# SHOUT4Rivers Program Review

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# Project Objective

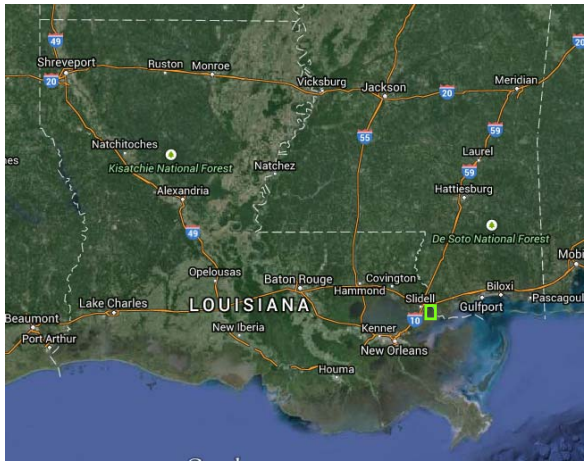
- UAS Applications
  - Mapping of waterways
  - Detect temporal changes in waterways
  - Discriminating intertidal waters
  - Identifying species (plants and animals)
  - Development of high resolutions DEMs
  - Water quality assessment
  - Boundary layer observation
- Improvements to hydraulic modeling
  - 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 @ 800ft 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.


Shreveport
Ruston
Monroe
Vicksburg
Jackson
Meridian
Natchitoches
Kisatchie National Forest
Natchez
Laurel
Alexandria
Hattiesburg
De Soto National Forest
Opelousas
Baton Rouge
Covington
Hammond
Slidell
Biloxi
Gulfport
Lake Charles
LOUISIANA
Beaumont
Port Arthur
New Iberia
Kenner
New Orleans
Houma


LOUISIANA
MISSISSIPPI
Pearl River
Pearlington
90
Chef Menteur Hwy
Old Pearl River
Pearl River
Old Pearl River
Old Pearl River
Old Pearl River
Old Pearl River
Little Lake

