files

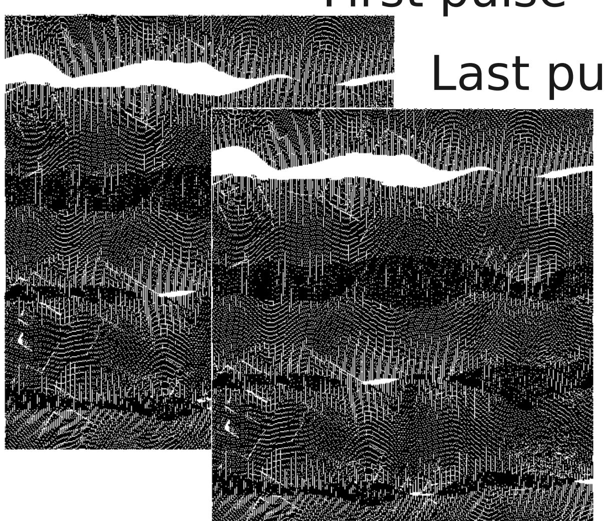
Output as vector points:

v.in.lidar

Lidar

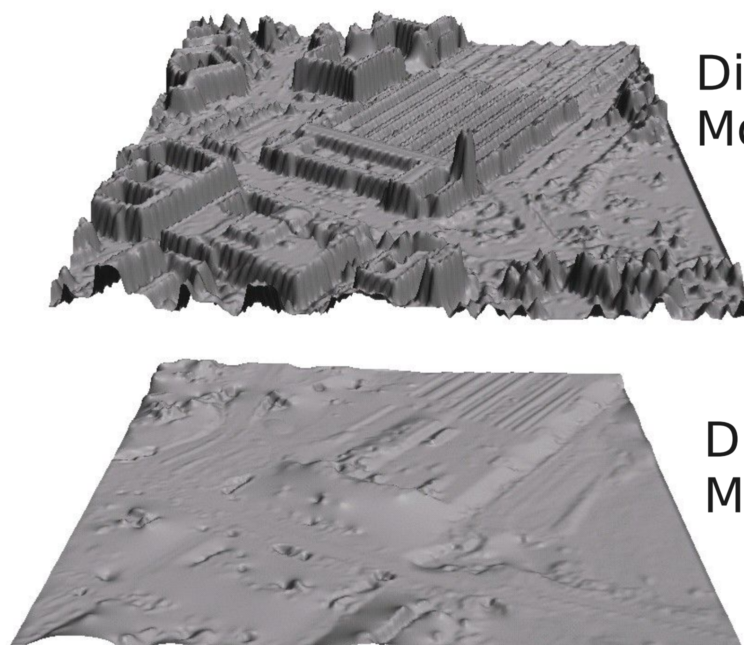
First pulse

Last pulse



Output as raster map:

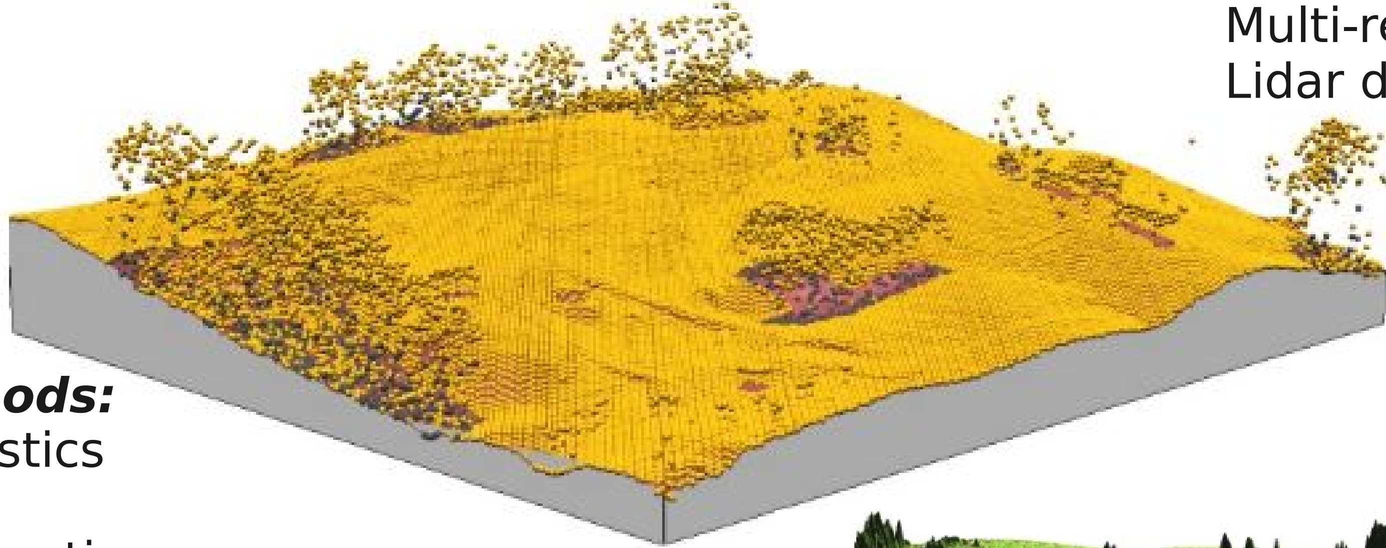
r.in.lidar



Digital Surface Model (DSM)

Digital Terrain Model (DTM)

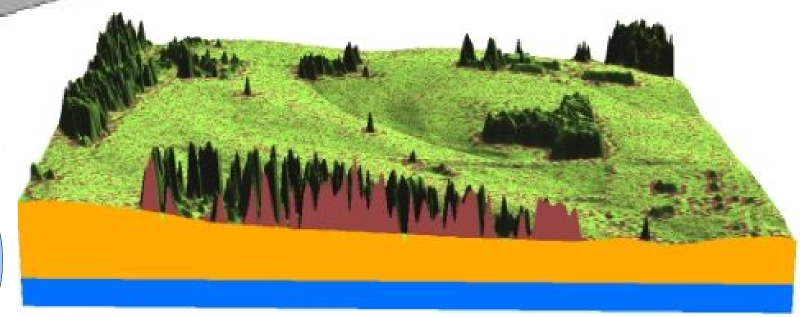
Lidar data analysis in GRASS GIS

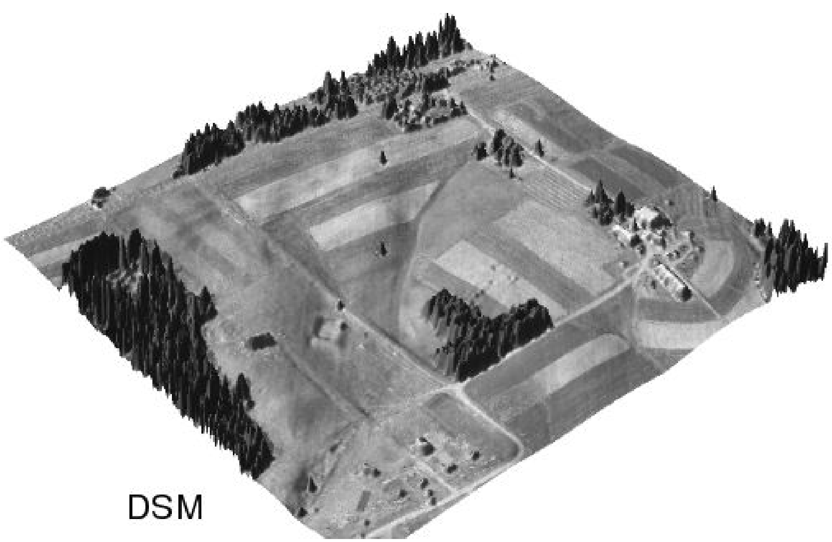


Multi-return
Lidar data

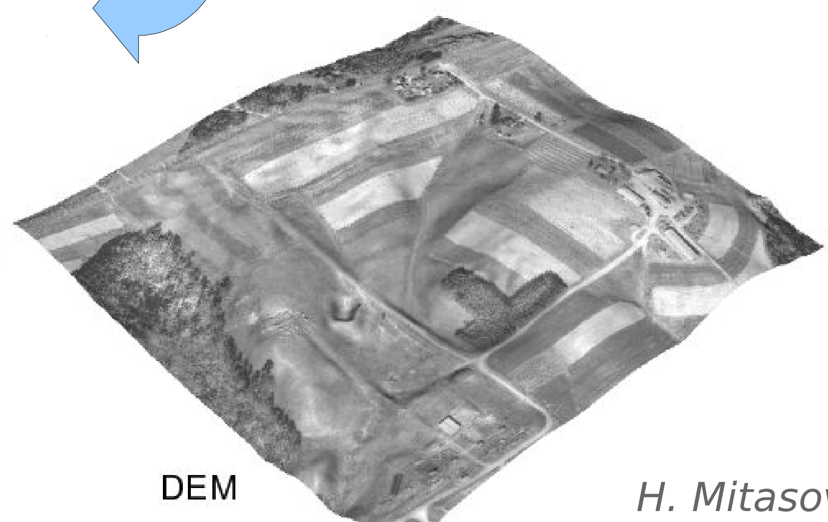
Available Methods:
- cell based statistics
- binning
- spatial approximation
- smoothing

Use cases:
- topographic analysis
- Feature extraction (Separation DEM/DSM)





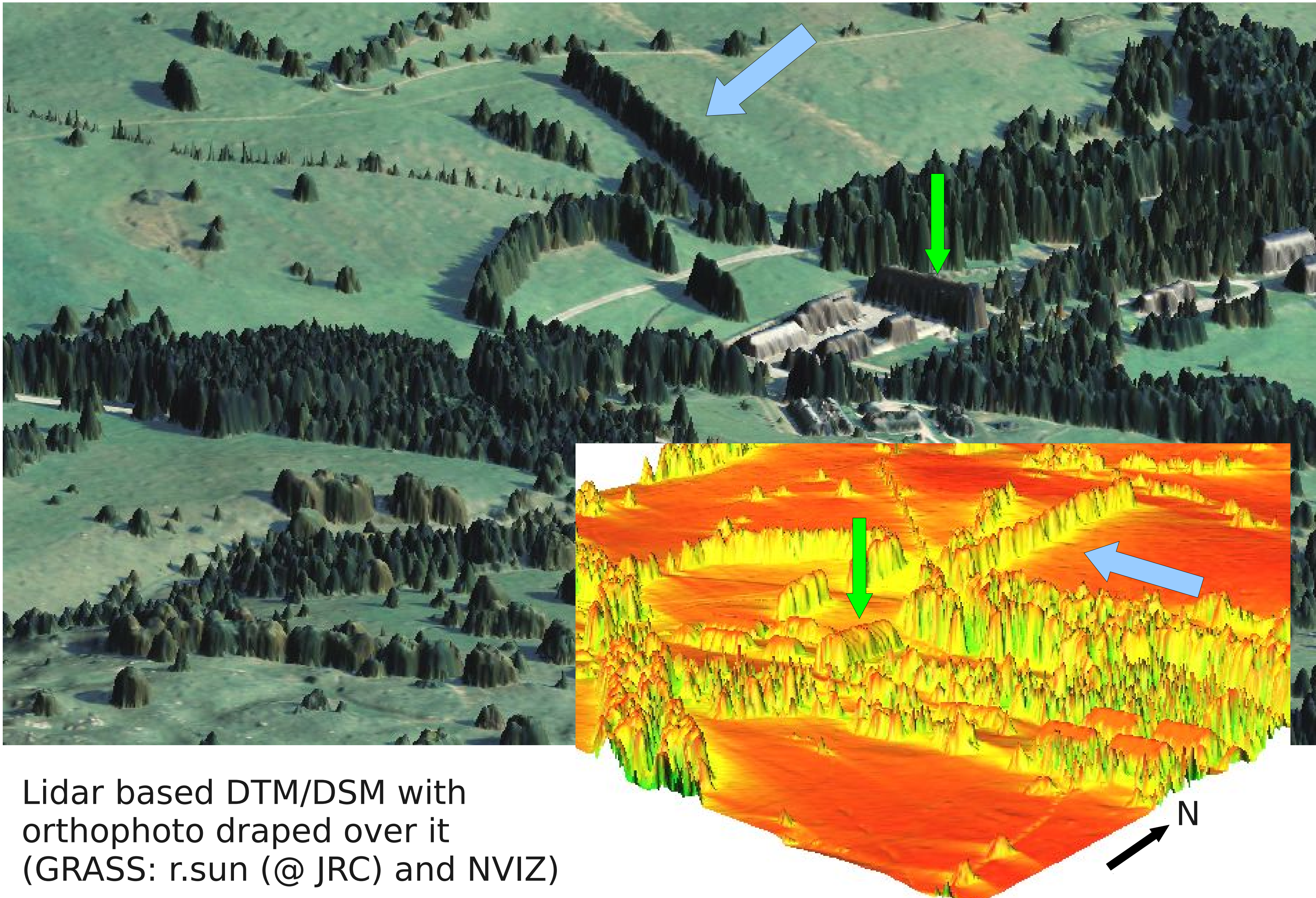
DSM



DEM

H. Mitasova, NCSU
M. Brovelli, PdM, Como

Lidar data in action: Visualization and solar energy



Lidar based DTM/DSM with orthophoto draped over it (GRASS: r.sun (@ JRC) and NVIZ)

GRASS 7: Support for massive datasets

What is massive?

Massive is relative to

- Hardware resources
- Software capabilities
- Operating system capabilities

Limiting factors

- RAM
- Processing time
- Disk space
- Largest supported file size

GRASS 7: Support for massive datasets

What is massive?

Massive is relative to

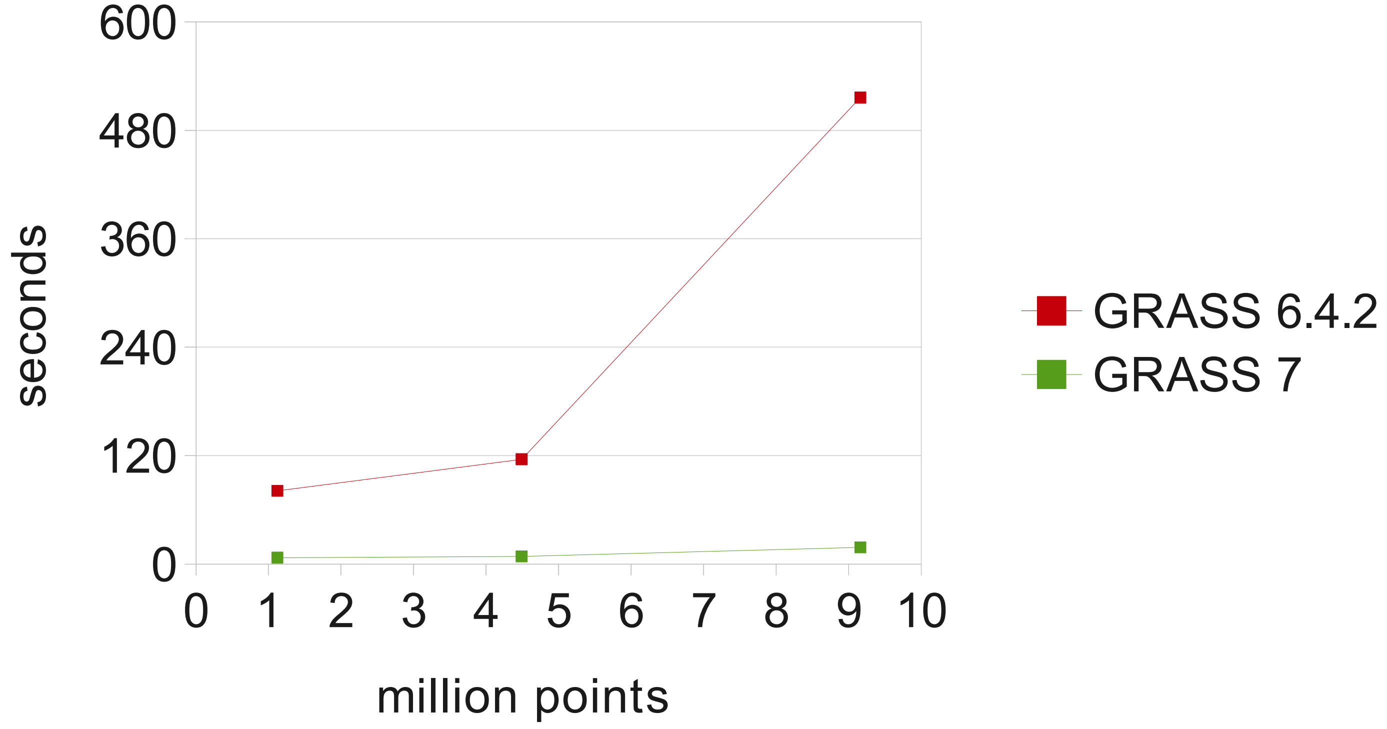
- Hardware resources
- Software capabilities
- Operating system capabilities

