



Snow drift modelling in complex terrain

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Snow drift, the snow transport due to wind, plays an important role for the snowpack's structure and its temporal and spatial development, especially in complex terrain. Mainly it adds a load of snow to some areas and erodes it elsewhere, thereby increasing shear stress.

Snow drift is a very complex process, depending on several meteorological parameters (e.g. precipitation or wind), the topography, and the properties of the existing snowpack, all of which may vary substantially over short distances and times.

Therefore, snowpack models including snow drift are often multilayer models coupled to complex snow physics. Hence they are also based on lots of observation/measurement data, which are mostly not available at a sufficient spatial resolution. An operationally usable snow drift model for a large domain encompassing an appropriate temporal and spatial resolution is lacking.

We introduce a simple statistical-empirical snow drift model for alpine terrain, which provides snow drift at very high temporal and spatial resolution (15 minutes and ≤ 100 m, respectively). To avoid the dependency of detailed measurement and thus forecast data, the 2-layer model computes the net snow drift amount using a function of wind speed and snow density solely. The snow drift amount itself is unsigned, as it represents the snow transport rate that is lifted up into the air. The algorithm is therefore independent of wind direction. This is a great advantage compared to other approaches, since wind directions in complex terrain can still not be modeled satisfyingly. The lateral distribution is implemented by a concept based on a terrain parameter (negative openness), which determines donor and acceptor cells of snow drift.

Due to the simple approach with only a few parameters required, the new snow drift model is computationally efficient, easily adaptable to other domains and applicable for operational use on large domains (e.g. 400 x 700 km, i.e. 30 m grid points).

In a first step the snow drift model was developed for modelling historical storm events in Tyrol, Austria. For the near future, a high resolution, snow drift forecast is planned by implementing the model into the operational snow cover model SNOWGRID of ZAMG.