



OSGeo Journal Volume 8

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FOSS4G 2009
Conference Proceedings

OSGeo Community
News & Announcements
Case Studies
Integration Examples



FOSS4G

D E N V E R **2011**

SEPTEMBER 12-16

The Annual International

FREE & OPEN SOURCE
SOFTWARE FOR GEOSPATIAL

Conference Event

2011.FOSS4G.ORG



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From the Editor

OSGeo has just past its 5th birthday, along with this 8th volume of the OSGeo Journal! With this edition we bring a few news headlines from the past couple months, a few general articles and, most significantly, several top papers from the **FOSS4G 2009** conference event held in Sydney, Australia.



The Journal has become a diverse platform for several groups and growth in each area is expected to continue. The key groups that read and contribute to the Journal include software developers sharing information about their projects or communities, power users showing off their solutions, academia seeking to publish their research and observations in a peer-reviewed, open source friendly medium. OSGeo also uses the Journal to share community updates and the annual reports of the organisation.

Welcome to those of you who are new to the OSGeo Journal. Our Journal team and volunteer reviewers and editors hope you enjoy this volume. We also invite you to submit your own articles to any of our various sec-

tions. To submit an article, register as an "author" and sign in at <http://osgeo.org/ojs>. Then when you log in you will see an option to submit an article.¹

We look forward to working with, and for, you in the upcoming year. It's sure to be an interesting year as we see OSGeo, Open Source in general and all our relate communities continue to grow. Nowhere else is this growth more apparent than at our annual conference: **FOSS4G 2011 Denver**, September, 2011.² Keep an eye on your OSGeo mailing lists, blogs and other feeds to follow the latest FOSS4G announcements, including the invitation to submit presentation proposals.³ It will be as competitive as ever to get a speaking slot, so be sure to make your title and abstract really stand out.

Wishing you the best for 2011 and hoping to see you in Denver!

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 Executive Director, OSGeo

¹The direct URL for article submission is: <https://www.osgeo.org/ojs/index.php/journal/author/submit>

²FOSS4G 2011 Denver: <http://2011.foss4g.org>

³FOSS4G 2011 Abstract Submission: <http://2011.foss4g.org/program>

News & Announcements

Brief News and Event Announcements from the OSGeo Community

Compiled by Scott Mitchell

To keep abreast of OSGeo news, watch <http://www.osgeo.org/news>, or subscribe to its RSS feed. This report includes highlights from recent months, plus items specifically sent to the News Editor.

OSGeo Governance

Charter member elections

On 12 December 2010, Chief Returning Officer Paul Ramsey announced the election of 10 new OSGeo charter members. This membership votes for and is drawn from for the OSGeo board of directors. The new members are Maria Brovelli, Jo Cook, Astrid Emde, Gavin Fleming, Danilo Furtado, Anne Ghisla, Hirofumi Hayashi, Andreas Hocevar, Alex Mandel, and Milena Nowotarska. Congratulations and thanks to all of the new members.

Conferences and Meetings

FOSS4G Denver 2011 Call For Papers

Paper submissions have been solicited for regular and academic tracks at the upcoming FOSS4G conference (September 12-16). The submission deadline is April 15 for both the academic and regular tracks. Full details are available at the conference web site.⁴

FOSSGIS 2011 - Heidelberg

FOSSGIS, hosted by the German Local Chapter of OSGeo, is “the German language sibling of FOSS4G” -

this year it will be held in Heidelberg from 5-7 April. Most talks will be in German, and there will be an exhibition and trade fair of service providers. More details can be found at the chapter’s wiki page on the topic.⁵

Bolsena Hacking Event 2011

Those monastic coders are at it again! The fourth OSGeo hacking event in a monastery in Bolsena, Italy will occur from 19 to 25 June, 2011. The venue is beautiful and has great facilities, with all meals for the week provided. There is limited space, however (25 beds), so if you are interested in joining, you are encouraged to sign up soon at the event’s wiki page.⁶

Montreal Code Sprint

An OSGeo code sprint is about to occur in Montreal, Canada, from March 15-18 at the Communauté Métropolitaine de Montréal. Many participants and sponsors have signed up, but there is still room for more. All OSGeo projects and tribes are welcome and encouraged to join in. More details, links to a mailing list, and a signup page are available from the event’s wiki page.⁷

Local OSGeo groups

The OSGeo Japan chapter has received the “Japanese OSS Encouragement Award” prize from the IT Promotion Agency, a Japanese government agency. This award is granted to developers that establish and manage influential projects, superior developers that take