Limiting factors

- ϟ RAM
- ϟ Processing time
- ✔ Disk space
- ✔ Largest supported file size

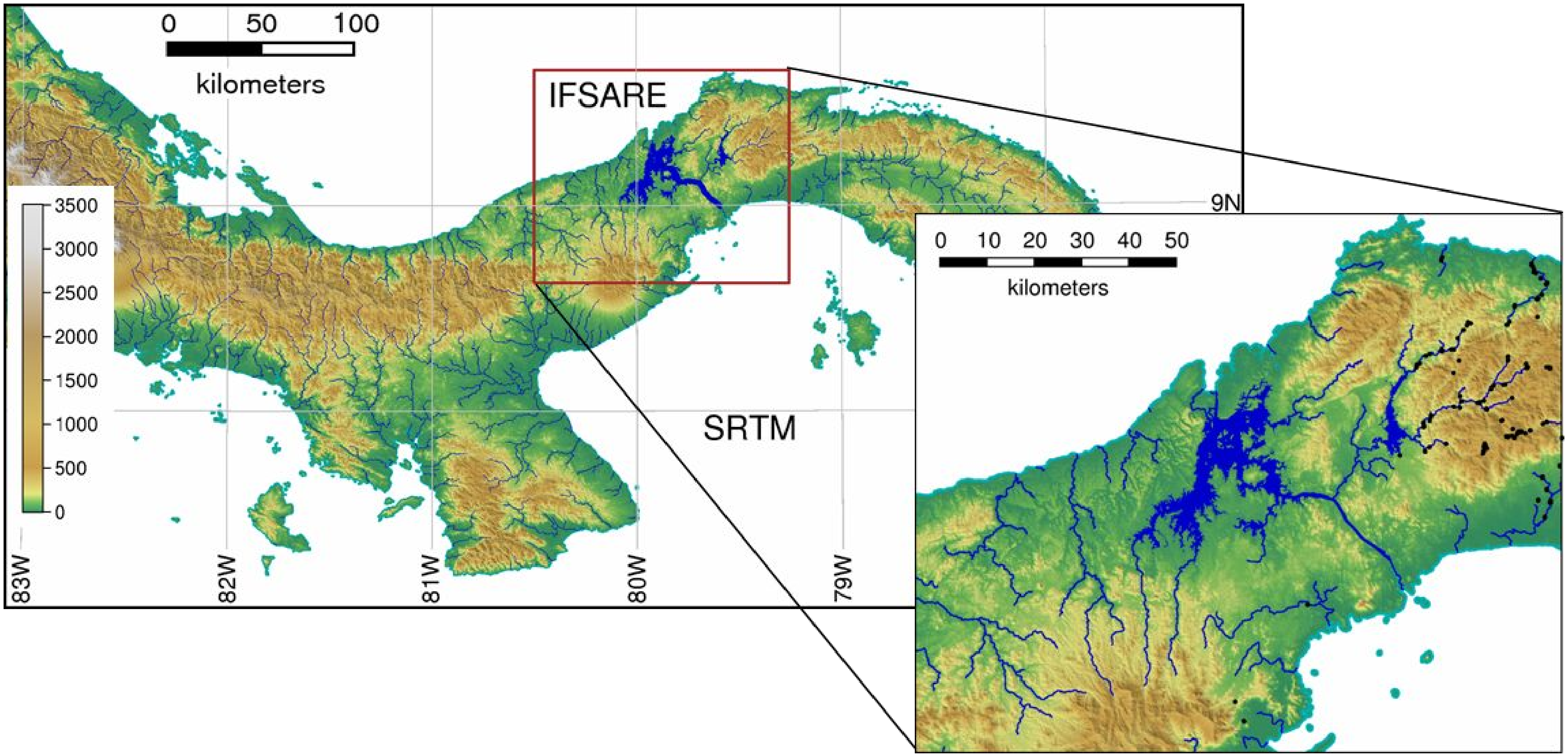
GRASS 7: Support for massive datasets

Cost surfaces: *r.cost*



Example: Hydrological modelling (think massive data)

Stream network extraction around the Panama channel (250 million pixel)



Metz et al. 2011, Hydrology and Earth System Sciences

New tools for hydrological modelling

J. Jasiewicz, M. Metz / Computers & Geosciences ▮ (▮▮▮▮) ▮▮▮–▮▮▮

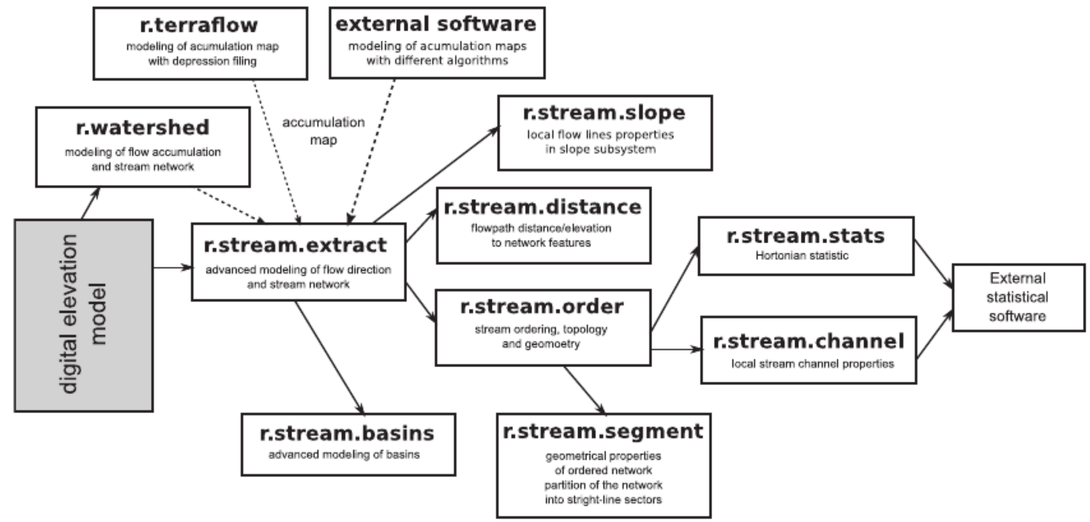
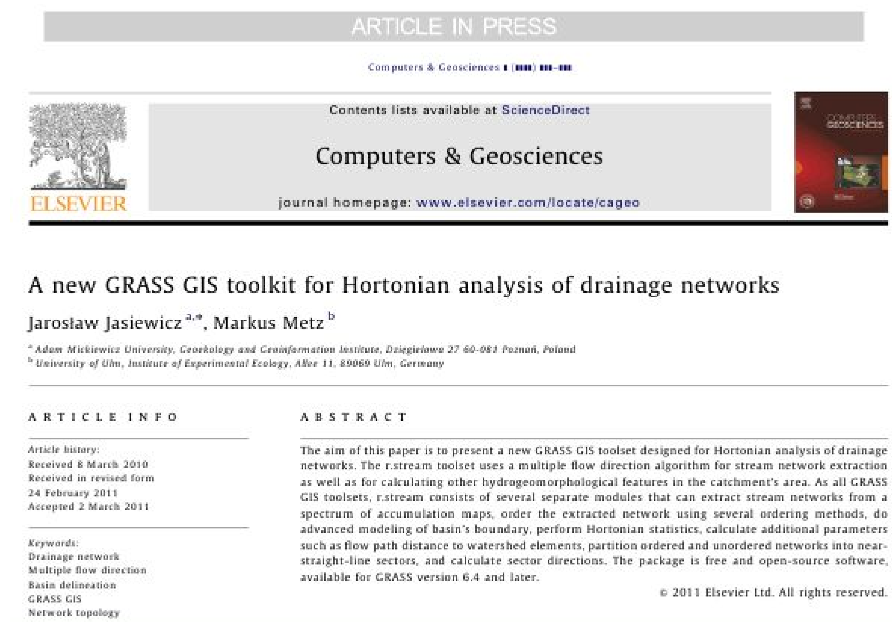


Fig. 2. The structure of the r.stream toolset and data flow between particular modules and external software.



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Computers & Geosciences ▮ (▮▮▮▮) ▮▮▮–▮▮▮

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journal homepage: www.elsevier.com/locate/cageo

A new GRASS GIS toolkit for Hortonian analysis of drainage networks

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[b] University of Ulm, Institute of Experimental Ecology, Allee 11, 89069 Ulm, Germany

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Multiple flow direction
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ABSTRACT

The aim of this paper is to present a new GRASS GIS toolset designed for Hortonian analysis of drainage networks. The r.stream toolset uses a multiple flow direction algorithm for stream network extraction as well as for calculating other hydrogeomorphological features in the catchment's area. As all GRASS GIS toolsets, r.stream consists of several separate modules that can extract stream networks from a spectrum of accumulation maps, order the extracted network using several ordering methods, do advanced modeling of basin's boundary, perform Hortonian statistics, calculate additional parameters such as flow path distance to watershed elements, partition ordered and unordered networks into near-straight-line sectors, and calculate sector directions. The package is free and open-source software, available for GRASS version 6.4 and later.

News in Image processing

Improved modules:

Georectification

Orthorectification

Atmospheric correction

Terrain correction

Landsat cloud detection

Rocchini, D., Metz, M., Frigeri, A., Delucchi, L., Marcantonio, M., Neteler, M. (2011). *Robust rectification of aerial photographs in an Open Source environment*. (in press)

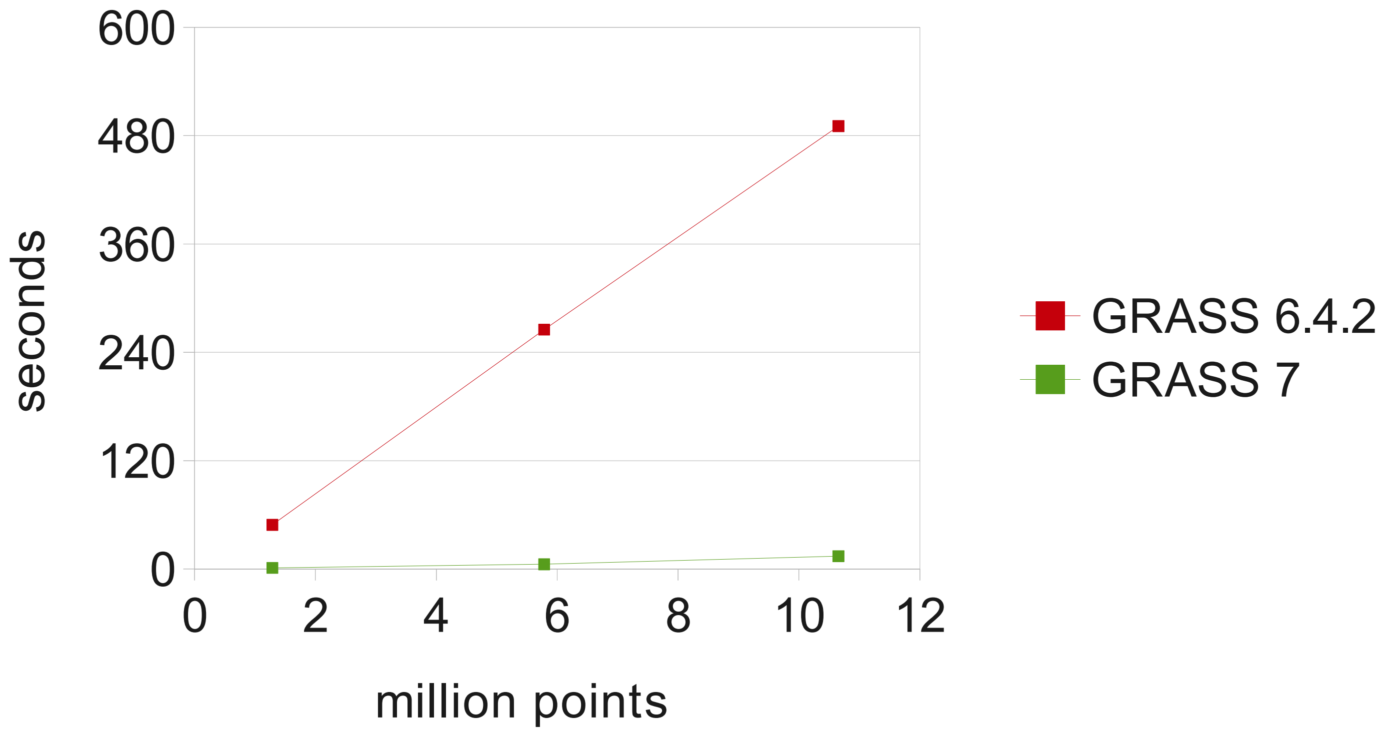
News in GRASS 7's Vector Topology

Spatial query example

Query of vector point maps

GUI: click on vector map, what is there?

CLI: v.what east_north=east,north



News in GRASS 7's Vector Topology

Slimmed down topology format

Size reduction most prominent for 3D points

E.g with ~120 000 points

GRASS 6.4: 5.5 MB

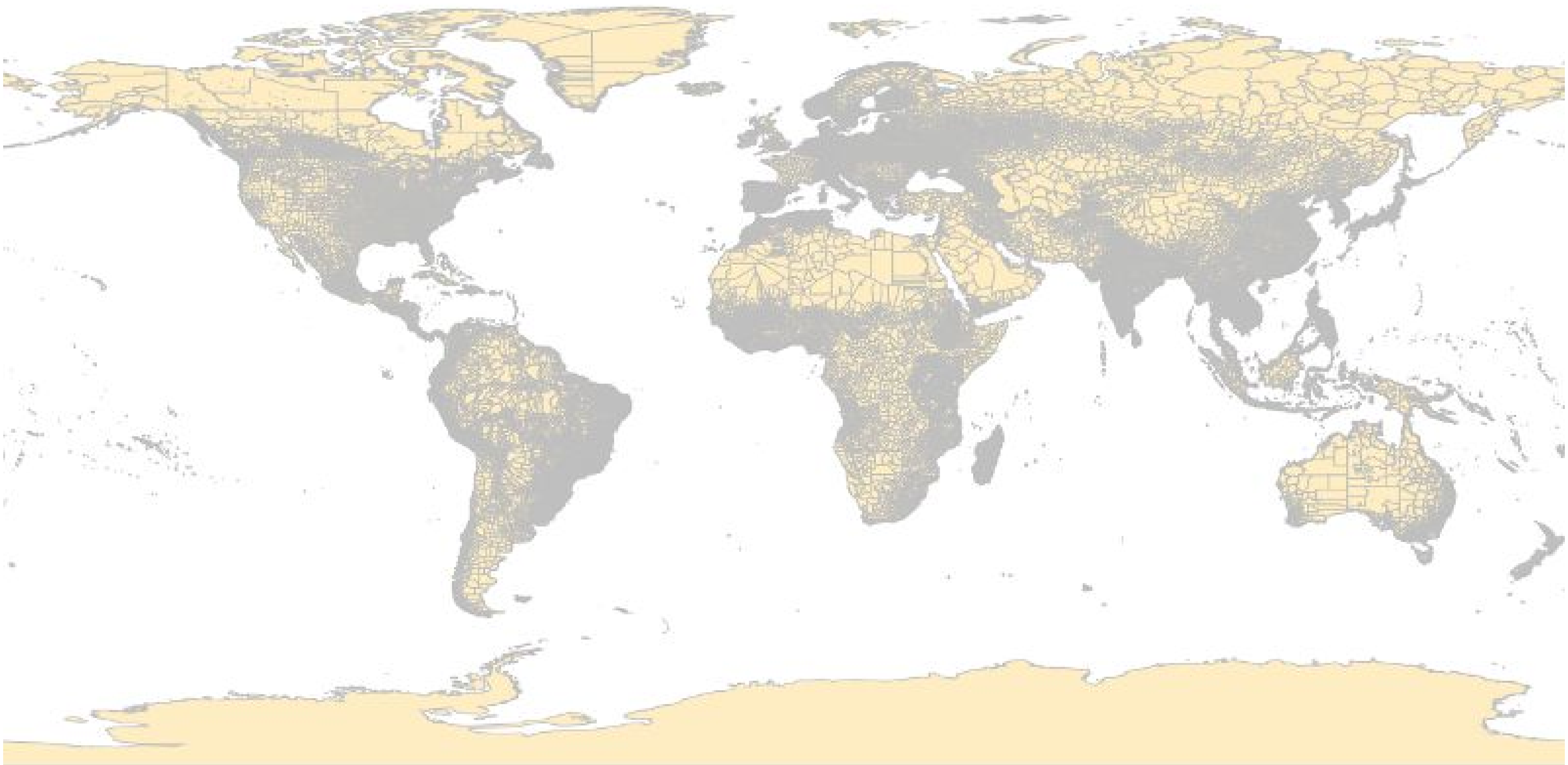
GRASS 7.0: 0.5 MB

News in GRASS 7's Vector Topology

Topological cleaning, vector import example

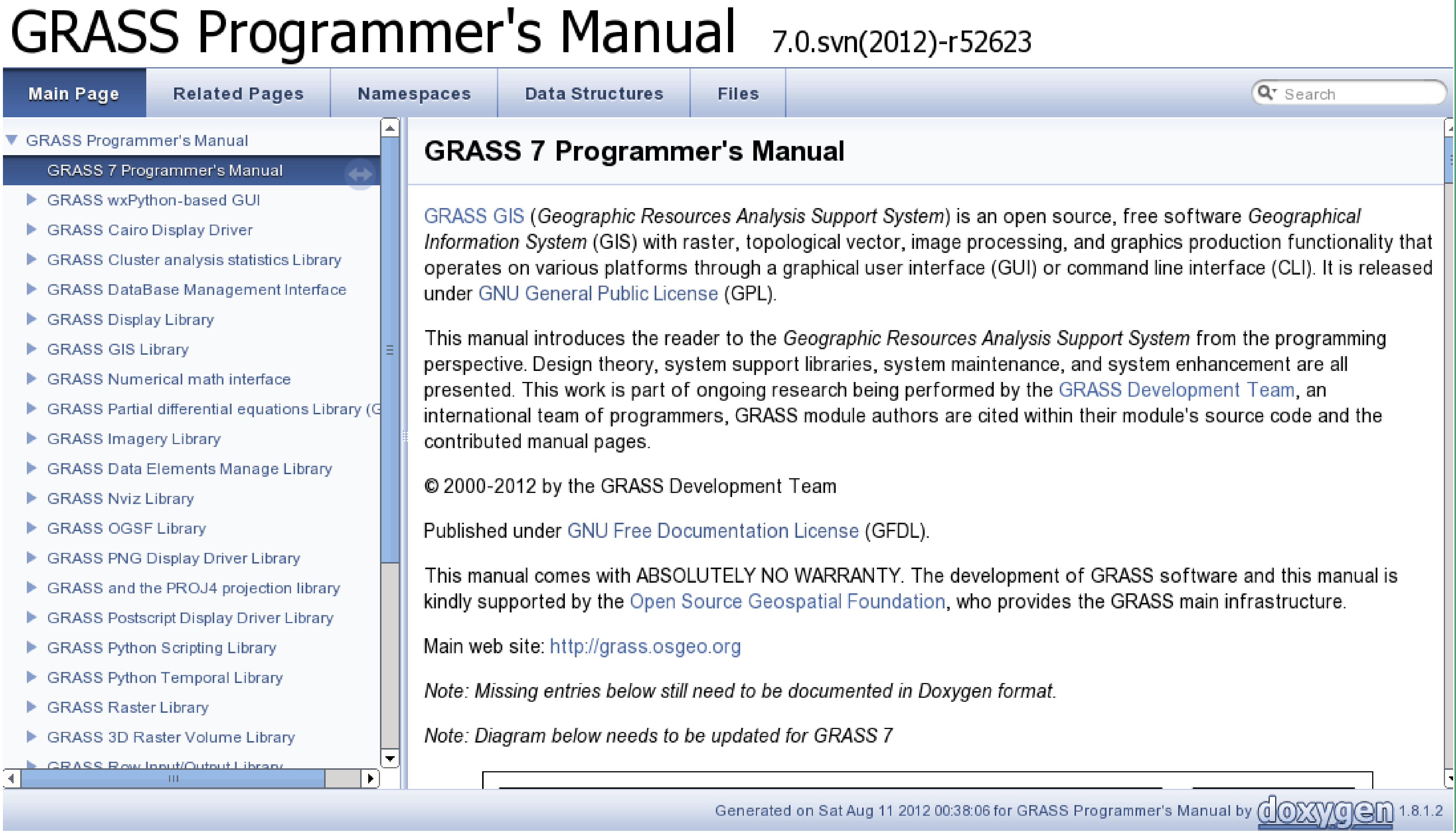
Example:

