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Towards simple terrain classification to represent snow distribution characteristics in a mountainous slope

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1. Introduction
Snow cover is distributed nonuniformly in a mountainous slope effected by terrain characteristics as relief and aspect. The aim of this study is to obtain a simple terrain classification method to represent a snow depth distribution in a mountainous slope.
2. Classification method
Gamahara-zawa basin, located in border between Nagano Pref. and Niigata Pref., is the heavy snow area which has more than three meter of snow depth in winter. In 2003, We conducted an airborne laser survey both in February (snow season) and in November (non-snow season), and developed a snow depth distribution map with five meter resolution mesh from the differences between each elevation. We extracted two contrastive rectangular slopes with 600 m length on a side from the basin. One is composed of rugged steep slopes, and the other is composed of gentle slope formed by lave plateau. We calculated terrain indexes (Lapen and Martz, 1996) for both slopes and found that Indexes of "Local shelter (LSHEL)", "Local relief (LRLF)", averaged relief (AVRLF) and aspect (ASPT) had strong relations with snow depth. We classified two slopes by these indexes and discussed whether the results represent appropriately the terrain characteristics and snow depth distribution.
3. Results and discussions
(1) Rugged steep slopes
We classified the slope into sheltered (>0) and exposed (0<) terrain using LSHEL, LRLF and AVRLF, and classified the exposed terrain into south-facing and north facing terrain using ASPT. Totally this area was classified into three terrain.
Classification by "LSHEL + ASPT" best represented terrain characteristics. Averaged snow depth was 433 cm in sheltered, 401 cm in north-facing exposed and 330 cm in south-facing exposed, showed same tendency with the true snow depth.
By classification by "LRLF + ASPT", more than 50 % cells were assessed as sheltered terrain. Averaged snow depth showed different tendency from the true snow depth.
Classification by "AVRLF + ASPT" represented mosaic-like pattern.
(2) Gentle slope formed by lave plateau
We classified the slope into sheltered, graded and exposed terrain using LSHEL, LRLF and AVRLF. Firstly, we set 15% and 60% of threshold values for "LSHEL", and classified the slope into them. In the result, the cell ratio that were classified into sheltered terrain was 0.47 %. The averaged snow depth in the sheltered terrain was dominantly higher (583 cm) compared with graded (395 cm) and exposed (353 cm) terrain, denoted the same tendency in the true snow depth. Therefore we considered the classification by "LSHEL" was appropriate to represent the snow depth characteristics in gentle slope formed by lava plateau. Next, we set 2.0 m and 0.0 m of the threshold value for "LRLF" and "AVRLF", and classified the slope into sheltered, graded and exposed terrain. Classifications by them had a problem to represent mosaic pattern in the area.
3. Conclusion
We concluded that the appropriate classification indexes to represent snow depth distribution in

our research area were local shelter (LSHEL) and/or aspect (ASPT). Toward to develop the accuracy, we need to reconsider the mesh size and the appropriate threshold value.

Keywords: snow depth, topographic relief, airborne laser survey, terrain classification