Training Course on Geospatial Data Processing with GRASS GIS

Professional Development Training Course Outline

Category	GIS	**Duration**	10 Days
Base Fee	$3,000 USD	**Delivery Mode**	Online / On-site Hybrid

Course Introduction

Training Course on Geospatial Data Processing with GRASS GIS provides a comprehensive introduction to **Geospatial Data Processing** using **GRASS GIS**, a powerful open-source Geographic Information System. Participants will gain hands-on expertise in **spatial analysis**, **remote sensing**, **cartography**, and **geodata management**, equipping them with the skills to tackle complex real-world challenges. The curriculum focuses on practical application, leveraging **cutting-edge techniques** and **industry best practices** to transform raw geospatial data into actionable intelligence.

Geospatial data is at the forefront of **digital transformation** across diverse sectors, from **environmental monitoring** and **urban planning** to **disaster management** and **precision agriculture**. This course addresses the growing demand for skilled **geospatial professionals** proficient in **open-source solutions**. Through a blend of theoretical knowledge and practical exercises, attendees will master **data manipulation**, **visualization**, and **modeling** within the GRASS GIS environment, fostering a deep understanding of **geospatial analytics workflows** and contributing to **data-driven decision-making**.

Programme Curriculum

Training Course on Geospatial Data Processing with GRASS GIS

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Course Objectives

1. Navigate and effectively utilize the GRASS GIS graphical user interface and command-line tools for efficient **geospatial workflows**.
2. Comprehend core **spatial data types** (vector, raster) and their respective applications in **geospatial analysis**.
3. Learn to import, export, and integrate diverse **geospatial datasets** from various sources, including **satellite imagery** and **field-collected data**.
4. Implement techniques for **geospatial data cleaning**, **validation**, **reprojection**, and **error handling** to ensure data quality.
5. Perform advanced **raster operations** like **map algebra**, **terrain analysis** (DEM, slope, aspect), and **hydrological modeling**.
6. Execute sophisticated **vector analysis** including **buffering**, **overlay analysis**, **network analysis**, and **topology management**.
7. Apply GRASS GIS for **image classification**, **change detection**, and **vegetation index calculation** using **satellite remote sensing**.
8. Utilize GRASS GIS's capabilities for **spatial statistical analysis**, **interpolation techniques** (e.g., Kriging, IDW), and **predictive modeling**.
9. Develop basic **Python scripts** to automate repetitive **geospatial processing tasks** within GRASS GIS.
10. Create and interpret **3D visualizations** of terrain and spatial data for enhanced **geospatial understanding**.
11. Understand and apply best practices for **geospatial metadata creation** and management to ensure data discoverability and usability.
12. Appreciate the benefits and interconnectedness of **open-source GIS technologies** and their role in the broader **geospatial industry**.
13. Apply GRASS GIS to solve practical **geospatial problems** across various domains, fostering **critical spatial thinking**.

Organizational Benefits

- Equip teams with the ability to extract valuable insights from complex geospatial data, leading to more informed and strategic decisions.
- Leverage open-source GRASS GIS to minimize software licensing costs and automate time-consuming geospatial tasks, improving operational efficiency.
- Develop an in-house team of skilled geospatial professionals capable of handling diverse spatial challenges.

- Optimize resource allocation and planning through advanced spatial analysis for environmental, urban, and infrastructure projects.
- Stay ahead in a data-driven world by harnessing the power of geospatial intelligence for strategic planning and problem-solving.
- Implement robust data processing and validation techniques, leading to more accurate and trustworthy geospatial products.
- Utilize a versatile open-source platform that can scale to handle large datasets and complex analytical requirements.

Target Audience

1. GIS Professionals.
2. Environmental Scientists & Researchers
3. Urban Planners & Civil Engineers
4. Geographers & Cartographers.
5. Remote Sensing Specialists.
6. Data Scientists
7. Government Agency Staff
8. Students & Academics pursuing careers or research in geospatial science.

