Moritz Lennert - ULB
Membre du comité de pilotage
du projet GRASS

GRASS GIS 7: La mère des SIG, toujours jeune !

Une histoire longue et particulière

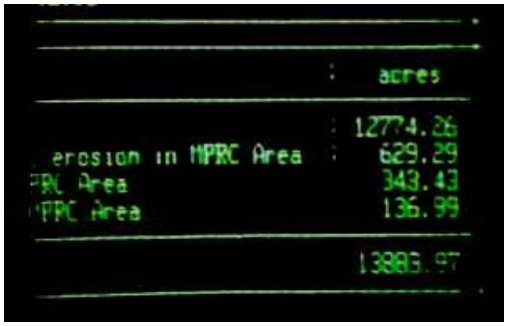
- Développé par l'armée US (CERL) à partir de **1982 !**
- Milieu 1990: CERL a rempli sa mission: arrêt du développement et transfert du code source vers le domaine public
- Reprise du développement par les Universités Baylor (Texas) puis de Hannover (Allemagne), et plus récemment (2001) par le ITC-irst devenu la Fondazione Bruno Kessler (FBK)
- 1999: license originellement du domaine public devient GNU General Public Licence (GPL) pour la version 5.0
- 2006: Open Source Geospatial Foundation (OSGeo)

• Un environnement d'analyse

- GRASS est de conception modulaire: une fonction = un module
  - Economie mémoire et CPU
  - KISS principle
- Modules regroupés en familles désignées par une lettre générique (ex r. pour les opérations sur raster, v. pour les vecteurs)
- L'interface graphique n'est qu'un module parmi les ~350 !
- Modules lancés à partir des menus de cette interface graphique ou à partir de lignes de commandes
- Possède ses propres formats de données (=> données sont importées)

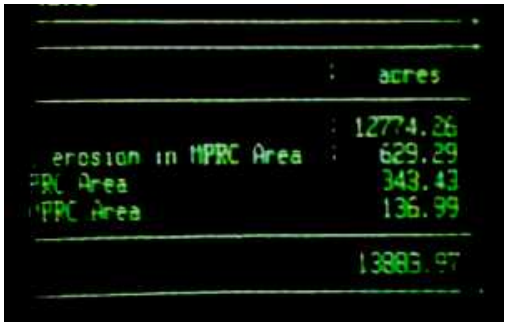
GRASS GIS 7 : Un renouveau en continu

L'image que certains ont encore de GRASS...

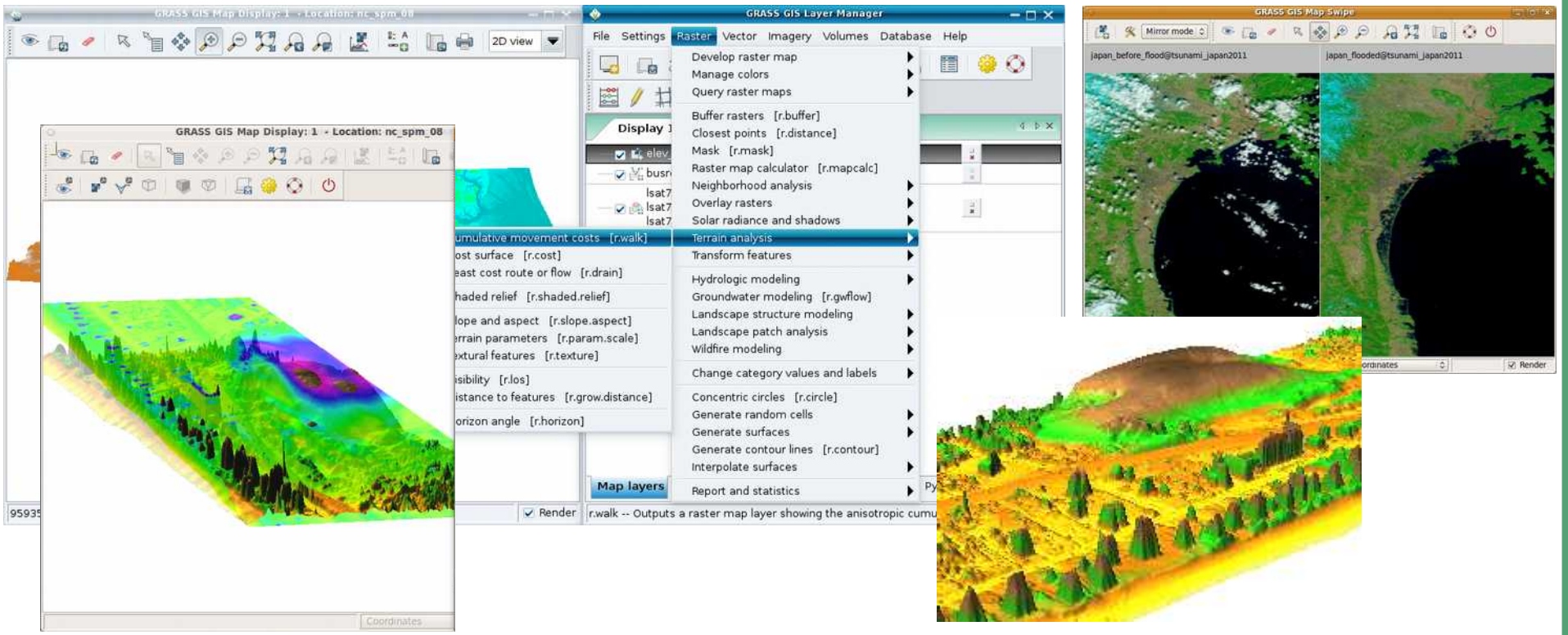


GRASS GIS 7 : Un renouveau en continu

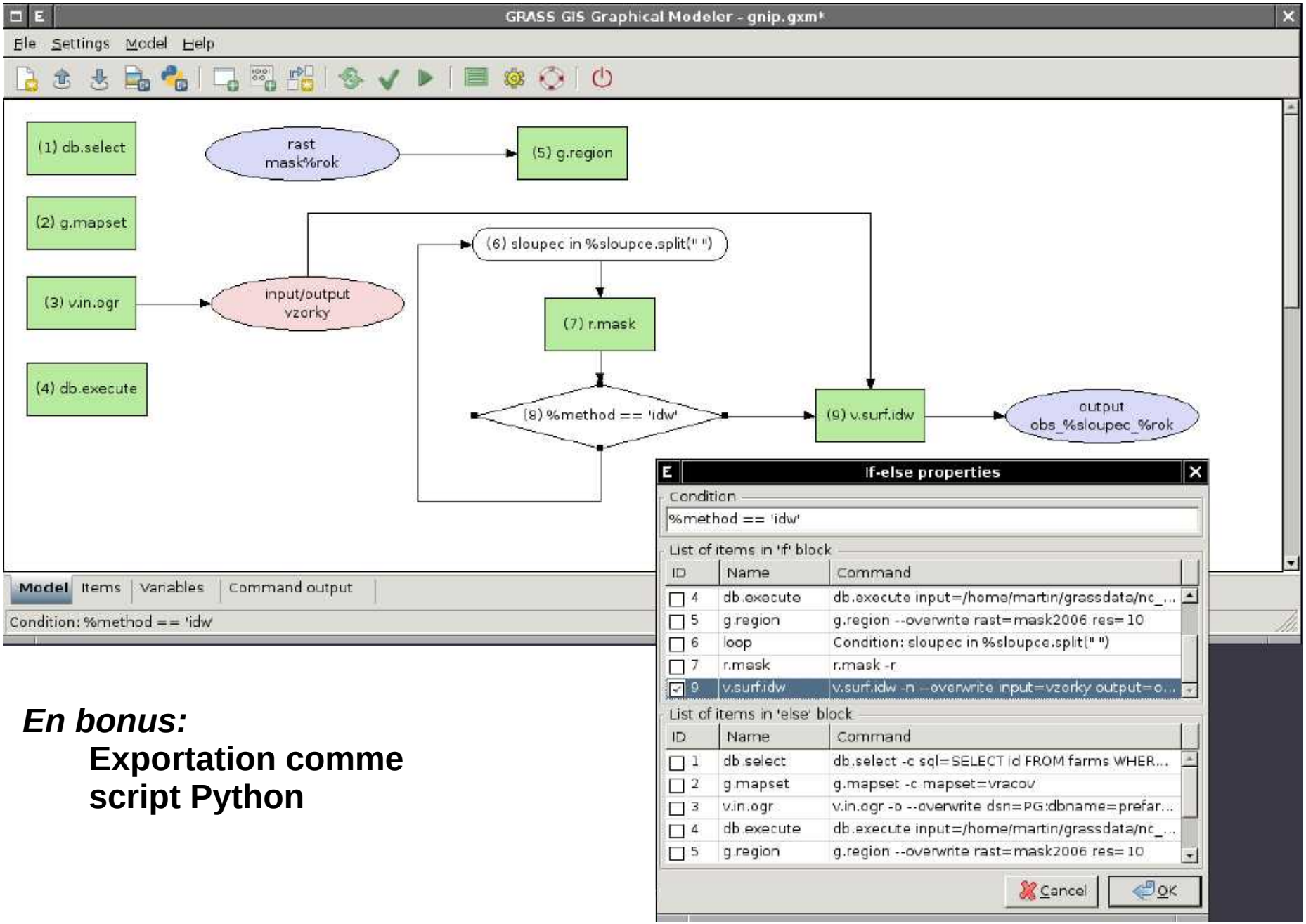
L'image que certains ont encore de GRASS:



