Supporting the mapping of intertidal mussel beds with Unmanned Airborne Vehicles

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Abstract

This poster shows the result of an experiment to support the mapping of intertidal mussel beds with Unmanned Airborne Vehicles (UAV's). The acquired imagery shows detailed information about the outline and composition of the mussel bed that is useful for the regular mussel bed mapping and monitoring activities.

Keywords: Mussel beds, UAV, drone, areal mapping, hyperspectral imagery .

1 Introduction

Intertidal mussel beds are widely seen as an important ecotope within the intertidal areas of the Netherlands, providing food for fish and birds and substrate and hiding places for other species thereby enhancing biodiversity. Mussel beds are mapped and sampled on a regular basis to provide information about their current state and long-term development. This mapping is done by fieldworkers. Equipped with hand held gps, they walk around and over the mussel beds to map the outline of the mussel bed and collect information about the coverage of mussels. This is time consuming and the working period is tide limited (Van den Ende, 2016). In this project the applicability of areal mapping of intertidal mussel beds using Unmanned Airborne Vehicles (UAV's) is explored.

This poster shows the first results and addresses the value of the acquired imagery in support of the traditional way of mussel bed mapping.

2 Materials and study site

2.1 UAV's and camera systems.

In this project, two types of UAV's were used, the DJI Phantom 3 professional and the Altura AT8 Pro v1 (Kramer, 2015).

The DJI Phantom 3 professional is a quadcopter with a 4k RGB camera already mounted on a gimbal. The system is fitted with a Global Navigation Satellite System (GNSS) receiver supporting GLONAS and GPS to record the position. It has an Inertial Measurement Unit (IMU) to record the UAV attitude and a barometer to the record UAV altitude. Al this information is used for geo-referencing the recorded images into an orthophoto of the flown area. The benefit of the Phantom 3 is the ease of use and the high accuracy of the geo-referenced positional information.

The Altura AT8 Pro v1 is an octocopter with the capability to mount different camera's. It can lift payloads up to 2.5 kg. The system is fitted with a Global Navigation Satellite System (GNSS) receiver supporting GPS to record the position. It has a barometer to the record UAV altitude. The benefit of the Altura AT8 is the flexibility to mount different camera's and capability to lift weights up to 2.5 kg. The system contains two cameras; a consumer grade RGB camera (Panasonic GX1) for recording orthophotos and a PhotonFocus SM2-D1312 pushbroom spectrometer for recording hyperspectral imagery with a spectral resolution of 9 nm FWHM from 400–950 nm. A detailed description can be found in the article from Suomalainen (2014).

A Samsung S7 smartphone was used to acquire very detailed imagery of a small part of the mussel bed.

2.2 Study site

The mussel bed near the sandbank Schildknopen is selected as study site. Schildknopen is located in the Waddenzee just north of Lauwersoog and can easily be reached by boat from Lauwersoog harbor. The location consist of a firm sandbank that can be used for take-off and landing of the UAV's. The mussel bed was recently measured by the traditional mapping method.

Due to the regulations for UAV flying in the Netherlands, that limits the distance to fly a UAV up to 500 meters from the take-off location, it is not possible to map the whole mussel bed. The mapable area is big enough to explore the

applicability of the imagery for support of the regular mussel bed mapping.

3 Results

With the DJI Phantom 3, an RGB orthophoto was acquired with a detail of 2 centimeters, covering an area of 300 by 150 meters.

With the Altura AT8, an RGB orthophoto was acquired with a detail of 2 centimeteres, covering an area of 700 by 300 meters. Also hyperspectral imagery was acquired with a detail of 20 centimeters, covering almost the same area as the RGB orthophoto. The hyperspectral imagery consist of four flight lines of 50 meters wide.

With the Samsung s7, an RGB orthophoto was aquired with a detail of 1 millimeter, covering an area of 5 by 3 meters.

4 Discussion

The different results are visually compared with the available contours from the regular mapping. The mussel bed experts did a visual inspection of the imagery and made a first estimation on the applicability of the imagery for the mussel bed mapping and monitoring.

The first results do show that the UAV imagery provides usable information on the internal composition of the mussel beds such as species composition, patchiness and elevation of the bed. This information is difficult to acquire by the regular mapping method by fieldwork.

The hyperspectral imagery also provides information on the composition of the mussel beds. Research on the automated classification of the hyperspectral imagery into land cover maps is still ongoing.

5 References

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