

A 3D snow depth analysis over complex terrain

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Snow depth, like many other meteorological parameters, shows typically a strong vertical gradient. If we want to analyze meaningful fields of this parameter over complex terrain, we need to know this vertical gradient. Very often it is estimated by the use of a set of close data points at different elevations. A problem arises due to the fact, that stations are typically located along a sloping terrain. Then we do not get a vertical gradient but rather a gradient (component) along that slope.

A more fundamental approach is the consideration of a three dimensional gradient, the vector sum of the horizontal and the vertical components. The VERA (Vienna Enhanced Resolution Analysis) algorithm has been applied to a three dimensional snow depth analysis. VERA, a variational method, minimizes the sum of different order spatial derivatives. This method represents a finite element approximation to the spline method.

As a result one obtains a 3D distribution of snow depth, which can be used to determine the corresponding 2D values along the terrain. As a by product the "real" vertical gradients are obtained. The application to real data show a considerable sensitivity to the parameter setting, i. e. the ratio between the horizontal and vertical grid spacing. The method can ideally be used to investigate the representativity of single data and to find biases.

Some examples will show the potential of the method.