Et le GRASS réel d'aujourd'hui:



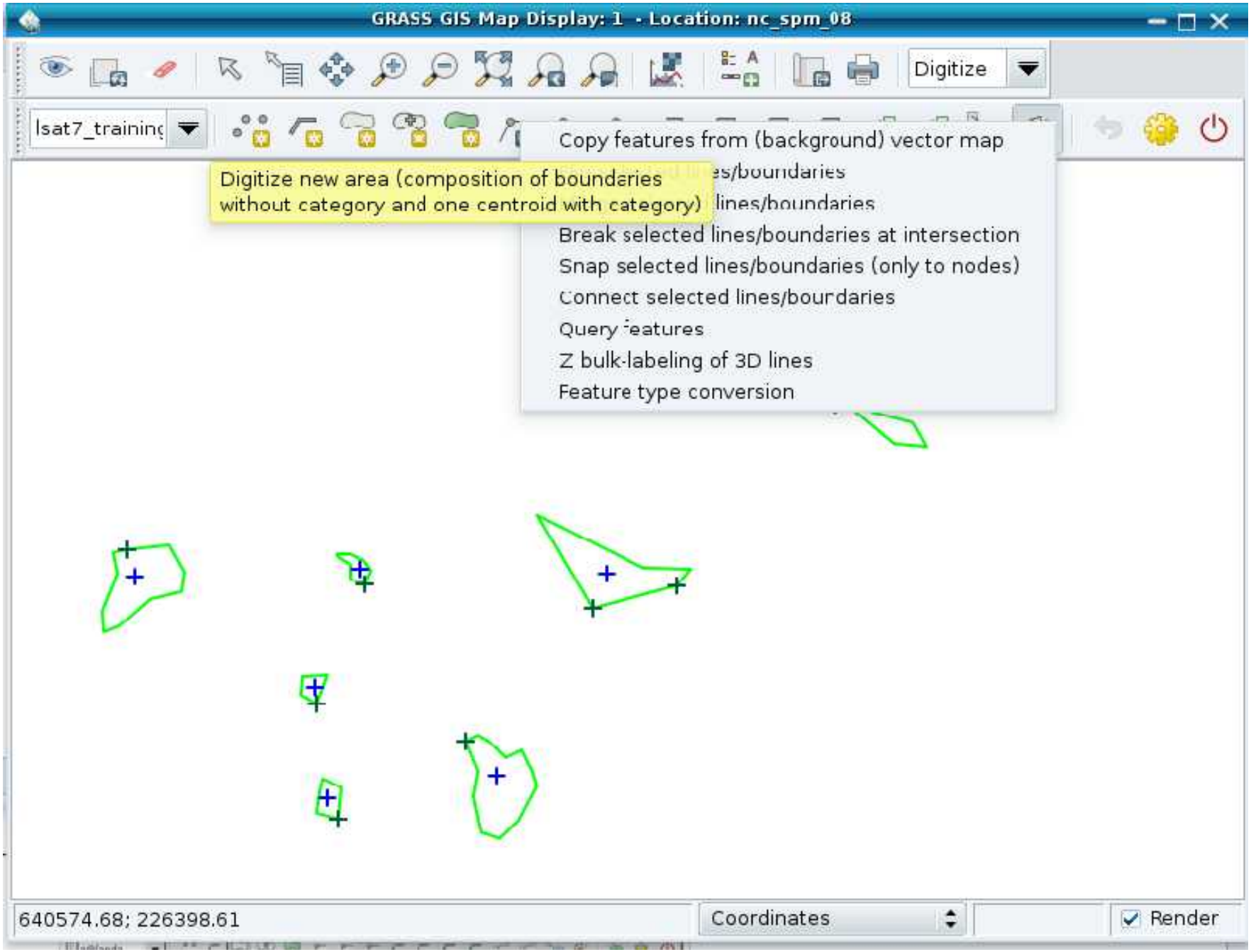
GRASS 7: Nouveau modeleur graphique



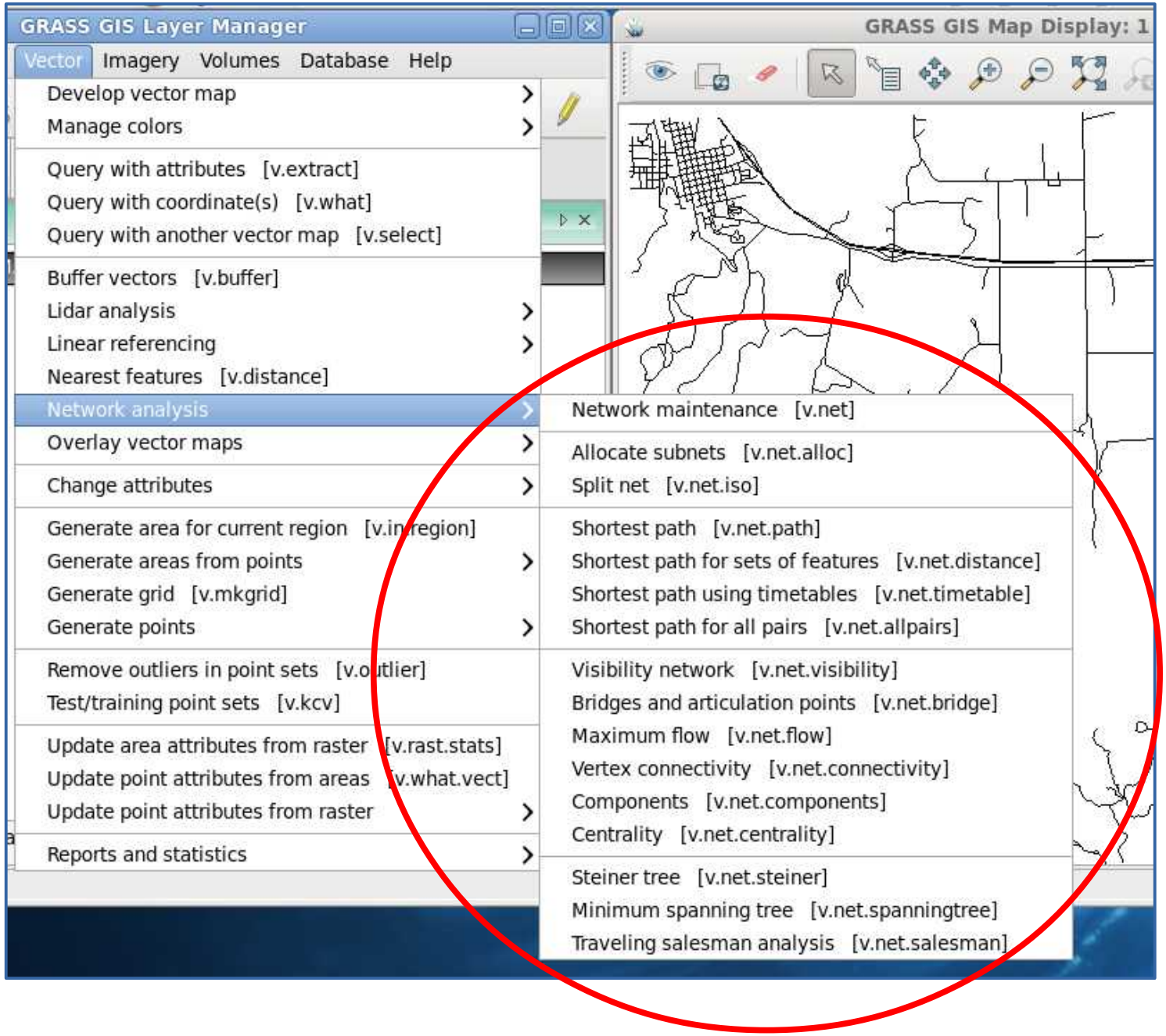
En bonus:

Exportation comme script Python

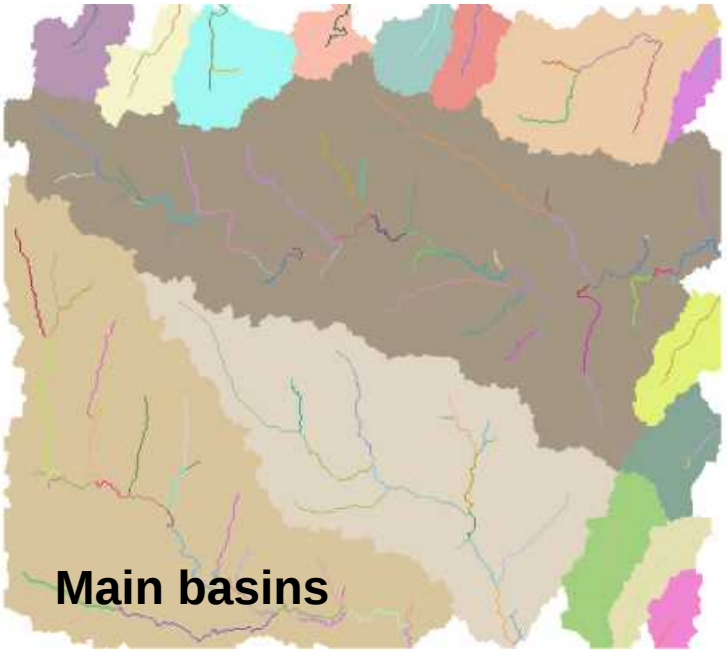
GRASS 7: Digitalisation topoligique



Analyse réseau dans GRASS



Nouveaux outils pour la modélisation hydrologique



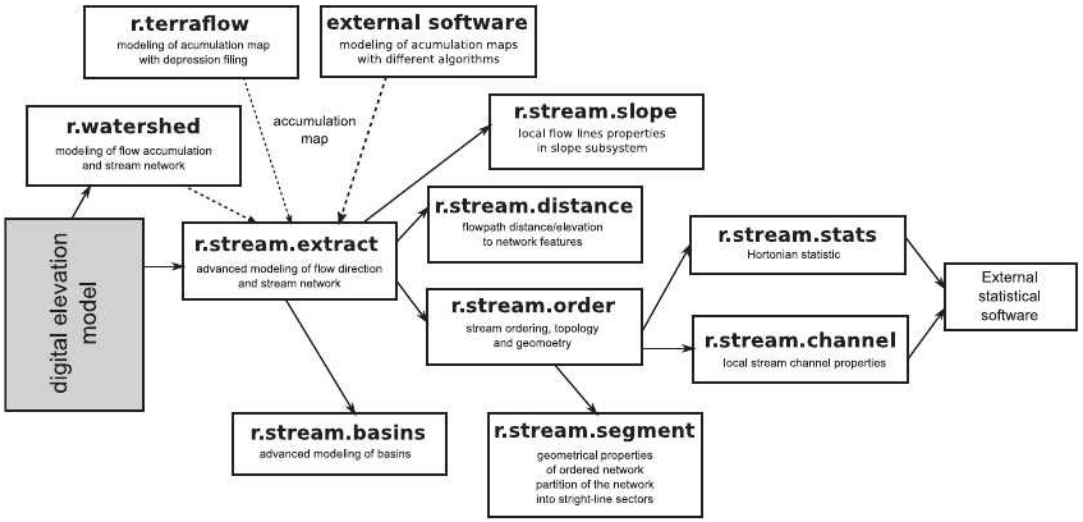


Fig. 2. The structure of the r.stream toolset and data flow between particular modules and external software.

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A new GRASS GIS toolkit for Hortonian analysis of drainage networks

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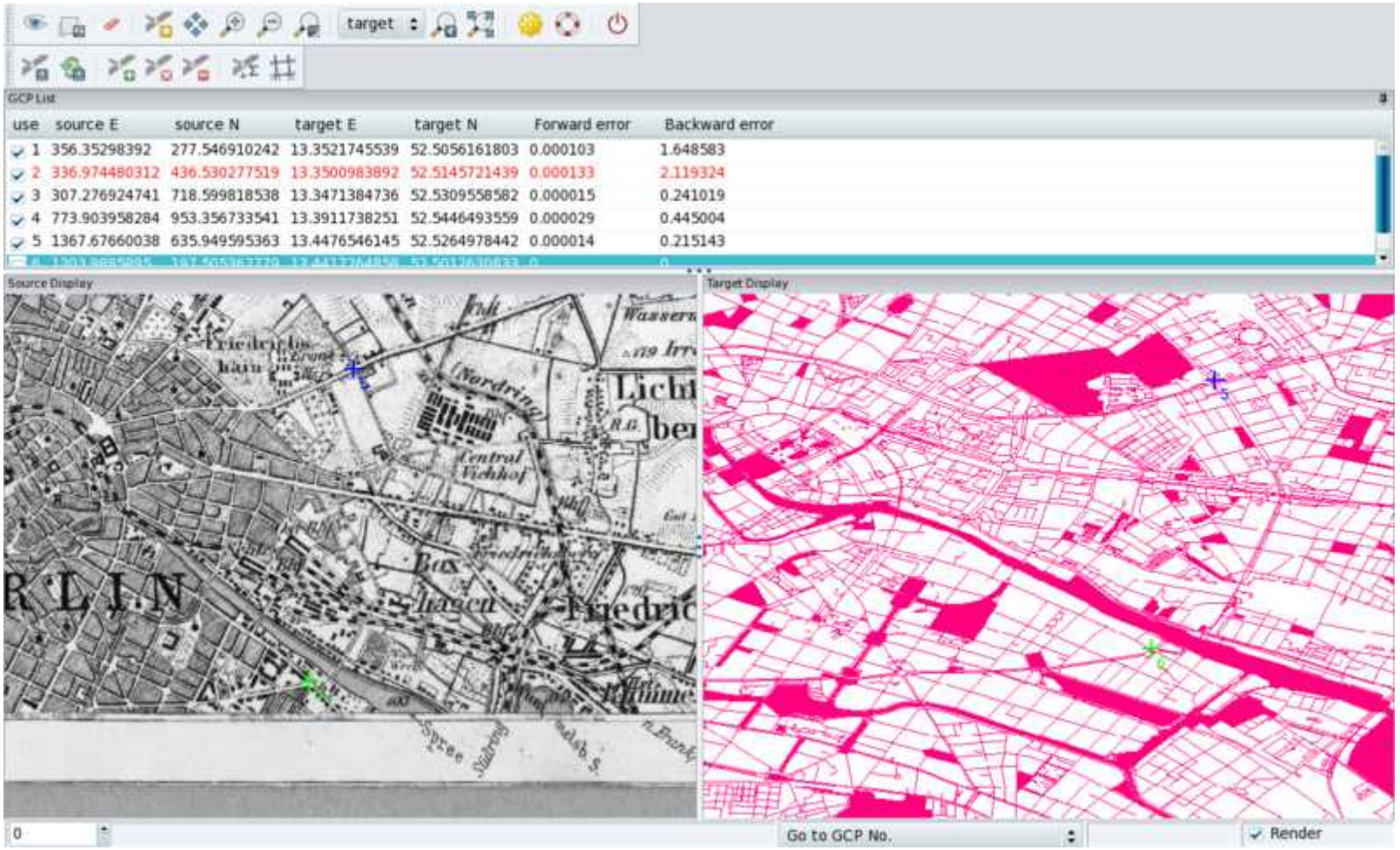
ABSTRACT

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.