# Data Acquisition





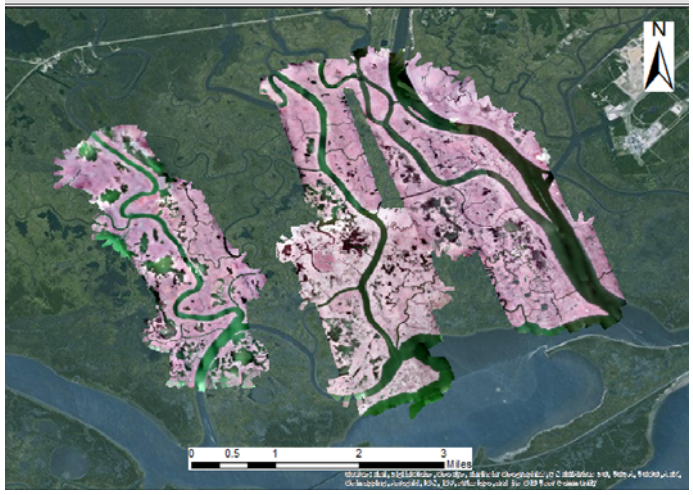




# Data Acquisition

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

December 2014



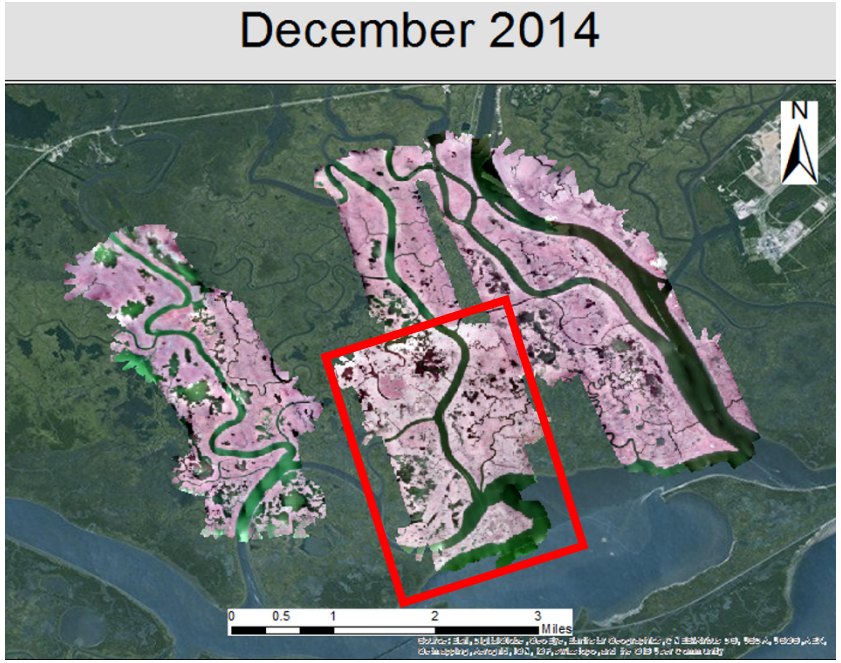

March 2015

# 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


**← NIR vs Mask →**

Mask Pixel Values

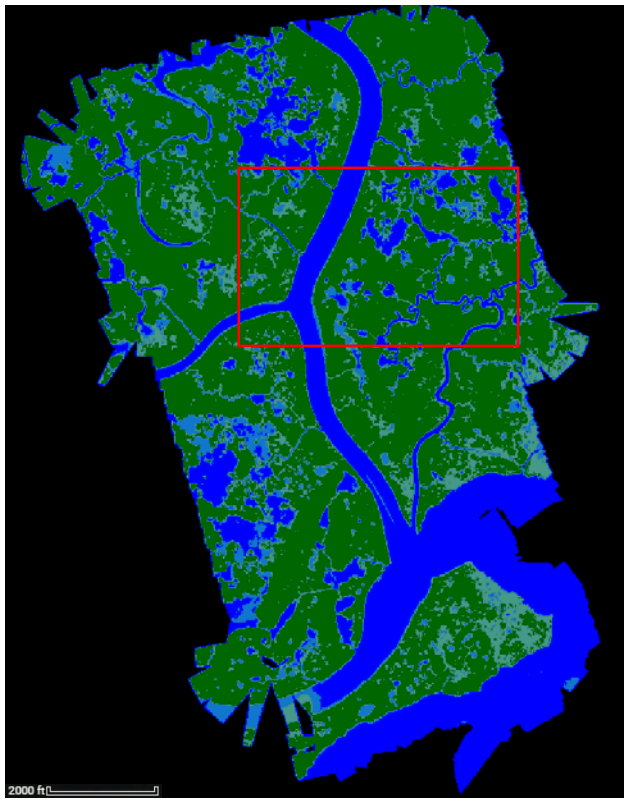
**Definite Water = 12-103**

**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)



