Geophysical Research Abstracts
Vol. 12, EGU2010-14544, 2010
EGU General Assembly 2010

Enabling Access to High-Resolution Lidar Topography for Earth Science Research

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High-resolution topography data acquired with lidar (light detection and ranging a.k.a. laser scanning) technology are revolutionizing the way we study the geomorphic processes acting along the Earth's surface. These data, acquired from either an airborne platform or from a tripod-mounted scanner, are emerging as a fundamental tool for research on a variety of topics ranging from earthquake hazards to ice sheet dynamics. Lidar topography data allow earth scientists to study the processes that contribute to landscape evolution at resolutions not previously possible yet essential for their appropriate representation. These datasets also have significant implications for earth science education and outreach because they provide an accurate digital representation of landforms and geologic hazards.

However, along with the potential of lidar topography comes an increase in the volume and complexity of data that must be efficiently managed, archived, distributed, processed and integrated in order for them to be of use to the community. A single lidar data acquisition may generate terabytes of data in the form of point clouds, digital elevation models (DEMs), and derivative imagery. This massive volume of data is often difficult to manage and poses significant distribution challenges when trying to allow access to the data for a large scientific user community. Furthermore, the datasets can be technically challenging to work with and may require specific software and computing resources that are not readily available to many users.

The U.S. National Science Foundation (NSF)-funded OpenTopography Facility (http://www.opentopography.org) is an online data access and processing system designed to address the challenges posed by lidar data, and to democratize access to these data for the scientific user community. OpenTopography provides free, online access to lidar data in a number of forms, including raw lidar point cloud data, standard DEMs, and easily accessible Google Earth visualizations. OpenTopography uses cyberinfrastructure resources to allow users, regardless of their level of expertise, to access lidar data products that can be applied to their research. In addition to data access, the system uses customized algorithms and high-performance computing resources to allow users to perform on-the-fly data processing tasks such as the generation of custom DEMs.

OpenTopography's primarily focus is on large, community-oriented, scientific data sets, such as those acquired by the NSF-funded EarthScope project. We are actively expanding our holdings through collaborations with researchers and data providers to include data from a wide variety of landscapes and geologic domains. Ultimately, the goal is for OpenTopography to be the primary clearing house for Earth science-oriented high-resolution topography.

This presentation will provide an overview of the OpenTopography Facility, including available data, processing capabilities and resources, examples from scientific use cases, and a snapshot of system and data usage thus far. We will also discuss current development activities related to deploying high-performance algorithms for hydrologic processing of DEMs, geomorphic change detection analysis, and the incorporation of full waveform lidar data into the system.