ES473 Environmental Geology – Class Assignment

Using internet, text, and other class resources, provide a brief definition or description of the following terms, with a sketch, equation or cut-n-paste photo where required.

LIDAR

Light Detection and Ranging. A method used remotely gain elevation data to determine the topography of a geographic area.



Laser

Light Amplification by Stimulated Emission of Radiation. Emits different wavelengths of light that can be used for several purposes, including obtaining LiDAR information.

Near-Infrared (define and sketch)

NIR, the section of wavelength on the light spectrum between 780 and 2500 nm. 1000 nm is a wavelength used for typical LiDAR operations.



Reflection (define and sketch)

The "bouncing away" of certain wavelengths of light when hitting any particular object. Different objects reflect different wavelengths.

Key Word Search on Lidar



Absorption (define and sketch)

The "taking in" of certain wavelengths of light when hitting any particular object. Different objects absorb different wavelengths.

Two-wave travel time (define, equation, sketch)

First definition is based on reflection of a wave from source to ground and back up, given by the following graphic. The second is based on knowing the speed through various media that different types of waves take, it's possible to determine distance using both of the waves' travel times from point A to point B. The reception of a LiDAR laser is a common use of two-way travel time.



Seismic Reflection

Laser source

Lasers emit light as coherent light, so that waves can be concentrated to a single point.

Pulse detector

A detector that calculates the amount of time it takes for emitted Laser sources to return to the source. This information can then be used to determine distance from the source.

Nadir

The point directly below someone in a spherical area.

first-returns second-returns last returns

The different levels of laser return for LiDAR pulse detection. First returns are always the highest point on the Earth's surface. Intermediate responses are often vegetation elevations. Last returns are bare-earth model elevations.

bare-earth model (define, provide example image)

The LiDAR elevation model that negates all other elevations that are not the geologic surface of the Earth. This takes out vegetation, buildings, and other obstructions that are not "the bare earth."



digital elevation model (DEM)

A 3D—or 2.5D—representation of the Earth's surface created from elevation data.

Laser swath mapping

A technique using airborne vehicles to map strips of a geographical area using LiDAR

Land classification

Geographical division of land based on its use i.e. agricultural, residential/urban, forest, etc.

Ground cover

Vegetation that obscures bare-earth materials. Ground cover may be grass, shrubs, or other types of vegetation.

Flight lines

Parallel lines planned out in order to map a quadrilateral area from Laser swath mapping

GPS – positioning systems

Global Positioning System. Used to determine locations on a 3D surface, notably Earth. GPS is the US version, though all international versions fall under positions systems. Uses satellites in order to calculate time and geographic location based on a receiver on the ground.

Point cloud

A set of data points often used to measure 3D (or 2D) surfaces. For instance, a point cloud of ball will resemble a spherical figure made up of clustered points.

Laser altimetry

The process that LiDAR falls under. Uses pulses of light from lasers in order to determine topography of a landscape.

Inertial Measurement Unit (IMU)

An instrument that measures a non-gravitational force per unit of mass. These devices are used to maneuver aircrafts.

Image Processing (provide examples)

Processes performed on an image or representation of an image to gather more data from it. Examples include creating a hillshade model, producing a digital image from a physical image (usually the first step), or determine different objects within a map using algorithms.

Hillshade/Shaded Relief Model (define and show image)

A 3D representation of a 2D space that has elevation data associated with it. The angle and direction that the sun shines on the surface affects the output of a hillshade model.



Image Resolution

The number of pixels that exist in a particular digital image OR the resolution based on distances between data points i.e. 1-meter resolution is one point per square meter.

LAS data file format

A dataset used to store LiDAR information, particularly in the ArcGIS software.