Geophysical Research Abstracts
Vol. 17, EGU2015-7296-3, 2015
EGU General Assembly 2015

GRASS GIS: The first Open Source Temporal GIS

Sören Gebbert and Thomas Leppelt
Johann Heinrich von Thünen Institute, Institute of Climate-Smart Agriculture, Braunschweig, Germany
(soeren.gebbert@ti.bund.de)

GRASS GIS is a full featured, general purpose Open Source geographic information system (GIS) with raster, 3D raster and vector processing support[1]. Recently, time was introduced as a new dimension that transformed GRASS GIS into the first Open Source temporal GIS with comprehensive spatio-temporal analysis, processing and visualization capabilities[2].

New spatio-temporal data types were introduced in GRASS GIS version 7, to manage raster, 3D raster and vector time series. These new data types are called space time datasets. They are designed to efficiently handle hundreds of thousands of time stamped raster, 3D raster and vector map layers of any size. Time stamps can be defined as time intervals or time instances in Gregorian calendar time or relative time. Space time datasets are simplifying the processing and analysis of large time series in GRASS GIS, since these new data types are used as input and output parameter in temporal modules. The handling of space time datasets is therefore equal to the handling of raster, 3D raster and vector map layers in GRASS GIS.

A new dedicated Python library, the GRASS GIS Temporal Framework, was designed to implement the spatio-temporal data types and their management. The framework provides the functionality to efficiently handle hundreds of thousands of time stamped map layers and their spatio-temporal topological relations. The framework supports reasoning based on the temporal granularity of space time datasets as well as their temporal topology. It was designed in conjunction with the PyGRASS [3] library to support parallel processing of large datasets, that has a long tradition in GRASS GIS [4,5].

We will present a subset of more than 40 temporal modules that were implemented based on the GRASS GIS Temporal Framework, PyGRASS and the GRASS GIS Python scripting library. These modules provide a comprehensive temporal GIS tool set. The functionality range from space time dataset and time stamped map layer management over temporal aggregation, temporal accumulation, spatio-temporal statistics, spatio-temporal sampling, temporal algebra, temporal topology analysis, time series animation and temporal topology visualization to time series import and export capabilities with support for NetCDF and VTK data formats. We will present several temporal modules that support parallel processing of raster and 3D raster time series.

[1] GRASS GIS Open Source Approaches in Spatial Data Handling In Open Source Approaches in Spatial Data Handling, Vol. 2 (2008), pp. 171-199, doi:10.1007/978-3-540-74831-1_9 by M. Neteler, D. Beaudette, P. Cavallini, L. Lami, J. Cepicky edited by G. Brent Hall, Michael G. Leahy

[2] Gebbert, S., Pebesma, E., 2014. A temporal GIS for field based environmental modeling. Environ. Model. Softw. 53, 1-12.

[3] Zambelli, P., Gebbert, S., Ciolli, M., 2013. Pygrass: An Object Oriented Python Application Programming Interface (API) for Geographic Resources Analysis Support System (GRASS) Geographic Information System (GIS). ISPRS Intl Journal of Geo-Information 2, 201–219.

[4] Löwe, P., Klump, J., Thaler, J. (2012): The FOSS GIS Workbench on the GFZ Load Sharing Facility compute cluster, (Geophysical Research Abstracts Vol. 14, EGU2012-4491, 2012), General Assembly European Geosciences Union (Vienna, Austria 2012).

[5] Akhter, S., Aida, K., Chemin, Y., 2010. “GRASS GIS on High Performance Computing with MPI, OpenMP and Ninf-G Programming Framework”. ISPRS Conference, Kyoto, 9-12 August 2010