Global Administrative Database (GADM), all three levels, global



GRASS GIS as Open Source GIS backbone:

Connecting to other software packages



GRASS Programmer's Manual 7.0.svn(2012)-r52623

Main Page | Related Pages | Namespaces | Data Structures | Files | Search

- GRASS Programmer's Manual
  - GRASS 7 Programmer's Manual
  - GRASS wxPython-based GUI
  - GRASS Cairo Display Driver
  - GRASS Cluster analysis statistics Library
  - GRASS DataBase Management Interface
  - GRASS Display Library
  - GRASS GIS Library
  - GRASS Numerical math interface
  - GRASS Partial differential equations Library (G
  - GRASS Imagery Library
  - GRASS Data Elements Manage Library
  - GRASS Nviz Library
  - GRASS OGSF Library
  - GRASS PNG Display Driver Library
  - GRASS and the PROJ4 projection library
  - GRASS Postscript Display Driver Library
  - GRASS Python Scripting Library
  - GRASS Python Temporal Library
  - GRASS Raster Library
  - GRASS 3D Raster Volume Library
  - GRASS Row Input/Output Library

GRASS 7 Programmer's Manual

GRASS GIS (*Geographic Resources Analysis Support System*) is an open source, free software *Geographical Information System* (GIS) with raster, topological vector, image processing, and graphics production functionality that operates on various platforms through a graphical user interface (GUI) or command line interface (CLI). It is released under GNU General Public License (GPL).

This manual introduces the reader to the *Geographic Resources Analysis Support System* from the programming perspective. Design theory, system support libraries, system maintenance, and system enhancement are all presented. This work is part of ongoing research being performed by the GRASS Development Team, an international team of programmers, GRASS module authors are cited within their module's source code and the contributed manual pages.

© 2000-2012 by the GRASS Development Team

Published under GNU Free Documentation License (GFDL).

This manual comes with ABSOLUTELY NO WARRANTY. The development of GRASS software and this manual is kindly supported by the Open Source Geospatial Foundation, who provides the GRASS main infrastructure.

Main web site: http://grass.osgeo.org

Note: Missing entries below still need to be documented in Doxygen format.

Note: Diagram below needs to be updated for GRASS 7

Generated on Sat Aug 11 2012 00:38:06 for GRASS Programmer's Manual by doxygen 1.8.1.2

http://grass.osgeo.org/programming7/

Doxygen generated programmer's manual

GRASS and Python

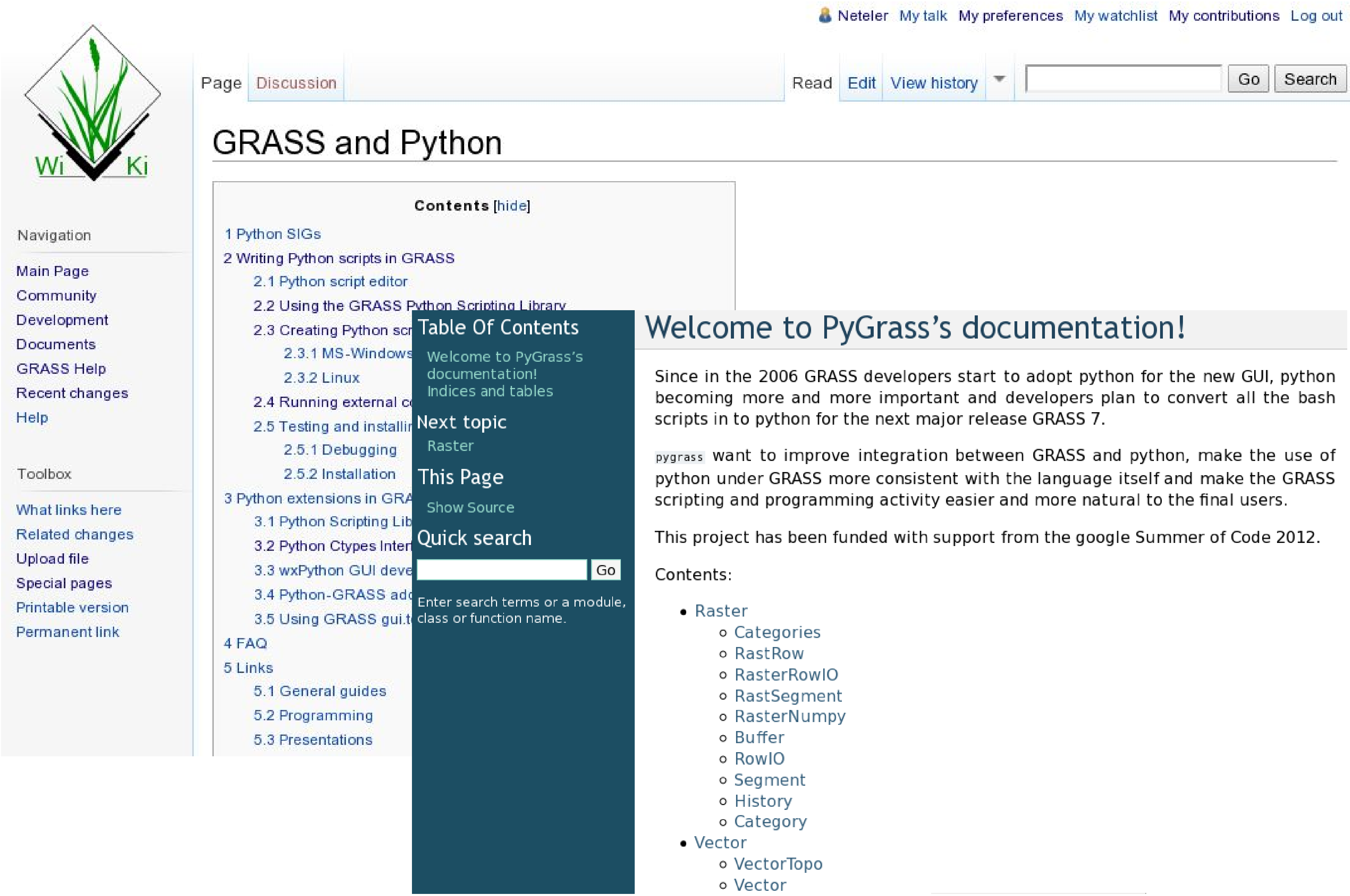
Parser part (for GUI autocreation and command line support):

```
#%Module
#% description: Drapes a color raster over a shaded relief map using d.his
#%End
#%option
#% key: reliefmap
#% type: string
#% gisprompt: old,cell,raster
#% description: Name of shaded relief or aspect map
#% required : yes
#%end
#%option
#% key: drapemap
#% type: string
#% gisprompt: old,cell,raster
#% description: Name of raster to drape over relief map
#% required : yes
#%end
```

Script part:

```
import sys
from grass.script import core as grass

def main():
    drape_map = options['drapemap']
    relief_map = options['reliefmap']
    brighten = options['brighten']
    ret = grass.run_command("d.his", h_map = drape_map,  i_map = relief_map, brighten = brighten)
    sys.exit(ret)

if __name__ == "__main__":
    options, flags = grass.parser()
    main()
```

New GRASS-Python API since 2012



http://grass.osgeo.org/wiki/GRASS_and_Python

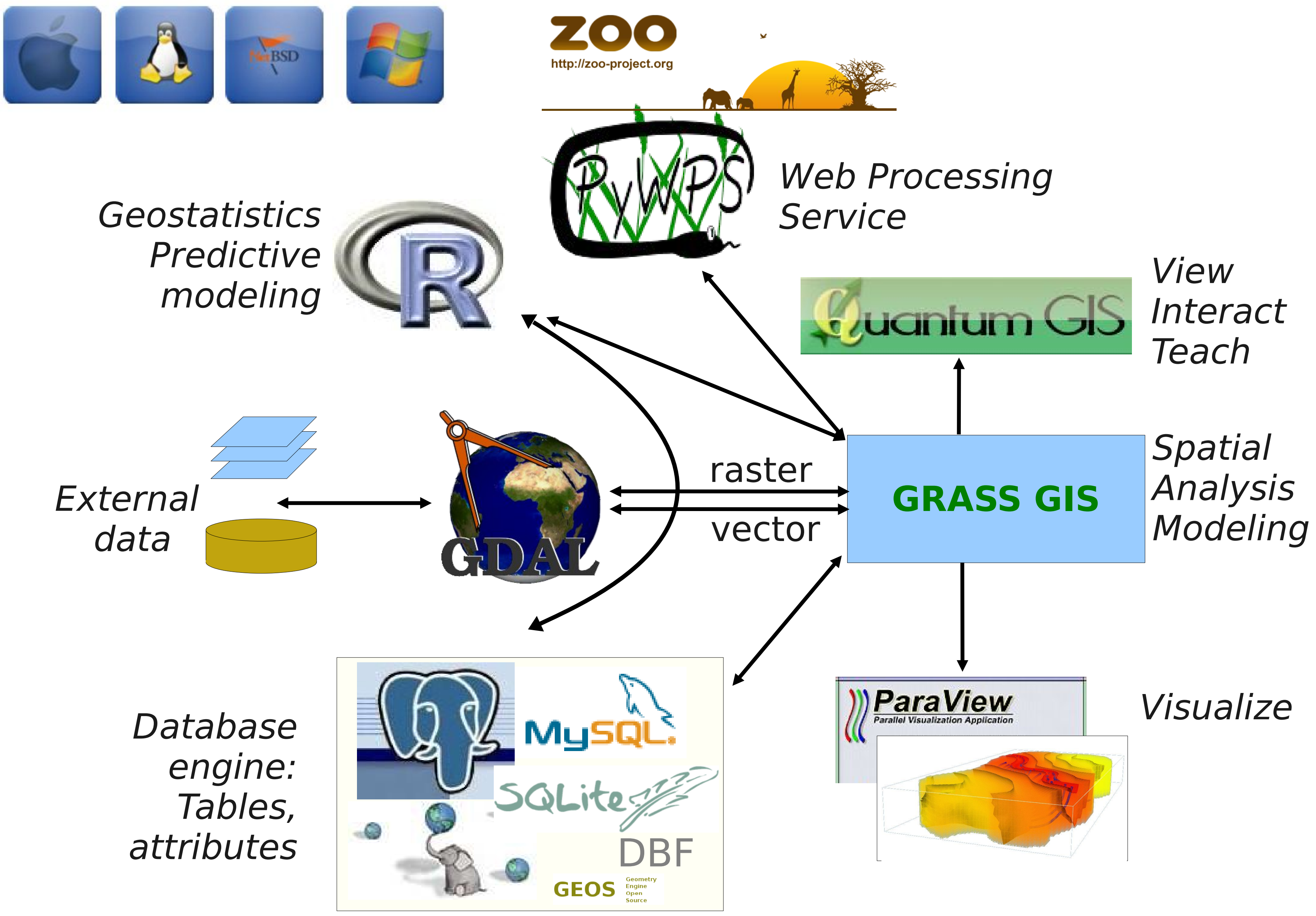
GRASS and Java

Source path: svn/ trunk/ Modules/ Java/ v_sample_rast.java Edit file

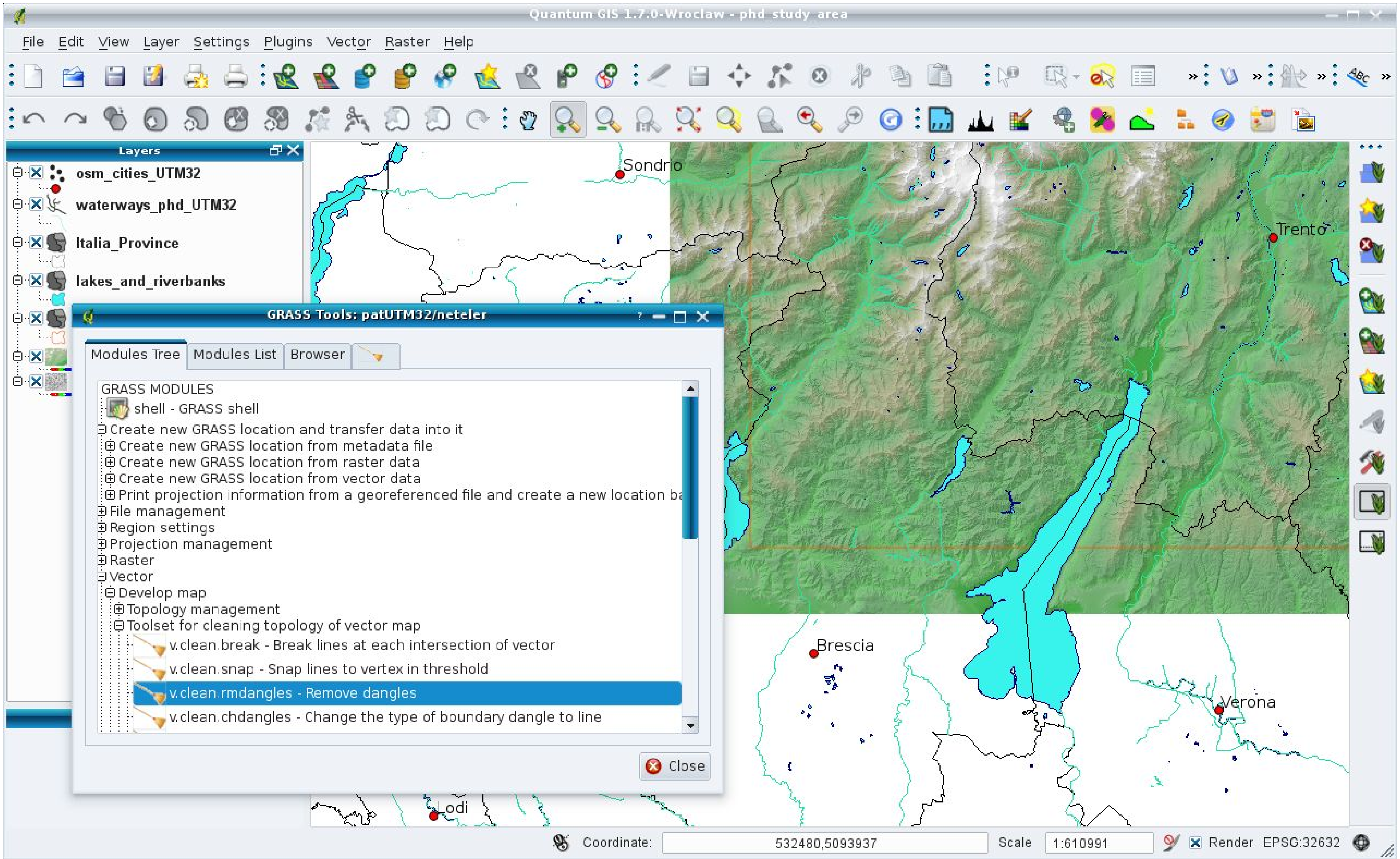
```
/*
 * Program: vtkGRASSBridge
 * COPYRIGHT: (C) 2011 by Soeren Gebbert, soerengebbert@googlemail.com
 *
 * This program is free software; you can redistribute it and/or modify
 * it under the terms of the GNU General Public License as published by
 * the Free Software Foundation; version 2 of the License.
 *
 * This program is distributed in the hope that it will be useful,
 * but WITHOUT ANY WARRANTY; without even the implied warranty of
 * MERCHANTABILITY or FITNESS FOR A PARTICULAR PURPOSE.  See the
 * GNU General Public License for more details.
 */

import vtk.*;

public class v_sample_rast {

    static {
        System.loadLibrary("vtkCommonJava");
        System.loadLibrary("vtkGRASSBridgeIOJava");
        System.loadLibrary("vtkGRASSBridgeRasterJava");
        System.loadLibrary("vtkGRASSBridgeVectorJava");
        System.loadLibrary("vtkGRASSBridgeCommonJava");
    }

    public static void main(String[] args) {
        // Initiate GRASS
```

http://code.google.com/p/vtk-grass-bridge/
source/browse/trunk/Modules/Java/v_sample_rast.java

What you can do with Open Source GIS....

