Comparison of DEMs derived from simultaneous airborne LiDAR survey using two types of laser scanner

*Mio Kasai[1], Tomomi Marutani[1], Hirotoshi Yoshida[2]

1.Research Faculty of Agriculture, Hokkaido University, 2.Hokkaido Regional Development Bureau, Ministry of Land, Infrastructure, Transport and Tourism

Airborne Light Detection and Ranging (LiDAR) survey provides geomorphic information with fine details even for forests; thus, it is being increasingly used in measuring landscape. Recently, the survey was operated sequentially for rivers to evaluate geomorphic changes from the difference of elevation, by using digital elevation models (DEMs) derived from each survey. However, it is difficult to apply the difference of DEMs to hill slopes as it often presents unrealistically large values. This is due to errors of DEMs, which can be expected to be higher for hill slopes, considering that denser vegetation cover and steeper slopes prevent the laser beams from the scanner from reaching the ground surface and less ground points are used to produce the models. In addition, it is difficult to estimate the error ranges of DEMs for hill slopes as there are fewer ways to crosscheck the values. To examine the ranges, this study conducted airborne LiDAR survey in four locations in Hokkaido by using two types of laser scanner, old and new version of SkEyes Box (SkEyes Unlimited), and compared the DEM products. One site was located on a volcano fan while three were on mountain slopes that were prone to landslides and covered by trees. The survey was carried out on the same day in each site in October 2015. The laser scanner was mounted on an unmanned helicopter (YAMAHA RMAX G1), which made it possible to operate the survey twice in a day. After ground data was extracted from the survey data, DEM of 1 m, 2 m, 5 m and 10 m sizes were produced for each case. When comparing between DEM values of the same location, finer DEM sizes showed less elevation difference in all the sites. However, 10 to 20% of the 1 m DEM sets presented more than 0.7 m of difference in each site. They were likely to appear along stream banks, slope breaks, and the rim of the survey areas. In addition to elevation, the slope angle was obtained on ArcGIS software using the DEMs and was similarly compared for each site. The larger DEM presented a better agreement for the values at the same locations, although 5 m DEM was considered to be better for analysis to avoid losing the information of fine geomorphic features. In this case, 10 to 20% of the DEM sets in each site presented a difference larger than 5 degrees. These analyses suggested that the DEMs for hill slopes contained the degrees of errors, which were difficult to use for volumetric evaluation from a sequential survey. However, the difference of DEMs from the survey could be still useful to extract the locations of moving slopes as the information of change in the ground surface should be reflected in a group of DEMs on those hill slopes.

