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Tutorials for the GRASS geocomputation engine

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Software

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Summary

This collection of tutorials is an introduction to the GRASS geospatial processing engine. GRASS is an open source computational engine for spatiotemporal data management, analysis, modeling, and simulation (GRASS Development Team et al., 2025). As an engine that can be integrated in data science pipelines with shell scripting, Python, R, and Jupyter, there are many ways to use GRASS. While GRASS already had extensive documentation, tutorials were needed to introduce the many ways to interface with GRASS. These open education tutorials - which cover integrations, core features, and disciplinary applications - were developed as part of an effort to grow the GRASS community. The tutorials are released under both the GNU Free Documentation License v1.2 or later and the Creative Commons Attribution-ShareAlike 4.0 International License.

Statement of need

Include a Statement of Need section, explaining how the submitted artifacts contribute to computationally enabled teaching and learning, and describing how they might be adopted by others.

- Growing the GRASS ecosystem
  - GRASS has extensive documentation, but lacked official tutorials
    - Manual pages, api documentation, programming manual, etc.
    - Community developed tutorials
      - Not maintained by GRASS Dev Team
  - Introduction to GRASS as geospatial engine
    - Examples of how to interface with engine needed
      - GUI, CLI, Py, R, Cloud, Jupyter, etc.

Description / Features

Describe the learning objectives, content, instructional design, and experience of use in teaching and learning situations.

Learning Objectives

These tutorials were developed to teach the fundamentals of geoprocessing with GRASS, integrations of GRASS into data science pipelines, and disciplinary applications of GRASS. The tutorials were designed for self-study, integration into courses, and deployment in workshops.

Instructional Design

- Design
  - Learning modules for self-study, classes, & workshops
  - Modular design for reuse and remixing
  - Scaffolded: getting started > core features > disciplinary topics
  - Interactivity for active learning
  - Worked examples for reduced cognitive load
  - Computational thinking with live coding
  - Scaffolding of explanations and code
- Audience
  - GRASS community of practice
    - Academics, professionals, & agencies
    - OSGeo Foundation
    - Broader FOSS4G community
  - Beginners to advanced
  - Self-learners: getting started tutorial series
- Mode
  - Online tutorials with computational notebooks
- Implementation, Infrastructure, & Deployment
  - Quarto > GitHub Pages
    - HTML pages & Jupyter notebooks

Contents / Tutorials

Modules	Tutorials	Level	Language
Get Started	Get started with GRASS GUI	Beginner	English
	Get started with GRASS & Python in Jupyter Notebooks	Beginner	English
	Get started with GRASS in Google Colab	Beginner	English
	Get started with GRASS in Jupyter Notebooks on Windows	Beginner	English
	Get started with GRASS & R: the rgrass package	Advanced	English
General	Basics of map algebra	Beginner	English
	Making plots with GRASS	Beginner	English
	Visualizing and modeling terrain from DEMs in GRASS	Beginner	English, Portuguese
	Modeling Movement in GRASS	Advanced	English, Portuguese
	Introduction to remote sensing with GRASS	Beginner	English
	Procedural noise	Intermediate	English
	Quick comparison: R and Python GRASS interfaces	Intermediate	English
Time series	Introduction to time series in GRASS	Intermediate	English
	Temporal subset, import and export	Intermediate	English
	Temporal aggregations	Advanced	English
	Temporal algebra	Advanced	English
	Temporal accumulation	Advanced	English
	Temporal gap-filling	Advanced	English

Modules	Tutorials	Level	Language
	Temporal query with vector data	Advanced	English
Earthworks	Basic earthworks	Beginner	English
	Gully modeling	Beginner	English
	Coastal infrastructure	Beginner	English
	Terrain synthesis	Intermediate	English

Story

Tell us the story of the project: how did it come to be?

Please add to the story!

- Teaching experiences
  - HTML: NCSU Geospatial Modeling (MEAS582/GISXXX) (**?**)
  - Jupyter: NCSU Geospatial Computing and Simulation (GIS714) (Haedrich et al., 2023)

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