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On the Airborne Laser Scanning data processing for capturing fuel layer and mapping fuel properties

rosa coluzzi, rosa lasaponara, and antonio lanorte
CNR, IMAA, tito scalo (PZ), Italy (coluzzi@imaa.cnr.it)

ALS (Airborne Laser Scanning) is an active remote sensing technology, based on laser pulses, which measures properties of scattered light to find range and/or other information of a distant target. The range to an object is determined by measuring the time delay between transmission of a pulse and detection of the reflected signal.
ASL can be mounted onboard an aeroplane or helicopter. The acquisition system consists of the following individual components: (i) laser ranging device, (ii) Inertial Measuring Unit (IMU), (iii) onboard Global Positioning System (GPS) positioning device, (iv) ground GPS data acquisition at the same time as the LiDAR survey, (v) Digital Camera (Optional). While each of these components are operating independently, integration of all of them that allows us to obtain measurements with a high level of accuracy. The LiDAR technology exceeds other methods such as stereo-photogrammetry or interferometric SAR particularly in vegetated areas due to the direct determination of elevation and the penetration capabilities of the laser beam through gaps in vegetation .
Through its efficient data sampling capabilities Airborne Laser Scanning (ALS) has completely revolutionized the area of bathymetric and topographic surveying, corridor mapping and coastal and urban area monitoring. ALS data are used in land cover classification, to estimate forest tree height, to assess seasonal canopy differences, to obtain forest inventories. The applications of airborne ALS have been increasing rapidly over recent years. Recent studies have examined the possibility of using LIDAR in fuel type characterization and mapping
The latest generation of airborne ALS, now available, is the Full –Waveform (FW) scanner which offers improved capabilities especially in areas with complex morphology and/or dense vegetation cover. Nowadays investigations based on the latest generation of ALS are still quite rare, the majority of published studies are based on data collected by conventional ALS.
In this paper we discuss the results obtained from the approach we devised to extract information on fuel layer. We derived tree-model using the measurements of crown diameter and height canopy obtained from the point clouds.
The workflow for processing airborne laser data (LiDAR) and airborne images may be divided into five major steps: (i) initial setup and data calibration, (ii) classifying points, (iii) processing images, (iv) validating positioning, and (v) creating delivery products.
The initial setup involves importing all the necessary raw data into the processing software, applying coordinate transformations and calibration, which is based on the comparison of the laser data produced by different flight passes which overlap each other.
Later both Digital Surface Model (DSMs) and Digital Terrain Model (DTMs) are obtained. Fuel characterization demands a detailed and reliable separation of different layer of vegetation. Such classification can be obtained using the diverse laser measurements and information, such as: (i) height; (ii) intensity; (iii) echo width. Herein, we will focus on the elaboration performed using both height, obtained from the 3D point clouds, and ortophoto acquired at the same time as ALS survey.
Due to its efficient data sampling capabilities, FW-LIDAR is capable of detecting target with an altimetrical resolution of <0.1m. To achieve this level of resolution, it is necessary to process the ALS point cloud using appropriate numerical filters.
In this case study, the classification of laser data was performed using a strategy based on a set of “filtrations of the filtrate”. Appropriate criteria for the classification and filtering were set to gradually refine the intermediate results.