UAV data acquisition protocol for coastal areas: testing and validation in the real World

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ABSTRACT:

The acquisition of reliable information in coastal and marine areas is crucial for mapping, monitoring, and management of marine environments. Unmanned Aerial Vehicles (UAVs) are widely used for mapping in coastal areas and marine environments since they can collect aerial data with a spatial resolution of some centimeters. However, there are several limitations that UAVs have to overcome for collecting accurate data. These limitations are related to i) the weather conditions (wind, temperature, clouds etc.) and oceanographic parameters (waves, turbidity, sun glint etc.), ii) the flight mission, iii) the system of the UAV (payloads and vehicle), and iv) the morphology of the study area.

A theoretical protocol that summarizes the parameters that affect the quality of aerial data acquisition from a light UAV, in a coastal area of interest, was developed. This paper presents the testing and validation of the UAV theoretical protocol in the real world. Prediction data used as input values in the protocol for resulting the optimal flight windows on the marine environment. A coastal area with a variety of marine habitats and bathymetric differences has been chosen as a testing area. Flights at different times and in different conditions were performed to test the parameters and the thresholds of the UAV model. Flight missions were created in different flight heights and with different payloads (RGB cameras, multispectral cameras). The aerial data processed in photogrammetric software and 3D models and ortho mosaics produced. These ortho mosaics were then compared to conclude on the optimal conditions of UAV data acquisition for the marine environment.

Results released significant differences on the quality of the produced ortho mosaics. The local weather condition and the water clarity, during the optimal flight windows, are the most important parameters for the quality of the produced data. Specifically, the sun glint effect on the sea surface as well as the waves make the collection of benthic information impossible. Clouds and humidity prevent the sunlight from reaching the seabed, making difficult the separation of benthic features. These conditions should be avoided during the data acquisition for desired results.

Considering the results, the optimal flight windows are important parameters of a cost-effectiveness methodology for marine mapping. The UAV protocol can be used for the acquisition of reliable and accurate data in the marine environment which is essential for many marine

applications like marine habitats, coastal bathymetry, and coastal morphology. The ultimate target is to combine the UAV ortho mosaics with satellite images for deriving accurate geoinformation on the coastal environment.