Study of Network Image of a Snowpack Microstructure For Quantification Using a Morphorometrical Method

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Computer tomography has advanced with respect to diagnostic imaging over the last several years in terms of the increasing capacity of computers. The technique of tomography is also useful to quantify the three-dimensional microstructure of snow. In this study, several methods were introduced to analyze the microstructure of snow in order to parameterize the network image of a snowpack. We used a three-dimensional NMR imaging data set of four snow types: artificial ice spheres, large rounded polycrystals, small rounded monocrystals, and depth hoar crystals. A three-dimensional gradient-echo sequence (image matrix = 128^3; voxel size = (200 μm) ^{3} or image matrix = 256^3; voxel size = (120 μm) ^{3}) was used for the three-dimensional imaging. We measured the porosity and number of terminus of the samples and carried out the node-strut analysis. The structure model index (platelike, rodlike, or spherelike) and trabecular bone pattern factor (concave or convex in three dimensions) were also calculated. By using each parameter, it was possible to distinguish between the four types of test snowpacks. Therefore, snow network analysis may be a useful method to characterize the microstructure of a snowpack.