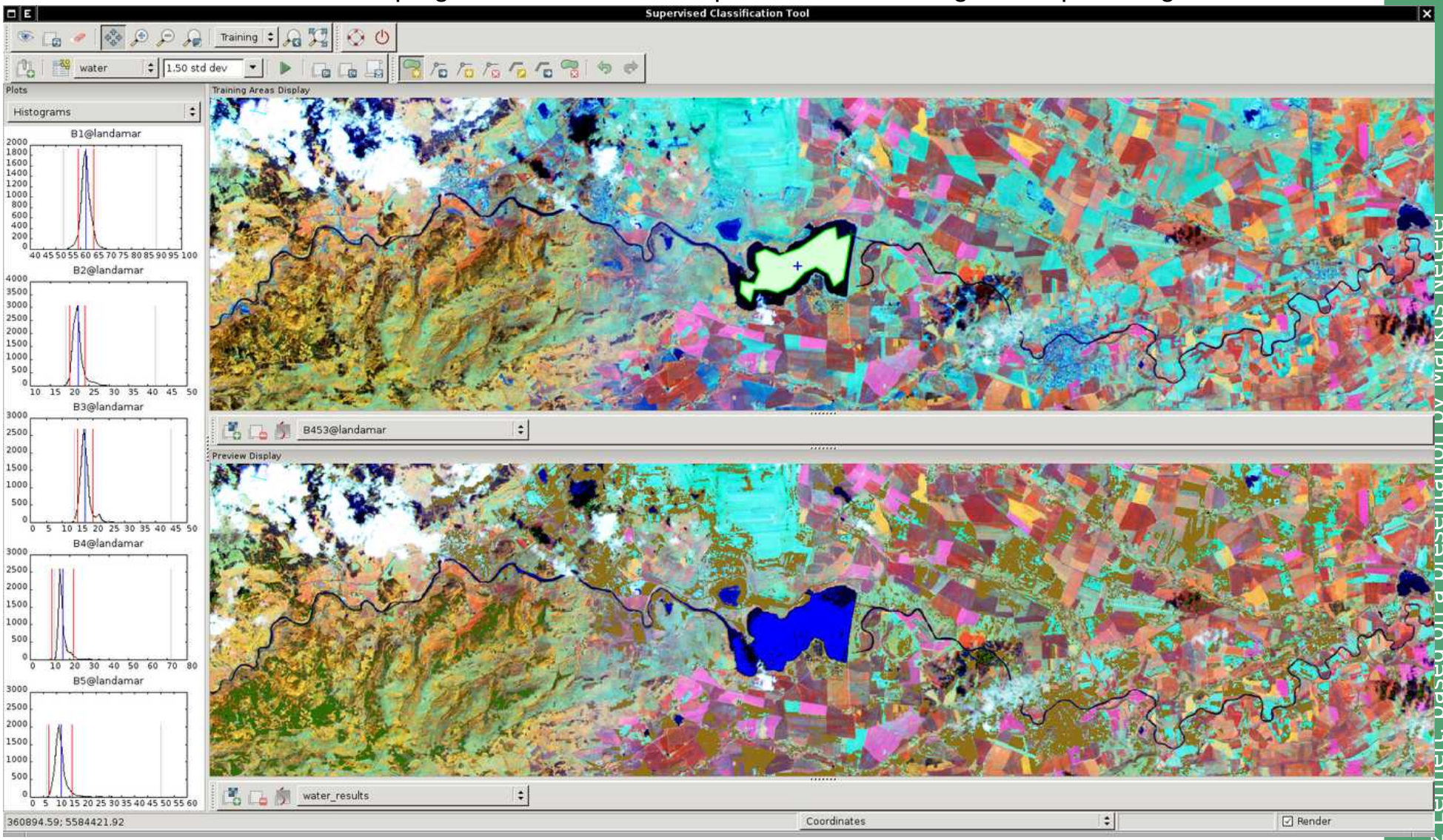
GRASS 7: Nouvel outil de géorectification

Pour données matricielles
(images, scans)
et vectorielles



GRASS 7: Outil pour classification supervisée

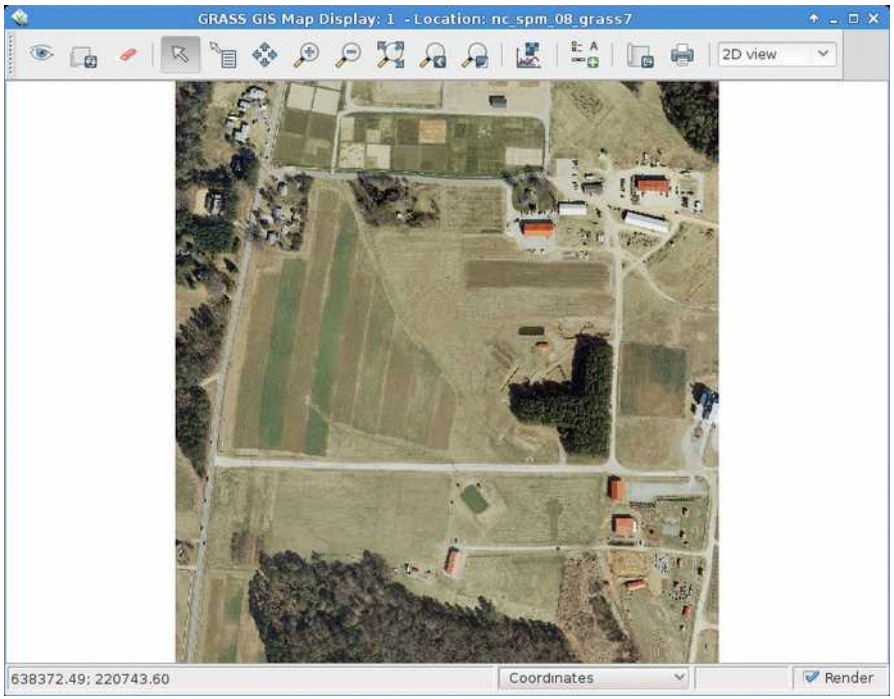
http://geo.fsv.cvut.cz/~landa/publications/2012/ogrs2012/poster/figures/

