Multi-spectral drone mapping over Indian River Lagoon

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Background

The University of Central Florida's Citizen Science GIS team led by Dr. Timothy Hawthorne launched its multiple NSF funded projects initiative to create high-resolution aerial imagery of vulnerable islands and coastal environments using relatively affordable, consumer-level drones. Recently, the drone mapping team utilized the same technology to capture high-resolution drone videos and images of the Indian River Lagoon, Florida. The fieldwork was planned and carried out by Dr. Bo Yang, Dr. Hannah Torres, Michael Feinman, Tori-Gaye Atterbury, and Amber Rutstein. This fieldwork was in preparation for the new 1.3M NSF eelgrass mapping project with the Smithsonian MarineGeo program. while we weren't looking at eelgrass here, we were using the fieldwork to train our student team in the drone data collection protocols we will use later in the eelgrass project on the west coast of North America.

Unmanned Aerial Vehicle (UAV)

Parrot Bluegrass Multi-spectral Drone

A Parrot Bluegrass multi-spectral drone was deployed over the Indian River Lagoon. The advanced UAV system is able to collect multi-spectral imagery including NIR, Red edge, Red, Green, and Blue bands. The imagery was stitched and georeferenced in Pix4D. See right section for the updated multi-spectral near infrared false color combination.

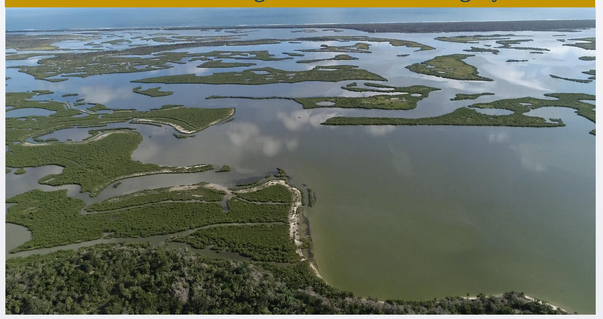
DJI Phantom 4 Pro with RGB camera

Besides the Parrot bluegrass multi-spectral drone, we also used a DJI Phantom 4 Pro to collect the RGB natural color combination over the Indian river lagoon. 200+ images were taken by the DJI phantom 4 and orthomosaics were created using ESRI Drone2Map. See right section for the natural color combination of the georeferenced imagery over the study region.

Drone vs. satellite mapping

Indian River Lagoon from Google earth imagery

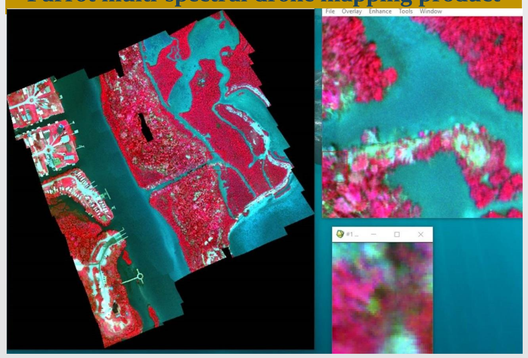
Indian River Lagoon from drone imagery



In addition to providing spectacular photos and videos for their aesthetic value, drone imagery can complement satellite imagery to improve scientific analysis and resource management. Below, you can see how the drone image (right) is more clear and up-to-date than the satellite imagery (left). Drones have the power to obtain real-time, high-resolution images, as well as videos of the land features.

Multi-spectral Drone mapping products

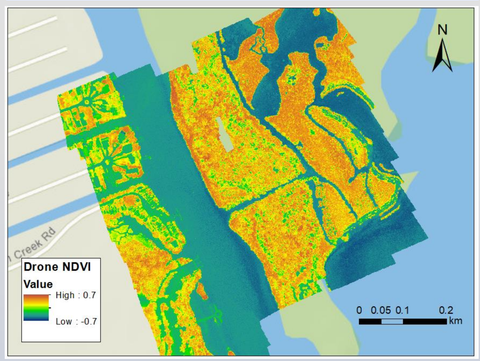
Parrot multi-spectral drone mapping product



The multi-spectral drone mapping product from the Parrot Bluegrass is able to generate multi-spectral imagery including NIR, Red edge, Red, Green, and Blue bands. Therefore, the normalized difference vegetation index (NDVI) could be calculated from the drone mapping imagery. NDVI is a widely used numerical indicator that uses the visible (VIS) and near-infrared bands (NIR) of the electromagnetic spectrum, and is utilized to analyze whether the area contains live green vegetation or not. NDVI values usually represent water bodies (ranging from −0.0175 to −0.328), Built environment (ranging from −0.019 to 0.060) and bare soil (ranging from −0.001 to 0.166). The NDVI values for dense vegetation ranges from 0.500 to 0.575.

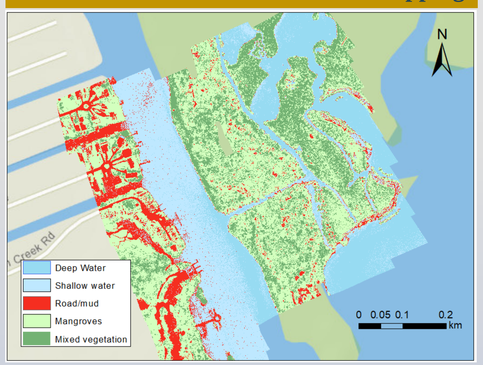
DJI drone mapping product

NDVI map derived from drone mapping



By taking advantage of the multi-spectral data, and NDVI calculated from the drone mapping imagery, we are able to generate a simple classification. Above is the classification result showing the deep and shallow water, road/mud, mangroves and mixed vegetation.

Classification derived from drone mapping



Product calibration

Ground Control Points (GCPs)

Ground Control Points (GCPs) were collected using a Trimble high-performance GNSS system. The horizontal accuracy of the GCPs collected using Trimble R1 GNSS system can reach 0.3-0.5 meter, which tremendously enhanced the geo-reference accuracy of the drone imagery. We selected the corner of the parking lot, intersection of the roads, and corner of the deck for collecting the GCPs, so those points can be obviously detected on the drone images.

Collaborative future work

The Citizen Science GIS team led by Dr. Timothy L. Hawthorne, assistant professor of GIS in the Department of Sociology and College of Sciences GIS Cluster at UCF, will collaborate with MarineGeo researchers at the Smithsonian Institution to drone map eelgrass meadow sites along the west coast of North America from California to Alaska. The collaborative grant was awarded in July by the NSF Biological Oceanography Program to a team of researchers led by Principal Investigator Dr. Emmett Duffy of the Smithsonian Institution.

The collaborative grant includes faculty and students from a variety of universities and organizations, including MarineGeo at the Smithsonian Institution, Cornell University, University of California-Davis, and University of Central Florida.

Smithsonian · Cornell University · UC Davis Aggies · UCF · CitizenScienceGIS.org · University of Oregon · San Diego State University · University of Alaska Fairbanks Equity and Compliance · Hakai Science on the Coastal Margin