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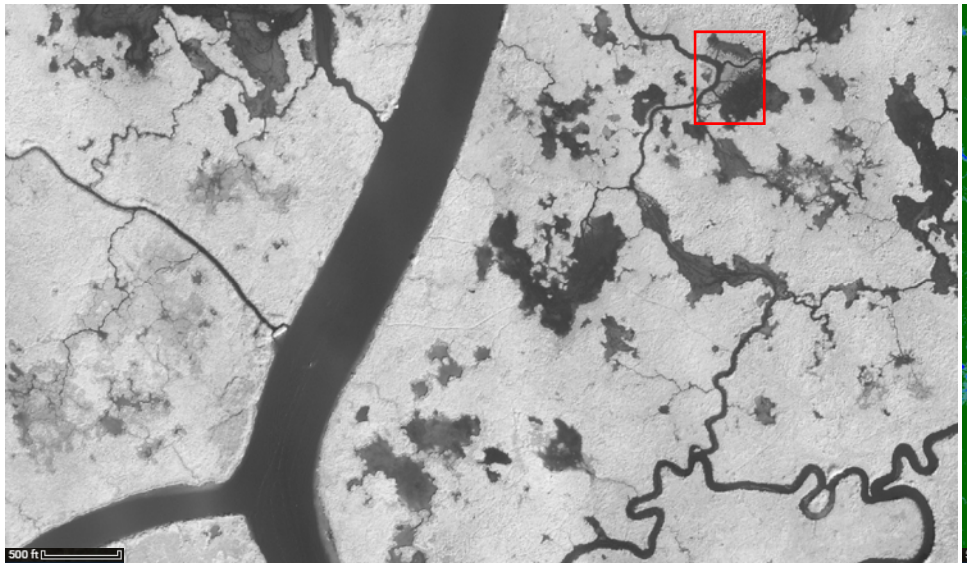
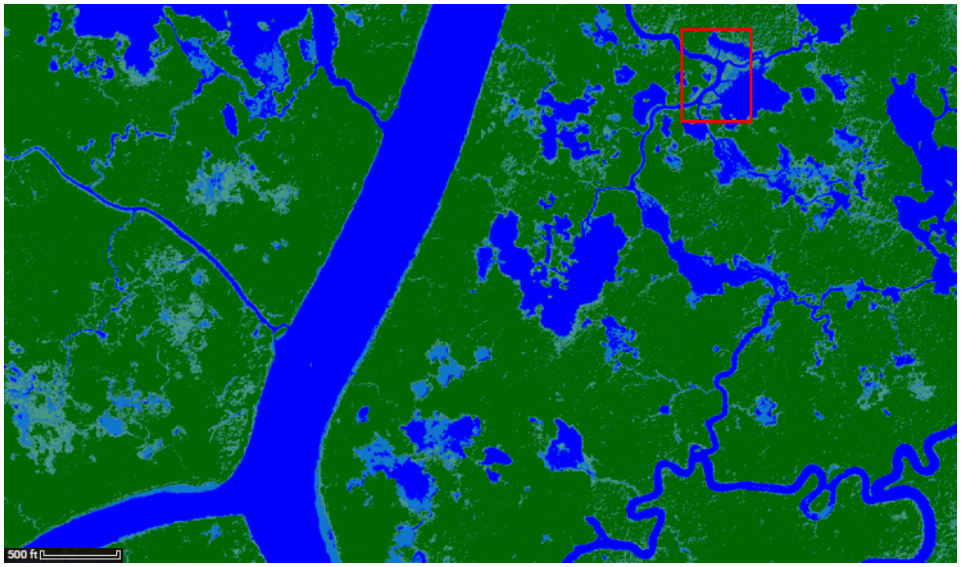
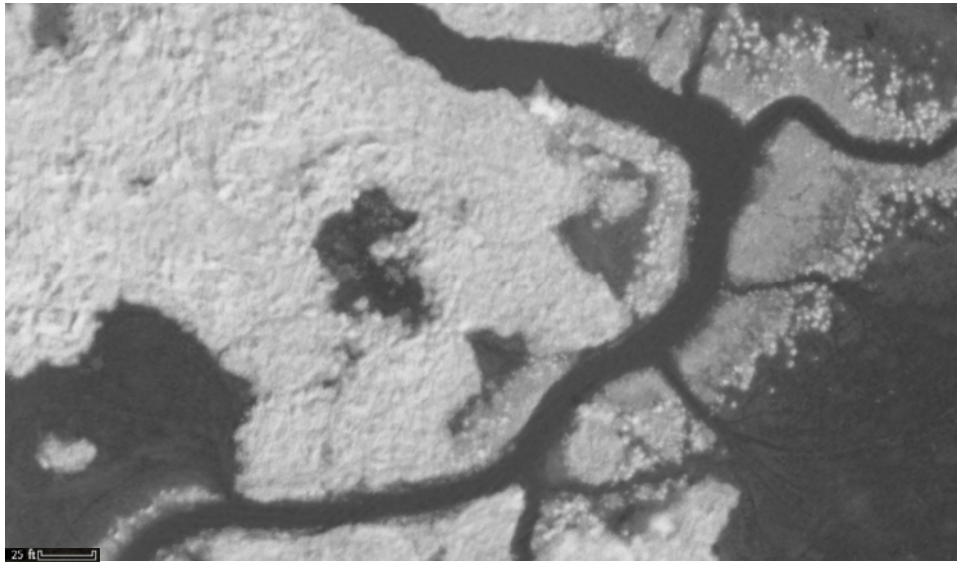



Near Infrared Imagery
Sortie Date: 12-17-2014
Sortie Time: 14:55 Z
Weather: 52° F (Clear)
Tide: -0.295 ft. (MTL, Verified)




Land Water Mask
**Definite Water = 12-103**
**Probably Water = 104-145**
**Probably Land = 146-179**
**Definite Land = 180-255**