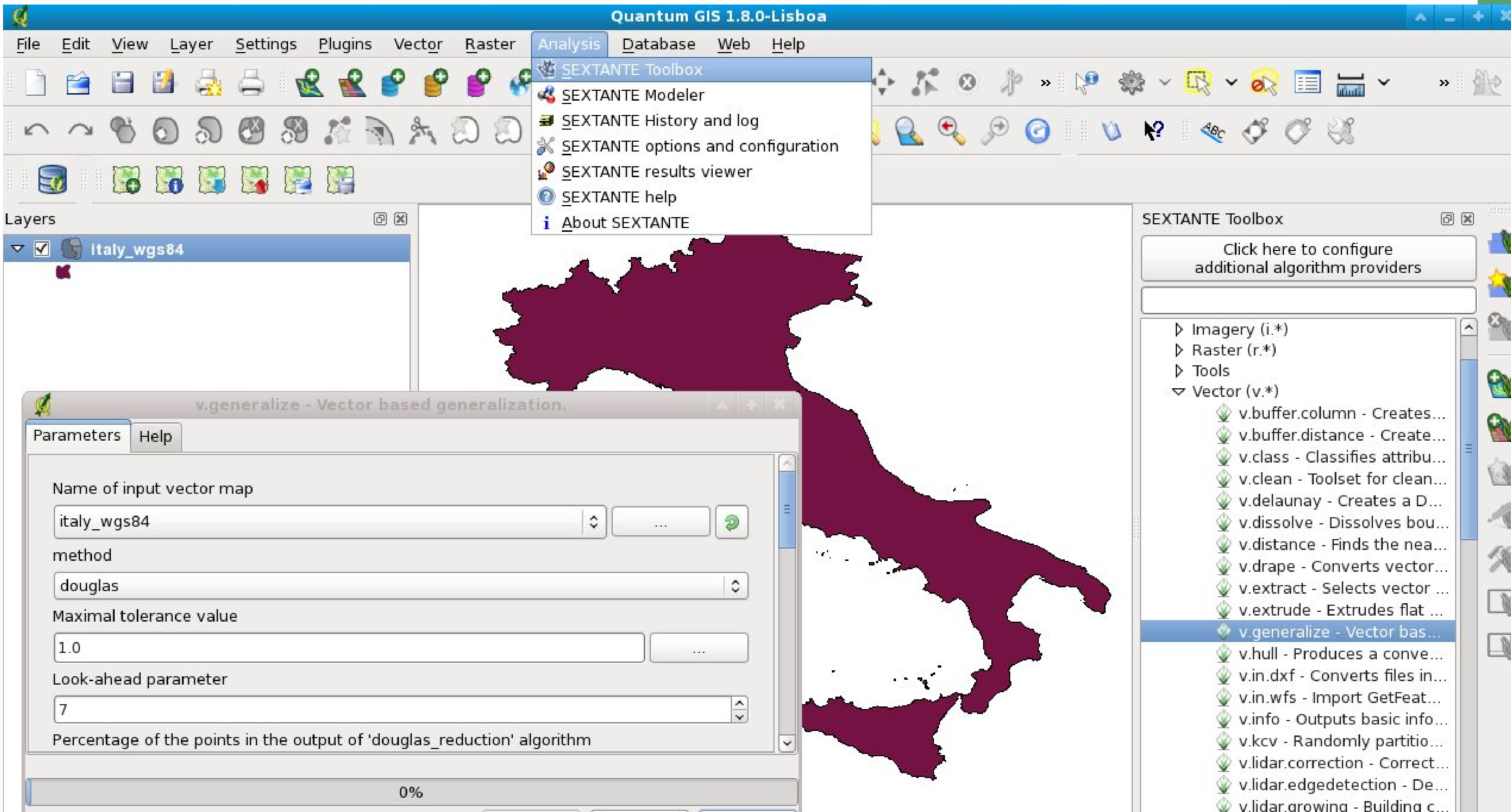


GRASS and QGIS Integration: GRASS Toolbox



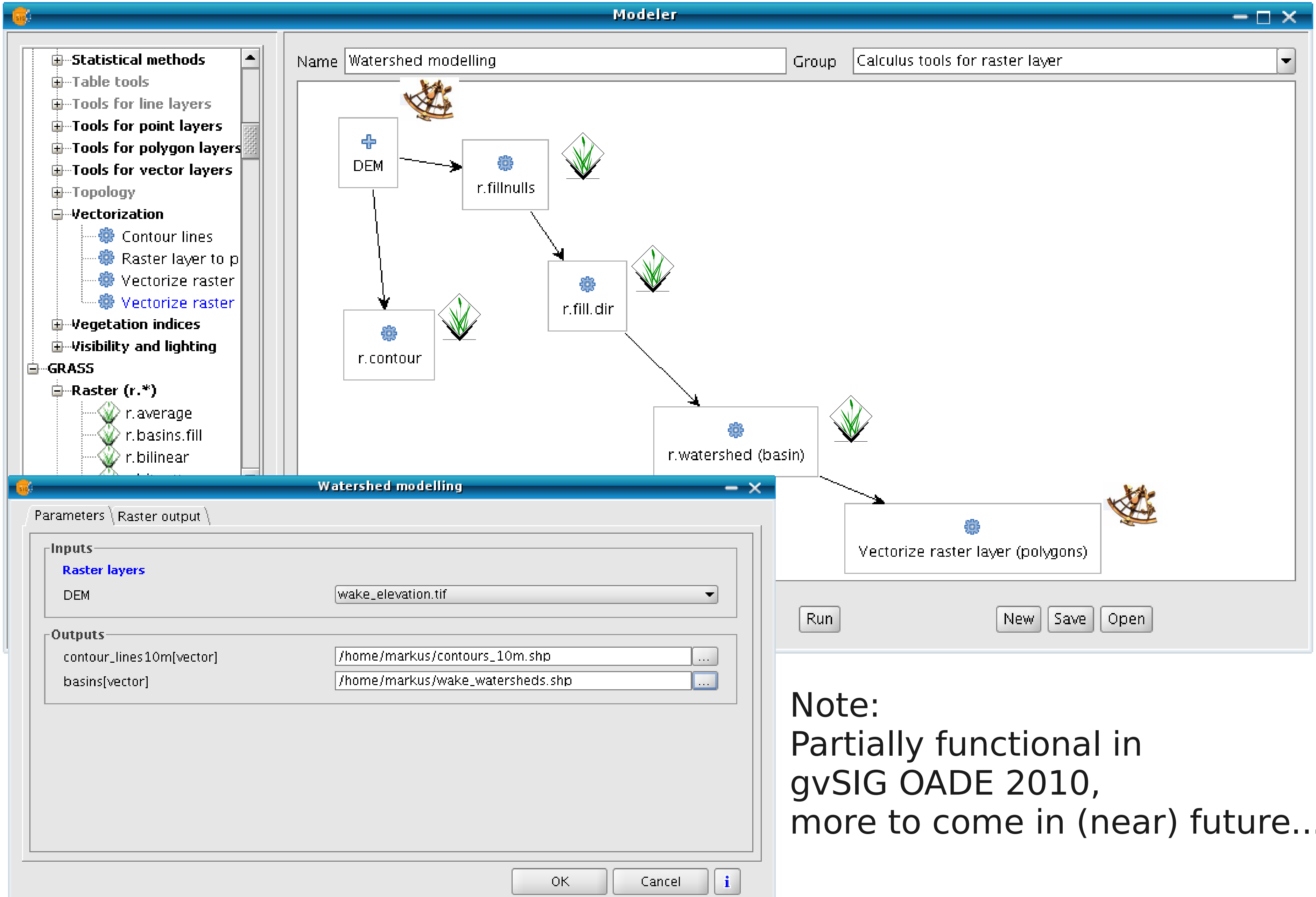
http://grass.osgeo.org/wiki/QGIS_GRASS_Cookbook

New GRASS and QGIS Integration: Sextante



http://grass.osgeo.org/wiki/GRASS_and_Sextante

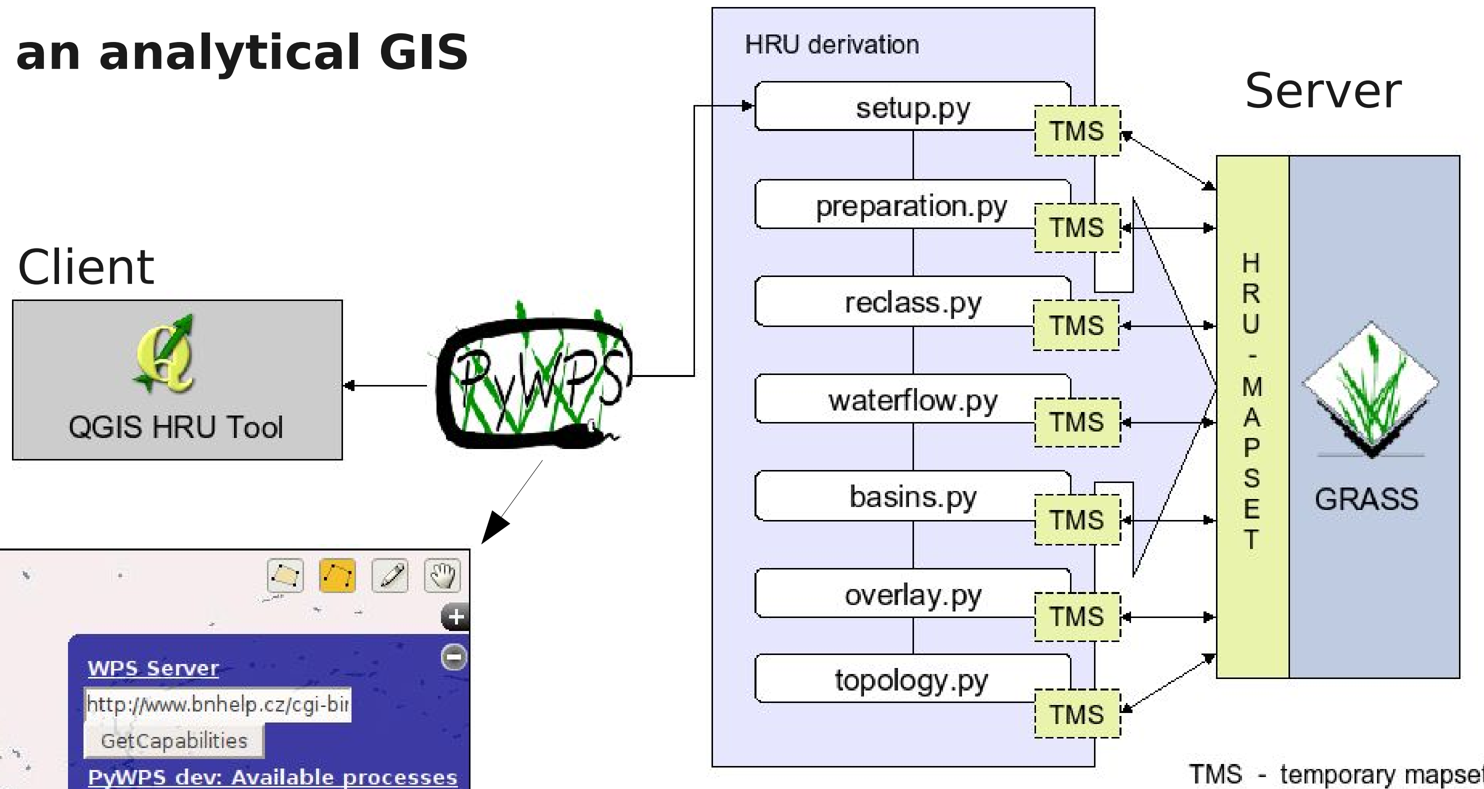
SEXTANTE – GRASS Integration: Modeller



Note:
Partially functional in gvSIG OADE 2010,
more to come in (near) future...

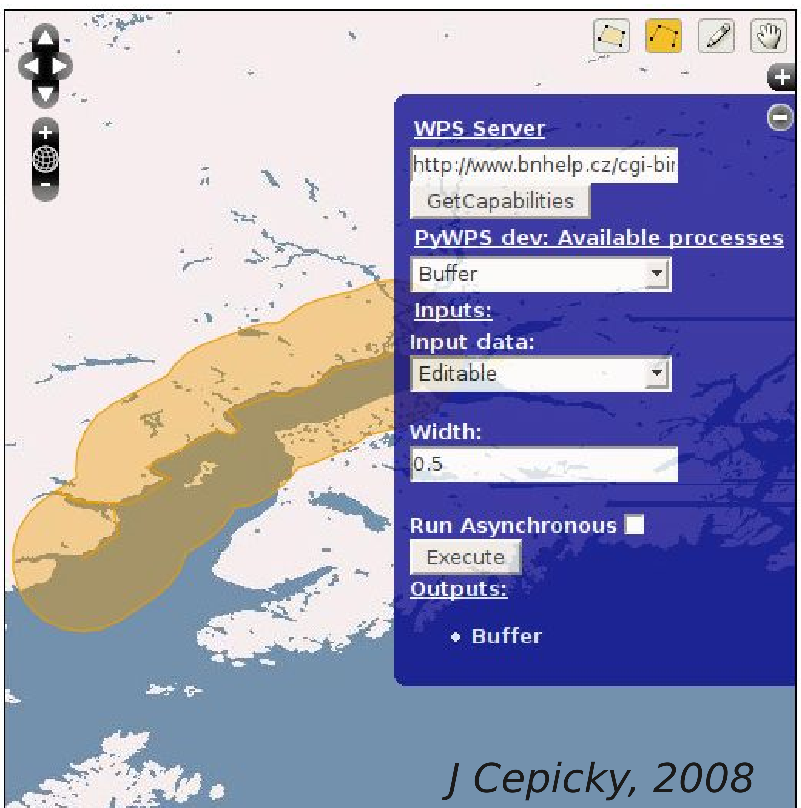
Web Processing Service – WPS

Controlling an analytical GIS from Web



Ch. Schwartze, Geoinformatics FCE CTU 2008

Web



Current Server implementations

- PyWPS: Python
- 52N WPS: Java
- vtkGRASSBridge: VTK, C, C++, Py, Java
- ZOO project - various languages
- ...

http://grass.osgeo.org/wiki/WPS

GRASS 7 WPS Support

```
r.grow --wps-process-description
```


```
<?xml version="1.0" encoding="UTF-8"?>
<wps:ProcessDescriptions xmlns:wps="http://www.opengis.net/wps/1.0.0"
xmlns:ows="http://www.opengis.net/ows/1.1"
xmlns:xlink="http://www.w3.org/1999/xlink"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:schemaLocation="http://www.opengis.net/wps/1.0.0
 http://schemas.opengis.net/wps/1.0.0/wpsDescribeProcess_response.xsd"
 service="WPS" version="1.0.0" xml:lang="en-US">
	<ProcessDescription wps:processVersion="1" storeSupported="true" statusSupported="true">
		<ows:Identifier>r.grow</ows:Identifier>
		<ows:Title>Generates a raster map layer with contiguous areas grown by one cell.</ows:Title>
		<ows:Abstract>The manual page of this module is available here: http://grass.osgeo.org/grass70/manuals/html70_use
		<ows:Metadata xlink:title="raster" />
		<DataInputs>
			<Input minOccurs="1" maxOccurs="1">
				<ows:Identifier>input</ows:Identifier>
				<ows:Title>Name of input raster map</ows:Title>
				<ComplexData maximumMegabytes="2048">
					<Default>
						<Format>
							<MimeType>image/tiff</MimeType>
						</Format>
					</Default>
					<Supported>
						<Format>
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						<Format>
							<MimeType>application/geotiff</MimeType>
```
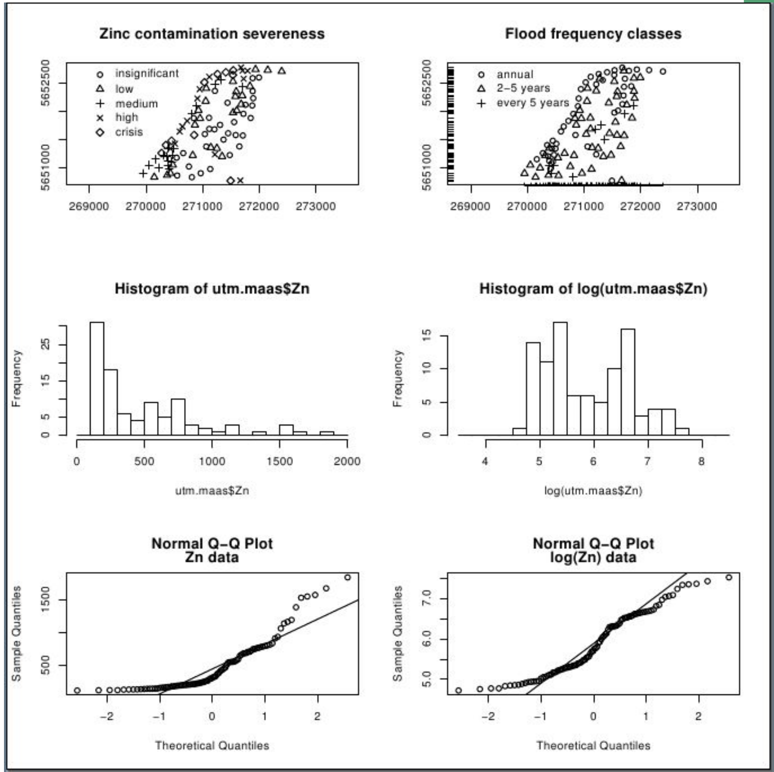