⁴FOSS4G Denver Call for Papers: <http://2011.foss4g.org/blog/2011/2/3/call-for-presentations-under-way.html>

⁵FOSSGIS 2011 - Heidelberg: http://www.fossgis.de/konferenz/wiki/Main_Page

⁶Bolsena Hacking Event 2011: http://wiki.osgeo.org/wiki/Bolsena_Code_Sprint_2011

⁷Montreal Code Sprint: http://wiki.osgeo.org/wiki/Montreal_Code_Sprint_2011

active roles in global projects, and remarkable contributors to the spread of open source software. The Japan chapter has been active since its formation in late 2006.⁸

OSGeo Collaboration

Centre for Geospatial Science and OSGeo sign MoU

On the 22nd of September, OSGeo and the Centre for Geospatial Science (CGS) at University of Nottingham announced the signing of a memorandum of understanding to create an Open Source Geospatial Lab, and to further develop collaborations between academics, industry, and governmental organisations involved in open source GIS and spatial data in the United Kingdom. Arnulf Christl, President of OSGeo, and Tyler Mitchell, Executive Director, have both made it clear that they hope this is the first of many formalized developments in OSGeo's support of educational partnerships. The agreement establishes a laboratory to support OS geospatial technology and training, and will provide internships for promising students. The first phase of the internship program has been announced.⁹

Project News

deegree

The deegree project¹⁰ announced a new major release (3.0 - "Celsius") to correspond with the project's tenth anniversary. Deegree is a Java-based library for spatial data infrastructures and other web-based geographic services, with full implementation of the OGC WMS, WFS, WPS, and CS-W protocols. High performance moving large amounts of data was a focus of this release, as well as complex applications, support for all relevant GML versions, and advanced integrated development tools. A preconfigured application called inspireNode offers the capability to rapidly deploy a fully transactional WFS and WMS server rendering INSPIRE styling rules on-the-fly.

Geomajas

In November, OSGeo announced that the Geomajas project has graduated from incubation, making it a full-fledged OSGeo project. This enterprise-ready

GIS framework for client-server display and editing of geographic data is implemented in Java, supports OGC standards, and can be downloaded from <http://www.geomajas.org>.

GDAL

On January 23rd, the GDAL community announced the release of GDAL/OGR 1.8.0, the library and command line tools for accessing a wide range of geospatial raster and vector file formats, databases and web services. This is a major new feature release, with highlights including 26 new format drivers, significant improvements to the DXF and GML drivers, implementation of 6 RFCs developed by the community, and a new command line utility, `gdallocationinfo`. Details about the release can be read online.¹¹

GeoNetwork

The GeoNetwork team has released GeoNetwork Open Source version 2.6.0 (since updated to 2.6.2¹²). GeoNetwork is a standards based catalog application to assist the web publication of geospatial data, and is used in a number of Spatial Data infrastructure projects around the world. Highlights of new or improved functionality include performance improvements on search and indexing, an INSPIRE search panel and metadata viewer, an OpenLayers embedded web map viewer, multilingual support, keyword and coordinate reference system selection panels, advanced data and metadata exporting, metadata relations management, advanced schema and schematron validation of metadata, and visual warnings in the metadata editor.

Ingres Geospatial

The Ingres Geospatial community project has released binaries for Ingres 10.1 with built-in new OGC Simple Features-based geospatial support. The software has been released under the GPL version 2 license, making it free to download, develop against, modify and redistribute. Installers are available¹³, as well as a project wiki.¹⁴ Ingres Geospatial incorporates many OSGeo projects including PROJ.4 and GEOS, and Ingres is supported by (or work on this support is in progress for) GDAL/OGR, GeoTools, MapServer, Drupal and other common tools in the OS geospatial world. Ingres has also been a sponsor of OSGeo, GDAL/OGR, and FOSS4G2010.

