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Issues with using high-resolution DEMs for fluvial geomorphology modelling

Andres Castro
University of Birmingham, United Kingdom (acastrob76@yahoo.com)

It is widely recognized that undertaking detailed fluvial morphology studies can be a difficult and expensive task due to the high amount of resources, such as time and highly trained personnel, that such studies requires in order to obtain accurate results. Yet, for a wide range of projects that in one way or another require the understanding fluvial systems, engineers are frequently challenged with the daunting task of managing expenses within tight budgets and expecting high quality results. It is with this perspective that it is often desired to simplify processes while maintaining a high reliability of results. In an attempt to tackle this issue the current PhD research presents an alternative methodology to undertake river geomorphology studies, by applying an automated procedure to model stream power from DEMs generated from high resolution LiDAR data. The main aim of the research is to estimate the stream power distribution along selected UK catchments and link the estimated stream power values to floodplain development processes. The raw LiDAR data, in the form of ASCII text files, used for the study correspond to 1m, 2m and 10m resolutions. During the process of creating the DEM of one of the selected rivers, the River Teme, the presence of a number of "blank spots" within the mosaic was noted. These areas corresponded to NoData zones generated presumably from the deflection of the laser beam on a water surface. Given that the GIS software didn't consider the missing data areas as part of the DEM, even though most of the "blank spots" were located on the river channel, it was necessary to develop a procedure in order to eliminate the NoData zones and correct the DEM, prior to undertaking the hydrological analysis of the catchment, without compromising the quality of the rest of the data.
In search of an improved quality of results it has been commonly assumed that the higher resolution of the data the better and more accurate results are to be obtained. In the past much attention was focused on how to obtain and process the high resolution data. Nowadays with the availability of very high resolution spatial data and very powerful hardware it is becoming apparent that the quality and accuracy of results depends greatly of the software performance, as it has been found of the current research. While performing the hydrological analysis on GIS of the aforementioned selected UK rivers it was found that very high (1m or 2m) resolution LiDAR data does not provide of the most accurate representation of the rivers' flow paths. When compared with 10m resolution data it becomes apparent that the "lower" resolution data produces better results than the 1m or 2m data, more adjusted to the river actual path. It is possible to argue that the reason for this resides in limitations of the software itself. It is also necessary to point out that, while the for the current research purposes the 10m resolution data provides of better results, for other applications, such as topographic analyses of the area, very high resolution data (1m or 2m) is probably more adequate.