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A methodology to assess the exactness of Stream Network modeling process on agricultural watersheds

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The goal of our study is to evaluate the exactness of stream network modeling process on agricultural watersheds. Agricultural watersheds topography is always changing, making it difficult to be modeled.
According to the standard ISO-7078 (ISO-7078, 1985) of the Inernational Organization of Standardization, the exactness of a measurement process or a modeled process can be defined as the difference between results obtained from the measurement process and a reference accepted as the «true value».
A small watershed of a dozen hectares size has been surveyed by terrestrial LiDAR (Light Detecting And Ranging) scanner and photogrammetrical techniques to produce a row data of 30 cm resolution. Three interpolation techniques i.e. natural neighbourg, multiquadratic radial basis function and inverse distance weighted have been applied on the original data to create original digital elevation models (DEM) of 1 m resolution. RTK (Real Time Kinematics) GPS (Global Positionning System) ground control points have been surveyed on the watershed to evaluate DEM errors and fit a variogram that is used by a conditional sequencial gaussian simulation model to generate error maps. However, ground control point's elevations accuracy is depending on the microtopography of parcels in an agricultural watershed. Depending on the crop that is planned by the farmer, the soil tillage will be different, and soil structure and roughness can considerably influence ground control point's elevation. Analysis of variance and geostatistical methods have been applied on total station and RTK GPS data to estimate intervals in which, ground control points elevations vary. These intervals have been estimated for two parcels that soils are tilled in different ways. These errors are added to the generated errors maps to create final error maps. The final errors maps are added to the original DEM to create likely DEM realizations for the watershed (Temme and al., 2007). Then, two spurious sinks filtering methods (Colson 2006; Lindsay and Creed, 2005) and one flat area treatment method (Jenson and Domingue, 1988) are applied on each DEM realization for preprocessing. Finally, the three common flow direction extraction methods (D8, D-infity and Multiple Flow Direction) are applied on each preprocessed DEM to extract stream Network. The extracted stream network is overlapped with RTK GPS field positioned stream network i.e. a polyline format data. To estimate the exactness of the stream extraction methods, the polyline format is converted in raster format. That allows to compute for each pixel of the observed stream network, the distance to the extracted stream network. Then, for each pixel the mean distance can be calculated, and can be represented through the stream network.
LiDAR technology is becoming useful for environment modeling because of his accuracy. Such quantity of data is not free of errors. This research will allow us to estimate the uncertainty of stream network modeled from agricultural watersheds by considering the main sources of errors that are propagated through computing processes.