

# **Bathymetry and lakebed mapping of Lake Altaussee using Multibeam Echo Sounding, UAV photogrammetry and underwater ROV imagery**

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**Key words:** Education; Hydrography; bathymetry; lake; multibeam echosounding; ROV; UAV; Structure for Motion

## **SUMMARY**

As part of an international research cooperation, Lake Altaussee - located in the Styrian Salzkammergut in Austria - is being surveyed using state-of-the-art hydroacoustic measuring methods and investigated hydro-geologically. With the help of a high-resolution multibeam echosounder (MBES), a precise 3D model of the lake basin was created. It is highly detailed and shows sediment formations, larger rocks, cracks, cables and water supply pipelines at the lake bottom as well as submarine spring pits of varying extent and depth. Additionally, water column information as well as backscatter data of the multibeam echo sounder were used to classify zones of different sediments of the lakebed, and to detect objects of interest, such as gas plumes or submarine spring discharges.

An unmanned aerial vehicle (UAV) with RTK-GNSS positioning provided high-resolution multi-view stereo imagery from the 5 km long shoreline. Structure from Motion photogrammetry (SfM) delivered the topographic information of the shallow water zones and its adjacent land zone. Water refraction models were applied to the SfM results to correctly map the lakebed topography of the water-covered areas. Due to a water transparency value (Secchi depth) of 10 m it was possible to map shallow water zones of up to 2 m water depth.

A remotely operated underwater vehicle (ROV) with a manipulator arm was used to investigate the geological situation of the karst springs located at a depth of 70 meters and to map further interesting geomorphological lakebed structures located nearby. Furthermore, the ROV video-imagery was used for validating and classifying even small objects of this high-resolution and detailed topographic 3D model of Lake Altaussee.

Based on this lake model, a first WebMap application was developed for the local rescue

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or-ganizations to support them in their operations on the lake.

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