# Land Water Mask; Density Slicing



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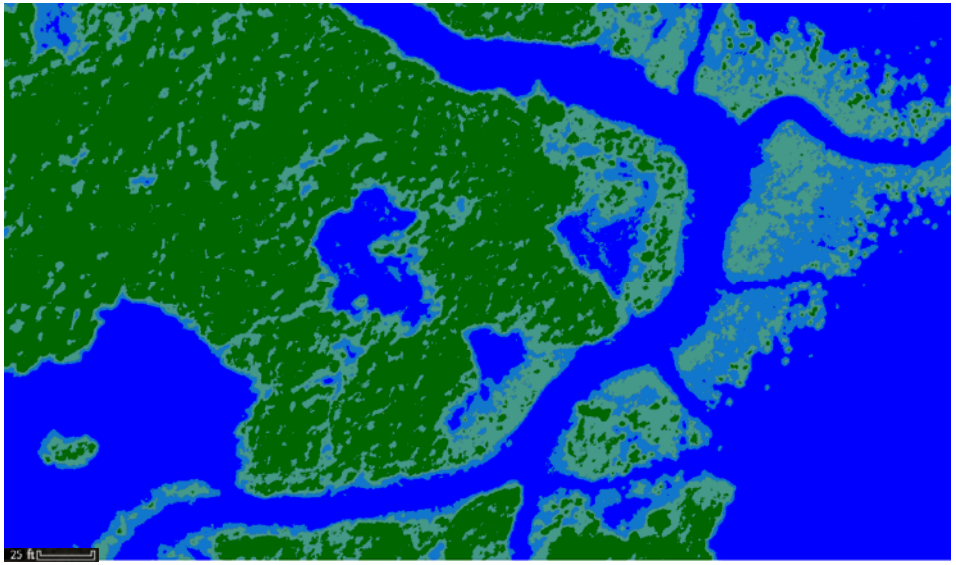

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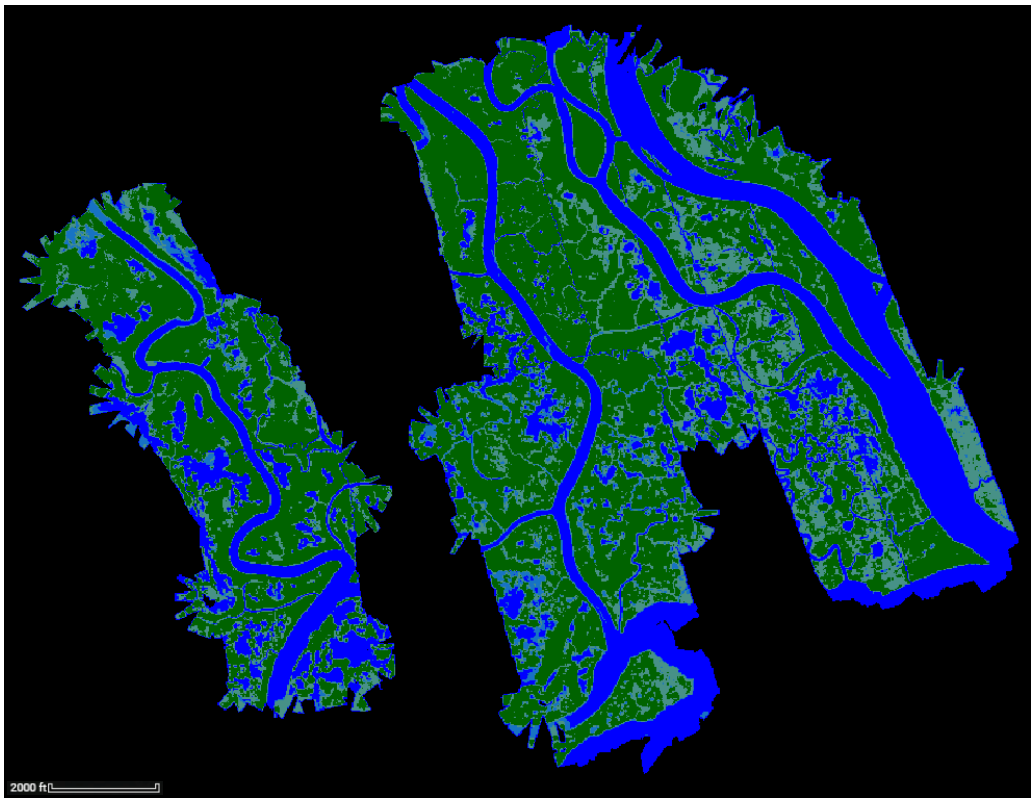
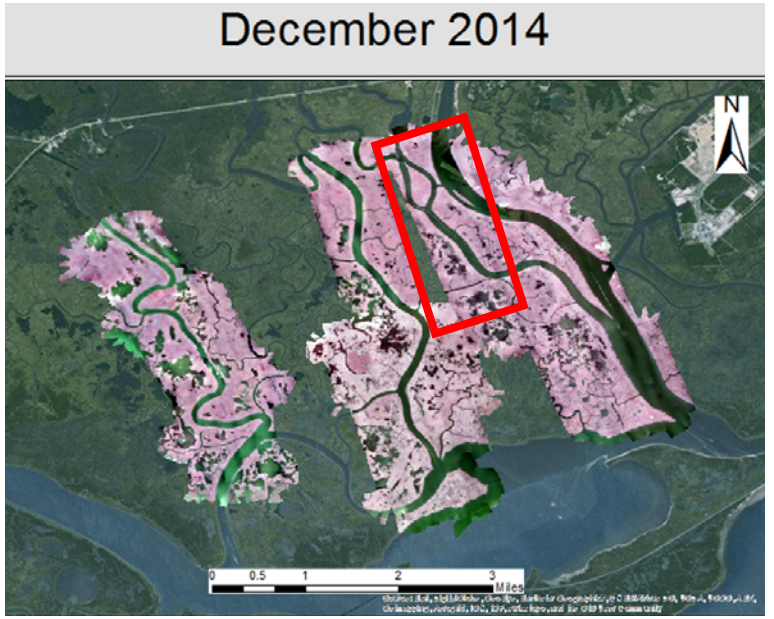
# Final Product




