Temporal and spatial analysis of ecological data in an open source environment

October 26 – 29, 2015

Organized by
GIS and Remote sensing unit
Research and Innovation Centre
Fondazione Edmund Mach
San Michele all'Adige, Trento, Italy
http://gis.cri.fmach.it/

Lecturers

Markus Neteler, Roger Bivand, Sören Gebbert, Luca Delucchi, Duccio Rocchini

WHY THIS COURSE?

Much of the ecological research demands know-how in advanced processing of spatio-temporal datasets. Last two decades witnessed remarkable change in the way data is disseminated over web and many institutes adopted open data policies. With the free availability of big amount of geodata, the open source tools to process them has also grown to maturity. The raising trend of openness in data and software is a welcoming change in the scientific community. This course deals with spatio-temporal data analysis using one of the most popular open source software – GRASS GIS 7. During this intensive 4 days course, the students will become familiar with GRASS GIS and its interaction with the R environment. The participants will gain a solid understanding on topics like spatial data, landscape fragmentation, temporal data and satellite image analysis, handling big amount of data for ecological research using GRASS GIS. Moreover, the last day will be devoted on spatial data analysis using GRASS-R interface.

TARGET AUDIENCE

The course is aimed at PhD/MSc students and early career researchers who deal with spatio-temporal ecological data. A maximum of **20 participants** will be accommodated.

PRE-REQUISITES

Basic knowledge in dealing with spatial data is expected. It will be an added advantage to already have experience in open source software packages and scripting using bash and R. The course is planned at an advanced level.

HOW TO APPLY

IRSAE participants – Email the application form (email subject: TS-GRASS course 2015), containing a brief description of your PhD project and description of the relevance of the course to your research, along with a CV to the local organizers (pgiscourses@fmach.it) and in copy to Lucrezia Gorini (lucrezia.gorini@hihm.no).

Non IRSAE participants – Send a motivation letter (1 paragraph) justifying your participation in the course along with the CV, email to local organizers (pgiscourses@fmach.it)

IMPORTANT: Please add the clause "*I authorize Fondazione Edmund Mach to use my personal data in accordance to decree 196/2003.*" at bottom of your CV, otherwise we cannot process it internally.

FEES

IRSAE participants – Fees, board and lodging are covered for participants from IRSAE partners, who may also apply for a mobility grant to cover travel costs, after admission to the course (see application form at (http://irsae.no/grants/).

ICA-OSGeo students – Students/early career scientists who are part of ICA-OSGeo labs initiative ("Geo For All") will pay discounted rates of 150€. The fees include t-shirt, lunch, coffee breaks for 4 days and the social dinner. The list of the labs under this initiative is here: http://www.geoforall.org/locations/

Non IRSAE participants – Students: 200€. Others: 250€. The fees include t-shirt, lunch, coffee breaks for 4 days and the social dinner. We can assist you in finding an appropriate accommodation near the Fondazione Edmund Mach. Guest rooms can be pre-booked upon request; however, we will have to check for their availability.

SELECTION OF CANDIDATES

- Motivation letter – 1 Paragraph (max 30 points)
- Publication record derived as sqrt of number of publications and multiplied by total citations (max 20 points)
- CV (max 20 points)
- Contributions to the open source software community, please claim/update as needed your page on https://www.openhub.net/ (max 20 points)

IMPORTANT DATES	
August 20th 2015	Application dateline
August 30th 2015	Acceptance email to candidates
September 10th 2015	Invitation letter for visa application (if needed)
September 25th 2015	Deadline to pay registration fees

PROGRAM

(The program may subject to minor changes before the course)

26 Oct 2015, Monday: Day 1

Session 1: 9:00 – 13:00 Spatial data analysis using GRASS GIS 7 (Markus Neteler)
   • Geospatial data import
   • Exploratory data analysis
   • Zonal statistics
   • Interpolation
Exercise 1: Eco-climatic characterisation of a large landscape.
 	
Session 2: 14:00 – 17:30 Landscape fragmentation analysis (Duccio Rocchini)
   • Main modules in GRASS to explicitly deal with landscape fragmentation
   • Deriving fragmentation indices from remote sensing imagery
Exercise 2: Fragmentation analysis on an ecologically sensitive region using change maps derived from remote sensing images representing two time frames.

