Geophysical Research Abstracts
Vol. 13, EGU2011-6268, 2011
EGU General Assembly 2011

Multitemporal aerial LiDAR data for supporting the monitoring and preservation of archaeological areas

Rosa Coluzzi and Rosa Lasaponara

Istituto di Metodologie per l'Analisi Ambientale, IMAA-CNR, 85050 Tito Scalo (PZ), Italy (lasaponara@imaa.cnr.it; coluzzi@imaa.cnr.it)

This paper is focused on the potential of airborne ALS for supporting (i) the detection,(ii) monitoring and (iii) preservation of archaeological areas. Airborne laser scanning (ALS) is an optical measurement technique for obtaining high-precision information about the Earth's surface including basic terrain mapping (Digital Terrain Model, bathymetry, corridor mapping), vegetation cover (forest assessment and inventory), coastal and urban areas. Recent studies examined the possibility of using ALS in archaeological investigations to identify earthworks, although the ability of ALS measurements in the change detection and monitoring has not yet been studied in detail.
The investigations were carried out for a test site in Southern Italy which is characterized by vegetation cover, complex topographical and morphological features. The LIDAR survey was carried out by GEOCART on September 2008 and November 2009 using a full-waveform scanner, RIEGL LMS-Q560 on board a helicopter to obtain a higher spatial resolution.
The difference obtained from the DTMs extracted on 2008 and 2009 was processed using spatial autocorrelation statistics, in order to measure and analyze differences and variations. The use of classic spatial autocorrelation statistics such as Moran's I, Geary's C, and Getis-Ord Local Gi index (for more information see Anselin 1995; Getis and Ord 1992) enables the characterization of the spatial autocorrelation within a user-defined distance. For each index, the output is a new image which contains a measure of autocorrelation around the given pixel. In particular:
(i) the Local Moran's I index identifies pixel clustering. Positive values imply the presence of a cluster of similar values which means low variability between neighboring pixels, whereas negative values indicate the absence of clustering which means high variability between neighboring pixels.
(ii) the Getis-Ord Gi index permits the identification of areas characterized by very high or very low values (hot spots) compared to those of neighboring pixels.
(iii) the Local Geary's C index allows us to identify edges and areas characterized by a high variability between a pixel value and its neighboring pixels.
All of these indices are available as tools of commercial software for Geographical Information System (GIS) or image processing such as ENVI.
Results from the analyses we performed enabled the identification and characterization of a small landslide, which appeared to be quite stable during the investigated time window. Some variations in geomorphological features were captured.
Results from geostatistical analysis emphasize that the multitemporal DTM-LiDAR data is a powerful instrument for detecting small surface discontinuities as well as subtle changes which can be relevant not only for investigating geomorphological processes but also for assessing the state of "conservation" of the archaeological area. Further investigations will be done in order to link the multitemporal data analysis with the meteorological data set.