UAS Based Morphological Change Detection of Wetland Area

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Following the incredible development of Unmanned Aerial System (UAS) these past years, research using UAS as the main vehicle in collecting field data. The research is focusing on how far a UAS based morphological change detection of wetland area can be used in analyzing and quantifying the morphological changes of wetland area over time. A protected wetland area which known as Bleistätter Moor was chosen as test site. This wetland area is located near Ossiacher See and Tiebel River, Charintia, Austria. The Moor had been reconstructed into artificial basin. Thus, the research monitored the morphological change on this area and examine changes over seasons from the Bleistätter Moor before filled with water (prior to construction) until fall season in the following year, from March 2017, until October 2017. High resolution aerial photography was taken using UAS. These data was then generated into Digital Surface Model (DSM) using photogrammetry technique. Four different time stamps were taken along the year which described as T1 (after construction of site finished), T2 (in the middle of spring season), T3 (in the middle of summer season), and T4 (in the middle of fall season). Additionally, a T0 time stamp is also prepared which shows the area before any construction begin. From the aerial photography, a Structure-from-Motion (SfM) was done and generated Digital Surface Models (DSM) and orthorectified mosaic images. A DSM quality assessment was done. The change detection process applied DSM differencing for the elevation change detection and water level change detection. Geomorphic Change Detection (GCD) ArcGIS extension tool was used and 16 comparison scenarios were formulated. Minimum Level of Detection (minLOD) and Probabilistic Thresholding with 95% confidence level were applied on each scenario of comparison. The research proves that UAS based morphological change detection on wetland area could monitor the morphological changes on wetland area including elevation changes and water level changes. The morphological changes can be visually analyzed, and quantification can be done on the detected changes. The quantification of the results could detect the total area of surface lowering, the total area of surface raising, average depth of surface raising, and average depth surface lowering including the errors. The biggest changes happened between T2 and T3. The total area of detectable change could reach 1.001.192m^2 (92,35% of total area of interest) on minLOD applied and 678.542,96m^2 (62,59% of total area of interest) on the probabilistic thresholding applied. Most of the significant changes were detected from open water area and vegetation. On the other hand, the water level change detection results shows that the water level is increasing from T1 until T3 and decreasing from T3 until T4.

Although quantification and analysis could be done, the project goes with problems. The main problem came from the result of photogrammetry. Open water area tend to have error in elevation detection. This error happened because the nature of photogrammetry which detect unique feature of the image to generate 3D model and open water area often does not have any unique feature (image shows flat area). Another problem came from the ground control point (GCP) measurement. It is unfortunate that the GCP was changed in the middle of the year. Thus, resulting on poor quality of GCP positioning between T2 and T3.

Nevertheless, the project was satisfying and the potential of UAS based change detection is far from maximized. With proper method and better data quality, similar project could be done with better result.