

Use of Ground-Based LIDAR in Geomorphic and Surface Stratigraphic Studies

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ABSTRACT

In some circumstances ground-based LIDAR (three-dimensional laser scanning) can be more effective in mapping topography than airborne LIDAR. Although it takes a greater amount of time and effort to obtain coverage for a large area, ground-based LIDAR can yield digital elevation models with a spatial resolution of a few centimeters or better. Moreover, there are some environments where airborne sensors are not suitable. Here we report three such cases. The first is mapping the interior of natural caverns. In this situation 3-D laser scanning may be the only way to produce a highly detailed and accurate map. To illustrate this point, we present data from a 3-D scanning survey at Carlsbad Caverns National Park, New Mexico. The second case involves the mapping of sand dunes and monitoring their movement. To document the geomorphic evolution of a dune, researchers need to survey it repeatedly with centimeter resolution and co-register the coordinates of the digital elevation model from each survey. Here, we show examples from surveys conducted in the White Sands National Monument, New Mexico. The third case is where the topography involves vertical features such as deeply incised canyons, which airborne sensors cannot see. Using data obtained from an experiment in the Caprock Canyons State Park, we show that ground-based LIDAR can digitally capture the topography of an overhanging canyon wall and the stratigraphic boundaries exposed on the wall surface.