Geophysical Research Abstracts
Vol. 17, EGU2015-3661, 2015
EGU General Assembly 2015

Determining long-term regional erosion rates using impact craters

Stefan Hergarten and Thomas Kenkmann

Universität Freiburg, Institut für Geo- und Umweltnaturwissenschaften, Freiburg, Germany
(stefan.hergarten@geologie.uni-freiburg.de)

More than 300,000 impact craters have been found on Mars, while the surface of Moon's highlands is even saturated with craters. In contrast, only 184 impact craters have been confirmed on Earth so far with only 125 of them exposed at the surface. The spatial distribution of these impact craters is highly inhomogeneous. Beside the large variation in the age of the crust, consumption of craters by erosion and burial by sediments are the main actors being responsible for the quite small and inhomogeneous crater record. In this study we present a novel approach to infer long-term average erosion rates at regional scales from the terrestrial crater inventory.

The basic idea behind this approach is a dynamic equilibrium between the production of new craters and their consumption by erosion. It is assumed that each crater remains detectable until the total erosion after the impact exceeds a characteristic depth depending on the crater's diameter. Combining this model with the terrestrial crater production rate, i.e., the number of craters per unit area and time as a function of their diameter, allows for a prediction of the expected number of craters in a given region as a function of the erosion rate. Using the real crater inventory, this relationship can be inverted to determine the regional long-term erosion rate and its statistical uncertainty. A limitation by the finite age of the crust can also be taken into account.

Applying the method to the Colorado Plateau and the Deccan Traps, both being regions with a distinct geological history, yields erosion rates in excellent agreement with those obtained by other, more laborious methods. However, these rates are formally exposed to large statistical uncertainties due to the small number of impact craters. As higher crater densities are related to lower erosion rates, smaller statistical errors can be expected when large regions in old parts of the crust are considered. Very low long-term erosion rates of less than 4 meters per million years are obtained for large parts of the Baltic Shield and the Canadian Shield. A rather coarse world-wide map of erosion rates can be created using Voronoi diagrams.