⁸Japan Local Chapter: <http://www.osgeo.jp/>

⁹CGS Internship Program: <http://www.nottingham.ac.uk/cgs/news/internships.aspx>

¹⁰The deegree project: <http://wiki.deegree.org/>

¹¹GDAL/OGR Release 1.8.0: <http://trac.osgeo.org/gdal/wiki/Release/1.8.0-News>

¹²GeoNetwork 2.6.2: <https://sourceforge.net/projects/geonetwork/>

¹³Ingres Geospatial Installers: <http://www.fosslc.org/drupal/content/ingres-101-geospatial-support-available>

¹⁴Ingres Geospatial Pproject wiki: <http://community.ingres.com/wiki/IngresGeospatial>

r.in.swisstopo

A new module for the GRASS GIS application for importing digital elevation model data of Switzerland in swisstopo format

Juergen Hansmann

Abstract

The Swiss federal office of topography, swisstopo¹⁵, offers digital elevation models of Switzerland in several different formats. When working with the open source geographic information system software GRASS (Geographic Resources Analysis Support System), these data need to be imported into a GRASS raster layer. For this task a new GRASS module *r.in.swisstopo* has been developed, which detects the format of the swisstopo input elevation data and imports it into a GRASS raster map. Users can run *r.in.swisstopo* from the command line, which provides the means to do automated script runs over a large number of input files. Alternatively, a graphical user interface is provided as well, which provides a more comfortable way of working with the module.

The new module has been tested on an example dataset of digital elevation data of the Matterhorn area in Switzerland, provided by swisstopo free of charge. All three file formats supported by *r.in.swisstopo*, could be imported without any problems.

Introduction

According to Sonnentag (3), the *Geographic Resources Analysis Support System* (GRASS¹⁶) is probably the most well-known free, open source geographical information system (GIS). GRASS was originally developed in 1985-1995 by the US Army Construction Engineering Research Laboratory (CERL), which is part of the US Army Corps of Engineers. When CERL ceased the GRASS development, further GRASS development was done at Baylor University (2, 1). Today it is released under the General Public License (GNU GPL; <http://www.gnu.org/>) and is a part of the Open Source Geospatial Foundation.

GRASS is a software assemblage for processing geospatial raster and vector data. It provides tools for processing, analysis and management of spatial data, spatial modelling (e.g. hydrological modelling), processing of (multi spectral) images and advanced data visualisation. According to the GRASS homepage, GRASS is applied in academic and commercial settings and also in governmental agencies, such as for example NASA, NOAA and the USGS.

¹⁵Swisstopo: <http://www.swisstopo.admin.ch/>

¹⁶GRASS GIS: <http://grass.itc.it/>

Swisstopo digital elevation data

The Swiss 'Bundesamt fuer Landestopographie' (Swiss federal office of topography), swisstopo, offers digital elevation data of Switzerland in several formats, all based on the reference system 'Schweizerisches geodætisches Datum CH-1903' (swiss geodetic datum CH-1903), with the Bessel (1841) reference ellipsoid and the fundamental point at the coordinates 600000 / 200000 (old observatory in Bern). The provided datasets have a grid spacing of 25 m. Data with a grid spacing of 50m, 100m and 200m are available as well. Elevation data have an error of < 2 m in the northern region of Switzerland, whereas in rare cases in the mountainous parts of southern Switzerland, elevation data might have errors of up to 3 m. Three of the offered data formats are considered for import into a GRASS raster map by the new module *r.in.swisstopo*. This three format types are:

- MMBLT (*.mlt): elevation data saved sequentially
- MMBL (*.mbl): elevation data saved in a matrix
- xyz (*.xyz): elevation data saved in xyz coordinate triples

MMBLT and MMBL formats are matrix models with quite a similar file structure. Both file formats consist of a header (see Figure 1), followed by data records of integer elevation values (i.e. elevation values in decimetres). The header section starts and ends with the keywords NEWHEADER and ENDHEADER respectively, where all important model parameters, such as the coordinates of the northwestern and the southeastern edge, the matrix model dimensions and the grid spacing are defined.

In the case of the MMBLT format, elevation data is stored sequentially in records, which by default contain 2040 digits, yielding 340 elevation values with 6 digits each. The first line of a digital elevation model of a region, that consists of m rows with n elevation values, always consists of 340 elevation values. If n was 9 for example, the first line would look like:

```
e1,1 e1,2 e1,3 e1,4 e1,5 e1,6 e1,7 e1,8 e1,9 e2,1 e2,2 e2,3
e2,4 e2,5 ...
```

until the row contains 340 values, then the next row is written.

