

Applications of Lidar

1. Look at the “Applications of Lidar” side of the GMD poster

APPLICATIONS OF LIDAR

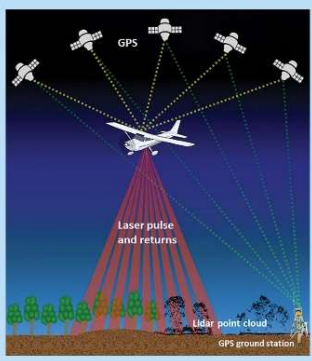
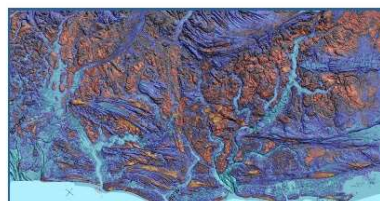
Across the geosciences, a technology called lidar is supporting innovative approaches to problem solving. Short for Light Detection and Ranging, lidar is a technology that uses light pulses to collect three-dimensional information. Lidar data is often collected from an airplane using a laser system pointed at the ground. The system measures the amount of time it takes for the laser light pulses to reach the ground and return. Billions of these rapidly-collected measurements (points) can create extremely detailed three-dimensional models of the Earth's surface (called bare earth) and of objects above the surface (such as trees and buildings).

Lidar is an invaluable tool that geoscience professionals can use to see and study large areas of the Earth's surface, particularly in places where trees and vegetation obscure the landscape. Geoscientists can use lidar products to:

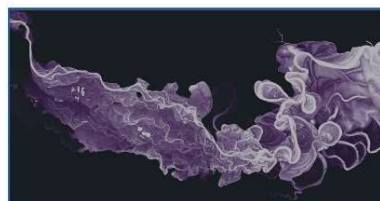
- map geology, landslides, and faults
- study volcanoes, glaciers, forests, and rivers
- model potential flood zones
- identify potential locations of critical minerals
- identify safe locations for infrastructure

Learn more about lidar and its many applications to the geosciences in “The Bare Earth” StoryMap (bit.ly/3CjLqB).

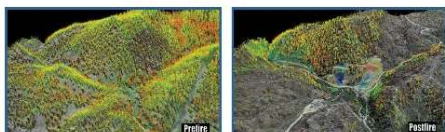
Source: 2018 Light Detection and Ranging Department of the Interior, Geological Survey, G30M-22-B0646-01-00000

Airborne magnetic and radiometric data were collected over Charleston, South Carolina in a joint effort to locate sands containing critical mineral resources and to image deep faults that might rupture in an earthquake. This image displays equivalent thorium concentrations draped over lidar elevation data. Pairing lidar and radiometric data with elevation data helps identify the geomorphologic context of mineral deposits. These data were released by the USGS through the Earth Mapping Data User Improvement (EarthMap) Joint Program and National Cooperative Geology, Geology Program (NCGP). <https://www.usgs.gov/centers/earth-mapping-data-user-improvement-program>

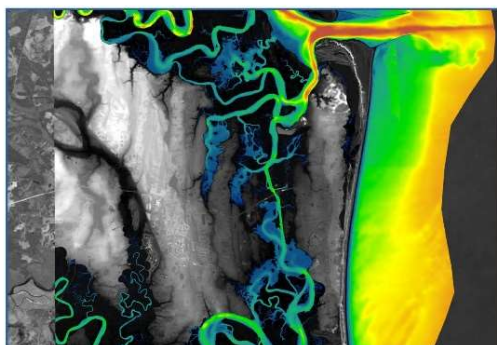


A Relative Elevation Model derived from lidar data collected in Flathead County, Montana reveals active and past river channels. The Flathead River meanders extensively near the lake, leaving behind dry channels filled with sediment. Some of these dry channels may fill during high waters, while others remain cut off from the main river. <https://www.mt.gov/Portals/0/StateLibrary>