- 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

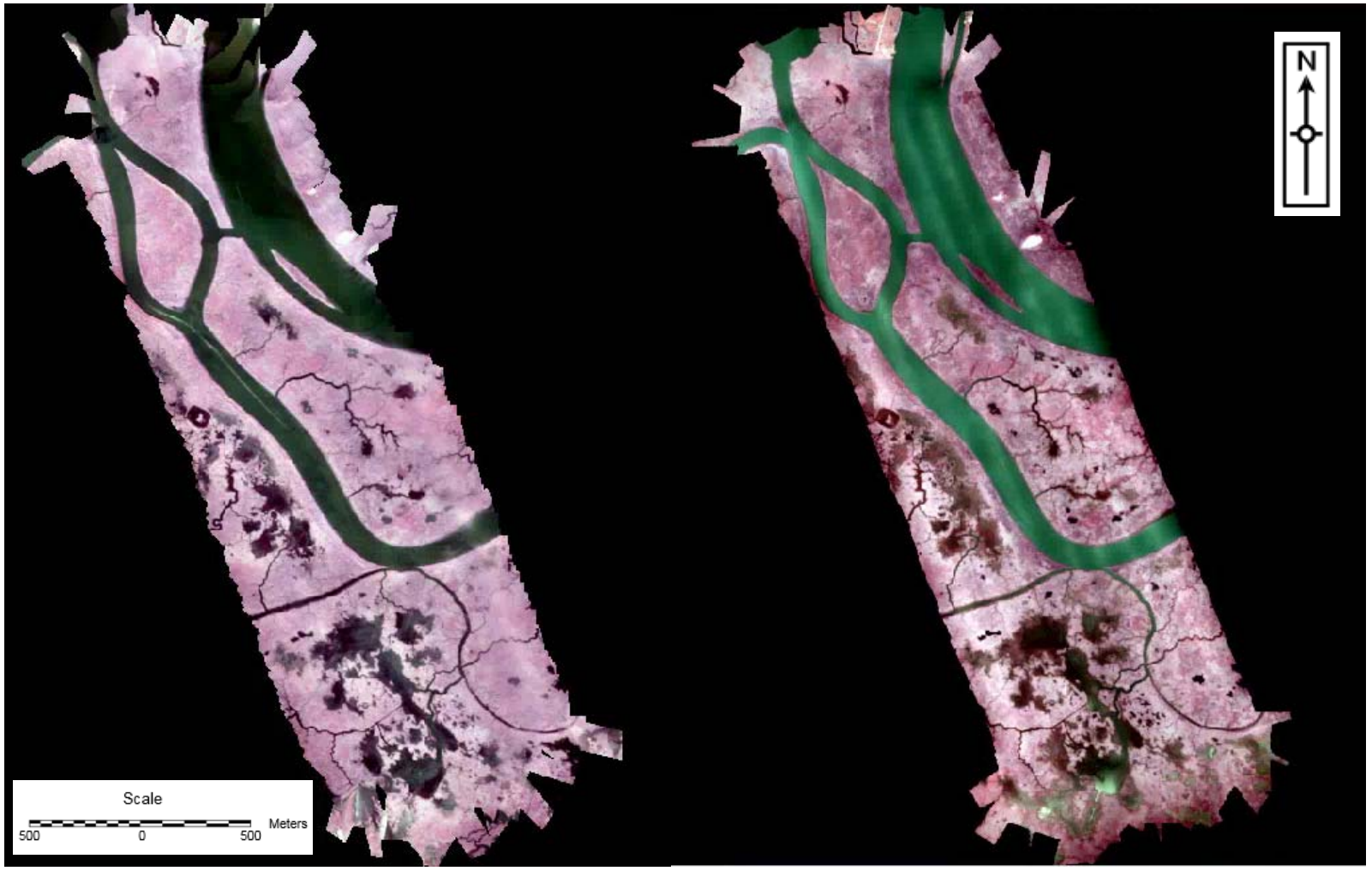
# Unsupervised Classification

- ERDAS Imagine
- Unsupervised Classification
  - Pixel clusters identified by computer
  - 36 clusters classified into 4 classes by interpreter



