

Geoscientists discover hillslopes can reveal geographic activity below

August 23 2013, by Bob Yirka



Chocolate Hills of the Philippines. Credit: Ramir Borja / Wikipedia

(Phys.org) —A team of geoscientists from the U.K. and the U.S. has found that measuring the contour of hilly regions using a laser scanner can reveal aspects of the geographical history that led to its formation. In their paper published in the journal *Science*, the team describes laser scan analysis they undertook of a pressure ridge in California and the model

they created using data they'd obtained.

Scientists have known for many years that studying the shape of hills can sometimes offer some insight into the [geological history](#) that led to their formation—but because of erosion, such analysis can prove difficult. Now, in this new effort, the research team has taken advantage of new advances in digital topographic technology which has led to new ways of measuring hilly terrain, to create models that they report, just might lead to advances in predicting [geological activity](#).

In this new effort, the researchers looked to better understand hilly regions that came about due to the shifting of tectonic plates, i.e. earthquakes. They chose Dragon's Back Pressure Ridge, which lies along the San Andreas Fault. First, they loaded a [laser scanner](#) onto an airplane and used it to capture high [resolution data](#) describing the ridge below. Back on the ground, they analyzed the data comparing its geologic history with the slope and contour of the hills that formed the ridge. Because the data was so highly detailed, they were able to correlate the shape of the slopes to activity that had transpired below—something that had not be achieved before.

Also, because the data was both digital and highly detailed, they were able to use it to construct computer models that they could then manipulate to simulate different geographic scenarios. One interesting aspect they noted was that the contour of hilly regions appeared to lag behind their slope which was itself impacted by erosion. That finding allowed them to distinguish between hills that were growing versus those that were being worn away. Growing hills generally indicate seismic activity, which means the models they created could perhaps help predict future activity.

Overall, the researchers report that it is now possible, at least in some instances, to learn more about the geologic history of a region simply by

studying its contour and hills.

More information: Hillslopes Record the Growth and Decay of Landscapes, *Science* 23 August 2013: Vol. 341 no. 6148 pp. 868-871
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ABSTRACT

Earth's surface archives the combined history of tectonics and erosion, which tend to roughen landscapes, and sediment transport and deposition, which smooth them. We analyzed hillslope morphology in the tectonically active Dragon's Back Pressure Ridge in California, United States, to assess whether tectonic uplift history can be reconstructed using measurable attributes of hillslope features within landscapes. Hilltop curvature and hillslope relief mirror measured rates of vertical displacement caused by tectonic forcing, and their relationships are consistent with those expected when idealizing hillslope transport as a nonlinear diffusion process. Hilltop curvature lags behind relief in its response to changing erosion rates, allowing growing landscapes to be distinguished from decaying landscapes. Numerical modeling demonstrates that hillslope morphology may be used to infer changes in tectonic rates.

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