Geophysical Research Abstracts
Vol. 15, EGU2013-13321, 2013
EGU General Assembly 2013

DEM Uncertainty propagation in second derivatives geomorphometrical maps

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In order to model the uncertainty from DEM a special model was created and implemented as Python script in ArcGIS Desktop using the ArcPy SDK provided by ESRI. The model is based on Monte Carlo simulation for generating noise and Map Algebra for adding the noise to DEM. The model can be used and independent script or combined with any other models. The inputs of the model are a DEM and an estimation of the DEM accuracy expressed as mean and standard deviation of the errors. The mean and standard deviation may be obtained from a crossvalidation/validation operation, if the model is obtained with geostatistics or by a simple validation with ground control points, if the model is obtained by other means than geostatistics. The DEM uncertainty propagation model assumes that the errors are normally distributed and thus the noise is normal distributed. This version of the model requires a Spatial Analyst extension, but the future versions may be used without or with Spatial Analyst extension. The main issue related with the addition of noise to DEM's in order to compensate for uncertainty is that the second derivatives are almost impossible to extract. This drawback was overcome by using and interpolated noisy surface in the uncertainty propagation model. Statistical analysis on raster obtained in each Monte Carlo simulation; for each realization of the model the following statistical analysis are performed: mean, minimum, maximum, range and standard deviation are extracted and saved as ESRI GRID format When the model finishes the specialist have an image about the uncertainties that might be contained by the DEM and in the same time have a collection of DEM that can be used to generate first and second order derivatives