THE USE OF COMPUTER-BASED QUANTITATIVE STEREOLOGY FOR STUDYING MICROSTUCTURE OF SNOW

by

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ABSTRACT

In an earlier study software was developed for the automated measurement of snow microstructural parameters by means of quantitative stereology. Comparison of measurements from surface sections and exact results for similarly sized particles were made. In earlier work, theory was developed by the authors to determine trends for neck length and bond radius evolution during deformation of natural snow. The trends indicated by the theory and the stereological technique remained unresolved. This study was undertaken in order to answer these remaining questions.

Artificial snow consisting of spherical particles was produced in order to validate the theory. The use of spherical particles eliminated problems associated with validating stereological measurements of irregularly shaped particles. The artificial snow had mean diameters of 0.5mm and densities in excess of $350KG/m^3$. Mean 3-d coordination number, surface to volume ration, grain volume and number of bonds per volume values were obtained from surface section measurements and an algorithm developed earlier by the authors for determining these values with out any assumptions of grain shape. These measurements compared favorably with values obtained for nonspherical particles of the same average dimensions. Serial section results were in agreement with values obtained from single section measurements.

Samples of the artificial snow were subjected to deformation under differing strain rates. Previous measurements obtained in the earlier large deformation studies were of insufficient resolution to firmly establish any trend in neck length changes. New surface section images obtained using a CCD camera, resulted in better quality and higher resolution images, thus enabling the authors to accurately measure trends in neck length changes due to compressive deformation. Comparison of the experimental measurements and theory showed agreement with neck length and bond radius evolution trends.