Bathymetry and bottom classification mapping by a remotely controlled watercraft and a high performance fish finder

*Shintaro Yamasaki[1], Tomonori Tabusa[2], Shunsuke Iwasaki[2], Masahiro Hiramatsu[1]

1. Kitami Institute of Technology, 2. National Institute of Technology, Yuge College

Acoustic investigations for small and shallow water areas are significant and high potential value for earth science studies and for disaster prevention researches. For example, estimating water volume for a glacial lake or a landslide dam-created lake is useful to predict outburst flood, and also imaging a bottom of the volcanic crater lake is useful to observing volcanic activities under water. However, such investigations have been difficult due to their cost, mobility and high risk for manned operation. The authors recently are investigating shallow water areas by using modern light-weight and low-cost fish finders. This method enables bathymetric mapping, bottom classification, and high-resolution sonar imaging (Yamasaki and Kamai, 2015). In this presentation, the authors presents an unmanned watercraft survey system equipped with those fish finders to investigate small and shallow water areas.

The developed system is based on Tabusa et al (2013), consists of a commercially available materials, low cost electric devises and a free software. The unmanned watercraft body was constructed with an electric motor and plastic floats to be a form of twin-hulled ship. For this type of small watercraft, the twin-hulled shape was stable in wavy condition by experiments. The electric motor drives with a 12-voltage battery, and had a remote controlling mechanism. Setting radio transmission devices (2.4 GHz ZigBee RF modules) in the mechanism, the communication distance was enlarged as long as 1 km. A GNSS receiver was installed in the watercraft and its positioning data was transmitted through similar radio transmission devise to the operator on land. The position and, calculated speed and heading of the watercraft from GNSS data were shown on a display of PC in real time.

The authors present a case study in Lake Ashinoko, Kanagawa Japan. In the northern part of the lake, a number of submerged trees were found on the lake floor. Some of trees remains to stand on the floor. It has been called “Sakasasugi” in Japanese. Oki et al. (1988) inferred that submerged woods were deposited by a landslide. The authors presumed that the topography and the base materials of the area of submerged woods would differ from other part of lake if a landslide had occurred and investigated the area with the developed system. Then the authors obtained a bathymetric map and distribution maps regarding bottom materials. The bathymetric map shows characteristic rises that differ from other part of lake. The relative surficial hardness values and surficial roughness values of the base of submerged trees defer from most part of the lake. Their results are consistent with that the idea that submerged woods had been transported via a landslide.

Yamasaki, S., Kamai, T., 2015. A novel method of surveying submerged landslide ruins: Case study of the Nebukawa landslide in Japan. Engineering Geology, 186, 28-33.
Tabusa, T., Sawamura, K., Mukai, T., Kuzume, K., 2013. Development of small scanning Boat by Automatic Cruise and Making of 3-Dmimensional Topography of Mekong River. Navigation, 186, 15-23. (in Japanese, title in translation)
Oki, Y., Hakamada, K., Ito H., 1988. Fossil Cedar Trees of Hakone (Hakone-no-Sakasasugi)–Kanashin Books 23. 180p. Kanashin publishing company. (in Japanese, title in translation)

Keywords: fish finder, sonar, bathymetry, remote investigation, landslide, Lake Ashinoko