The indices in $e_{i,j}$ represent the row (i) and column (j) of the matrix. For a MMBL type matrix model, the number of values per row exactly matches the matrix model dimensions. If the digital elevation model matrix has the format $m \times n$, and n was 9 for example, then the data of the above example would be stored in the following way:

Figure 1: Sample header section of the example dataset provided by swisstopo.

```

NEWHEADER
-----
DHM25-MATRIXMODELL LEVEL 2                                (c)BUNDESAMT F. LANDESTOPOGRAPHIE
-----
NORD-WEST ECKE      [M]  616000.0  92700.0  ERSTER HOEHENWERT
SUED-OST ECKE      [M]  618000.0  90700.0  LETZTER HOEHENWERT
MASCHENWEITE WE/NS [M]    25.0    25.0
MATRIXDIMENSIONEN WE/NS  81      81      TOTAL      6561 MATRIXPUNKTE
HOEHENBEREICH      [DM]  30368   44780   (6 CHARACTER PRO HOEHENWERT)
-----
FORMAT              ASCII              L+T-FORMAT DHM25-MATRIXMODELL
RECORDLAENGE (CHAR.) 2040              340 HOEHENWERTE PRO RECORD
-----
ENDHEADER
    
```

$e_{1,1} e_{1,2} e_{1,3} e_{1,4} e_{1,5} e_{1,6} e_{1,7} e_{1,8} e_{1,9}$
 $e_{2,1} e_{2,2} e_{2,3} e_{2,4} e_{2,5} e_{2,6} e_{2,7} e_{2,8} e_{2,9}$
 and so on. Elevation models, that are provided in the xyz format simply consist of one x-, y- and z-coordinate triple per row.

The module r.in.swisstopo

The module *r.in.swisstopo* imports digital elevation models provided by swisstopo in the three previously mentioned formats. It can be run from the command line, which provides a means to script the command in order to import large number of files automatically. Optionally, the module provides a graphical user interface (GUI) as well, which is shown in figure 2 and is based on the GRASS module *g.parser*.

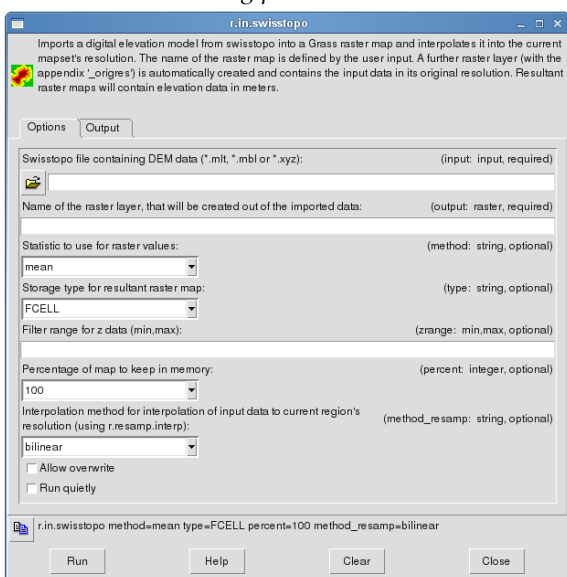


Figure 2: The graphical user interface of the module r.in.swisstopo.

r.in.swisstopo extracts information about the DEM matrix model from the header section, by searching for the according keywords, rather than assuming a certain, fixed position of the values inside the header

section. Therefore, even if the layout of the header section should change in future, the module should still be able to find the required information in the new header format.

In the first step of the automatic import process by *r.in.swisstopo*, the input data is processed with an *awk*-script and converted to a format, that can be read with *r.in.xyz*. After the import of the elevation data, two raster maps will be generated by the module.

A first raster map, which has the suffix 'origres', contains the elevation data in its original resolution (which will be 25m in most cases). Whereas a second raster map is generated, that contains the imported elevation data, interpolated to the current GRASS region's resolution, using *r.resamp.interp*. Elevation data in both raster maps will be stored in meters.

The first parameter, which has to be set by the user (either at the command line or in the GUI) is the name of the swisstopo input file. Next, the name of the resultant output raster map has to be defined. Since *r.in.swisstopo* invokes the GRASS module *r.in.xyz*, which uses univariate statistics to create a raster map from an assemblage of large amounts of coordinates, a statistical method for this has to be chosen (see the GRASS help page of *r.in.xyz* for details). The default method is 'mean'. Next, the storage type of the resultant raster map has to be defined, as it will be passed to the *r.in.xyz* module. Default type is FCELL, yielding floating point values (again, see GRASS help page of *r.in.xyz* for details). Optionally, the range of elevation data, that is imported by *r.in.xyz*, can be restricted by defining the parameter *zrange*. For large datasets, the percentage of the map, that is kept in memory, can be chosen as well.

The region settings of GRASS GIS are temporarily adjusted in order to cover the input dataset extent completely. When the data import is finished, the region settings will be restored to their original state.