Course Outline

Module 1: Introduction to GRASS GIS & Geospatial Fundamentals

- Understanding the Open Source GIS Ecosystem and GRASS GIS philosophy.
- Navigating the GRASS GIS interface (GUI and command line).
- GRASS GIS data model: Location, Mapset, and working with different data types.
- Basic concepts of geographic coordinate systems, projections, and datums.
- Introduction to data import and export within GRASS GIS.
- **Case Study:** Setting up a new GRASS GIS project for a local municipality and importing publicly available administrative boundaries and elevation data.

Module 2: Raster Data Management & Visualization

- Importing various raster formats (GeoTIFF, ASCII, etc.).
- Displaying and styling raster maps, creating color tables.
- Querying raster data and extracting cell values.
- Raster resampling and reclassification techniques.
- Managing raster map metadata and history.
- **Case Study:** Visualizing land cover changes in a protected area over a decade using multi-temporal satellite imagery.

Module 3: Raster Map Algebra & Basic Processing

- Performing arithmetic and logical operations on raster maps.
- Applying conditional statements and reclassification rules.
- Creating derived raster maps from existing ones.
- Working with null values and masks in raster analysis.
- Introduction to neighborhood operations.
- **Case Study:** Identifying suitable areas for solar panel installation based on solar radiation, slope, and land use through map algebra.

Module 4: Terrain Analysis with DEMs

- Importing Digital Elevation Models (DEMs).
- Calculating slope, aspect, and hillshade from DEMs.
- Generating contours and topographic profiles.
- Performing viewshed analysis and intervisibility.
- Analyzing hydrological features like flow direction and accumulation.
- **Case Study:** Delineating watersheds and stream networks for a flood risk assessment in a hilly region.

Module 5: Hydrological Modeling

- Advanced hydrological analysis: stream ordering, catchment delineation.
- Calculating upslope and downslope contributing areas.
- Modeling water flow paths and accumulation.
- Identifying depressions and flat areas in DEMs.
- Introduction to flood inundation modeling.
    - **Case Study:** Simulating potential flood extent given a specific rainfall event and identifying vulnerable areas downstream.

Module 6: Vector Data Introduction & Management

- Understanding vector data models: points, lines, polygons.
- Importing and exporting vector formats (Shapefile, GeoJSON).
- Digitizing new vector features and editing existing ones.
- Managing vector attribute tables and database connections.
- Cleaning vector data: snapping, generalizing, repairing topology.
- **Case Study:** Digitizing unmapped roads and buildings from aerial imagery to update a city's base map.

Module 7: Vector Overlay & Proximity Analysis

- Performing vector overlay operations: intersection, union, difference.
- Executing buffering and proximity analysis.
- Clipping, dissolving, and merging vector layers.
- Spatial joining attributes between different vector layers.
- Understanding and resolving topological errors.
- **Case Study:** Analyzing the impact of a proposed highway extension on protected wildlife habitats using buffer and overlay analysis.

Module 8: Network Analysis

- Creating and preparing network datasets from vector lines.
- Calculating shortest paths and optimal routes.
- Determining service areas and accessibility.
- Solving location-allocation problems.
- Introduction to advanced network algorithms.
- **Case Study:** Optimizing emergency vehicle routes to reduce response times in an urban environment.

Module 9: Working with Attribute Data

- Advanced attribute table manipulation: adding, deleting, modifying columns.
- Performing SQL queries on attribute tables.
- Joining tabular data to spatial features.

- Calculating statistics from attribute data.
- Creating charts and graphs based on attributes.
- **Case Study:** Analyzing demographic data linked to census tracts to identify areas with high socio-economic vulnerability.

Module 10: Remote Sensing Image Processing

- Radiometric and atmospheric correction of satellite imagery.
- Image enhancement techniques: contrast stretching, filtering.
- Calculating vegetation indices (NDVI, EVI) for environmental monitoring.
- Unsupervised and supervised image classification.
- Accuracy assessment of classified images.
- **Case Study:** Mapping changes in agricultural land use over five years using Landsat imagery and supervised classification.

