Lidar Love Lost? Can phodar from historic air photos replace lidar in Eastern Oregon?

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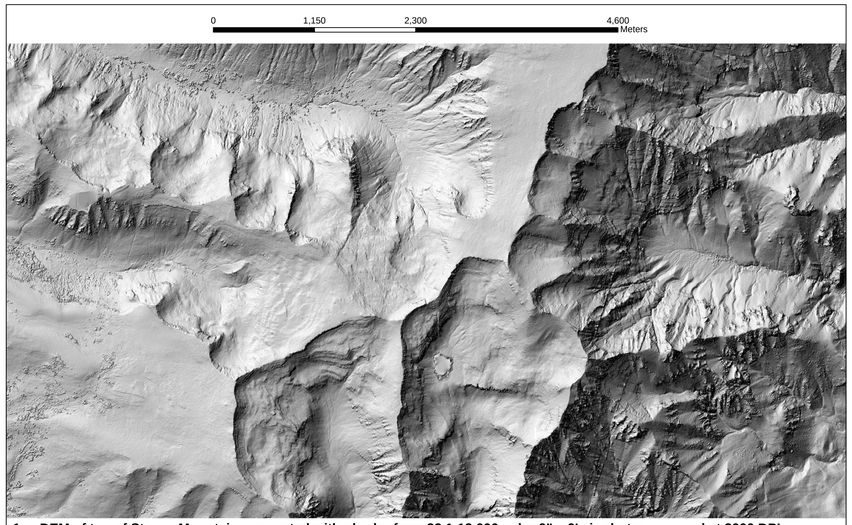
Steens

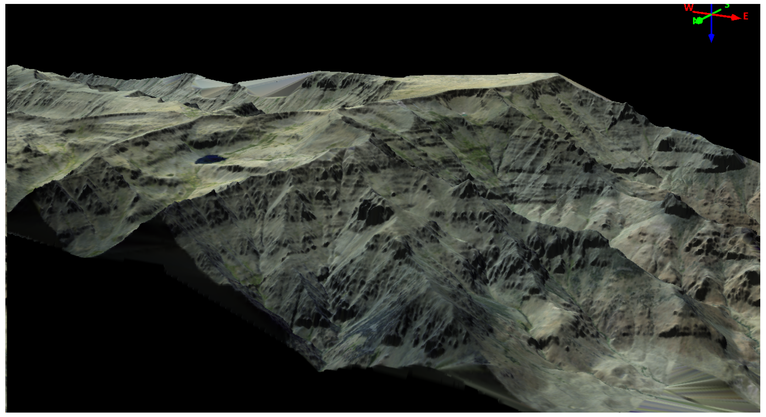


1 m DEM of top of Steens Mountain, generated with phodar from 33 1:12,000 color 9" x 9' air photos scanned at 2000 DPI, georeferenced with 5 control points from orthoimagery and 10 m DEM. Pixel size is 6 inches.

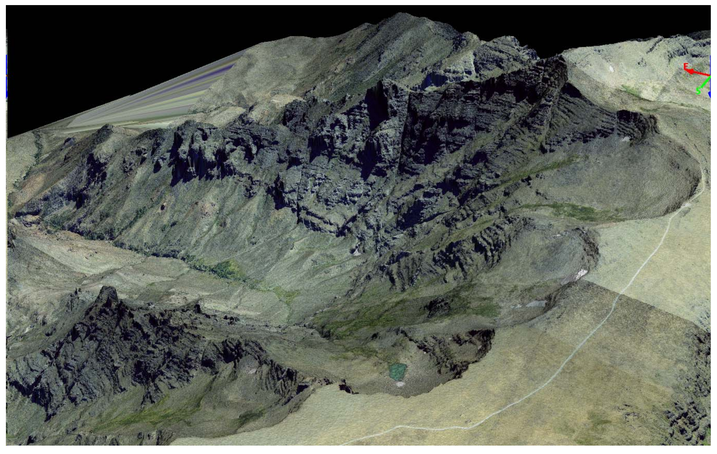
XY registration of the phodar DEM and orthoimagery is excellent

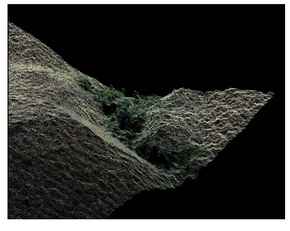
Although considerable progress has been made in collecting lidar data for western Oregon, statewide coverage is only at about 37% currently, and there is little prospect for funds to cover most of eastern Oregon. Phodar, or Structure from Motion (sfM) may provide an alternative approach to acquirring low cost topographic data in less densley vegetated areas, taking advantage of existing aerial imagery. DOGAMI is experimenting with this approach to support geologic mapping projects in the Harney Basin where lidar is not available. These tests use scanned historic aerial photos dowloaded from Earth Explorer or provided by the BLM.