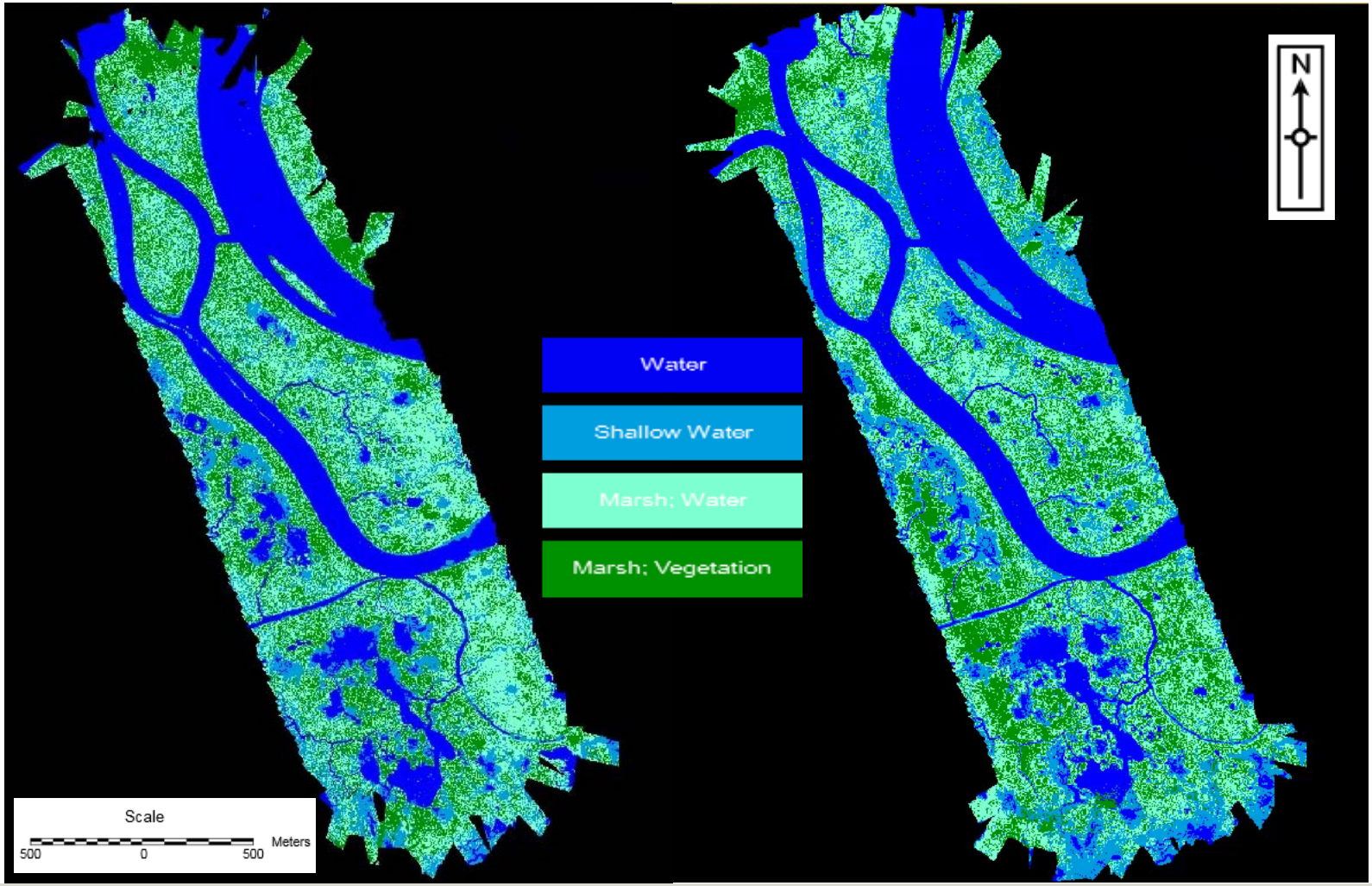
# Unsupervised Classification

**December 16 2014** **March 16 2015**



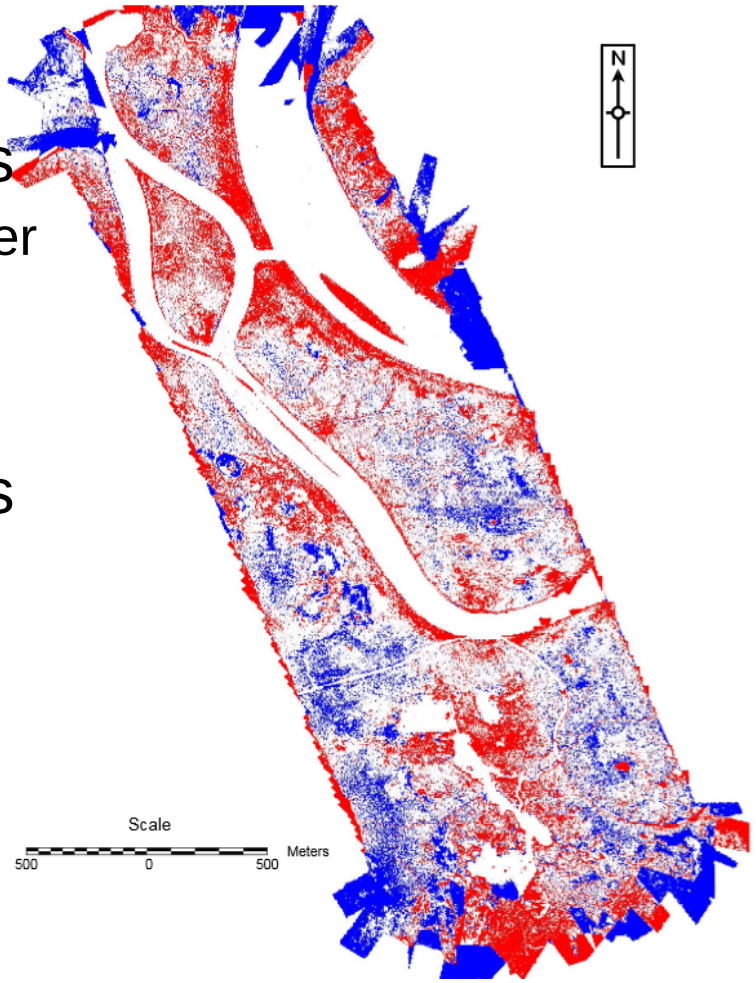
# Unsupervised Classification

**December 16 2014** **March 16 2015**



