Brief introduction to GRASS GIS Temporal Framework

GRASS GIS Temporal Workshop

September, 2013

Motivation

How to handle big data in GIS?

- different sources – satellites, lidar, results from models and simulations
- different temporal and spatial resolution

Example: Reconstructed MODIS Land Surface Temperature Dataset (4 maps per day since 2000, 250 m resolution)[1]

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[1] Metz, M.; Rocchini, D.; Neteler, M. 2014: Surface temperatures at the continental scale: Tracking changes with remote sensing at unprecedented detail. Remote Sensing. 2014, 6(5): 3822-3840

GRASS GIS Temporal Framework (TGRASS)

- fully integrated in GRASS GIS 7
- main author Sören Gebbert

Functionality available through

- t.* modules
- Python API for power users and developers

Time concepts

interval vs. instant

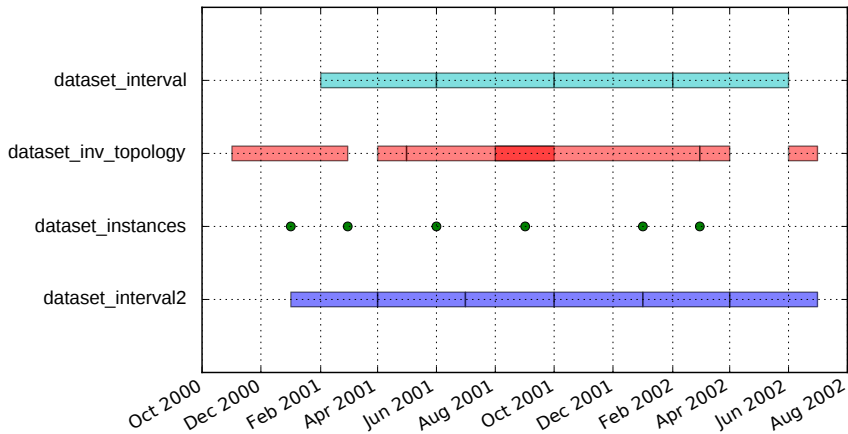- not always so easy to decide which to use
- precipitation as interval vs. current temperature as instant
- generally, when both make sense, use interval
- interval defined with start time and end time: [start, end)

absolute vs. relative

- again, not always so easy to decide which to use
- absolute date time format: 2013-10-15 13:00:00
- relative: 4 years, - 90 days

Approach

We do not work with individual map layers but with *space-time datasets*. Dataset is a collection of individual map layers with assigned time stamps.

- strds – space-time raster dataset
- stvds – space-time vector dataset
- str3ds – space-time 3D raster dataset

Note that raster, vector and 3D raster data is still stored in standard GRASS database, and temporal framework manages the temporal metadata in separate temporal database.

Advanced concepts

Temporal granularity

Granularity is a characteristics of a spatio-temporal dataset similar to resolution.

Temporal granularity is the greatest common divisor of the temporal extents (and possible gaps) of all maps of the dataset

Temporal topology

Temporal topology analyzes temporal relations between time intervals.

X ▬▬▬▬ Y ▬▬▬▬		before/after
X ▬▬▬▬ Y ▬▬▬▬		precedes/follows
X ▬▬▬▬ Y ▬▬▬▬		overlapped/overlaps
X ▬▬▬▬ Y ▬▬▬▬		starts/started
X ▬▬▬▬ Y ▬▬▬▬		during/contains
X ▬▬▬▬ Y ▬▬▬▬		finishes/finished
X ▬▬▬▬ Y ▬▬▬▬		equals

Temporal sampling

Temporal sampling is used to determine the state of one process during a second process.
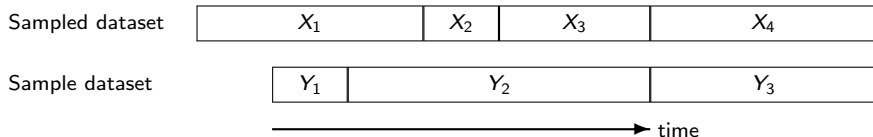
	start	during	contain	overlap	equal	follow	precede
Y_1	—	—	X_1	—	—	—	—
Y_2	X_2, X_3	X_2, X_3	—	X_1	—	X_4	—
Y_3	X_4	—	—	—	X_4	—	X_3

GRASS GIS 7   Free download for MS Windows, Mac OSX, Linux and
              source code: http://grass.osgeo.org/download/

              Addons (user contributed extensions):
              http://grasswiki.osgeo.org/wiki/GRASS_AddOns

Sample data   Rich data set of North Carolina (NC) available as GRASS
              GIS location and in common GIS formats:
              http://grass.osgeo.org/download/sample-data/

User Help   Mailing lists (in different languages):
              http://grass.osgeo.org/support/

              Wiki including FAQ:
              http://grasswiki.osgeo.org/wiki/

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