AIAD #10842

Research Opportunity (Cadet)

ORGANIZATION/PROJECT SPONSOR
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Location of Sponsoring Directorate or Division: Research Triangle Park, NC

PROJECT

Title: Studies in LIDAR for Terrain Analysis

Description: The research, to be conducted at North Carolina State University in Raleigh, NC, will focus on using airborne, terrestrial, and/or laboratory lidar technology to study landscape dynamics. Three projects are available:

1 - Digital Elevation Model (DEM) Time-Series Analysis for Determining Short-Term Landscape Change in Dynamic Coastal Environments
Airborne lidar data time series analysis and visualization High-resolution, multi-year lidar surveys are now available for North Atlantic coastal regions, offering unprecedented insight into topographic change and land surface evolution. Two methods for quantification of land surface evolution and assessment of changes in structures have been developed for time-series of raster DEMs derived from lidar point clouds: (a) A feature-based method that extracts specific morphologic features (peaks, dune crests, or shorelines) from raster DEMs for each time snapshot and then measures their vertical change and horizontal migration; (b) A raster-based method that applies a per-cell statistical analysis to high-resolution raster DEM time series, generating new types of maps that characterize the temporal evolution of land surface while preserving the original spatial resolution of the DEM. Extraction and quantification of both discrete and continuous changes can be performed, including identification of changes in built structures, vegetation growth, and impacts of management practices. The project will compare the spatial pattern of terrain dynamics in locations with high level of human intervention and locations where the change is driven primarily by natural forces.

2 - Optimization of Ground Based Laser Scanning and Monitoring Using Line-of-Sight Analysis
Ground-based (terrestrial) laser scanning provides capabilities to produce high resolution (cm) digital elevation data and measures changes in surface topography at high level of detail and accuracy. Because the terrestrial system is limited in extent of a real coverage to 100-1000m depending on technology, multiple scans are required for landscape scale studies. To improve the efficiency of scanning, especially when rapid response is required and time for planning is limited (such as in pre- and post-storm surveys or military applications) GIS-based approaches for optimization of scanning designs are investigated. Elevation data acquired from an airborne lidar can be used to generate a digital terrain model at 1-3m resolution at a regional scale. This model can then be used to perform line of sight analysis to find ground-based lidar scanner positions and target locations that will provide largest coverage within shortest time in the field and minimum number of different scans that need to be fused to obtain full coverage of the study area. The project will apply the analysis to an experimental study site and results of the survey design optimization will be tested by performing actual scans in the field.

3 - Impact of Landscape Modification on Water Flow Using Tangible GIS with a Focus on Military Impacts on Topography: Off-road Vehicle Tracks and Explosive Impacts
To improve our understanding of terrain change impacts on landscape processes a real-world DEM can be combined with a flexible laboratory 3D model, indoor laser scanner and projectors into a tangible geospatial modeling system. A flexible model of the DTM having a surface of plasticine clay can be manually modified to simulate wide range of changes in landscape surface character and texture (such as grading, furrowing, the

addition of ponds, dams, rip-rap, buildings, forests, etc.). The modified model is scanned, imported into GIS, analysis of topographic parameters and landscape process simulations (such as water flow) are performed and the results are projected over the model. The project focus will be on assessment of military impacts on topography and surface water flow such as off-road vehicle track or explosive impacts to provide information for remediation to provide military land use sustainability.

ARL/Army Benefit: Enhanced research capability in terrain geospatial analysis.

Background Required: Some training in geographic skills related to geospatial analysis, such as computer mapping, remote sensing, and geographic information systems.

Security clearance required: None.

Capacity: Up to 3 Cadets

Duration: 2-3 weeks each.

Block Preference: Timeframes that DO NOT WORK for the organization: 19-25 June