GRASS and R Integration

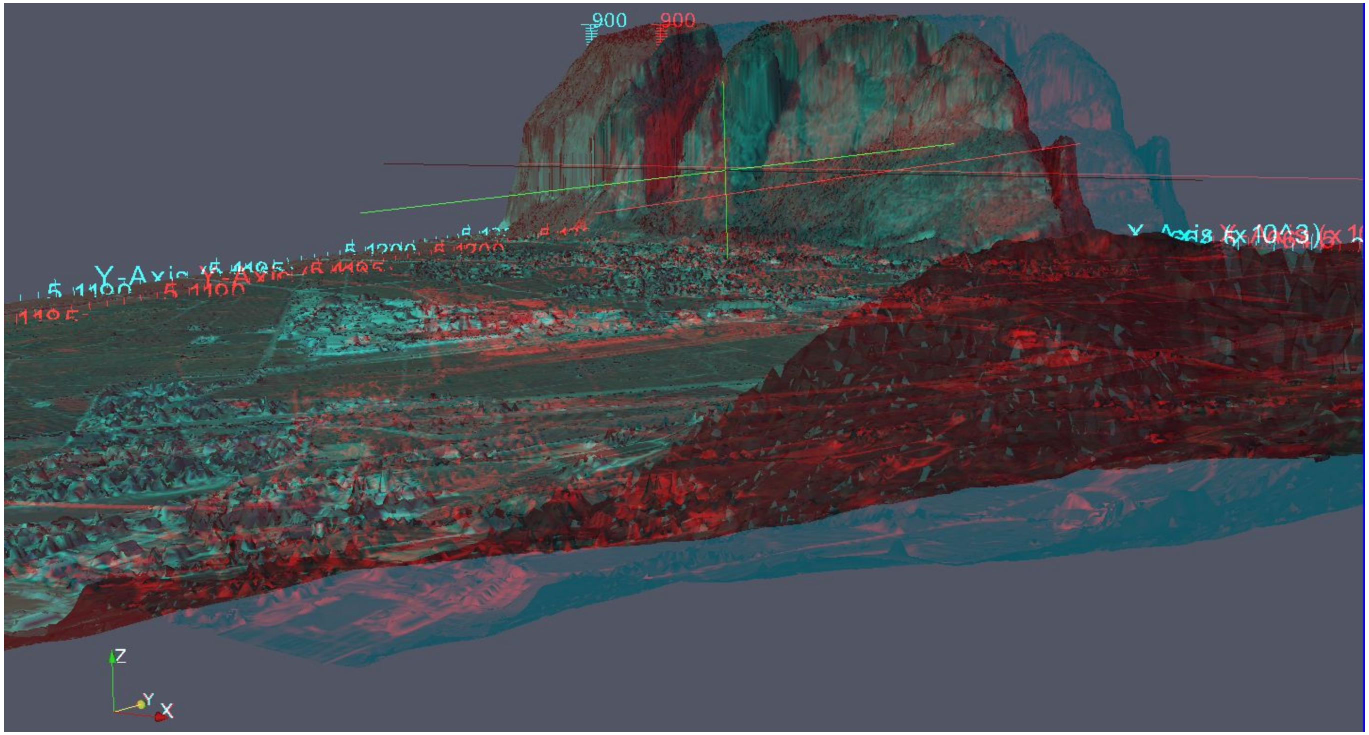


GRASS 6.4.2svn (patUTM32):~/papers > R

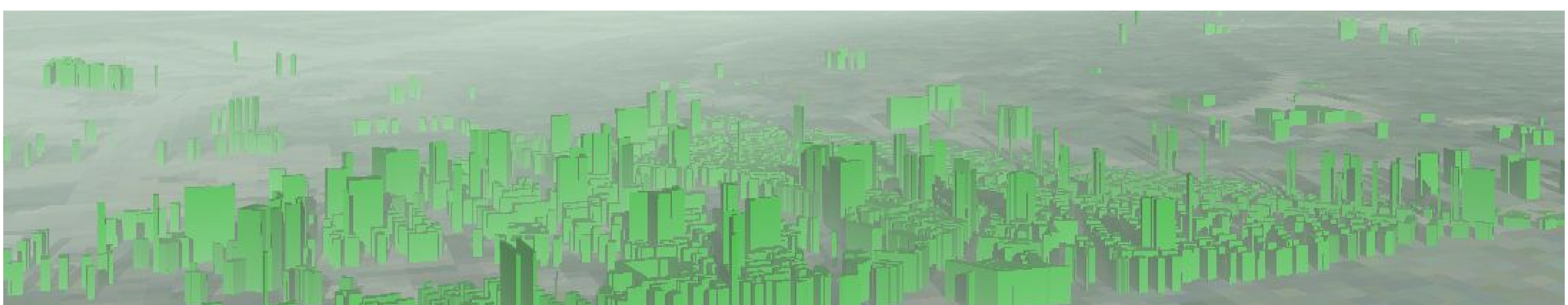
R version 2.13.1 (2011-07-08)
...
> library(spgrass6)
Loading required package: sp
Loading required package: rgdal
Geospatial Data Abstraction Library extensions
Loaded GDAL runtime: GDAL 1.7.3, released 20
Path to GDAL shared files: /usr/local/share/gdal
Loaded PROJ.4 runtime: Rel. 4.7.1, 23 September 2009, [PJ_VERSION: 470]
Path to PROJ.4 shared files: (autodetected)
Loading required package: XML
GRASS GIS interface loaded with GRASS version: 6.4.2svn
and location: nc_spm_08
> myrast <- readRAST6(c("geology", "elevation"), cat=c(TRUE, FALSE))
> myvect <- readVECT6("roads")
...
> writeRAST6(myrast, "elev_filt", zcol="elev")
...

http://grass.osgeo.org/wiki/R_statistics

Visualization: GRASS data export to Paraview and Povray

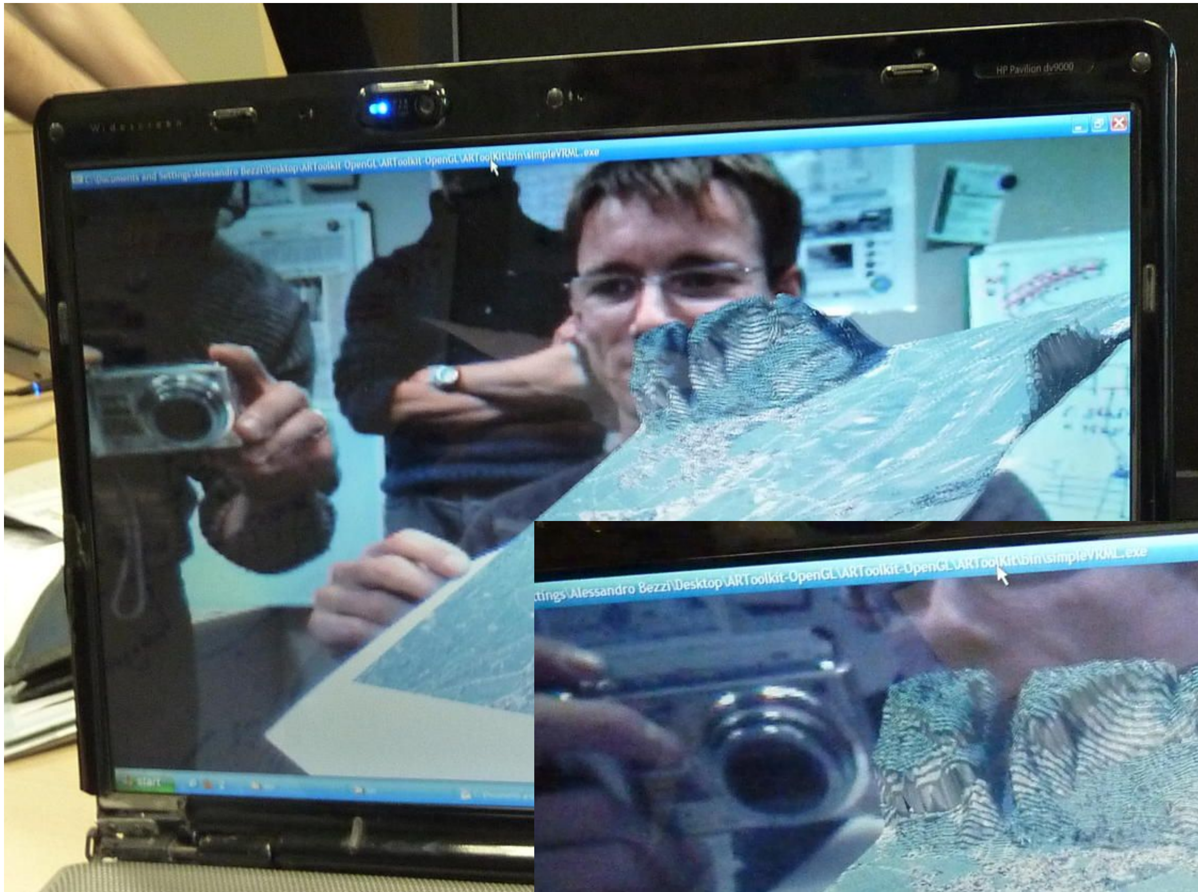


Povray rendering (www.povray.org): adding clouds and haze



Furthermore: OpenSceneGraph, Ratman, ...

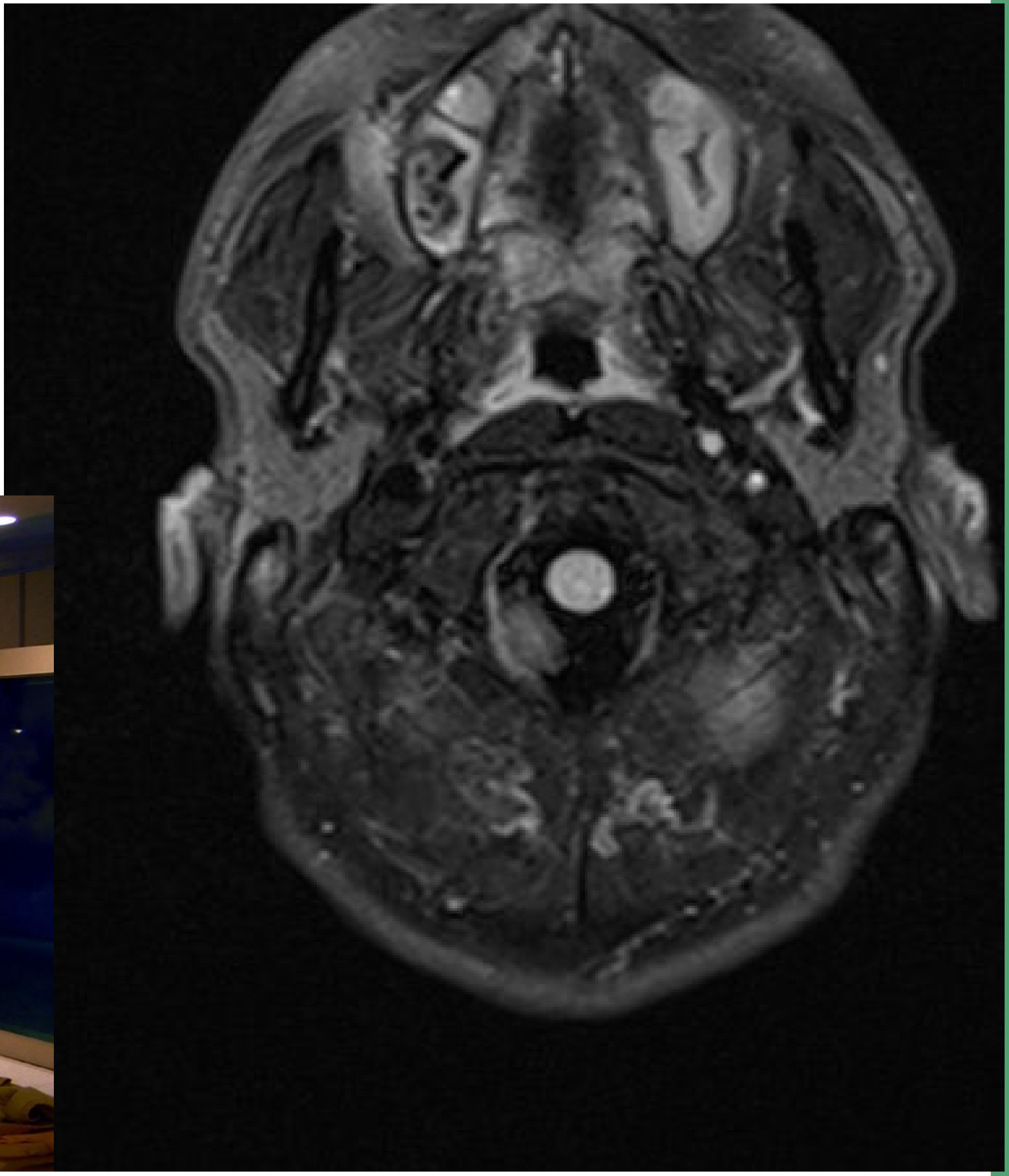
Visualization: GRASS data export to for Augmented Reality



GRASS GIS,
Paraview, and
ARToolkit

A researcher's brain... From MRT scan to Voxels

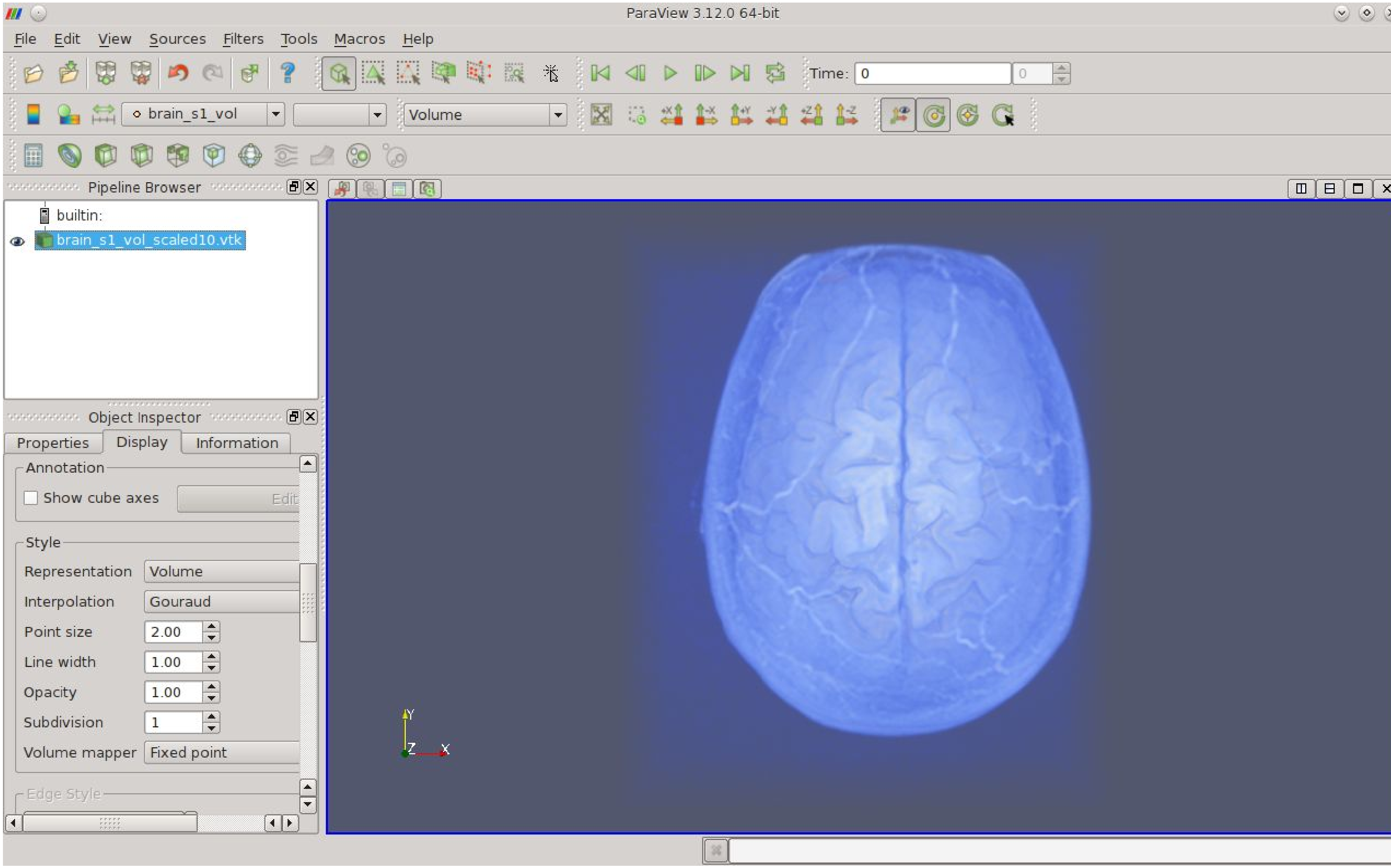
Our FEM colleague
-->



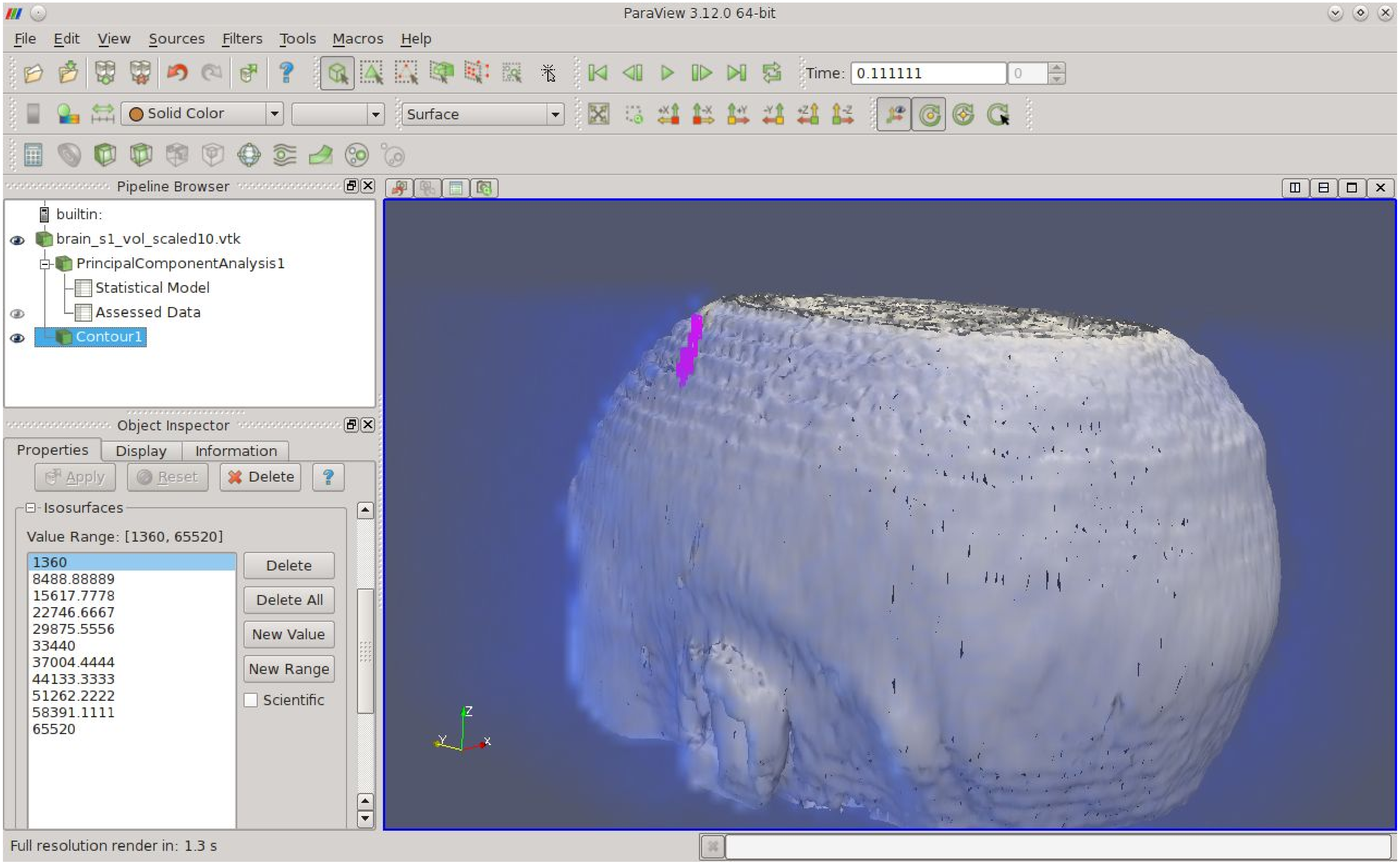
http://it.wikipedia.org/wiki/Imaging_a_risonanza_magnetica

Personal comm.