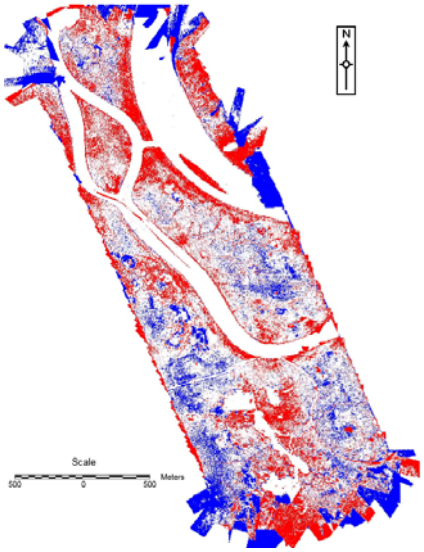
# Change Detection

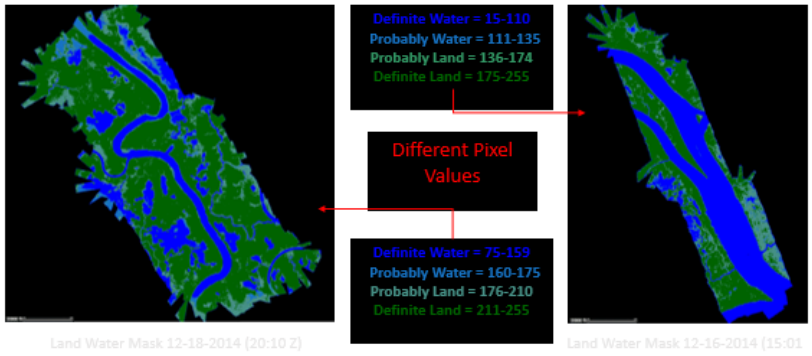
- Blues
  - March class > December class
    - Marsh Vegetation vs Marsh Water
    - Marsh Water vs Water
- Reds
  - March class < December class