27 Oct 2015, Tuesday: Day 2

Session 3: 09:00 – 13:00 Temporal data analysis using GRASS – part 1 (Sören Gebbert)
   • Space-time datasets in GRASS
   • Importing, registering, creating space time rasters in GRASS using climatic datasets
   • Space-time voxel cubes with raster and vector data

Session 4: 14:00 – 17:30 Temporal data analysis using GRASS – part 2 (Sören Gebbert)
- Exploratory data analysis using space-time datasets
- Aggregation and seasonal analysis of climatic datasets
- Linear regression analysis between two space-time datasets

Exercise 3: Spatio-temporal analysis of statistical relationship between two climatic variables using temporal modules in GRASS

28 Oct 2015, Wednesday: Day 3

Session 5: 09:00 – 13:00 Satellite image analysis, (Markus Neteler)
- Importing raw satellite data (Landsat 8)
- Applying corrections
- Deriving vegetation indices from spectral bands
- Image classification to derive land cover maps

Exercise 4: Land cover classification using Landsat 8 data and validation using existing land cover
Session 6: 14:00 – 17:30 Handling big data for ecological research (Luca Delucchi)
- Introduction to pymodis
- Importing MODIS products to GRASS
- Extracting the spatial and temporal transects from time series

Exercise 5: Developing NDVI time series from MODIS for Trentino region and develop a map representing ecological niches.

29 Oct 2015, Thursday: Day 4

Session 7: 09:00 – 13:00 Spatial data analysis using GRASS-R interface – part 1 (Roger Bivand)
- Spatial data representation using R packages
- Spatio-temporal data representation using R packages
- The R-GRASS interface – rgrass7 package

Exercise 6: Using the R-GRASS interface
Session 8: 14:00 – 17:30 Spatial data analysis using GRASS-R interface – part 2 (Roger Bivand)
- Extracting ecological data in R (GBIF)
- Modelling using R: an introduction
- Integrating species data and environmental drivers: challenges

Exercise 7: Integrating species data and environmental drivers

Coffee breaks: 10:45 – 11:00 AM; 15:30 – 15:45 PM
*Lunch breaks: 13:00 – 14:00*

DATA AND SOFTWARE PACKAGES

We will use Virtual box + OSGeo-Live virtual machine image (http://live.osgeo.org/) on your personal laptop with all the required setup installed. Please bring your own laptops to work on sessions provided.
We will let you know more about this after the acceptance.

LOCATION

We are located in San Michele all'Adige, about 20km north of the city of Trento in Italy.
http://gis.cri.fmach.it/location/

Nearest Airport(s):
Verona Villafranca is the nearest airport to Trento. From Verona airport, there is bus service (every 20-40 minutes) to the central station (Verona Porta Nuova) which is well connected to the city of Trento (1.20 hours) by "Regionale trains" (5:25 AM – 10:50 PM).

Milano Bergamo Airport – Catch the airport bus (every 30 mins) to the Milan Centrale. From Milan Centrale you can reach Trento (via Verona) by train in about 3 hours (6:35 AM – 8:35 PM).

Milano Malpensa Airport is a major international airport which is well connected to destinations outside Europe**.** It is connected with Milan Centrale by bus (every 30 mins). From Milan train station you can reach Trento (via Verona) by train in about 3 hours (6:35 AM – 8:35 PM).

Venice Marco Polo Airport is connected with Venezia Mestre train station by bus. From Venezia Mestre train station you can reach Trento (via Verona) by train in about 3 hours (5:52 AM – 9:24 PM).

Arriving by Train: Take the "**Trento-Malé**" train service which is the small train next to the main train station in Trento. Get down at "Grumo/San Michele all'Adige" station. From there, take the foot pathway over a nice white bridge to cross the river, use the pedestrian street tunnel to cross the big street in front of S. Michele to reach the roundabout and then FEM (**route**).

