

# ProTools and ProNXD: Record and manage avalanche activity

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## PROTOOLS AND PRONXD: RECORD AND MANAGE AVALANCHE ACTIVITY

Avalanche activity data are essential, both, for avalanche forecasting and for avalanche danger verification. Whereas the recording of avalanche activity should be as detailed as possible for the purpose of forecasting and verification, for the observer it should be as easy and efficient as possible. We therefore developed ProTools as web-based Software to record avalanches on a topographic map. In addition, ProNXD is a module within ProTools that helps avalanche safety personnel of ski areas, roads, railways or settlements to recognize avalanche days. ProNXD is based on a nearest neighbor model and compares the current snow and weather situation with situations from the past by displaying similar days including the avalanche activity.

### PROTOOLS

Avalanches can be entered on a map in a very simple manner, either as polygons (avalanche outline) or points (top of starting zone or end of avalanche deposit) (see Figure 1). Avalanches can further be characterized with typical attributes such as avalanche type (e.g., slab avalanche or loose snow avalanche), liquid water in snow (dry- or wet-snow avalanche), type of triggering (e.g., explosion, person, natural avalanche) or avalanche size. Geographical information of the avalanche such as elevation of the starting zone or avalanche length is directly generated from the mapping. Hence, many avalanches can be recorded in a short time, for example, in a ski area after an avalanche control operation.

Avalanches can be entered by a variety of users such as SLF observers, rescue and avalanche services or SLF staff and are centrally managed by the SLF avalanche forecasting team. In the future, ProTools will be used to enter and manage data of

**Sprengdaten erfassen** Speichern Abbrechen

Spreng ID	54303f6d-41d0-4ba5-97a5-fe57daaf74cf												
Sprengdatum	10:00 - 12:00	17.12.2014											
Patrouilleure	Patrouilleure <a href="#">Übernehmen</a> • Meier Karl • Müller Walter												
Sprengpunkt	Ob der Schlucht												
Sprengkoordinaten	782850 / 189250												
Sprengmittel	<table border="1"> <thead> <tr> <th>Anzahl</th> <th>Sprengmittelart</th> <th>Ladungsgrösse</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>Knallzündschnur</td> <td>0.012 cm</td> </tr> <tr> <td>1</td> <td>Gamsit</td> <td>4.16 cm</td> </tr> </tbody> </table>			Anzahl	Sprengmittelart	Ladungsgrösse	1	Knallzündschnur	0.012 cm	1	Gamsit	4.16 cm	
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1	Gamsit	4.16 cm											
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Vertikale Position	In Schneedecke												
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Ausgelöste Lawinen	<table border="1"> <thead> <tr> <th>Lawinenart</th> <th>Lawinenfeuchte</th> <th>Gleitfläche</th> <th>Exposition</th> <th>Grösse</th> </tr> </thead> <tbody> <tr> <td>Lockerschnee</td> <td>Nass</td> <td></td> <td>E</td> <td>sehr klein</td> </tr> </tbody> </table>			Lawinenart	Lawinenfeuchte	Gleitfläche	Exposition	Grösse	Lockerschnee	Nass		E	sehr klein
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Figure 1. Recording of avalanche control work including detailed data on the location and type of delivery of the explosive in ProNXD.

all reported avalanches in Switzerland, in particular those that caused damage. To this end, interfaces to other databases such as StorMe, the avalanche tool of the cantons, will be developed. Eventually, all reported avalanches will be stored in one central database. ProTools will be accessible for registered observers of the Swiss avalanche warning service at SLF.

### PRONXD

ProNXD is a data-driven forecasting tool based on the nearest-neighbor approach. Its aim is to support avalanche safety services in better recognizing avalanche days. Primarily, ProNXD replaces the existing algorithms and functions of NXD2000. However, in the next years the algorithms will be improved in collaboration with the local avalanche safety services. ProNXD is web-based and especially suited for ski areas since ski areas regularly do avalanche control work with explosives. Apart from recognizing avalanche activity, ProNXD supports control services in ski areas in their daily reporting, not only for snow and avalanche data but also for explosive management (see Figure 2).

