Application of unmanned aerial vehicle (drone) technology for an evaluation of surface drainage to an urban lake at the New Jersey shore

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Introduction

By using aerial drone footage we can study drainage paths to a lake, which may play a role in the occurrence of harmful algal blooms (HABs) in Monmouth County's Lake Como (pictured to the right). Lake Como has an urban watershed that supports a highly active community of residents. Much of the work studying this lake is a first of its kind.

Methods

-Use of **DJI Phantom 4 Pro** for aerial imaging at a height of 100 meters

-**WebODM** "stitches" together a to-scale orthophoto map of an area draining to the lake

-Classify orthophoto using **maximum likelihood classes** of surfaces

-A digital surface model (DSM) is constructed using **structure from motion**

-**ArcGIS hydrology** tools map drainage paths

-Compare to light detection and ranging (**LiDAR**) data

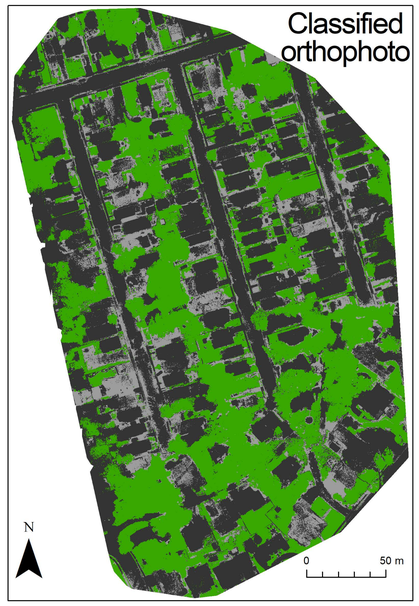
Results

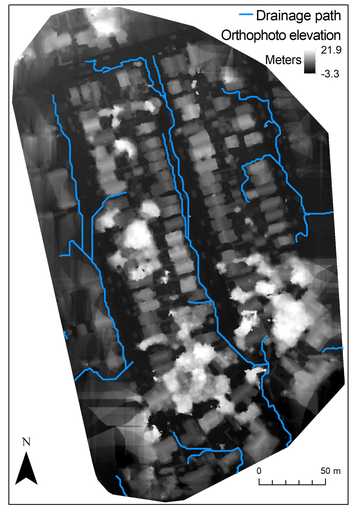
-**Orthophoto** of 40 drone images

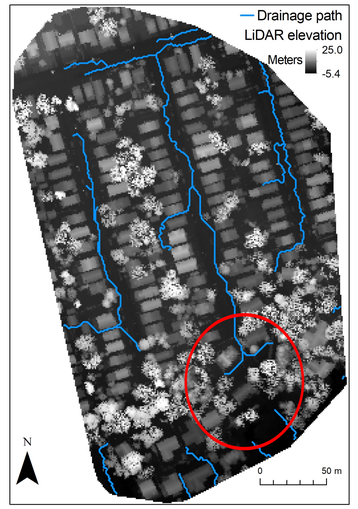
-**Impervious surfaces** assigned to drainage paths

-LiDAR drainage paths require **more processing** (first returns at buildings and last returns elsewhere)

-Comparison of orthophoto and LiDAR drainage paths completed at right, with some **key similarities and differences**



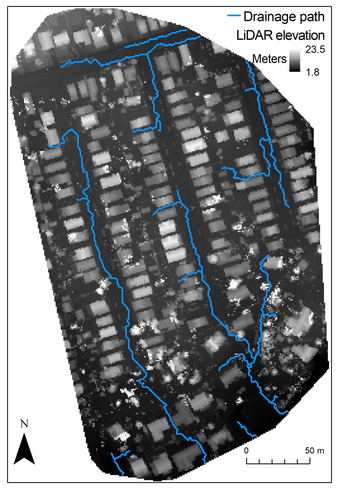


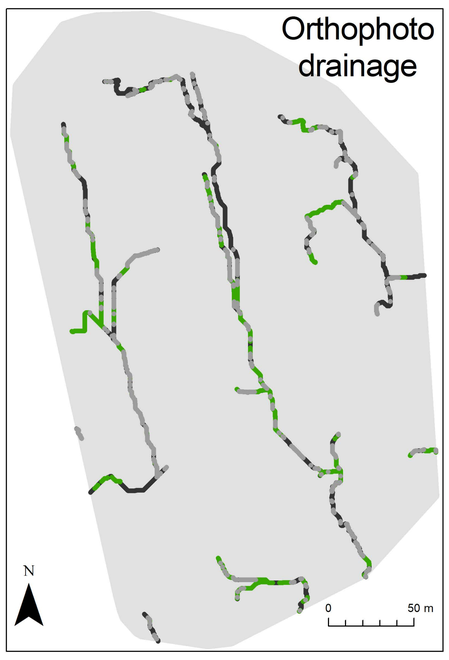


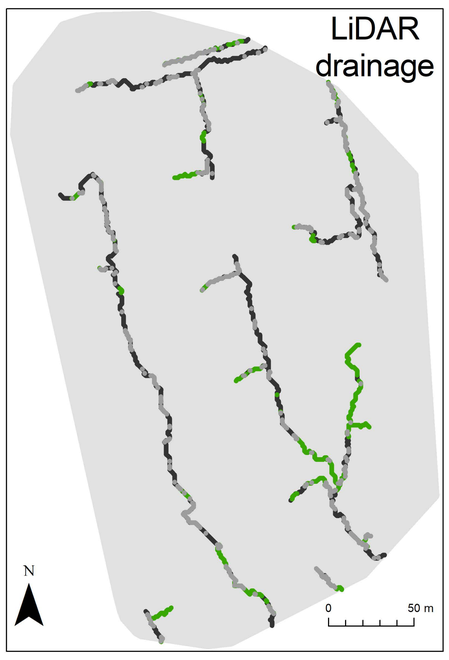
Surfaces

- Impervious
- Vegetation
- Bare ground

LiDAR → **Last returns**







Comparison of drainage paths derived from orthophoto and LiDAR

	Length (m)	Average difference (m)	Percent draining to lake	Percent impervious
Orthophoto	1457	14	100	50
LiDAR	1464	-	63	60

Conclusions

-Drone is an **inexpensive** approach to map high-resolution drainage paths in an urban area compared to LiDAR

-Proposed approach allows **surface classification** and **return mapping** on a regular basis

-DSM processing of drone imagery is **automated** as opposed to LiDAR, which requires post-processing

-Due to differences, drainage paths of both approaches need to be **field-verified** during a storm

-Drainage paths of the proposed approach can be used in a **comparative study** of a lake that has HABs and a lake that does not (is this due to drainage?)

Acknowledgements

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