SHOUT4Rivers Program Review

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Project Objective

- UAS Applications
  - Mapping of waterways
  - Detect temporal changes in waterways
  - Discriminating intertidal waters
  - Identifying species (plants and animals)
  - Development of high resolutions DEMs
  - Water quality assessment
  - Boundary layer observation

- Improvements to hydraulic modeling
  - Updated stream networks
  - Improvements in flood forecasts
The System

- Nova by Altavian
- Flown at 800 feet AGL
- Covers 1-2 mi\(^2\) per hour
- ~ 60 minute flight time
- Flown every two months
- Multispectral payload (CIR)
- Still imagery, 5184x3456 pixels
- FOV is 58.27 degrees cross-track (40.86 degrees along-track)
- Footprint is 892 ft x 596 ft @ 800 ft AGL
- GSD is 2.06 in/pixel along-track @ 800 ft AGL
Data Collection

- Nov 6-7, 2013: Test mission
  - Alternated flying an AeroVironment Puma and Altavian Nova over 1.5 days.
    - Puma more durable, but Nova had mapping payload.
- July 8-11, 2014: 1” GSD RGB & 2” GSD CIR imagery
- Aug 5-8, 2014: 1” GSD RGB & 2” GSD CIR imagery
- Sep 23-26, 2014: 2” GSD CIR imagery
- Dec 15-18, 2014: 2” GSD CIR imagery
- March 2-6, 2015: 2” GSD CIR imagery
- May 17-22, 2015: 2” GSD CIR imagery
- Aug 9-14, 2015: 2” GSD CIR imagery

Imagery can be obtained from
http://www.gri.msstate.edu/geoportal/
  - Apply for account in upper right. Human approves.
Data Acquisition
Data Acquisition

- Data are prepared at NGI
- Flight imagery is mosaicked
- Imagery is then analyzed using RS and GIS platforms
  - ERDAS Imagine
  - ArcMap
Creating Land Water Masks

- Method used:
  - Density Slicing
  - NDVI (Normalized Difference Vegetation Index)
  - Principle Component Analysis
  - Supervised and Unsupervised Classifications
Density Slicing

- ERDAS Imagine
- Density Slicing:
  - One-dimensional selection used for classification (single band only)
  - UAS has 3 bands, but only the NIR band will be used for land water masks
Land Water Mask; Density Slicing

<=$\text{NIR vs Mask}$ $->$

Mask Pixel Values

Definite Water = 12-103
Probably Water = 104-145
Probably Land = 146-179
Definite Land = 147-255

Sortie Date: 12-17-2014
Sortie Time: 14:55 Z
Weather: 52° F (Clear)
Tide: -0.295 ft. (MTL, Verified)
Land Water Mask; Density Slicing

Near Infrared Imagery
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Final Product

- December 16th – 18th, 2014
- 10 different land water masks created
- Each land water mask was assigned a custom pixel value
- Archived tidal and weather data available for each mask
- Intensive: Each image is assigned new brightness value thresholds
Unsupervised Classification

• ERDAS Imagine

• Unsupervised Classification
  • Pixel clusters identified by computer
  • 36 clusters classified into 4 classes by interpreter
Unsupervised Classification

December 16 2014

March 16 2015
Change Detection

• Blues
  • March class > December class
    • Marsh Vegetation vs Marsh Water
    • Marsh Water vs Water

• Reds
  • March class < December class

• White
  • No difference
Implications

- Potential temporal changes
- Georeferencing inaccuracies
- Impacts from using brightness values
- Need for UAS calibration and conversion to reflectance
Water Sample Sites

Field Data
- Hanna Instrument (Temp., Salinity, DO, & pH)
- Water sample
- Radiometer (in Situ Rs)
- 3 Eco-Triplets (Backscattering and Fluorescence)

- SPM
- HPLC
- PC
- CDOM
- Absorption
- Toxin
- Nutrients
- Microscopy
- Toxic Metals
- Bacterial Counts
Water Quality

• Match imagery with water samples
• Develop regression between imagery and samples
• Track sediment transport and algal blooms
Next Steps

- Calibrate UAS data
- Correct georeferencing issues between flight missions
- Expand classifications to all flight imagery
- More detailed classifications with new sensor (Micasense)
  - Identify aquatic vegetation
Future Plans

• Explore potential to create high-res DEMs
• Explore utilizing a UAS-mounted meteorological instrument package to measure low-level atmospheric characteristics
• Transition research data into NOAA operations
• Quick response pre/post-storm reconnaissance