Surface model built from phodar point cloud with RGB values from air photos



Surface model built from phodar point cloud with RGB values from air photos

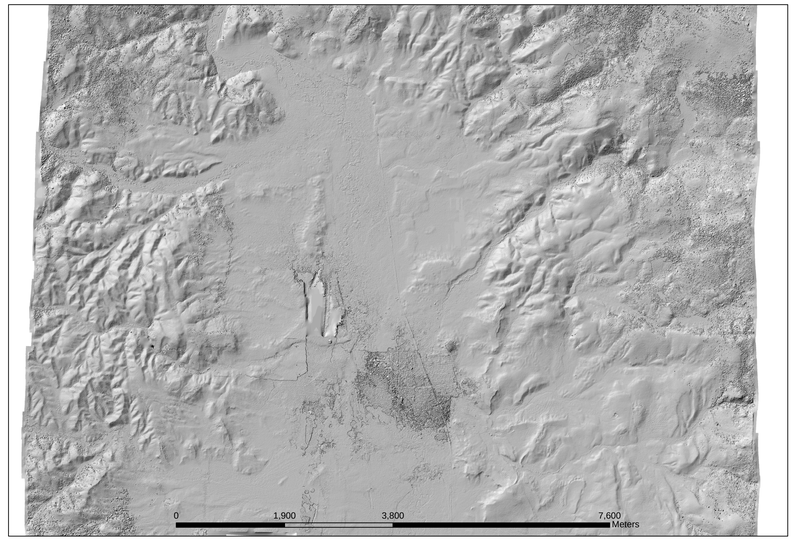


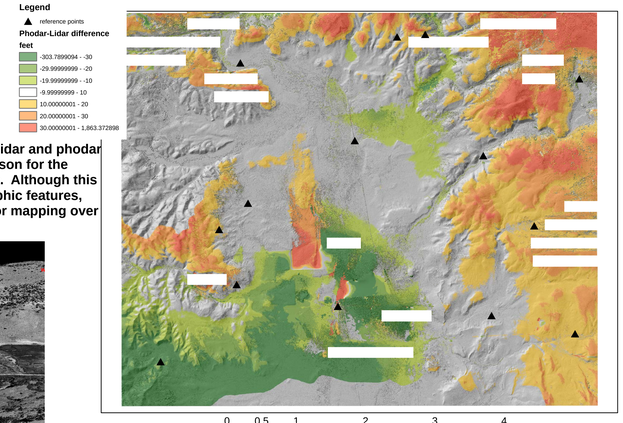


Trees visible in Steens phodar point cloud

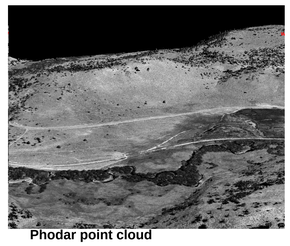
Silvies

Phodar DEM from forty seven 1962 BW 9" photos (1:15,000), scanned at ~ 2000 DPI. This image uses the high resolution dense cloud setting, which downsamples the original photos by a factor of 2. It was georeferenced with 15 points with XY values taken from current orthoimagery and Z values from 2007 lidar. Pixel size ~20cm.

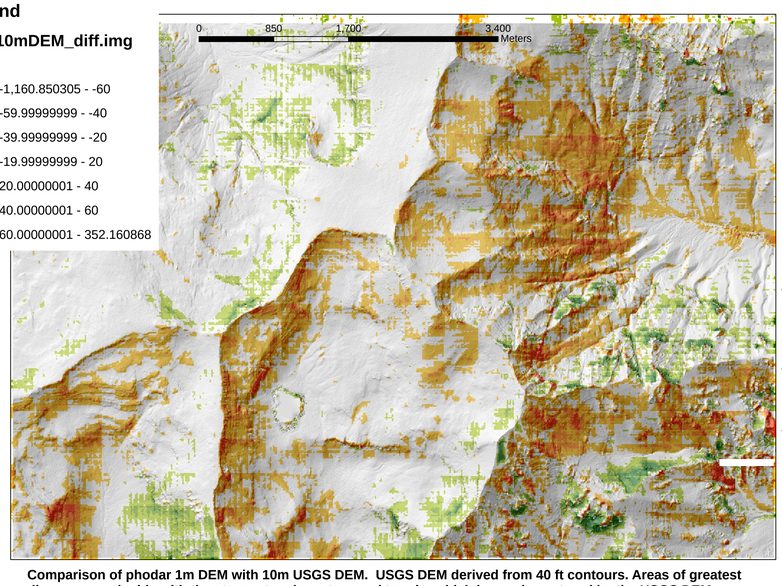




The elevation differences between the lidar and phodar in the Silvies test are large, and the reason for the distribution is not immediately obvious. Although this DEM could be used to identify geomorphic features, the vertical accuracy is not adequate for mapping over much of the area.



Phodar point cloud



Comparison of phodar 1m DEM with 10m USGS DEM. USGS DEM derived from 40 ft contours. Areas of greatest divergence coincide with the steepest and most rugged terrain, which is poorly captured by the USGS DEM.

Phodar DEMs from historical photos hold real promise, though issues of registrtion and resolution still need to be worked out. The next approach to test will be to use scanned frames of NAIP imagery, providing consistent age, resolution and color characteristics. If successful, DOGAMI may seek to complete new phodar DEMs for the entire Harney basin. Although there may be problems with absolute Z accuracy, the fact that XY accuracy is excellent still allows for geomorphic interpretation and mapping, and these DEMs could be used as a geologic map base. In the case of the Steens, the accuracy is within the tolerance of the 10m DEM.

1m phodar DEM | 1m lidar DEM | 40 cm phodar DEM