Here we describe and apply a semi-automated, object-based method for extracting vector-building footprint polygons from aerial photographs (orthophotos) within urban settings. The approach integrates the use of high resolution orthophotos and image segmentation software and is compared with methods using Light Detection and Ranging (LiDAR) as the source data input. LiDAR data gives the best results with less processing, but is not widely used by municipalities due to the expense. Results from semi-automated image segmentation of the orthophotos showed a high accuracy between extracted building segments and reference building footprints for two study sites, comparable to those achieved using LiDAR data. We recommend image acquisition during summer months with a resolution of 10 cm by 10 cm. When data acquisition budgets are limited, combining ancillary GIS on roads with a semi-automated and object-based segmentation approach is a best practice strategy for land cover feature extraction and change quantification.

1. Introduction

Accurate and up-to-date building footprints are an essential component of all municipal geographic information system (GIS) databases. Vector footprint data are used on a routine basis for multiple purposes in urban planning, utility management and general land development monitoring needs [Schneider et al. 2009; Aldred and Wang 2011]. Given the rate of global urban change, it is essential to devise reliable methods for systematic updating and maintenance of urban GIS databases and individual building locations [Hermosilla et al. 2011].

The current state-of-the-art method for building footprint or rooftop mapping, is to combine Light Detection and Ranging (LiDAR) data with multi-spectral imagery that has sub-metre spatial resolution. While LiDAR data provide the basis for extracting building structures in two and three dimensions (e.g., Alexander et al. [2009]; Mongus et al. [2014]), the multi-spectral data are used to differentiate rooftops from other impervious surfaces [Hermosilla et al. 2011] and to provide additional spatial context. The LiDAR data need to have a sufficiently high point density to define the planes of the roof. In previous work, a LiDAR point density as low as 1 point/m² (e.g., Rottensteiner and Briese [2002]), or lower (e.g., 0.1 points/m² [Sohn and Dowman 2007]) was sufficient, but typically higher point densities are preferred (e.g., 8 points/m² [Niemeyer et al. 2014]) to improve results. Analysis approaches that