Creating High Resolution Digital Terrain Models with Airborne Laser Scanner (ALS)

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The standard way of obtaining the topographic measurements of the land surface has been primarily through the use of photogrammetry, assisted by field data collection. Nowadays, Airborne Laser Scanning (ALS) is gaining importance as a tool for acquiring Digital Terrain Models (DTM) in forested areas as it overcomes most photogrammetry limitations. The quality of a DTM derived from ALS data is influenced by a large number of factors such as systems, filtering algorithms and interpolation methods. This dissertation analyses the interpolation errors introduced by eight different interpolators in a forest area site in Kielder Forest District. The study area is a 750 x 1800 m forest dominated by Sitka spruce plantations aged from 9 to 57 years. The influence of the ALS point density in the interpolation error was studied using the Split-Sample validation. The ALS dataset was reduced to 50%, 25 % and 5 % of the original density (0.72 points/m^2), and the effects of others factors like terrain slope, vegetation characteristics and the spatial pattern of the error in the interpolated surface were also examined. In order to approximate a model of the ground surface, the last returns were previously filtered. Kriging interpolation method was found to be the most suitable in terms of RMSE and reliability for all the studied densities. The original dataset kriging error was 6 cm and it increased to 13 cm when only 5 % of the initial points were used to perform the interpolation. The interpolation error was only affected by the terrain slope in areas of low point density. It was also found that with the initial point density, even in very dense Sitka spruce stands (2000 stems/ha) there is sufficient ALS penetration to provide a reliable and accurate DTM. However, as ALS samples diminish, the interpolation error increases, especially in Sitka stands aged between 20 and 35 years.