Modeling winter snow distribution with ALPINE3D and parameterization of snow erosion and deposition for use in other applications

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Assessing the water availability in the mountain basins requires accurate estimation of water stored within the snow, firn and ice thus knowledge of the distributed snow and ice mass balance throughout the year. The inhomogeneous snow distribution found in Alpine terrain is the result of wind and precipitation interacting with the snow surface over topography. In order to quantify the redistribution of snow due to these mechanisms, we are first implementing the ALPINE3D model, which is coupled to a module that is describing saltation, suspension and preferential deposition of snow. Coupled to this snow drift module is the snowcover model SNOWPACK, for the assessment of the erodability of the snow cover and the development of the snow cover at different locations due to erosion and deposition of snow. Wind fields are calculated with a local meteorological model (ARPS).

This model framework has been used to simulate the winter season 2006/2007 over Haut Glacier d'Arolla in southwestern Switzerland. High resolution LIDAR measurements of snow depth over the entire catchment are used to validate the model output. With these results, we are attempting to parameterize the snow erosion and deposition for use in other applications which do not necessary require the high complexity of modules like SNOWPACK, but where a correct estimate of snow distribution is very important.