As the module *r.resamp.interp* is invoked for the interpolation of the input data into the current GRASS region's resolution, an interpolation method has to be chosen by the user (see the GRASS help page for

r.resamp.interp for details). If the flag ‘allow overwrite’ is set, existing raster maps will be overwritten without further warnings. The ‘run quietly’ flag reduces the output messages to a minimum.

The module *r.in.swisstopo* conducts some error checks on the imported data. When the number of imported elevation values is less than expected, the process will be cancelled and an error message will appear. If the number of elevation values in the input file exceeds the number that was defined in the header, a warning message will be shown and no further data points will be imported. This could be caused by padding (zero) values in the input file for example.

Test runs of *r.in.swisstopo*

Test runs of the module *r.in.swisstopo* were done for all three digital elevation model formats on the test datasets, that are provided by swisstopo free of charge.¹⁷

All three formats could be imported without any problems. Figure 3 shows the imported digital elevation model of the Matterhorn.

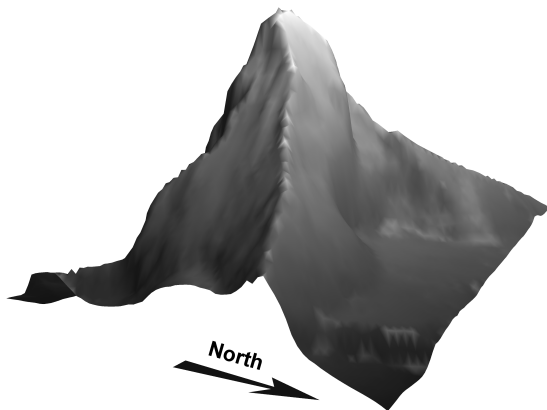


Figure 3: 3D view of the Matterhorn in Valais, Switzerland, created from imported digital elevation data of the swisstopo sample dataset, using the new GRASS module *r.in.swisstopo*.

Download and Installation of the module *r.in.swisstopo*

The source code of the current version of *r.in.swisstopo* is available at GRASS Addons repository.¹⁸ Installation can be done via SVN or manually. For a manual installation, the following steps need to be done (users might need to have root/administrative privileges for this):

- Download the files ‘r.in.swisstopo’ and ‘description.html’ to a temporary directory
- Copy the file ‘r.in.swisstopo’ into the `$GISBASE/scripts/` directory (To find out your `$GISBASE` directory, call the following command from within a GRASS terminal:

```
env | grep $GISBASE)
```

Alternatively, directly copy the file from within a GRASS terminal with something like: `cp r.in.swisstopo $GISBASE/scripts/`

- In most cases, the file ‘r.in.swisstopo’ needs to be made executable with:


```
chmod +x $GISBASE/scripts/r.in.swisstopo
```
- Finally, the file ‘description.html’ should be placed in the `$GISBASE/docs/html/` directory and renamed to ‘r.in.swisstopo.html’

Example shell script for processing large amounts of data

If a large number of files has to be imported, the user might want to automate this task, rather than importing every file manually, using the GUI. This can be achieved by running the script from the command line of a GRASS terminal. An example shell script, that runs over all input files of a certain file format in a directory, could look like the following:

```
#!/bin/bash
for filename in *.mlt; do
  r.in.swisstopo input=$filename output=$filename method=mean \
    type=FCCELL percent=100 method_resamp=bilinear \
    --overwrite --quiet
done
```

Note that the names of the resultant raster layers in the above example would be the same, as the names of the imported input data file.

Acknowledgments

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Bibliography

- [1] Carrera-Hernández, J., Gaskin, S., Apr. 2006. The groundwater modeling tool for grass (gmtg): Open source groundwater flow modeling. *Computers & Geosciences* 32 (3), 339–351.
- [2] Neteler, M., Mitasova, H., 2004. Open Source GIS: A GRASS GIS approach. The Kluwer International Series in Engineering and Computer Science, 2nd ed. Kluwer Academic Publishers, Boston, Dordrecht.
- [3] Sonnentag, O., Nov. 2009. Neteler, M., Mitasova, H., 2008. Open Source GIS A GRASS GIS Approach, 3rd ed. Springer, NY, USA, ISBN 978-0-387-35767-6, 406pp., USD 99.00, CDN 128.95, EUR 81.95, hardbound. *Computers & Geosciences* 35 (11), 2282–2282.

¹⁷Swisstopo test datasets: <http://www.swisstopo.admin.ch/internet/swisstopo/en/home/products/height/dhm25.html>

¹⁸GRASS Add-on directory: http://grass.osgeo.org/wiki/GRASS_AddOns#r.in.swisstopo

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