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# 3D Shoreline Mapping with Unmanned Aerial Vehicle

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- ❑ ***Introduction***
- ❑ ***Case Study with UAV***
- ❑ ***Evaluation of the Measurements***
- ❑ ***Conclusion***

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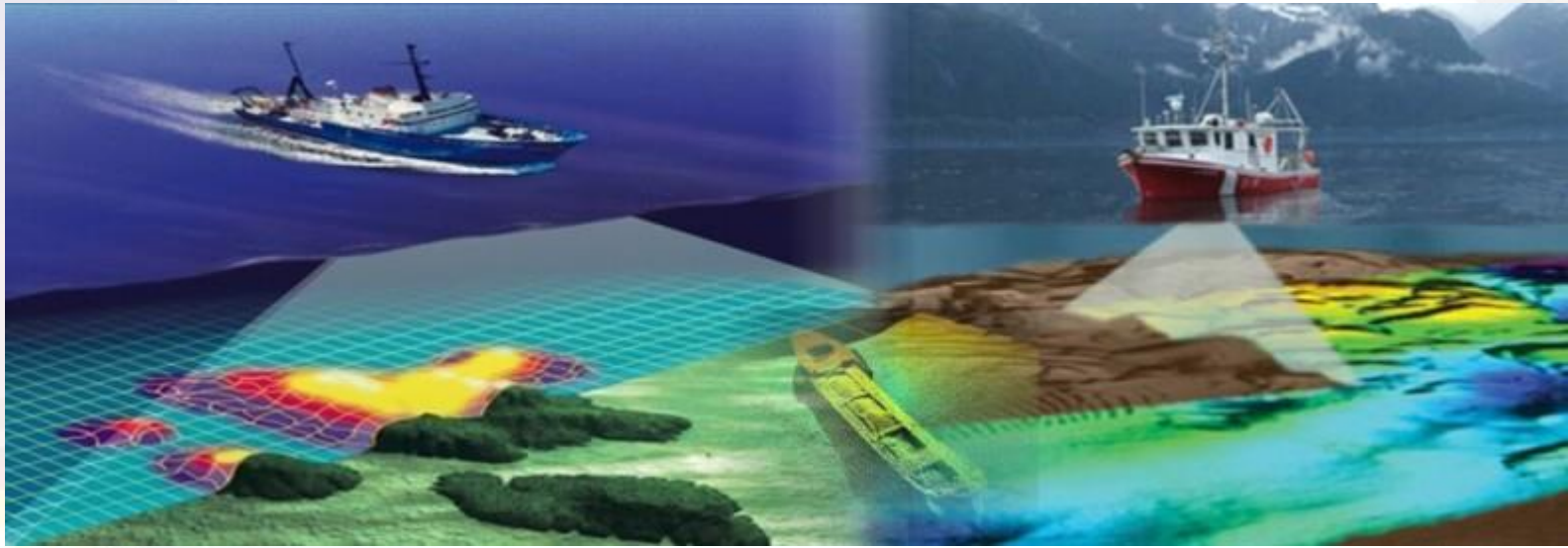


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## INTRODUCTION

Hydrographic surveys are carried out for many different type of projects, mainly the determination of underwater features and the water bottom surface of water-covered areas.

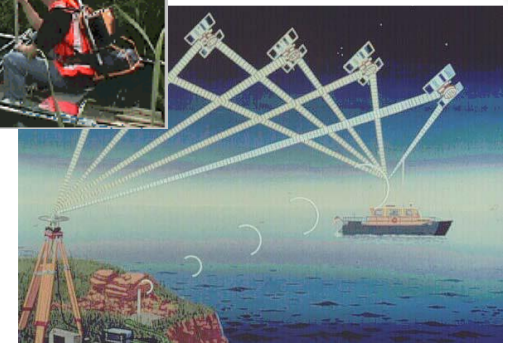


Although the boundary of this kind of study is generally restricted to the shoreline, the topography of a certain bandwidth (land strip) should be surveyed above the shoreline at the time of measurement.



Nowadays, there are various measurement methods in use for mapping projects.

Depending on the field conditions and the size of the area to be surveyed, conventional terrestrial, space-based GNSS measurements, photogrammetric and remote-sensing techniques are used.



**The conventional measurement techniques** have been used for a long time but *dependability of weather conditions, the requirement of labour field studies, and difficulties such as measuring at certain times of the day* restrict usability of this type of technique in practice.



**GNSS systems** cannot be properly implemented in some fields such as *densely wooded area* or *extreme/harsh environments*. Furthermore, there are some difficulties for measuring along the shoreline because of mud, brushwood that prevent walking or even moving.



Izmir-Balçova Baraj Gölü

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Recent developments in surveying technology, sensors and processing algorithm provide to develop some new measurement platforms. One of them is Unmanned Aerial Vehicle (UAV) and they are widely used in land, marine and air applications because of their economic and easy applications, as well as their accuracy.





## CASE STUDY

In this study, a test measurement was conducted in Obruk Dam Lake of Çorum City in Turkey in order to extract the dam's coastline with Unmanned Aerial Vehicle (UAV).



