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LONG FULL WAVEFORM LIDAR THROUGH 60 METER OF FOREST CANOPY

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THEME: Airborne and innovative remote sensing platforms and techniques (**SENS**)

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ABSTRACT:

The earliest airborne Light Detection And Ranging (LiDAR) scanners delivered just a single elevation return per laser shot. Later systems produced a return for the first and the last interaction between the laser and the ground below. Common discrete return LiDAR produces up to 4 returns. This allows picking up hits of electricity or telephone wires and captures more information about the vegetation structure. Recently, waveform digitizers have become popular that capture the reflection of the emitted laser pulse with much more detail: The waveform returning to the plane is digitized up to one billion times per second so that the intensity of the laser pulse's reflection is recorded every nanosecond giving a vertical resolution of one sample each 15 cm. Because these full waveform LiDAR system are capable of capturing the "stuff below" with much more detail, they are especially useful for vegetation analysis.

Due to data storage bandwidth limitations typical waveform digitizers record only one or two segments of 80 up to 256 samples for those parts of the returning waveform where sufficient signal activity is detected. This covers vertical distances of 12 up to 38 meters which is not always sufficient to record the entire interaction between the laser pulse and all vegetation layers down to the ground for tropical rainforests where the canopy contains tall tree that are 45 meters and higher. The entire full waveform could offer even greater advantages over discrete return LiDAR systems that often do not deliver a ground return. It should be possible to extract those faint waveform peaks that are usually not recorded and extract additional details about the topology of the terrain that is often missing from LiDAR surveys in dense tropical forests.

In this talk we present unique results of 60 meters of full waveform LiDAR digitized above dense primary rainforest with heights of 45 meters in Thailand. We used a RIEGL LMS Q680i full waveform LiDAR scanner with a non-standard acquisition setting that continued to always records 400 samples after the initial canopy hit.

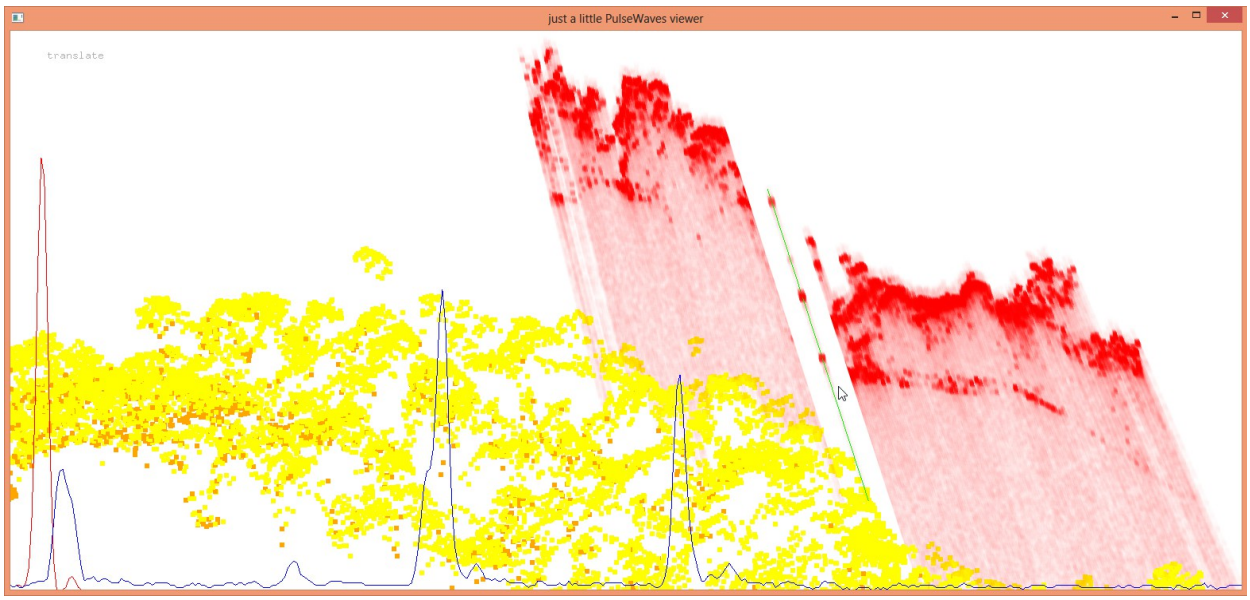

Figure 1: The outgoing (red) and returning (blue) waveform plots belong to the pulse pointed to by the cursor.

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