Inundation Mapping using UAVs: Fixed Wing vs. Multirotor

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**Flooding:** Most common and frequent natural disaster

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

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.

**Multirotor wings:**

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

**Disadvantages:** short flight time, small payload.


“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

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

Study area: Princeville, North Carolina during Hurricane Matthew

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