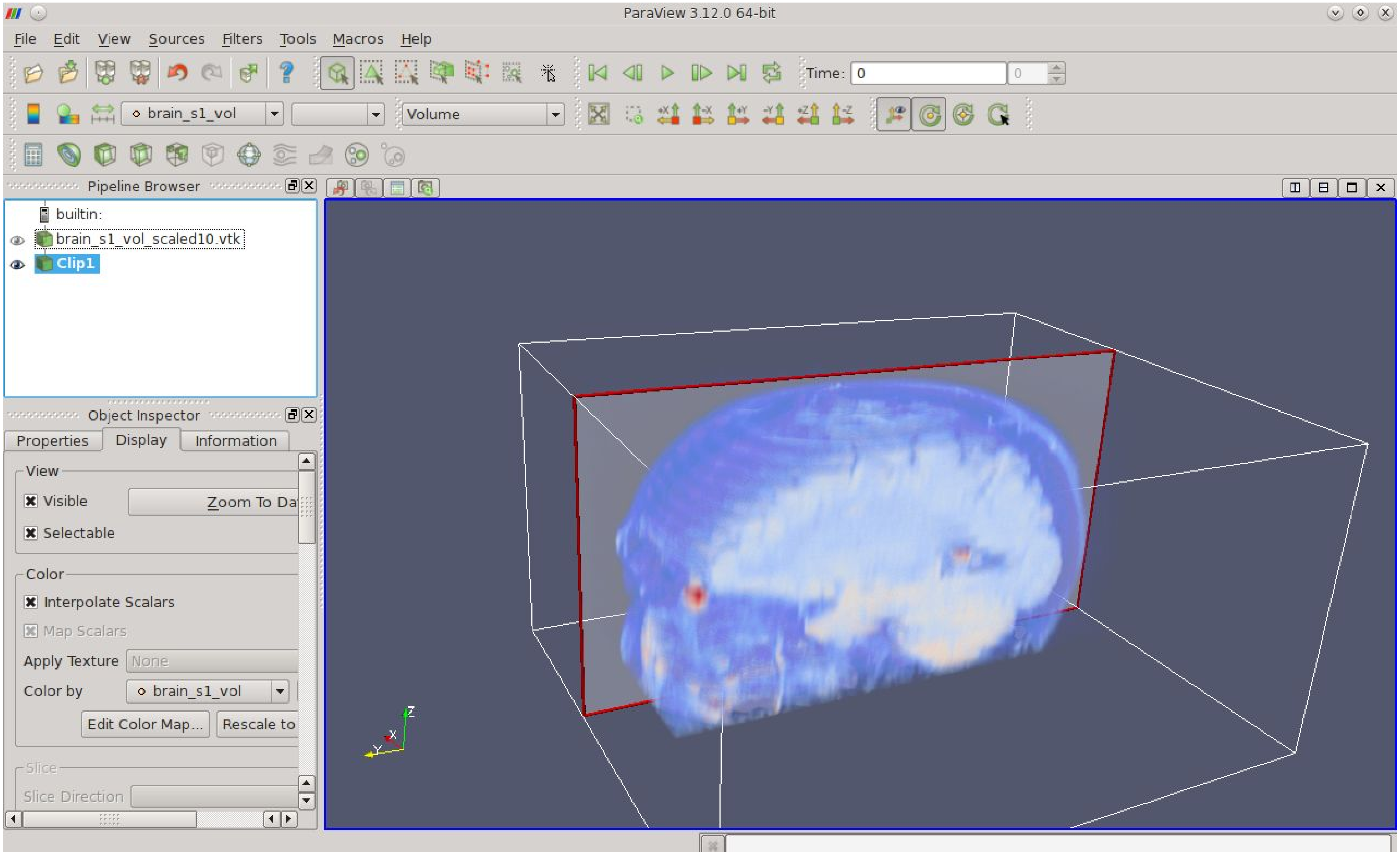
A researcher's brain... From MRT scan to Voxels



A researcher's brain... From MRT scan to Voxels



A researcher's brain... From MRT scan to Voxels



New Space-Time functionality in GRASS 7

Developed by Sören Gebbert
--> Enjoy on Friday!

Temporal data processing in GRASS GIS

The temporal GIS framework in GRASS introduces three new datatypes that are designed to handle time series data:

- *Space time raster datasets* (strds) are designed to manage raster map time series. Modules that process strds have the naming prefix *t.rast*.
- *Space time 3D raster datasets* (str3ds) are designed to manage 3D raster map time series. Modules that process str3ds have the naming prefix *t.rast3d*.
- *Space time vector datasets* (stvds) are designed to manage vector map time series. Modules that process stvds have the naming prefix *t.vect*.

Temporal data management in general

List of general management modules:

- t.connect
- t.create
- t.remove
- t.register
- t.unregister
- t.info
- t.list
- t.rast3d.list
- t.vect.list
- t.vect.db.select
- t.sample
- t.support
- t.topology

Export/import conversion

- t.rast.export
- t.rast.import
- t.rast.out.vtk
- t.rast.to.rast3
- r3.out.netcdf
- t.vect.export

Statistics and gap filling

- t.rast.gapfill
- t.rast.univar

Querying and map calculation

- t.rast.list
- t.rast.extract
- t.rast.gapfill
- t.rast.mapcalc
- t.rast3d.extract
- t.rast3d.mapcalc
- t.rast3d.univar
- t.vect.extract
- t.vect.import
- t.vect.observe.strds
- t.vect.univar
- t.vect.what.strds

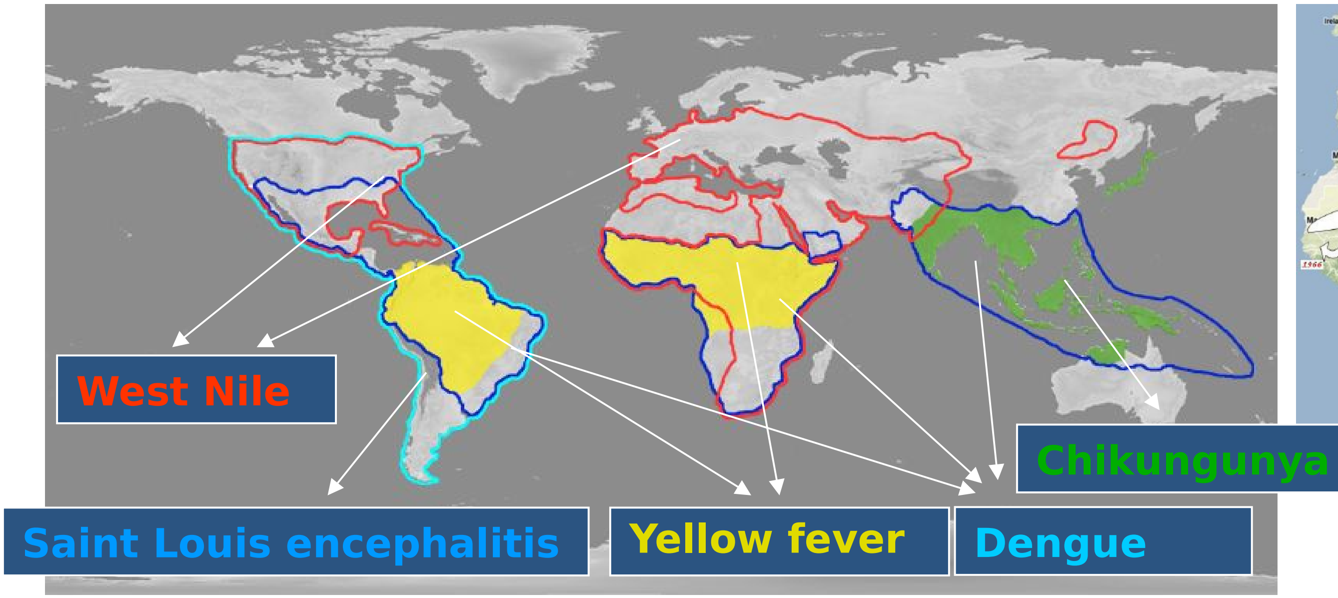
Aggregation

- t.rast.aggregate.ds
- t.rast.aggregate
- t.rast.series

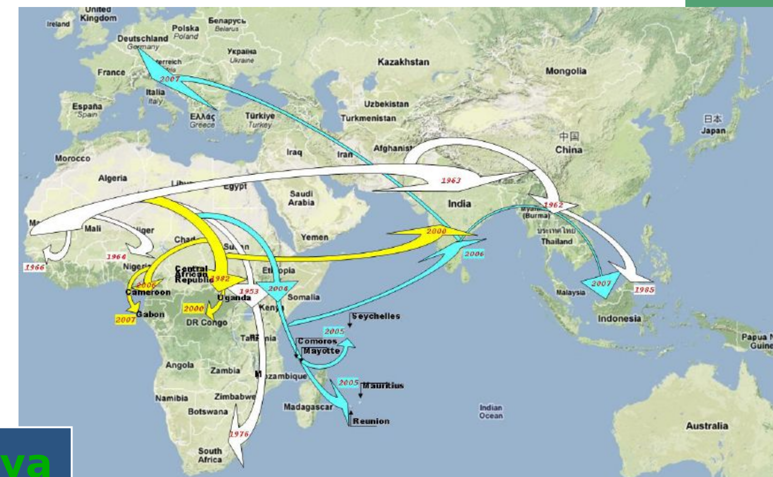
Space time datasets are stored in a temporal database. SQLite3 or PostgreSQL are supported as SQL database back end. Connection settings are performed with t.connect. As default a sqlite3 database will be created in the PERMANENT mapset that stores all space time datasets and registered time series maps from all mapsets in the location.

GRASS GIS applications in public health and eco-epidemiology

Spread of the tiger mosquito (*Aedes albopictus*): infectious disease vector



Roiz, Neteler et al. 2011



De Llamballerie et al., 2008: Chikungunya

- Tiger mosquito: Disease vector
- Spreads in Europe and elsewhere
- Small containers, used tires and lucky bamboo plants are relevant breeding sites
- >200 cases of Chikungunya in northern Italy in 2007 (CHIKv imported by India traveler and was then spread by *Ae. Albopictus*)

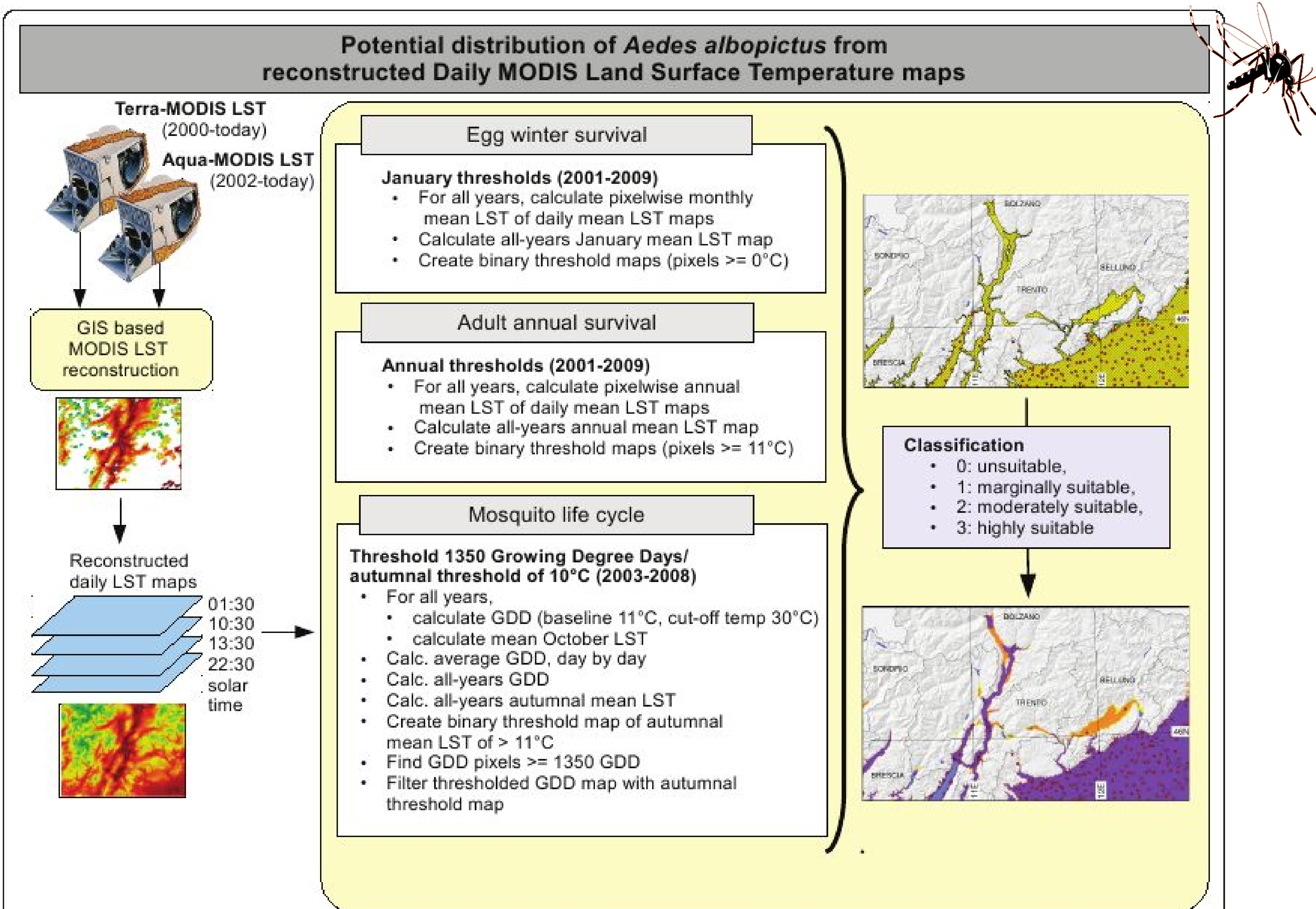


Figure 1 Workflow of aggregating MODIS LST into ecological indicators for the potential distribution of *Ae. albopictus*. The original daily MODIS LST data are reconstructed mapwise and then aggregated into three different ecological indicators used as proxies to predict the potential distribution of *Ae. albopictus*.

Neteler et al., 2011: Int J Health Geogr, 10:49, http://www.ij-healthgeographics.com/content/10/1/49
Roiz, D., Neteler, M., et al., 2011: Climatic factors ... tiger mosquito. ***Plos ONE****, 6(4): e14800*

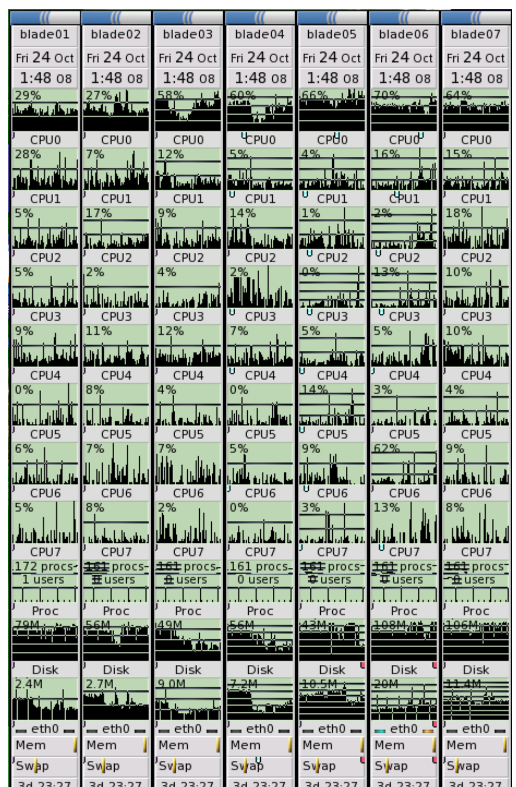
Parallelised GIS Processing

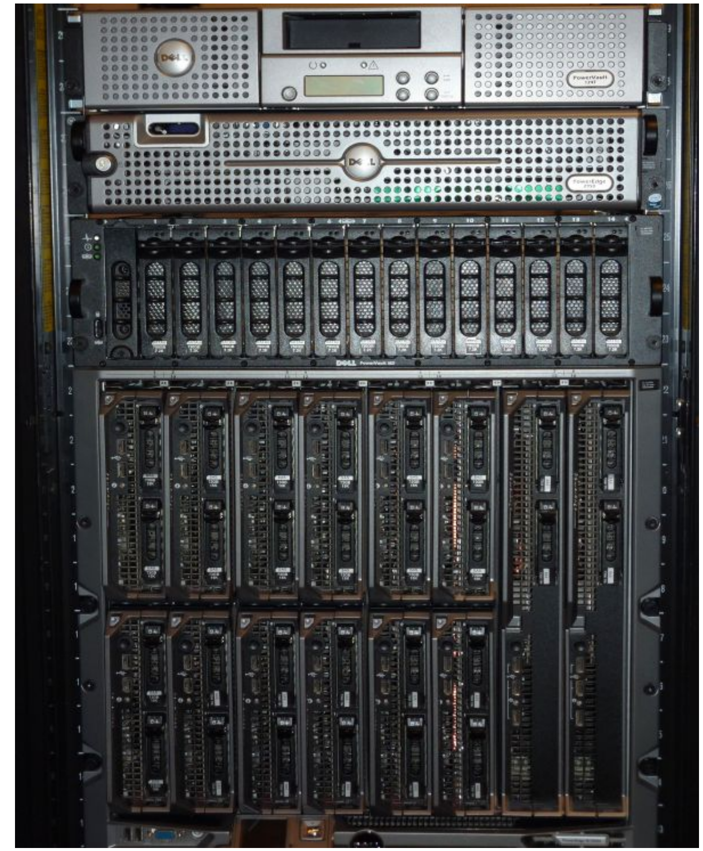
Infrastructure: FEM-GIS Cluster

- 19 single-blades and 2 double-blades
- In total 300 nodes with 600 Gb RAM
- Circa 2 Tflops/s
- Linux operating system, blades headless with oneSIS

- **GRASS GIS and R-stats**
- Queue system for job management (Grid Engine)

- Processing of all 14,000 maps in parallel: one map per node
- Computational time: 3 weeks with LST-algorithm V1.1





GRASS GIS

LST Applications: Tiger mosquito survival today...

