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A NEW EFFECTIVE WAY ON VEGETATION MORNITORING USING MULTI-SPECTRAL CANOPY LIDAR

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Abstract. Airborne Laser Scanning (*ALS*) has been a well-established tool for the measurement of surface topography as well as for the estimation of biophysical canopy variables, such as tree height and vegetation density. By combining *GPS* and *INS* together, *ALS* could acquire surface information effectively in getting the mass production of *DEM* and *DOM*. However, up to now most approaches are built upon single-wavelength Lidar system, which could only provide structure information of the vegetation canopy, the intensity information was rarely used to monitor vegetation growing state as its limitation on spectral characteristics. On the other hand, positive multi/hyper-spectral imaging instruments highly rely on the effects of weather, shadow and the background noise etc. The attempts to fuse single-wavelength Lidar data with multi/hyper-spectral data also been effected this way. Thus, a concept for a multi-wavelength, active canopy Lidar has been tested in this paper. The proposed instrument takes measurement at two vegetation-sensitive bands separately at 556 nm and 780 nm, which, according to the correlation analysis between the wavelengths and biochemical content with plenty of ground *ASD* reflectance dataset, showed a high correlation coefficient on the chlorophyll concentration as well as nitrogen content. The instrumentation of the multi-wavelength canopy Lidar employs low power, solid and semiconductor laser diodes as its laser source and the receiver consists of two channels, one for 556 nm back-scatter signal and the other for 780 nm. The system calibration has also been done by using a standard white board. Multi-wavelength back-scatter signals were collected from a scene consists of stones, healthy broad-leaf trees and unhealthy trees that suffer from disease(part of its leaves were yellow). It is shown that the multi-wavelength canopy Lidar could not only capture the structure information, but also could pick up the spectral characteristics. A further test of three dimensional reconstruction and *SVM* based classification were also done and the results showed that the spatial resolution could be as high as 5 mm and the accuracy of classification on those three features (woody/un-woody, healthy/unhealthy) reached to 86%. Therefore, the multi-wavelength canopy Lidar shows its

potential capability on vegetation monitoring in a new effective way.

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