

# ENLUF explore snow

## Energy- and Resource-Efficient Snow Demand Assessment for Winter Sports Resorts

In this project, a simulation model is developed that consolidates data from multiple sources. Based on frequently used sections of ski slopes, weather conditions, and additional data, the difference between target (planned) and predicted actual snow depth is used to calculate how much snow is required on specific sections of the slopes.

### Problem Statement

Technical snowmaking represents a major financial challenge for every ski resort and requires a careful balance: to protect the environment and control costs, resorts aim to avoid excessive snowmaking, while ensuring guest satisfaction requires sufficient snow coverage. Across Switzerland, approximately 40% of ski slope areas are equipped with snowmaking systems, resulting in total costs of around CHF 500 million. How can the production and redistribution of artificial snow be optimized in order to reduce costs as well as energy and water consumption?

### Concept

ENLUF explore snow is designed as a complement to commercially available snow management systems. These systems measure snow depth using GPS receivers combined with 3D terrain models or ground-penetrating radar. In both cases, the devices are mounted on vehicles that traverse the slopes multiple times.

The core idea of this project is to use simulation to predict snow erosion on ski slopes and determine the amount of technical snow that needs to be produced. This prediction enables optimized planning of snow production and transportation to the slope sections that require grooming.

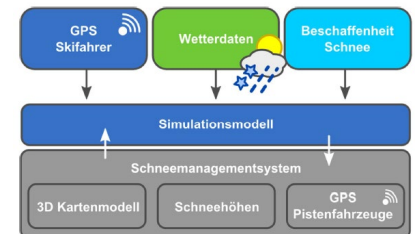
The simulation relies on a model that integrates the following information from various sources:

- 3D map of the ski area from an existing system
- Real-time measured snow depths
- GPS data from skiers
- Weather data such as wind, temperature, solar radiation, snowfall, or precipitation
- Snow quality and physical properties
- Snowmaking infrastructure, either imported from an existing system or recorded manually

From the GPS data collected via a smartphone app and transferred to the model at regular intervals, the paths taken by skiers on the slopes can be reconstructed. By aggregating all paths, the model identifies heavily frequented areas, indicating where snow erosion is greatest.

Once snow erosion on the slopes has been calculated, the required snow volume per slope section can be determined based on the difference between target and predicted actual snow depth. This allows identification of the most efficient production locations and transport routes. The resulting information is fed back into the system and made available to operations planners and snow groomer operators.

If the simulation accurately reflects real-world conditions, extrapolation can be used to make predictions about the future condition of the slopes.



### Contact

Prof. Dr. N. Frei

**I3 Institute for Interactive Informatics**

OST  
 Lerchenfeldstrasse 3  
 9000 St. Gallen  
 Switzerland

Phone: +41 (0)58 257 32 21

Email: [norbert.frei@ost.ch](mailto:norbert.frei@ost.ch)