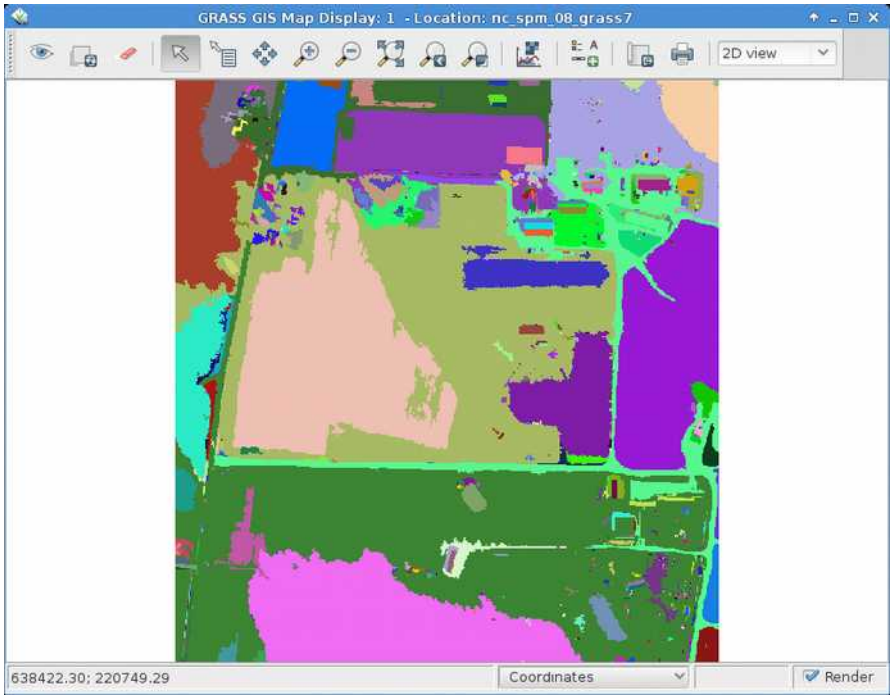


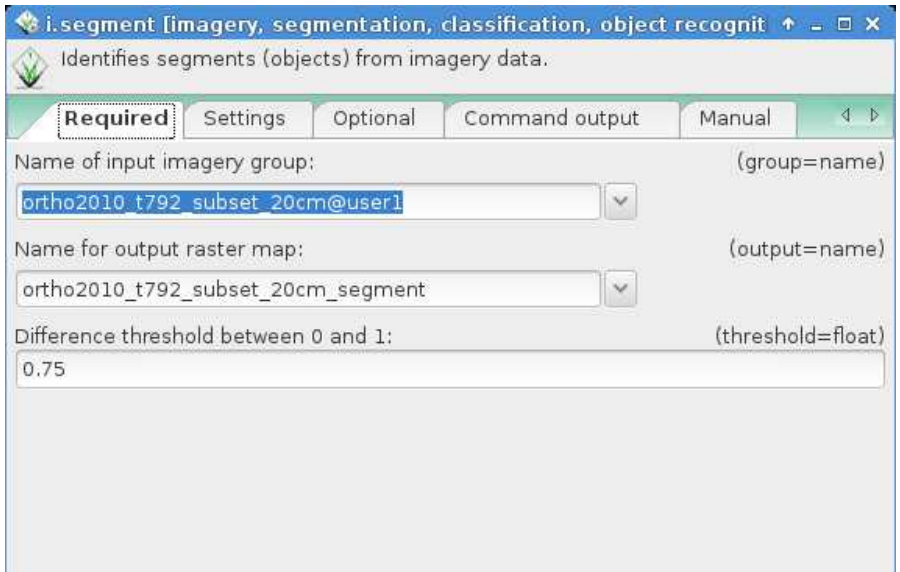
Génère des signatures spectrales pour une image et permet d'analyser les zones d'intérêt / d'entraînement