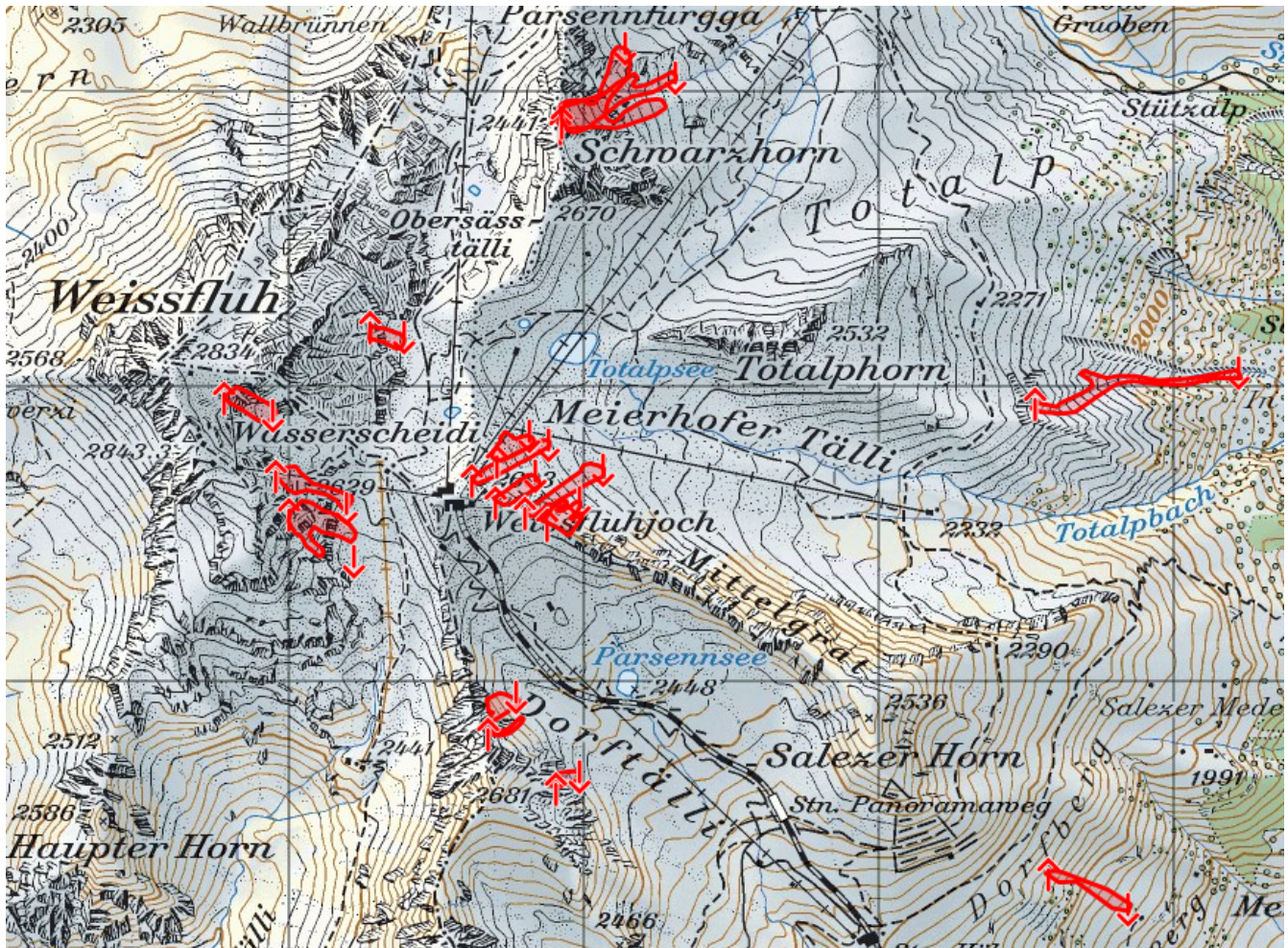


Figure 2. Avalanches mapped in the Davos Parsenn ski area after the avalanche control operations on the beginning of April 2015.

In addition, the avalanche warning service can also include the avalanche activity data in the ski areas in its analysis of the current avalanche situation. Pro NXD can be purchased by every user for an annual license fee (presently 700.- Swiss Francs).

## KEYWORDS

Avalanche recording, avalanche forecast, NXD, avalanche activity

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