Module 11: Advanced Spatial Interpolation

- Understanding different interpolation methods (IDW, Spline, Kriging).
- Applying interpolation techniques to generate continuous surfaces from point data.
- Assessing the accuracy of interpolated surfaces.
- Visualizing interpolation results and uncertainty.
- Introduction to geostatistical concepts.
- **Case Study:** Creating a continuous temperature map for a region using sparse weather station data.

Module 12: Time Series Analysis in GRASS GIS

- Managing and analyzing spatio-temporal datasets.
- Creating animations and visualizations of temporal changes.
- Performing time-series operations on raster and vector data.
- Detecting trends and anomalies in spatio-temporal data.
- Analyzing environmental changes over time.
- **Case Study:** Monitoring the growth of an urban area over several decades using historical satellite images and time-series analysis.

Module 13: Scripting with Python in GRASS GIS

- Introduction to Python programming for geospatial tasks.
- Using PyGRASS for interacting with GRASS GIS modules.
- Automating common data processing workflows.
- Developing custom GRASS GIS scripts.
- Integrating GRASS GIS with other Python libraries (e.g., NumPy, Matplotlib).
- **Case Study:** Automating the process of downloading, reprojecting, and clipping daily weather data for a specific study area.

Module 14: 3D Visualization and Advanced Cartography

- Creating 3D views of terrain and geospatial data.
- Draping 2D maps onto 3D surfaces.
- Generating cross-sections and profiles.
- Producing high-quality maps for presentation and publication.
- Advanced symbology and labeling techniques.

- **Case Study:** Creating an interactive 3D model of a proposed development site, integrating architectural plans with existing terrain and infrastructure.

Module 15: Real-world Applications & Project Work

- Applying learned skills to a comprehensive Capstone Project.
- Problem definition, data acquisition, and methodology design.
- Implementing a complete geospatial analysis workflow using GRASS GIS.
- Presenting findings and discussing results.
- Troubleshooting and best practices for large-scale geospatial projects.
- **Case Study:** Participants will work on a self-selected project, such as "Optimizing Public Transport Accessibility in a City" or "Assessing Deforestation Rates in a Forest Reserve."

Training Methodology

This training course employs a **highly interactive and practical methodology** designed for maximum knowledge retention and skill development.

- **Hands-on Labs:** The core of the training involves extensive hands-on exercises using real-world datasets, allowing participants to immediately apply concepts learned.
- **Instructor-Led Demonstrations:** Clear, step-by-step demonstrations by experienced instructors guide participants through complex GRASS GIS operations.
- **Case Study Approach:** Each module integrates practical case studies to illustrate real-world applications and encourage critical thinking.
- **Interactive Discussions:** Open forums and Q&A sessions foster collaborative learning and allow participants to share experiences and challenges.
- **Project-Based Learning:** A significant portion of the course is dedicated to a capstone project, where participants apply all acquired skills to solve a relevant geospatial problem.
- **Comprehensive Course Materials:** Participants receive detailed training manuals, exercise datasets, and supplementary resources for continued learning.
- **Problem-Solving Focus:** Emphasis is placed on developing problem-solving skills, enabling participants to adapt GRASS GIS tools to novel situations.
- **Flexible Learning Environment:** The training can be delivered in-person or virtually, with dedicated support for online participants.

Register as a group from 3 part

Upcoming Scheduled Sessions

Start Date	End Date	Location	Price
23 Nov 2026	04 Dec 2026	Online	$2,000
23 Nov 2026	04 Dec 2026	Physical	$3,000
23 Nov 2026	04 Dec 2026	Physical	$6,000
23 Nov 2026	04 Dec 2026	Physical	$6,000

Start Date	End Date	Location	Price
23 Nov 2026	04 Dec 2026	Physical	$12,000
23 Nov 2026	04 Dec 2026	Physical	$9,000
23 Nov 2026	04 Dec 2026	Physical	$12,000
23 Nov 2026	04 Dec 2026	Physical	$12,000

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