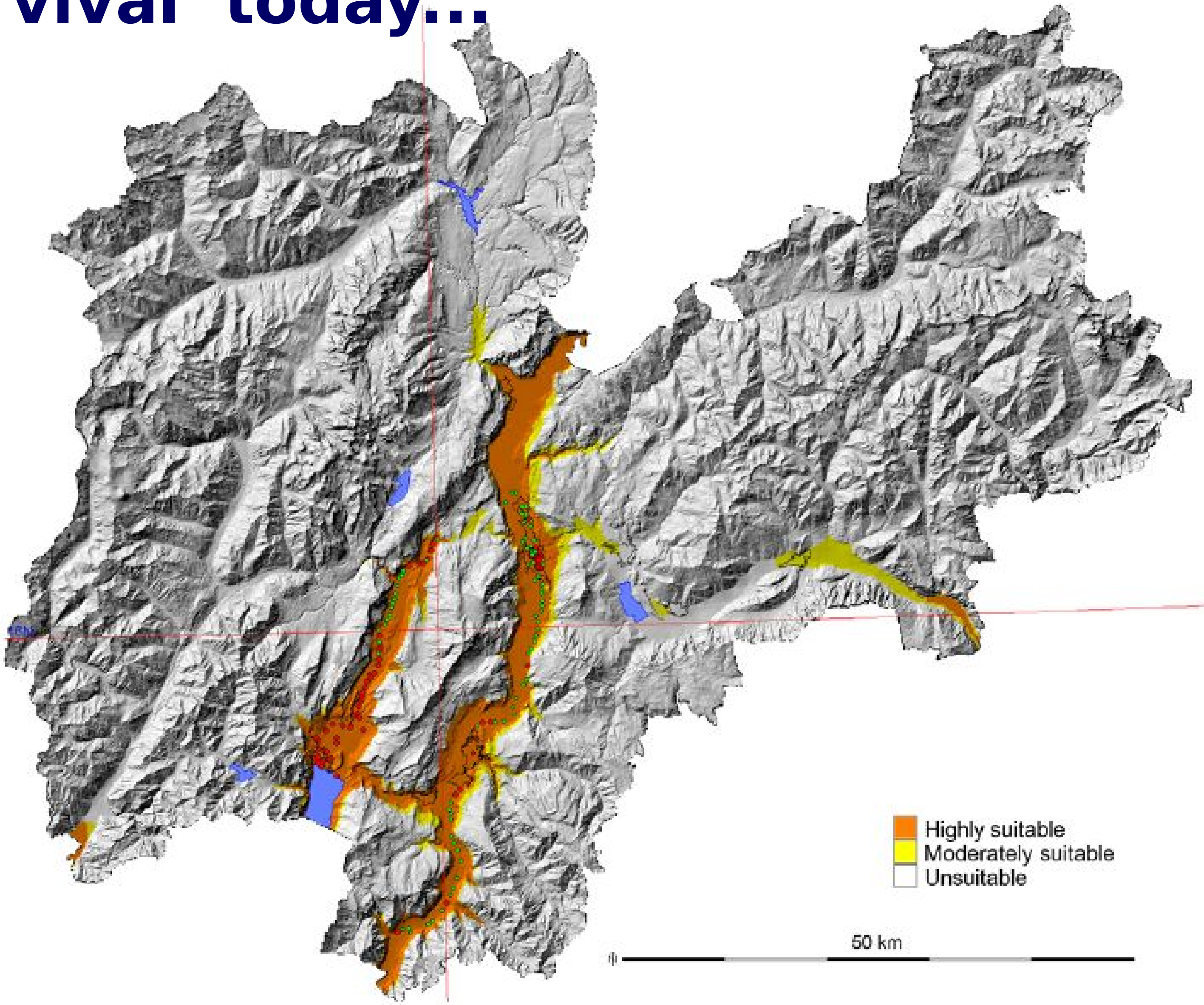
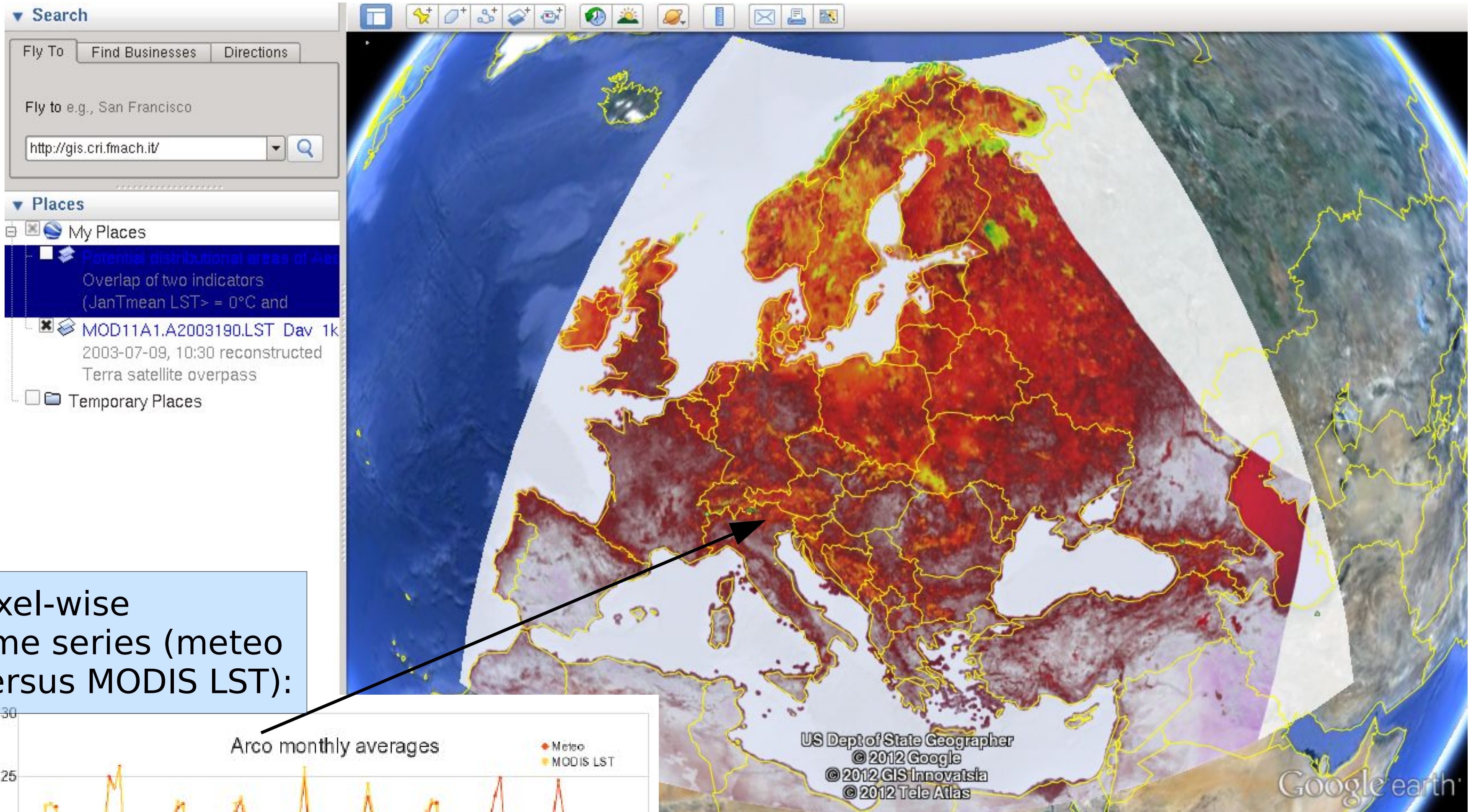


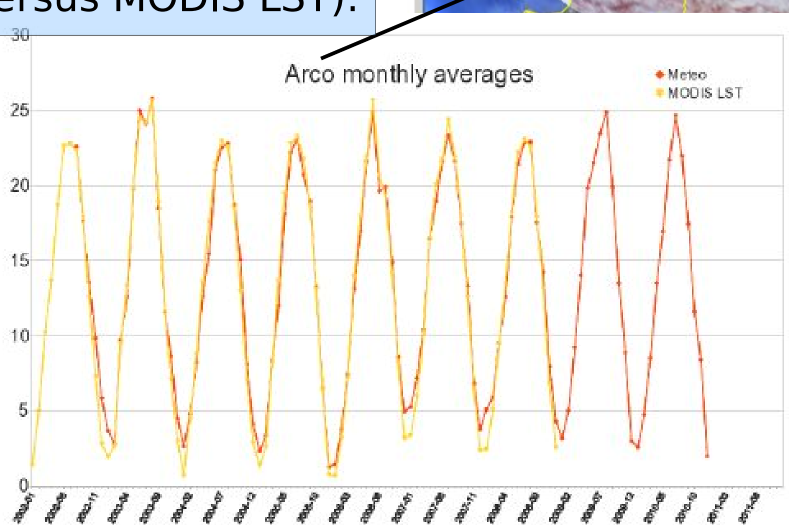
Figure 3. Potential and current distributional areas of *Ae. albopictus.* Overlap of both indicators (JanT^{mean} LST $>=0°C$ and AnnT^{mean} LST $>=11°C$) were plotted for the period 2001–09 and integrated in a final map with 3 categories (see methods). Red spots represent the presence and green spots the absence of *Ae. albopictus*.

Roiz D., Neteler M., Castellani C., Arnoldi D., Rizzoli A., 2011: Climatic Factors Driving Invasion of the Tiger Mosquito (Aedes albopictus) into New Areas of Trentino, Northern Italy. PLoS ONE. 6(4): e14800

The new European daily MODIS LST time series



Pixel-wise time series (meteo versus MODIS LST):



European LST mosaic

... usable as **virtual meteorologic stations for temperature**

250m resolution, **4 maps** per **day**, data since 2000

Metz & Neteler, in prep.

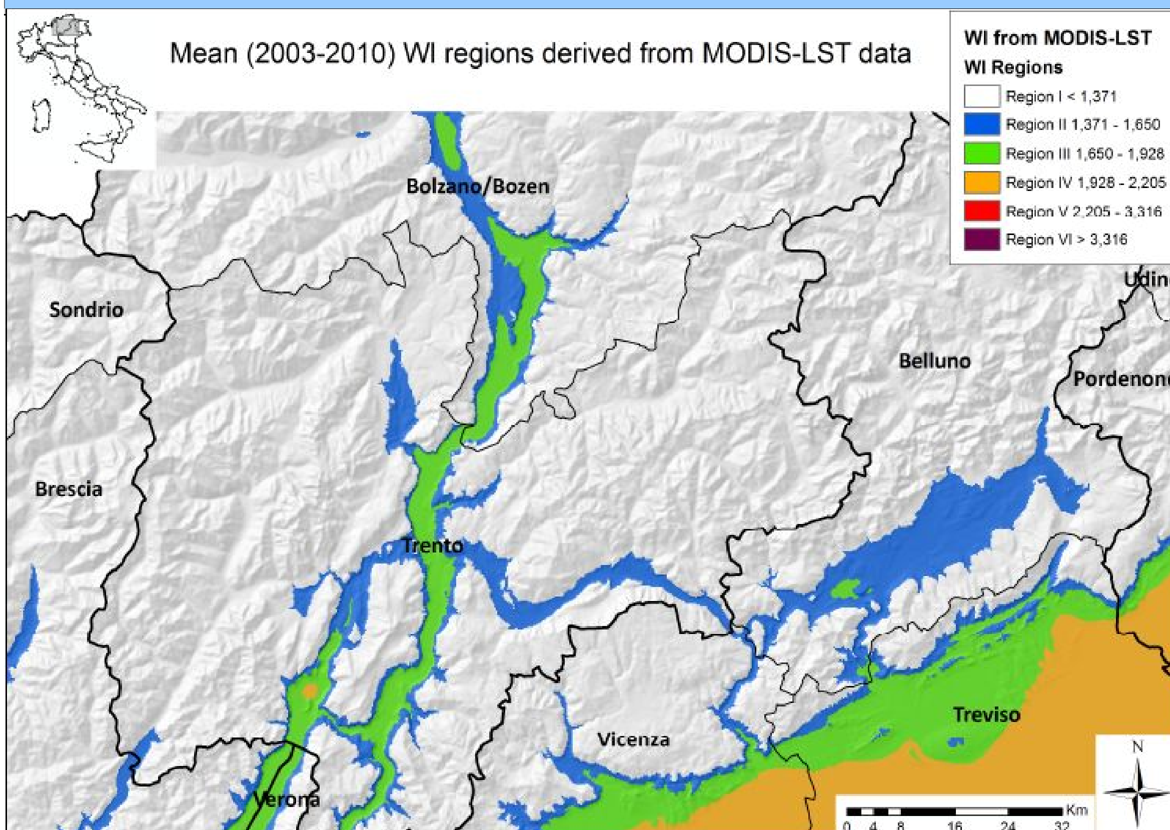
Neteler, M., 2010: Estimating daily LST... Remote Sensing 2(1), 333-351 [PDF]

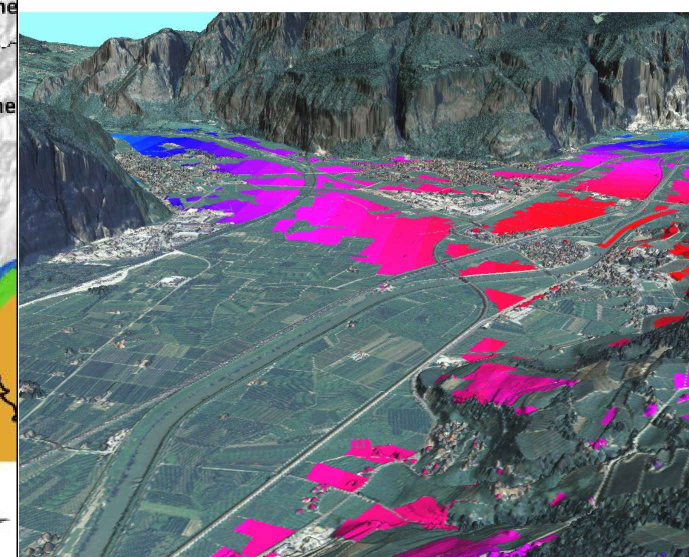
Further MODIS LST Applications

Agriculture examples:

- Wine production: Winkler index in order to classify climate
- Growing degree day (GDD) maps: plant- and insect phenology

Viticulture classification based on MODIS LST derived Winkler Index





Zorer et al., 2011. *Use of multi-annual MODIS land surface temperature data for the characterization of the heat requirements for grapevine varieties*. Proc. Multitemp 2011, Trento, http://www.multitemp2011.org

Open science wants Open Source!

Letters

Trends in Ecology and Evolution June 2012, Vol. 27, No. 6

Let the four freedoms paradigm apply to ecology

Duccio Rocchini and Markus Neteler

Fondazione Edmund Mach, Research and Innovation Centre, Department of Biodiversity and Molecular Ecology, Via E. Mach 1, 38010 S. Michele all'Adige (TN), Italy

In 1985, Richard Stallman, one of the most brilliant minds in computer science, founded the Free Software Foundation and launched the concept of 'copyleft', the opposite of copyright. The aim, outlined in the GNU Manifesto (http://www.gnu.org/gnu/manifesto.html, [1]), was to make software programs 'free' as in 'freedom'.

The famous 'four freedoms' expounded by Stallman [1] are: (i) the freedom to run the program for any purpose; (ii) the freedom to study how the program works and adapt it to one's own needs; (iii) the freedom to redistribute copies; and (iv) the freedom to make improvements to the program and release them to the public. Thus, the whole (scientific) community benefits from software development. These freedoms are also inherent in several free software licenses, the GNU General Public License (GPL) being one of the most popular.

Approximately a quarter of a century after Stallman put forward his ideas, William K. Michener and Matthew B. Jones, in an article in *TREE* [2] focusing on the analysis of ecological data, stated that: 'analytical processes are fundamental to most published results in ecology'. Explicit reference to the analytical procedures adopted in generating scientific results is crucial for reproducibility, yet these processes are rarely documented in published ecological papers [2]. Scientific workflow applications, such as Kepler (https://kepler-project.org), attempt to address the problem [2], but are only partially successful because the underlying algorithms may still be opaque.

In our view, the explicit use of Free and Open Source Software (FOSS) with availability of the code is essential for completely open science: 'scientific communication relies on evidence that cannot be entirely included in publications', but 'anything less than the release of source programs is intolerable for results that depend on computation' [3].

The idea of FOSS and the public availability of the code has been around for almost as long as software [4]. Nonetheless, as far as ecologists are concerned, the open source philosophy is only just taking off, as Stokstad has also pointed out [5].