- White
  - No difference



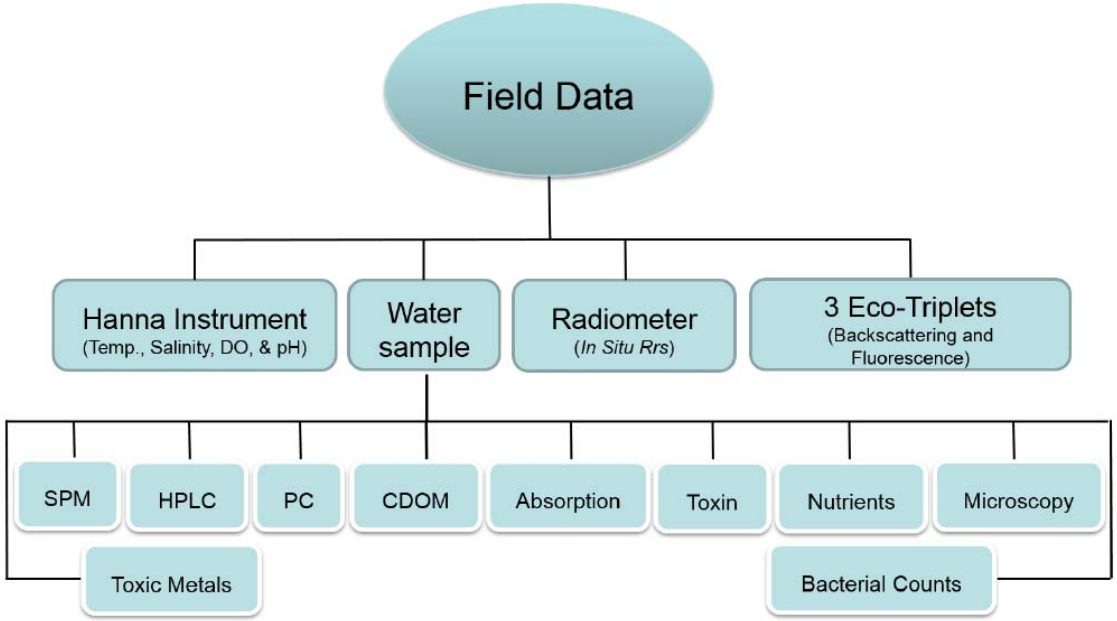
# Implications

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



# Water Sample Sites

# 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