GRASS 7: classification basée objet

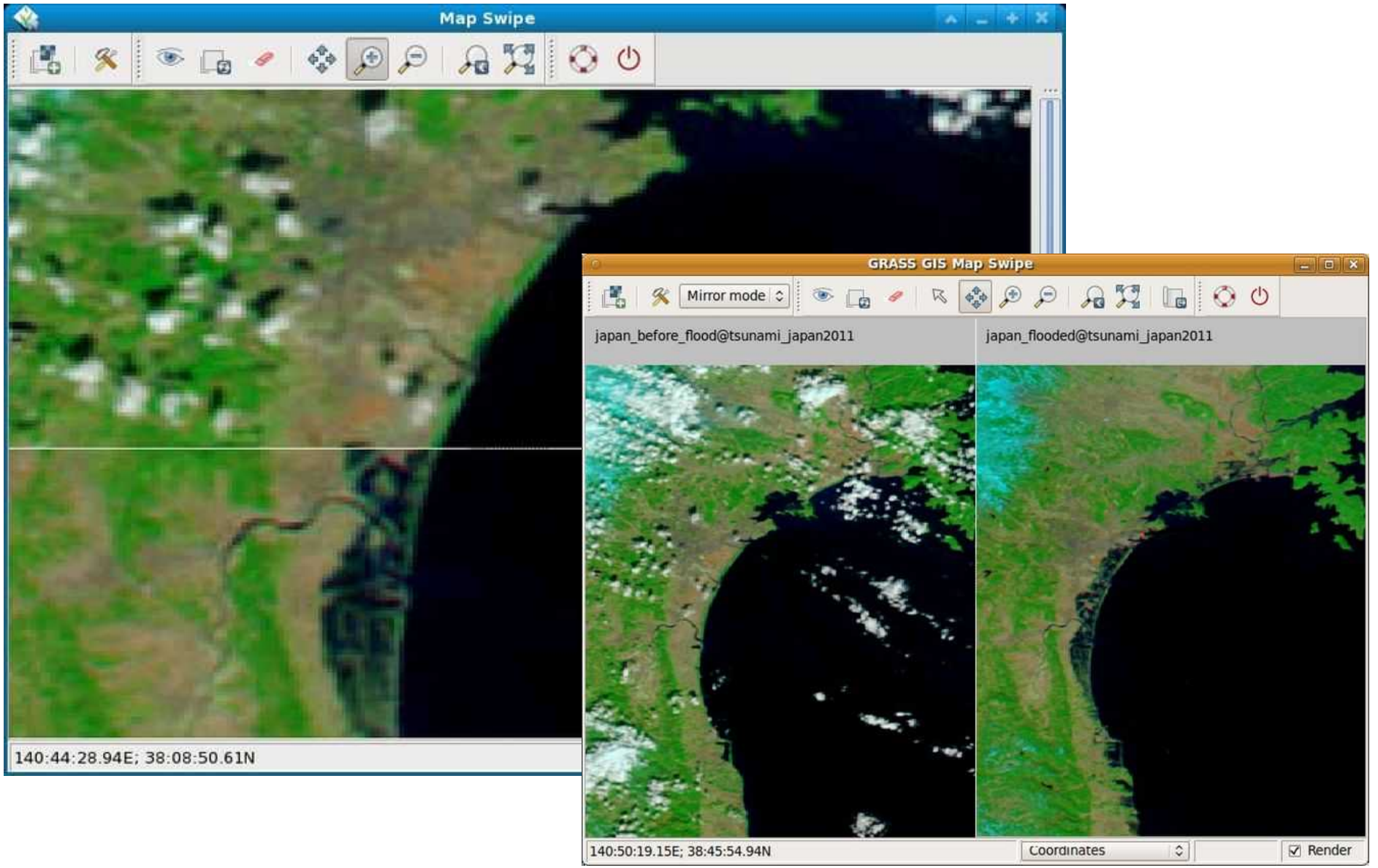
i.segment - Segmentation d'image





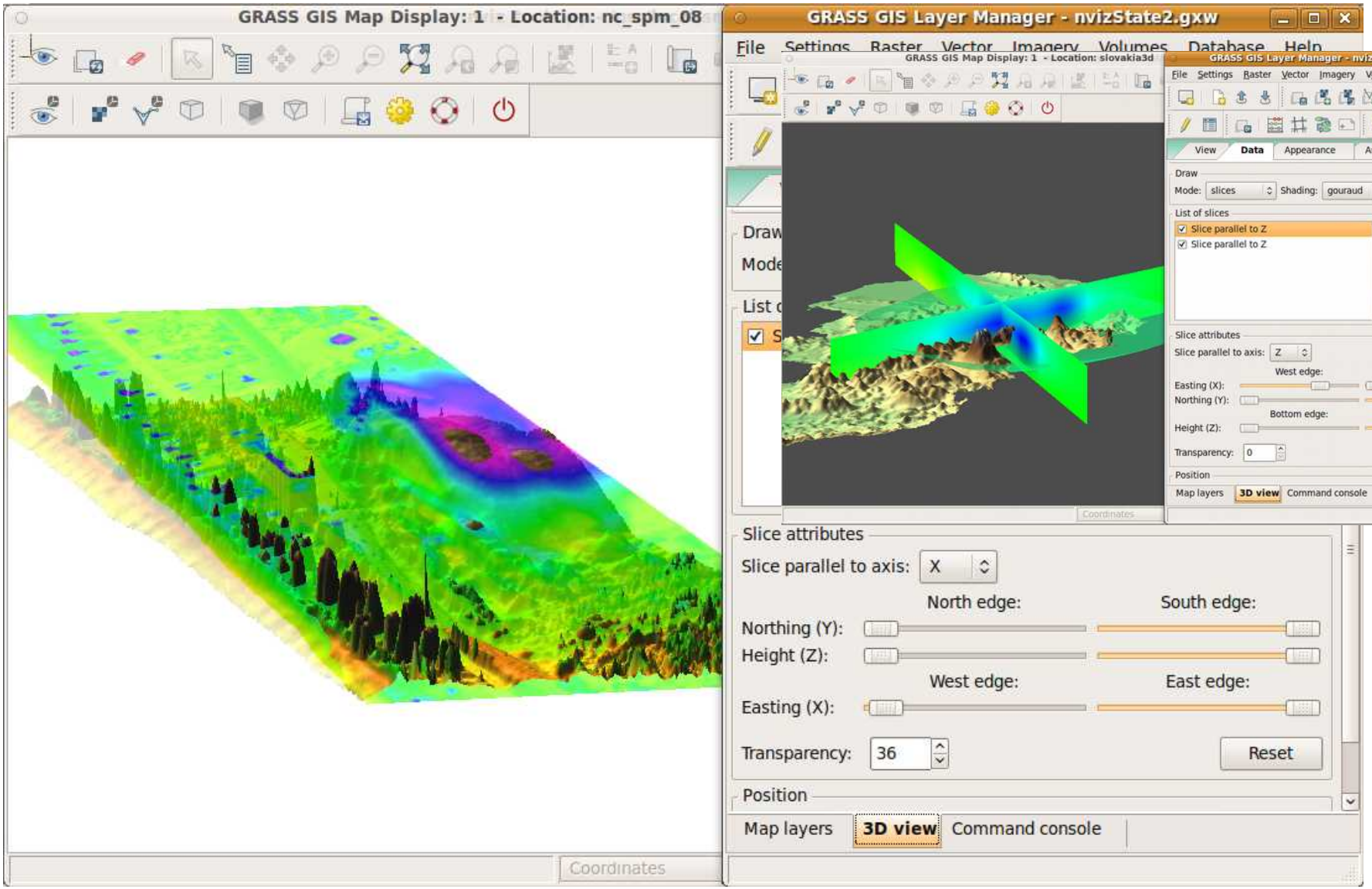


Nouvel outil de comparaison de cartes



Images pré et post catastrophe du tsunami au Japon en 2011
(Images MODIS des 26 février et 13 mars 2011)

GRASS 7: outil de visualisation 3D (wxNVIZ)



Programming/screenshot:
Anna Petrasova

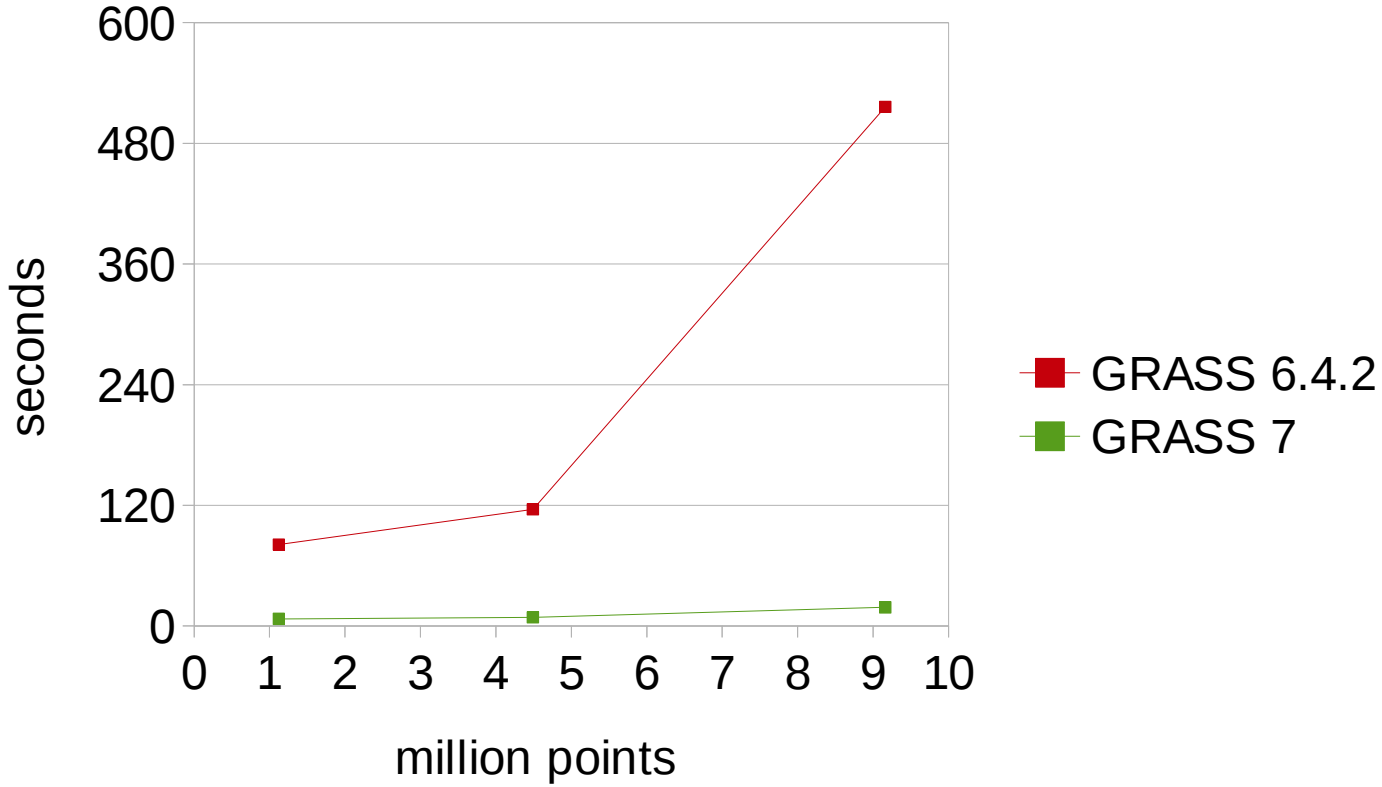
http://grasswiki.osgeo.org/wiki/WxNVIZ

GRASS 7: Traitement de données massives

- Depuis **2005** GRASS GIS support **native** des CPU 64bit
- GRASS GIS 7 supporte de gros fichier, même sur Windows 32bit
- Installé sur des Grids et super-ordinateurs du TOP500 (AKKA Umeå, ENEA Frascati, Aurel Bratislava, ...)
- Tourne sur Linux, AIX, Solaris, freeBSD, netBSD, ...
- Différentes possibilités de parallélisme

