Measurements of tensile fracture strength of high-density wet snow

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To clarify the tensile fracture strength of high-density wet snow, which can be seen in perennial snow patches of Japan during the ablation period, tensile fracture tests were carried out in the cold room of 0-1 degree Celsius. Test specimens, taken from the Nishi-honjyozawa snow patch in Mt. Arasawa, range in wet density from 500 to 830 kgm^{-3}, and in liquid-water content from 0 to 16 percent.

Consequently, the test data showed the tendency of the tensile fracture strength to increase with increasing wet density although the scatter of data was not small. This scatter indicates that the tensile fracture strength of high-density wet snow is highly dependent on not only density but also liquid-water content. Therefore, after the relationship between the tensile fracture strength of dry snow with a temperature of 0 degree Celsius and its density was formalized using the data obtained by Mellor(1975) in addition to this test data, the following relationship was obtained by taking into consideration the reduction rate of tensile fracture strength in response to the increase in liquid-water content:

$S=1.0*10^{-9}D_{dry}{}^{4.17}\exp(-0.052W)$,

where S is the tensile fracture strength of high-density wet snow (kPa), D_{dry} is the dry density of wet snow (kgm^{-3}) and W is the liquid-water content of wet snow (percent). This empirical formula was found to be capable of estimating the tensile fracture strength of high-density wet snow with sufficient accuracy.