The increasing availability of open ecological data through networks such as the Global Biodiversity Information Facility (GBIF, http://www.gbif.org, [6]) or the Data Observation Network for Earth (DataONE) federated data archive (http://www.dataone.org, [7]) makes it increasingly possible to test cutting-edge ecological theories, such as dark diversity [8], evolutionary paths [9] and climate change scenarios [10]. In using a shared open-source code for testing these ecological theories, researchers can be sure that their results are reliable and also that the code they have used is robust [11]. This is particularly true when complex algorithms (or statistical approaches) are involved.

To avoid black box calculations and built-in user interfaces, criticized in [2], researchers have recourse to several examples of FOSS in areas of ecological research, such as ecological statistics (e.g. R Language and Environment for Statistical Computing, http://www.R-project.org, [12]) and spatial ecology (e.g. Geographical Resources Analysis Support System (GRASS) GIS, http://grass.osgeo.org, [4]). The modular design of such software means decentralized contributions can be made to the source code and allows different institutions and individuals around the world to improve the code base.

If FOSS were more widely employed in ecology and the code used in data analysis provided in scientific papers, more researchers [11] would be able to rely on and replicate

Corresponding author: Rocchini, D. (ducciorocchini@gmail.com), (duccio.rocchini@fmach.it).

Why we are here...

peer-reviewed functions. Efforts still need to be made in this area to improve the processes for sharing what is in effect the backbone of ecological software: its code. Therefore, there is an urgent need to embrace Stallman's four freedoms paradigm in ecology.

Acknowledgments

We would like to thank Anne Ghisla, Luca Delucchi and Tessa Say for valuable suggestions. DR is partially funded by the Autonomous Province of Trento (Italy) within the ACE-SAP project (University and Scientific Research Service regulation number 23, June 12, 2008).

Conclusions

- Almost unlimited possibilities with GRASS GIS and other FOSS4G software thanks to the contributing communities
- Use GRASS GIS yourself on **Tuesday**!
- Enjoy!

Markus Neteler & Markus Metz
Fondazione E. Mach (FEM)
Centro Ricerca e Innovazione
GIS and Remote Sensing Unit
38010 S. Michele all'Adige (Trento), Italy
http://gis.cri.fmach.it
http://www.osgeo.org

A gentle introduction to OSGeo:

Open Source Geospatial Foundation

http://www.osgeo.org

Open Source GIS brought to you by...

... the OSGeo community: more than 19,000 unique subscribers in 150 topic oriented mailing lists

Open Source Geospatial Foundation

http://www.osgeo.org

OSGeo supports:
- Software
- Data
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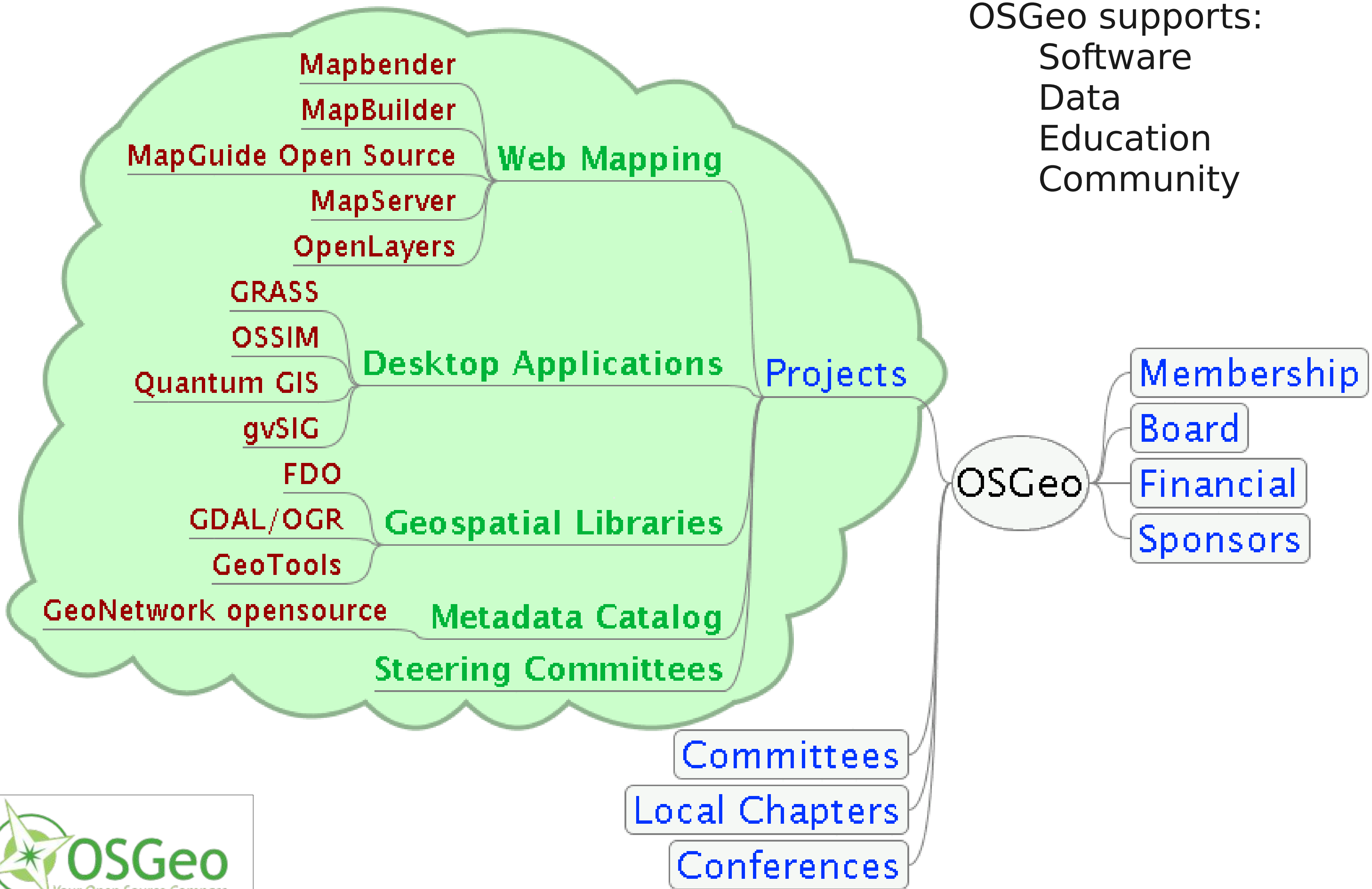
- Community



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Geodata Repository

The notes on the Talk:Geodata_Repository Talk page for this page describe the background to this effort

A full list of suggestions for public domain data sets that are nice-to-haves is maintained at Geodata Discovery Working Group.

Contents [hide]

On Offer !

[edit]

Short explanation of available datasets (to be extended - the number of datasets as well as their explanation ;-):

Name	Description	# of layers
VMap0	Selected subsets of Vector Smart Map Level 0 polygons, lines and points, starting with a selection that has proven to be useful for creating FlightGear Scenery from it. Added a 'geonameid' column for joining urban areas with GeoNames (see below). Current details explained at the World Custom Scenery Project, will get synced some day.	33 (DETAIL)
VMap1	First attempt of a selection that would be "nice to have" for FlightGear from Vector Smart Map Level 1 - and certainly for other purposes as well. Added a 'geonameid' column for joining urban areas with GeoNames. Details similar to VMap0.	58 (DETAIL)
AptNav	Geometric average of runway center locations plus runway/taxiway shapes as used by the FlightGear and X-Plane flight simulators; data taken from Robin Peel's Airport Database. Locations converted to OGC-style POINT geometries. Use 'icao' column for searching. • This import is currently tied to the state of the FlightGear 1.0.0 Base Package release.	1 (DETAIL)
GSHHS	Global Self-consistent, Hierarchical, High-resolution Shoreline Database 1.6 shorelines.	4 (DETAIL)
PGS	NGA Prototype Global Shoreline.	1 (DETAIL)
SWBD	SRTMv2 Water Body Data.	1 (DETAIL)

http://wiki.osgeo.org/wiki/Geodata_Repository

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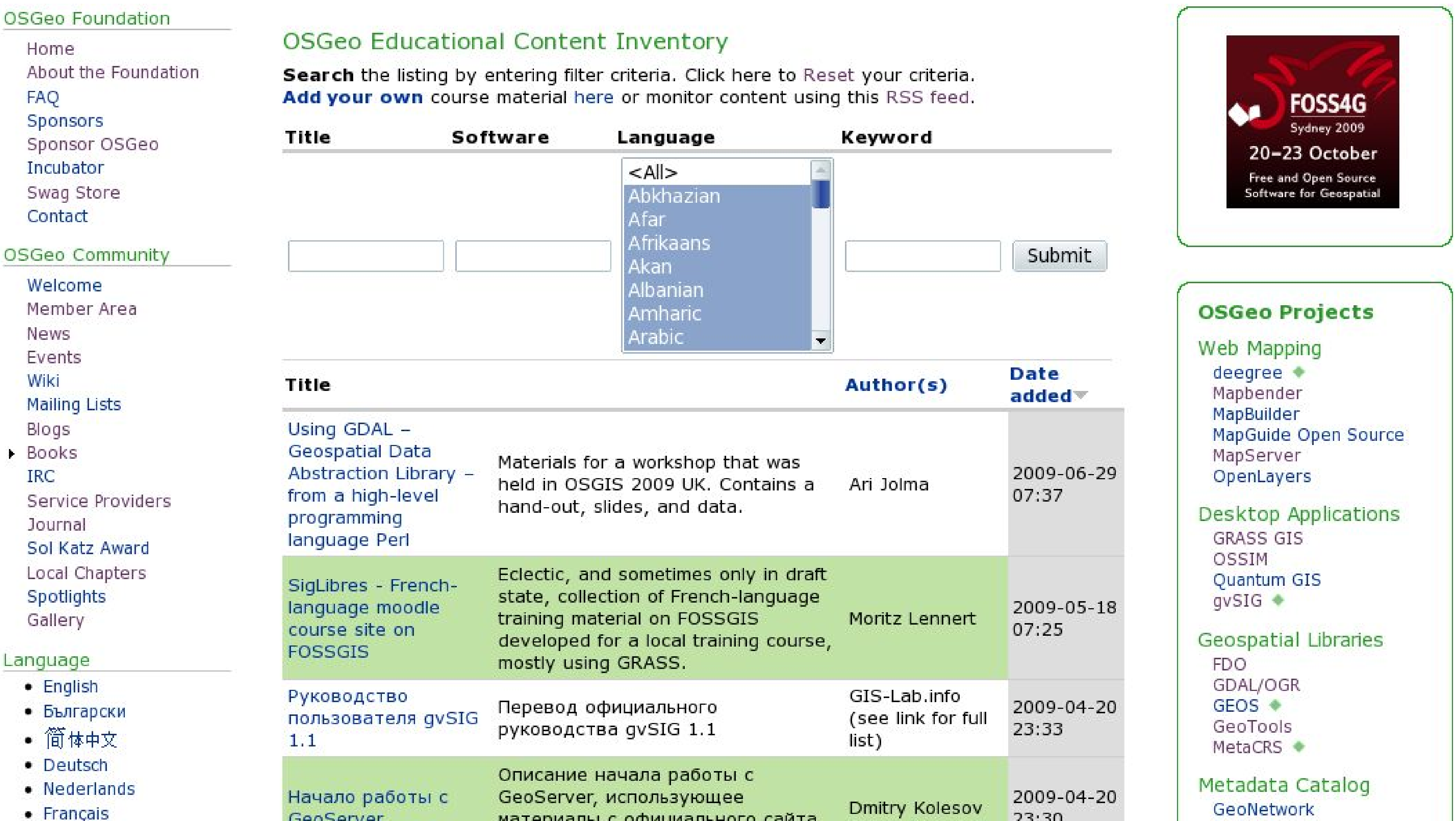
“enable people to teach“

http://www.osgeo.org/educational_content

2012: >60 Tutorials and courses



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Using GDAL – Geospatial Data Abstraction Library – from a high-level programming language Perl	Materials for a workshop that was held in OSGIS 2009 UK. Contains a hand-out, slides, and data.	Ari Jolma	2009-06-29 07:37
SigLibres - French-language moodle course site on FOSSGIS	Eclectic, and sometimes only in draft state, collection of French-language training material on FOSSGIS developed for a local training course, mostly using GRASS.	Moritz Lennert	2009-05-18 07:25
Руководство пользователя gvSIG 1.1	Перевод официального руководства gvSIG 1.1	GIS-Lab.info (see link for full list)	2009-04-20 23:33
Начало работы с GeoServer	Описание начала работы с GeoServer, использующее материалы с официального сайта	Dmitry Kolesov	2009-04-20 23:30

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Metadata Catalog
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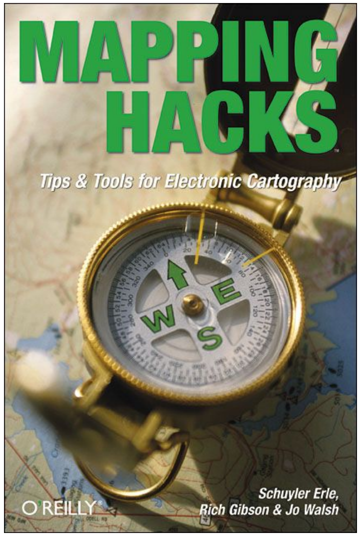
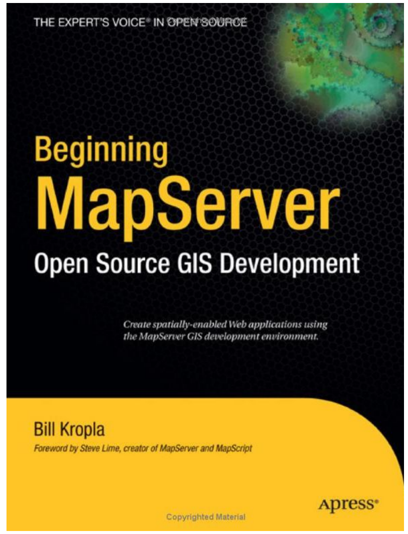
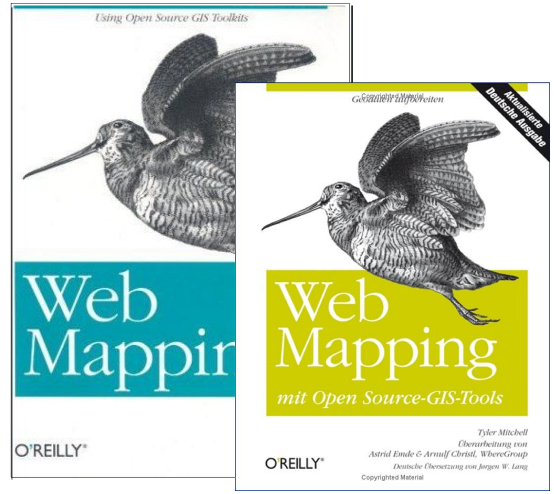
FOSS4G bookshelf: read more!

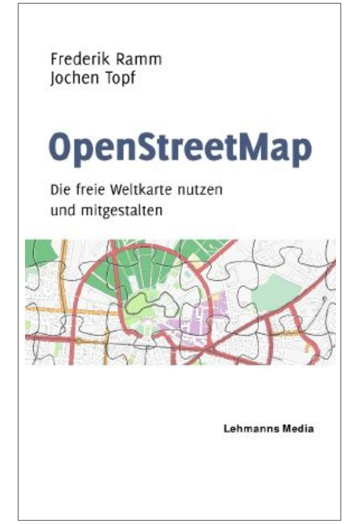
http://wiki.osgeo.org/wiki/Library

2005



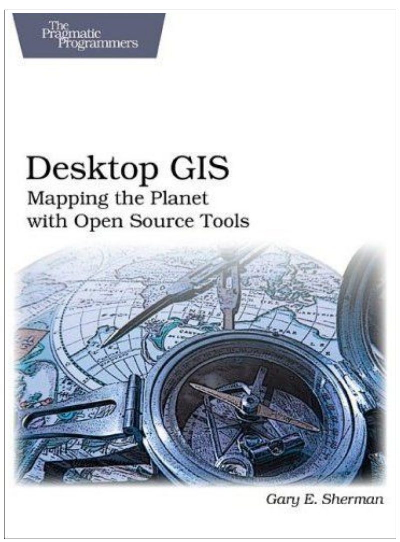




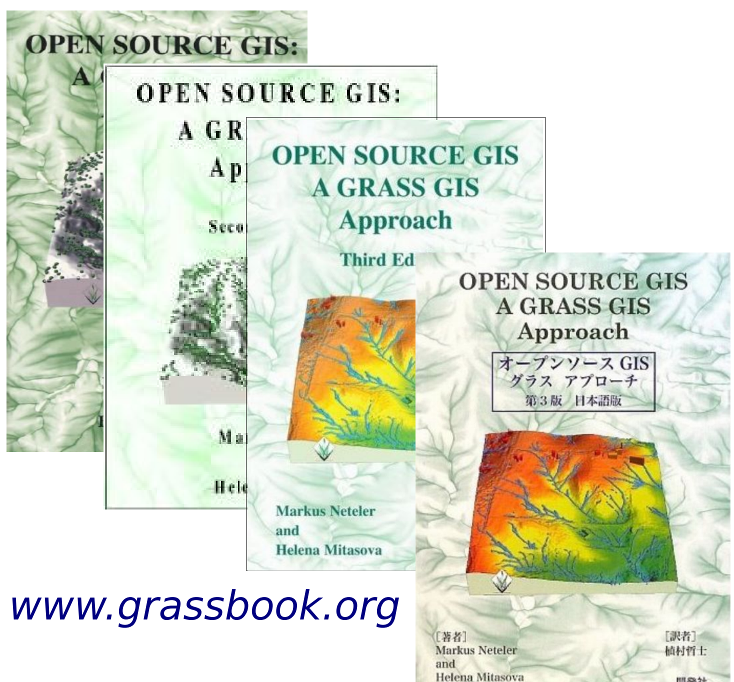


www.mappinghacks.com

www.spatialguru.com



2008



www.grassbook.org

2009