CAN APPLE LIDAR CAMERAS BE RELIABLY USED FOR COASTAL MONITORING?

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INTRODUCTION AND BACKGROUND

Smart phones are becoming ubiquitous devices that can be exploited for citizen science applications, including coastal monitoring (Harley et al., 2019). In 2020, Apple released new versions of their iPhone (12+) and iPad Pro (2020+) that included built-in LIDAR functionality. These were accompanied by a series of commercial applications (e.g., 3DScanner, Scaniverse, and many others) built to capture high resolution objects at close range using mesh or point-cloud formulations. The built-in GPS of the iPhone/iPads however is of low accuracy (~5m horizontal) compared to the demands for scientific surveys. Fortuitously, commercial hand-held RTK-GNSS units (e.g., EOS Arrow Gold, Pix4D viDoc, RedCatch) that can talk directly to the smart phones and provide survey-grade positioning have also been recently developed. The Pix4D viDoc and RedCatch devices are targeted at photogrammetry applications rather than the internal LIDAR scanner, while the EOS Arrow family is application independent.

In the past year, several papers have been published examining the ability of smartphones equipped with LIDAR to be used in various geophysical applications (Luetzenburg et al. 2021; Mokros et al. 2021; Spreafico et al. 2021). This then begs the question – can these smart phones equipped with LIDAR be reliably used for coastal monitoring with existing (free) commercial applications?

METHODS

The results presented here are based on the iPad Pro 2020 and the iPad Pro 2021, using the Scaniverse scan app, 3DScanner App, and the EOS Arrow Gold RTK-GNSS unit. iPad scans were done without the EOS Arrow Gold to understand raw capability indicative of what a person of the public might have access to as well as with the EOS Arrow Gold to understand if survey grade accuracy could be achieved without the need of ground control points. Scans were done at Narrabeen-Collaroy beach and at known survey marks. Repeat scans (x3) at each of the five transects were done to quantify repeatability using CloudCompare software. Scans were also compared to a Trimble RTK-GNSS survey (linescan or point) to determine raw accuracy.

RESULTS AND DISCUSSION

Repeat scans of five beach profiles at Narrabeen (Figure 1) were compared in both aligned (.xyz files) and raw georeferenced (.las) forms. Using 47 pairs of non-georeferenced (.xyz) scans, the aligned meshes had a mean error of ~0.07m and a standard deviation of error of ~0.11m. However, when raw georeferenced (.las) files were compared (total of 19 repeat scans) mean error was ~3m with a standard deviation in error of ~1.5m. When the scans were compared to the RTK surveys, mean errors were on the order of 3.5m with a standard deviation error of 0.05-0.06m. Overall, beach slopes were shown to be well captured with the source of error largely due to a vertical offset between the scans and the RTK data. This highlighted the expected issues with (1) the internal GPS accuracy and (2) how the scan apps create geo-referenced mesh files.

Further testing with the EOS Arrow Gold RTK-GNSS unit did not initially remove the vertical bias error or improve the geo-referenced mesh files. Correcting these errors will be discussed in the presentation.

Figure 1 - Example of scanning beach with iPad Pro.

REFERENCES

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