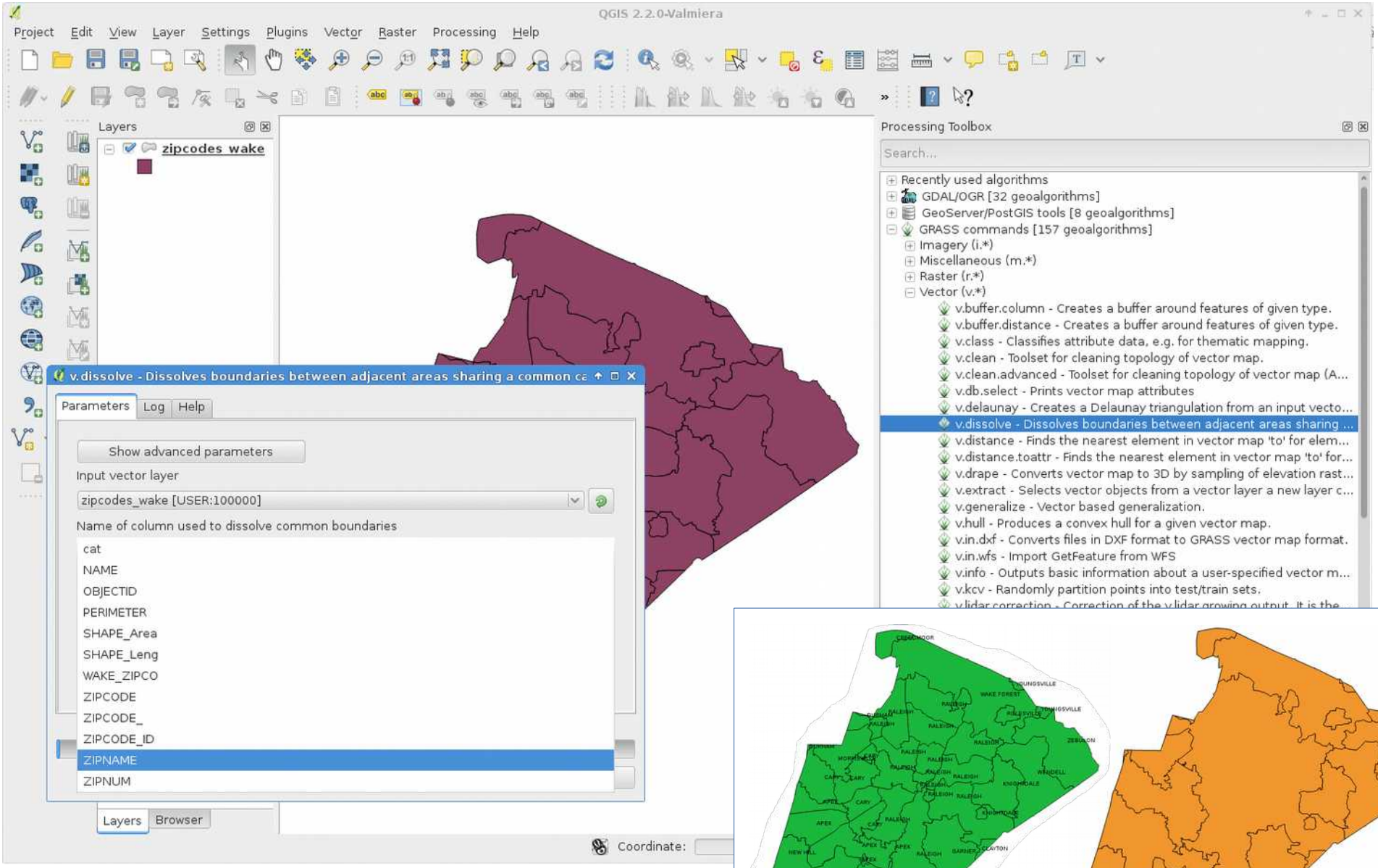
GRASS 7: Traitement de données massives

Un effort particulier pour améliorer les performances. Ex: *r.cost* (surfaces de coûts)



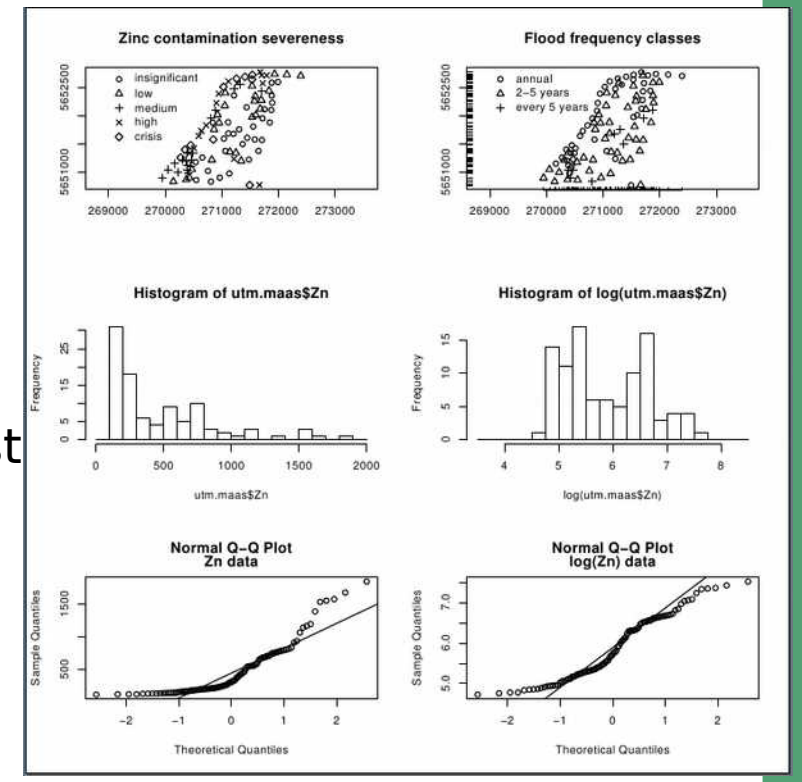
Autre exemple:
ACP sur 30 million de pixels en 6 secondes
sur un petit laptop

Intégration GRASS et QGIS : Traitements



Fusionner géométries selon colonne textuelle:
Traitements appelle GRASS dans une session virtuelle qui renoive le résultat (ici: SHAPE file)

Intégration GRASS et R




```
GRASS 7.0.svn (nc_spm_08_grass7):~ > R

R version 3.0.1 (2013-05-16) -- "Good Sport"
Copyright (C) 2013 The R Foundation for Statist
Platform: x86_64-redhat-linux-gnu (64-bit)

> library(spgrass6)
Loading required package: sp
Loading required package: XML
GRASS GIS interface loaded with GRASS version: GRASS 7.0.svn (2013)
and location: nc_spm_08_grass7
>
> 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

GRASS 7: Support native du WPS


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

Web Processing Service

