Inundation Mapping using UAVs: Fixed Wing vs. Multirotor

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OUTLINE

- Background
- Objectives
- Methodology
- Results
- Conclusions

Flooding: Most common and frequent natural disaster

- Hurricane Harvey (2017): $125 billion in damage, 88 deaths in Houston, TX (source: NHC)

Source: HTTPs://help.floodfactor.com/hc/en us/articles/360051062333-Adaptation-types

Accurate flood-risk mapping is critical:

- Supporting emergency-response planning
- Providing damage assessment
- developing land use plans and regulations

Boston flood map in 3D

https://www.bostonharbornow.org/what-we-do/work/climate-change-preparedness/maps/

Unmanned Aerial Vehicles (UAVs)

- It has created a new tool for surveying and geospatial data collection

UAVs main advantage:

- Flexibility
- Provide high-resolution images

http://myspatial.com.my/services/data-acquisition/light-detection-and-ranging-lidar/

Types of UAVs: Fixed wings vs Multirotor

Fixed Wings:

Advantages: Large area coverage, Long endurance.

Disadvantages: large area for landing/take off, Expensive, no hover.

https://www.directindustry.com/industrial-manufacturer/fixed-wing-uav-86134.html

Multirotor wings:

Advantages: vertical take-off and landing; can hover in a stationary position, ease of use.

Disadvantages: short flight time, small payload.

http://www.thedronesmag.com/responsible-flying-with-multirotors/

"To investigate the advantages of using small UAVs, both multirotor and fixed wing for flood mapping"

Study Area Data

Study area:

- Princeville North Carolina, USA

https://geology.com/lakes-rivers-water/north-carolina.shtml

Data:

- High-resolution UAV images acquired by North Carolina Emergency Management
- **Resolution**: up to 3cm

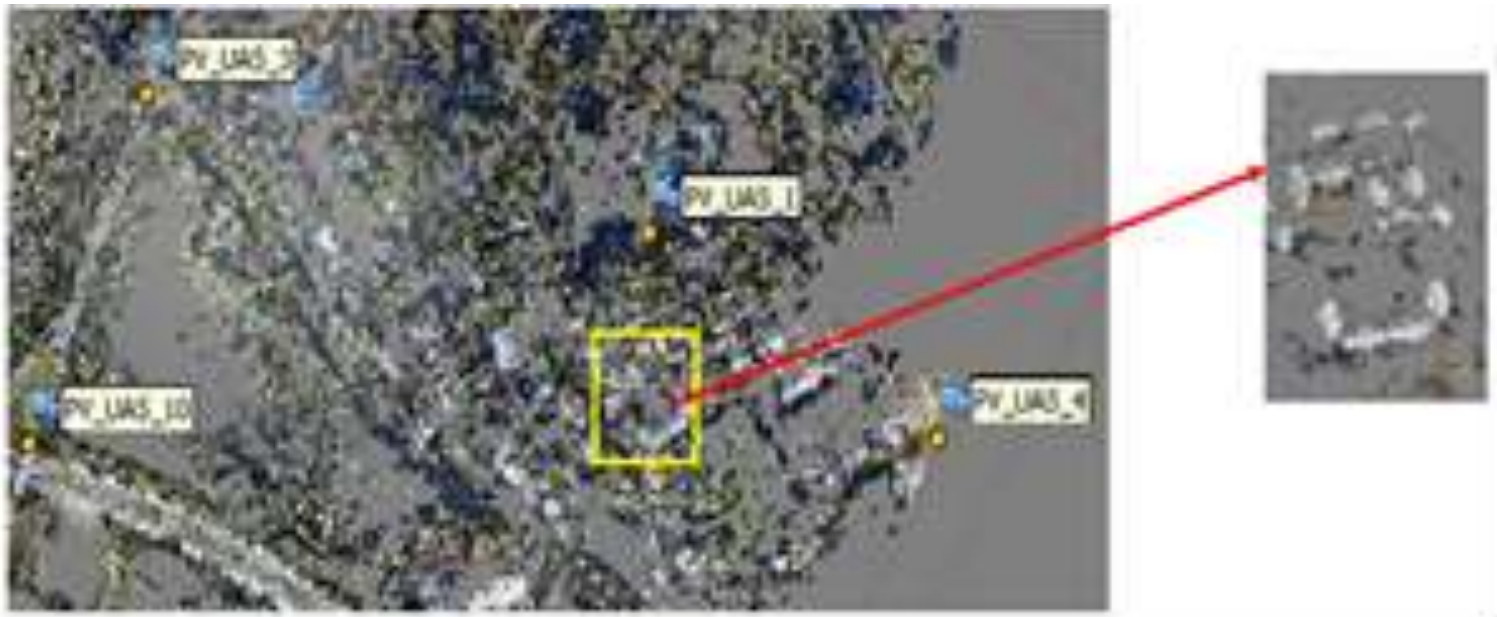
Study area: Princeville, North Carolina during Hurricane Matthew

UAV Flood Mapping:

Stage 1: 3D Point cloud generation

Stage 2: Georeferencing

Stage 3: Creating DSM



3D Point cloud generation and georeferencing

UAV Flood Mapping Results:

3D flood map

DSM

- UAV data collection is a quick, low-cost approach to collect high-resolution survey and geospatial data for emergency-response planning, maintaining and designing infrastructure.
- Creating quality flight plans, including sufficient control, and knowing the limitations of this technology before performing a mission is important.
- Surveying of large areas that do not require highly accurate data will be best served by a fixed wing. Smaller sites that need highly accurate, possibly multi-sensor, outputs may result best from a multi-rotor.
- Placing GCPs during flooding events is challenging, the use of RTK UAVs can be implemented.

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