Arriving by car: Leave the highway at "San Michele all'Adige-Mezzocorona". Our office is less than 2 km away from the highway exit. At the first roundabout take the left, and after crossing the bridge take right; Few meters ahead take a left, cross the round about and you reach the campus of the Fondazione Edmund Mach (route).
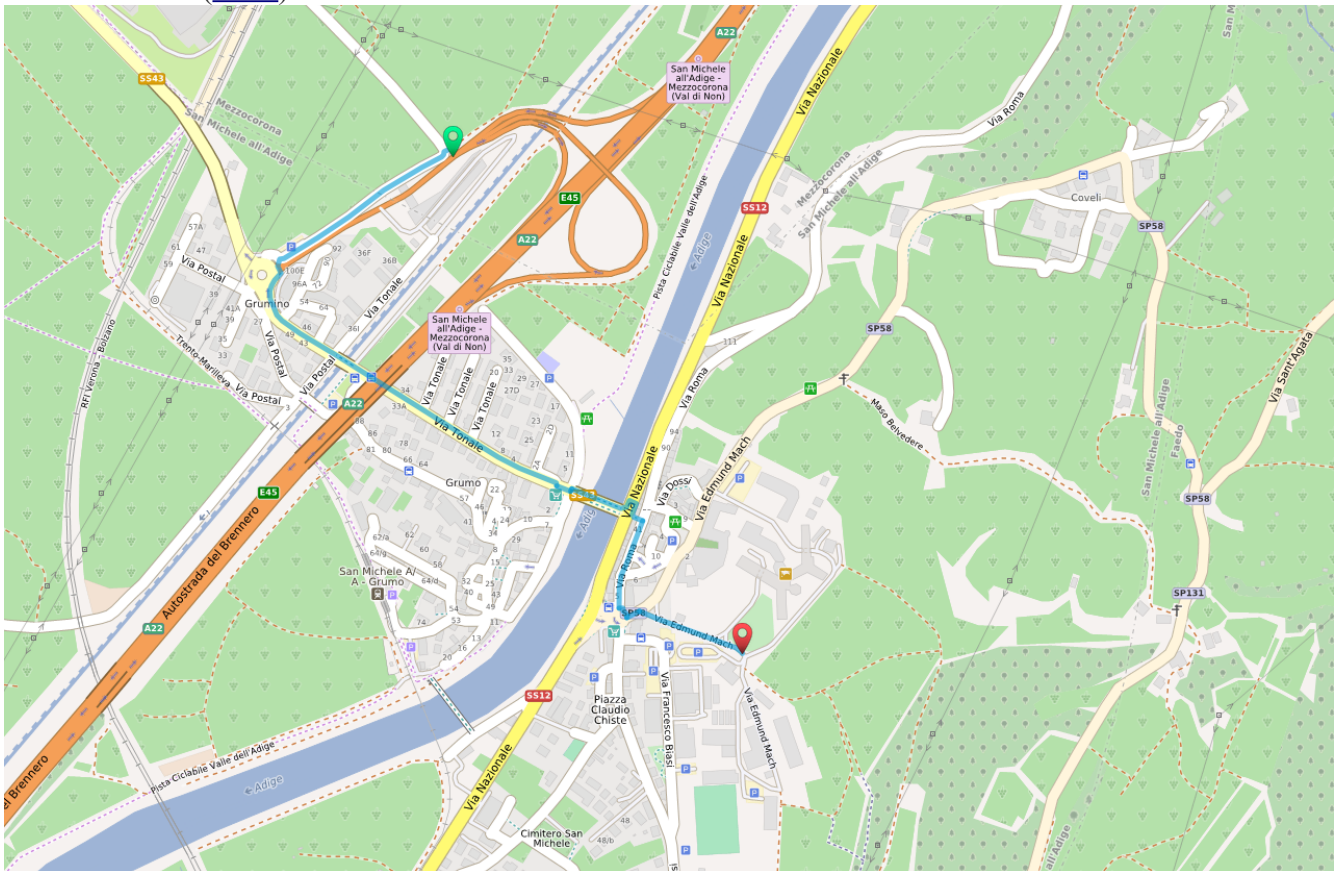
LECTURERS

Markus Neteler	**Luca Delucchi**
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Duccio Rocchini	**Roger Bivand**
profile	profile

Sören Gebbert

profile

Scientific staff at Thünen Institute of Climate-Smart Agriculture in Braunschweig, Germany. Open Source Software developer and involved in
GRASS GIS since 2006. Author of the temporal GIS extension in GRASS GIS and maintainer of the GRASS GIS voxel and web processing
implementations.

REFERENCES

Short-list of literature relevant for the course:

Neteler M. and Mitasova H. (2008). Open Source GIS: A GRASS GIS Approach. Third Edition. Springer, New York, 406 pages, 80 illus., http://grassbook.org/

Rocchini, D., Neteler, M. (2012). Let the four freedoms paradigm apply to ecology. Trends in Ecology & Evolution, 27: 310-311.

Bivand, R. S., Pebesma, E. J., Gomez-Rubio, V. & Pebesma, E. J. (2008). Applied spatial data analysis with R. 747248717, Springer, New York. http://www.asdar-book.org/

Gebbert, S. & Pebesma, E.A. (2014). Temporal GIS for Field Based Environmental Modeling. Environmental Modelling & Software, 53, 1–12.

Neteler, M., Bowman, M. H., Landa, M. & Metz, M. GRASS GIS (2012). A multi-purpose open source GIS. Environmental Modelling & Software 31, 124–130.

Rocchini, D., Delucchi, L., Bacaro, G., Cavallini, P., Feilhauer, H., Foody, G.M., He, K.S., Nagendra, H., Porta, C., Ricotta, C., Schmidtlein, S., Spano, L.D., Wegmann, M., Neteler, M. (2013). Calculating landscape diversity with information-theory based indices: A GRASS GIS solution. Ecological Informatics, 17: 82-93.