

# Assessing the consistency of LiDAR elevation models

Peter F Fisher and Nicholas J Tate

*Department of Geography,  
University of Leicester  
e-mail: pff1@le.ac.uk*

**Abstract.** The recent availability of LiDAR-derived elevation data has enabled the widespread creation of high resolution and high precision DEMs. The Environment Agency for England and Wales regularly collects such LiDAR-derived elevation data with a spatial resolution of 2.5 m and specified vertical precision of 5 cm. This paper reports on research with the objective of assessing the reliability of these data for monitoring the in-fill of landfill sites in order to determine the tax liability of landfill operators. Given the high vertical precision of the LiDAR sensor, it is very hard to obtain elevation data of greater precision for comparison and accuracy evaluation. Therefore in this research we employed a methodology whereby consistency is estimated from a time-series sequence of elevation models. Specifically, we compared elevation models of the landfill area from LiDAR measurements obtained at two dates. We then assumed that the elevation surface outside the landfill has not changed between these dates. In the case of buildings and roads and other man-made features this is undoubtedly true, however vegetation growth and even field ploughing may result in some elevation change. A visual examination of the resulting models suggested that the elevation errors were normally distributed, and slightly biased but with systematic spatial patterns, probably related to re-sampling. The variogram characterising the distribution of these errors was then used to interpolate realisations of a possible error surface across the landfill. This allowed a comprehensive set of error statistics to be generated for the change in landfill elevation. In this paper we discuss the results of this analysis, and compare the relative usefulness of the theoretical sensor precision with the empirical error estimates from the comparison of the multi-temporal images and the stochastic simulations for evaluating the accuracy of the estimate of the volume change of the landfill site.