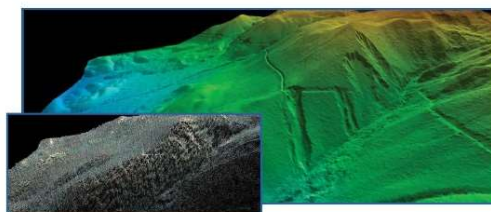


After the Hayman Fire in Colorado, lidar data was collected in order to make comparisons to pre-fire data. Lidar points that were recorded on trees are color coded by their heights above ground (green=low, red=high). Changes in the bare earth that are statistically different than the pre-fire lidar are also displayed (blue=loss in elevation, red=gain in elevation). Areas not colored blue/red had not significantly changed after the fire. <https://www.usgs.gov/centers/earth-mapping-data-user-improvement-program>

Lidar can help map bathymetry in shallower coastal areas. This data can assist with ship navigation, coastal change monitoring, tide modeling, and studying marine habitats such as coral reefs and estuaries. This example shows the coastal transition of a river estuary near Amelia Island, Florida. The image was created for the USGS Coastal Research Database (CRDB). Credit: Florida Geospatial Information Office.



In this composite lidar/photo image, the Toe Jam Hill fault scarp (a strand of the Seattle fault zone) is clearly visible in the landscape on Bainbridge Island in Washington. When viewing only the aerial photo, the fault scarp is not visible due to tree cover and infrastructure on the island. Credit: The all-Geo, with rights from Department of Natural Resources.



High-resolution elevation data can aid in locating where and when landslides occur. In this image, small-scale landslides are visible through lidar bare earth data that were previously unknown due to tree cover. Credit: <https://www.usgs.gov/centers/earth-mapping-data-user-improvement-program>

AGI is grateful to the following individuals and organizations who contributed images, resources, and guidance during the development of this poster: Daniel Coe and Abigail Gleason (WA-DNR); Jason Stoker, Vicki Lukas, Anjana Shah and Warren Day (USGS); Aaron Koelker (FL-GIO); and Troy Blandford (MT State Library). Poster ©2023 AGI.



2. Learn more about the [United Nation's Sustainable Development Goals](#) (SDGs). For each image on the poster, list which SDGs could be aligned to what is shown and explain how.
3. Lidar can make geologic features apparent, such as fault scarps and landslides, that may not be visible in satellite imagery. What other types of geologic features or processes might be hidden that lidar can help locate and measure?
3. The USGS used lidar data to help make comparisons of pre- and post-fire conditions. What differences do you notice between the two models? What questions can be answered with these images? What other questions do you have after analyzing these models?
4. Three images on the poster show rivers. List how these rivers are similar and how they are different. What could be some factors causing these differences?
5. Consider the Montana active and past river channels in the purple image on the right side of the poster. What do you notice about the right side of the image and the left side? What might have caused these differences?
6. Examine the top right image that displays the airborne magnetic and radiometric data collected over Charleston, South Carolina. What do you notice about the bright yellow colors that display a concentrated thorium deposit? Is there a pattern that you see? Are there common locations where they are found? What might explain your observations? Learn more about this image by watching the ESW webinar, "[The Future of Earth's Critical Materials](#)", on October 12 during ESW.

NGSS

PE: Engineering, Technology, and Applications of Science, [2-ESS1-1](#), [4-ESS2-2](#), [MS-ESS2-2](#), [HS-ESS2-1](#)

DCI: The History of Planet Earth; Earth's Materials and Systems; Plate Tectonics and Large-Scale System Interactions

SEP: Analyzing and Interpreting Data; Constructing Explanations and Designing Solutions; Developing and Using Models

CCC: Patterns; Scale Proportion and Quantity; Stability and Change

Metadata

Tags: [activity](#), [geologic map](#), [lidar](#)

NGSS ESS Disciplinary Core Ideas (DCI's): [Earth's Place in the Universe \(ESS1\)](#), [Earth's Systems \(ESS2\)](#)

NGSS ESS Topics: [Earth's Systems](#)

NGSS Performance Expectations: [2-ESS1-1](#), [4-ESS2-2](#), [MS-ESS2-2](#), [HS-ESS2-1](#)



connecting earth, science, and people

Copyright 2024. American Geosciences Institute. All rights reserved.