UAV measurements were conducted with DJI Phantom 3 Pro quadcopter. The images were acquired with 12 MP camera with the average Ground Sampling Distance, i.e. resolution of the images or pixel size, was 4.77 cm (1.88 in).



**DJI Phantom 3 Professional Quadcopter Drone with 4K UHD Video Camera**

Model Name: DJI Phantom 3 Professional Quadcopter Drone with 4K UHD Video Camera  
 Brand: DJI  
 Type: Drone  
 Quick Fact: Comes with 4K UHD Video Camera

[toyrobotsdroidsdrones.com](http://toyrobotsdroidsdrones.com)



**The UAV flew** autonomously at an altitude of 100 m AGL at a maximum speed of 16 m/s and photos were taken.

**UAV mission** was planned to have a 75% of *side-overlap* and 70% *forward-overlap* rates.

The taken photographs were carefully screened and totally 933 (out of 973) clear and suitable selected photos were used for processing.

In order to geo-referencing the data collected with UAV, i.e. calculate scale, orientation, and absolute position of the photos, **10 Ground Control Points (GCPs)** were established in suitable locations through the study area.

The coordinates of these points were determined by **Network-RTK GNSS** measurement technique with centimetre-level of accuracy.

- **Pix4D Mapper Pro** software was used.
- Dense **3D point cloud** was extracted.
- **Digital Surface Model (DSM)** generation and an orthophoto map covering about 176.67 hectare production was implemented.
- **Inverse Distance Weighting** algorithm was used to interpolate the DSM from the point cloud.



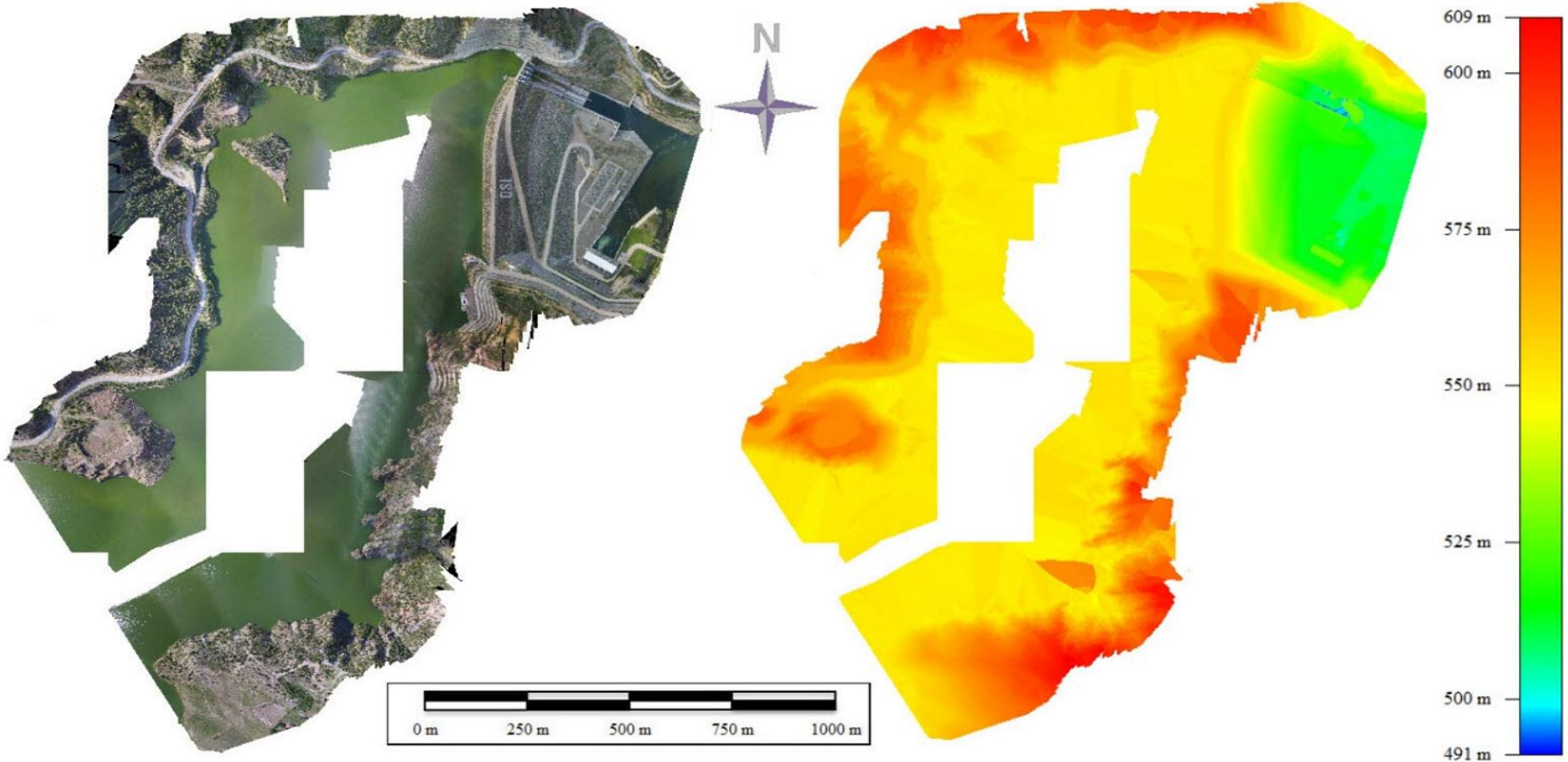
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Produced Orthomosaic and Corresponding DSM