```
<?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>
                                                        <MimeType>image/tiff</MimeType>
                                                </Format>
                                                <Format>
                                                        <MimeType>image/geotiff</MimeType>
                                                </Format>
                                                <Format>
                                                        <MimeType>application/geotiff</MimeType>
```

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

Nouveaux outils de gestion de données spatio-temporelles

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 ger

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.

Gebbert, S., Pebesma, E., 2014. *TGRASS: A temporal GIS for field based environmental modeling*. Environmental Modelling & Software 53, 1-12. (DOI)

Démonstration

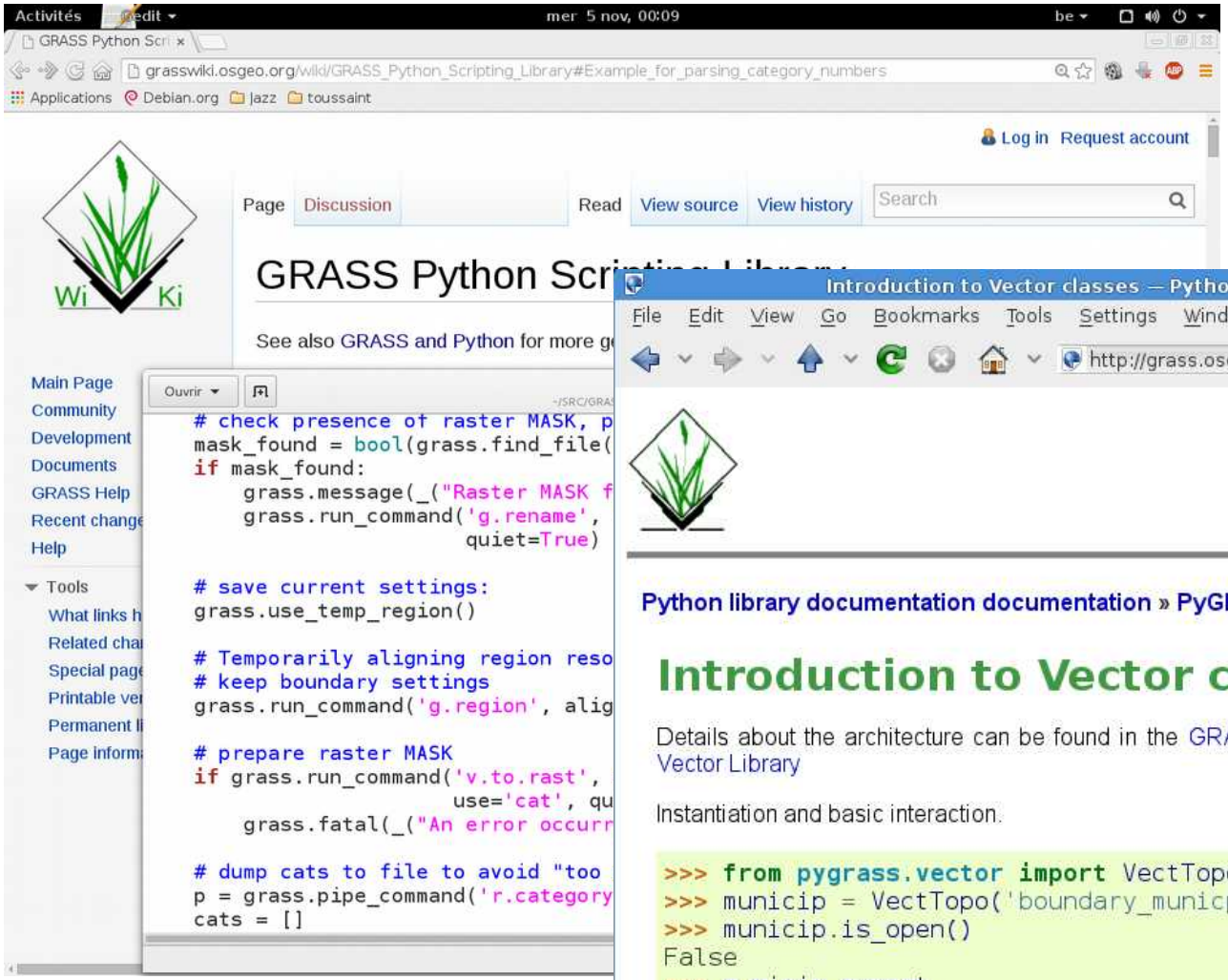
Nouvelle API Python

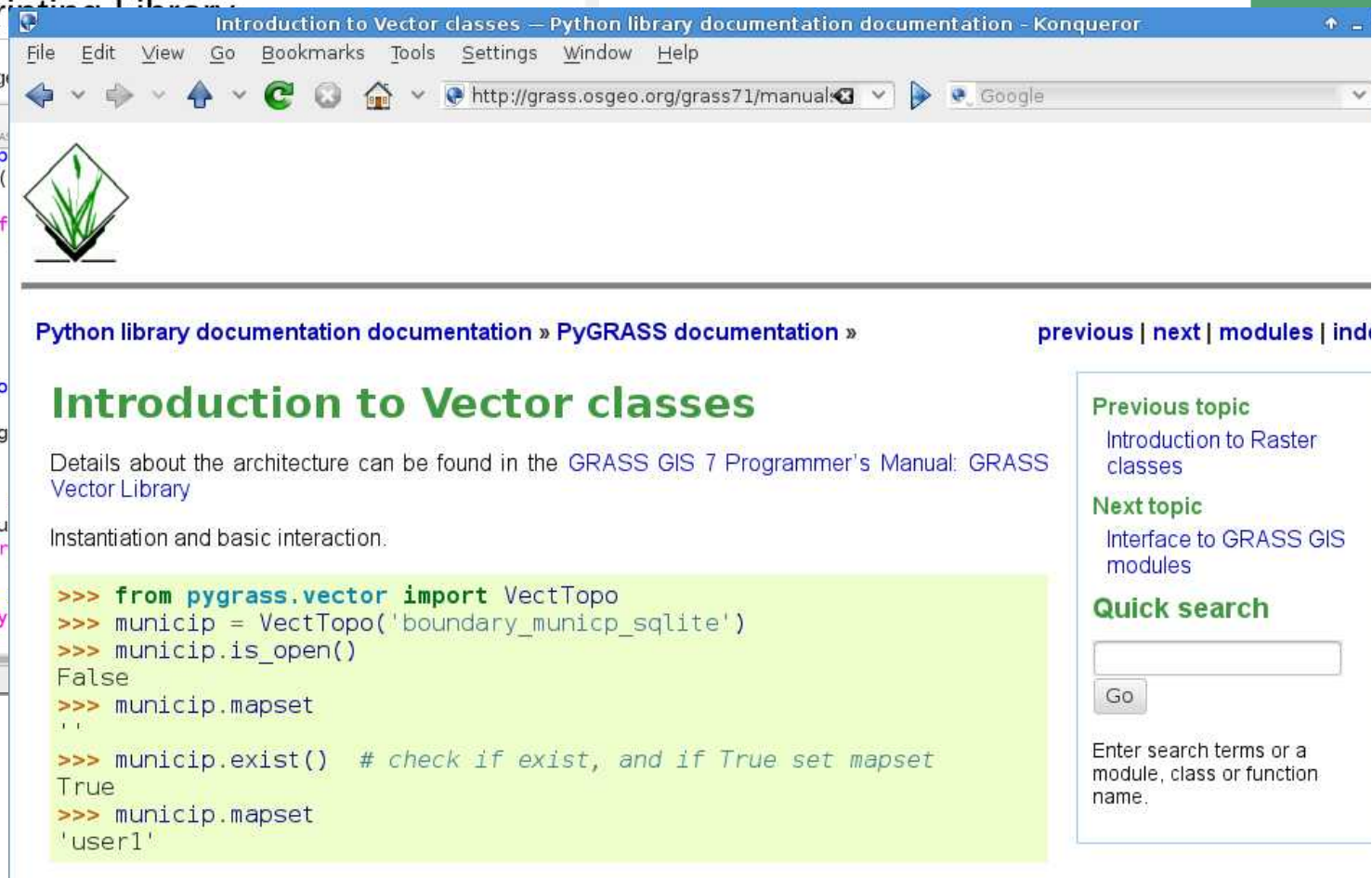
http://grass.osgeo.org/wiki/GRASS_and_Python

High-level API (GRASS scripting library) pour faciliter l'utilisation des modules GRASS

Low-level API (avec Ctypes) pour accéder directement aux routines :

Neteler





Démonstration

Où peut-on trouver tout cela ?

GRASS GIS 7 Software:

Téléchargement gratuit pour MS Windows, MacOSX, Linux:

http://grass.osgeo.org/download/

Addons (extensions contribuées par les utilisateurs):

http://grasswiki.osgeo.org/wiki/GRASS_AddOns

De données d'exemple libres :

Set de données très riche sur la Caroline du Nord

… disponible comme secteur GRASS ou d'autres formats courants

http://grass.osgeo.org/download/sample-data/

Aides pour les utilisateurs:

Mailing lists (également en français):

http://grass.osgeo.org/support/

Wiki:

http://grasswiki.osgeo.org/wiki/

Manuels:

http://grass.osgeo.org/documentation/manuals/

http://grass.osgeo.org

http://trac.osgeo.org/grass/wiki/Grass7/NewFeatures

Thanks to
Markus Neteler, GRASS project leader

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

markus.neteler@fmach.it
neteler@osgeo.org

Coming soon:
GRASS GIS 7!

THANKS

OSGeo
Your Open Source Compass