# SMP cone penetration in homogeneous snow layers

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For avalanche forecasting, knowledge about snow stratigraphy is of crucial importance. The SnowMicroPen (SMP), a constant speed small diameter digital cone penetrometer, is used to determine in situ snow characteristics and stratigraphy. When deriving micromechanical snow parameters from the SMP force signal, the compaction of failed elements around the SMP cone is generally neglected. Given the high porosity of snow, it is assumed that this results in minimal errors. A method to analyze the deformation of snow around the SMP tip using particle image velocimetry is presented in order to verify this assumption. Results from laboratory experiments with uniform snow show that a compaction zone around the SMP tip develops during penetration. The size of the compaction zone was on average twice as large as the actual size of the cone, increasing with increasing snow density. Furthermore, an average penetration depth of about 4 cm was required for the compaction zone to fully develop. This critical penetration depth was found to decrease with increasing snow density. These results show that the compaction zone around the SMP tip is far from negligible. The implications for the interpretation of SMP force measurements in stratified snow are discussed.