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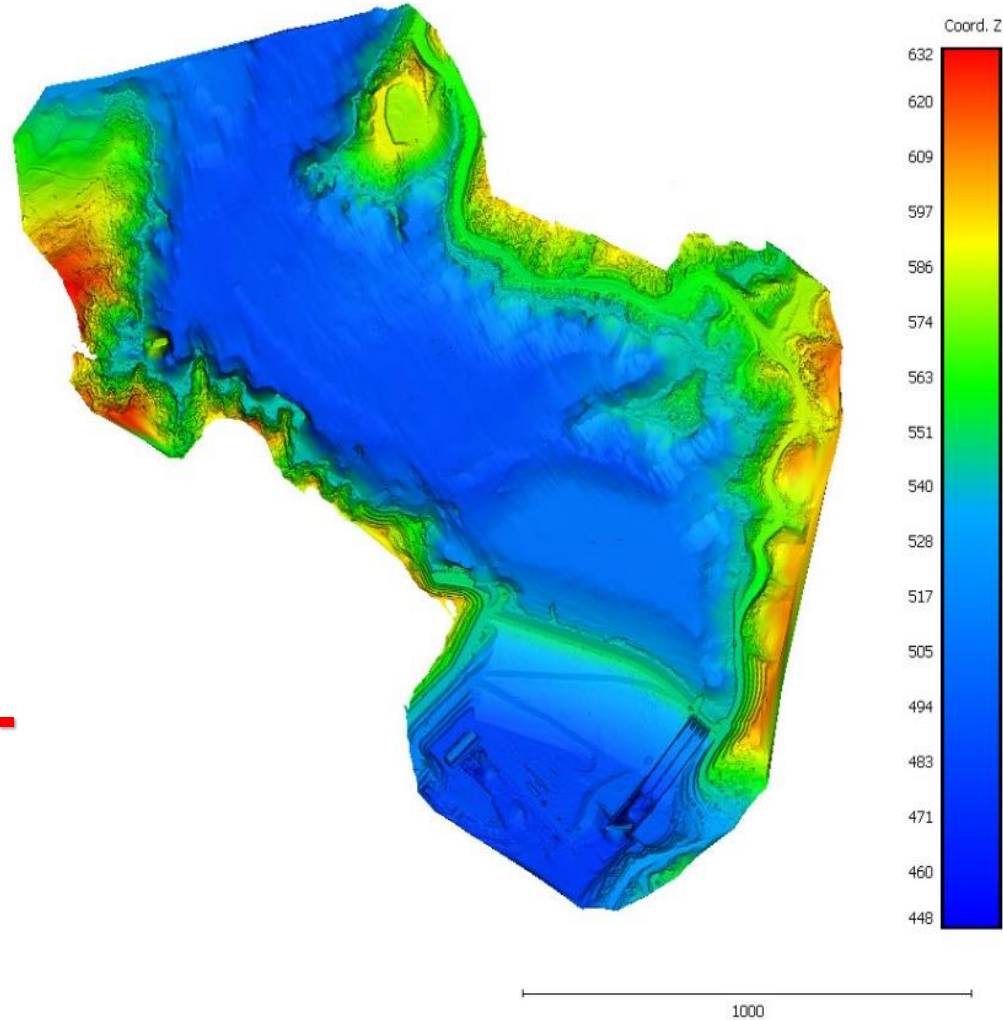
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The water surface topography which was obtained from this study area by bathymetric surveying in the same day and UAV-based land measurement data were merged and; **a high-resolution 3D model of the study area was produced.**



**In order to make a precise assessment** of the attainable accuracy of the models obtained from UAV measurement, some sharp, well defined, and clearly identified points **on images** were determined.

The coordinates of these points were coordinated;

- *from the produced 3D Model*
- *and in the field.*



The coordinates of the points having different characteristics were then compared with those obtained from the model.

According to the obtained results from the comparison, we conclude that; **the final orthophoto map has about 2 dm-level or better for 2D positional accuracy while having about twice vertical accuracy.**

## CONCLUSION

**The result of this study shows that, 3D maps can be prepared very quickly and easily by using UAVs for dam basins, which usually have harsh environmental topography, inaccessible, dangerous and forbidden areas (zones).**

## CONCLUSION

**The achieved results of this study indicate that, the obtained 2D positional accuracy can meet the requirements for several coastal mapping studies with low-cost and fast.**

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## CONCLUSION

**From the results of the gained experience in the study, the use of UAVs with the RTK-capabled is suggested instead of the use of GCPs for difficult and rough terrain. Unfortunately, this is a cost increasing factor.**

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**Thank you very much for your  
interest and attention...**

**Contributions, Questions???**

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