

Operational applications of snow cover modelling



Veronika Hatvan



Andreas Gobiet



ZAMG
Zentralanstalt für
Meteorologie und
Geodynamik

Overview

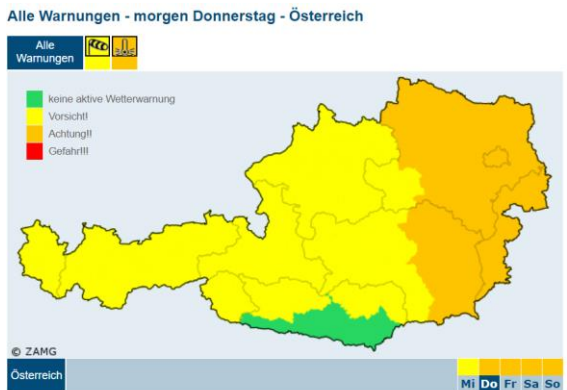
1. ZAMG as provider of operational avalanche services
2. Model-based tools for regional avalanche warning
3. Model-based tools for local avalanche warning
 - Case Study



1. ZAMG - Zentralanstalt für Meteorologie und Geodynamik

— National weather service of Austria

- Provider of **weather forecasts and warnings**
- **Developer of models** within the fields of meteorology and geophysics
- **Monitoring various data** on meteorological and geophysical processes

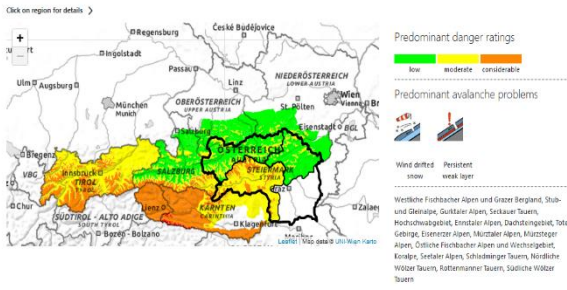


— Avalanche warning service (AWS)

- **Operator** of two (three) regional AWSs
- Provider of **IT infrastructure** for five regional AWSs
- Provider of **weather/snow data and forecasts** for all regional AWSs in Austria
- Provider of **tailored services for local decision makers and experts** (avalanche commissions).

Monday, 08.02.2021 PDF Version | Subscribe now

Considerable avalanche danger due to fresh snowdrifts in southern regions. Old-snow problem in northern regions.



In-house weather forecast/warning and modelling expertise is an extremely valuable background for the operation of AWSs



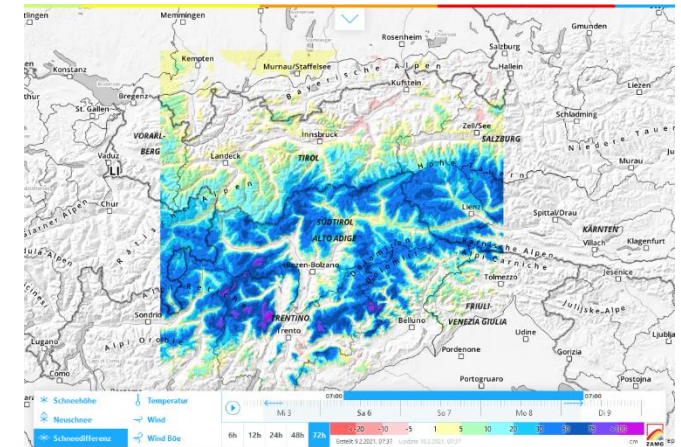
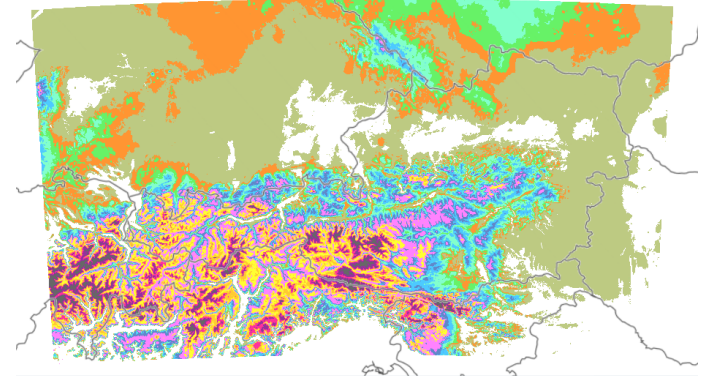
2. Model-based tools for regional avalanche warning

SNOWGRID: Provides spatially distributed information

- 2-layer snow cover model
- Simulates snow cover evolution in Austria in 15-min time steps (1x1km and 100x100m)
- Provides snow cover analyses and forecasts up to +72h (Based on INCA and AROME)
- Operationally implemented for several Regional AWS

Folie 4

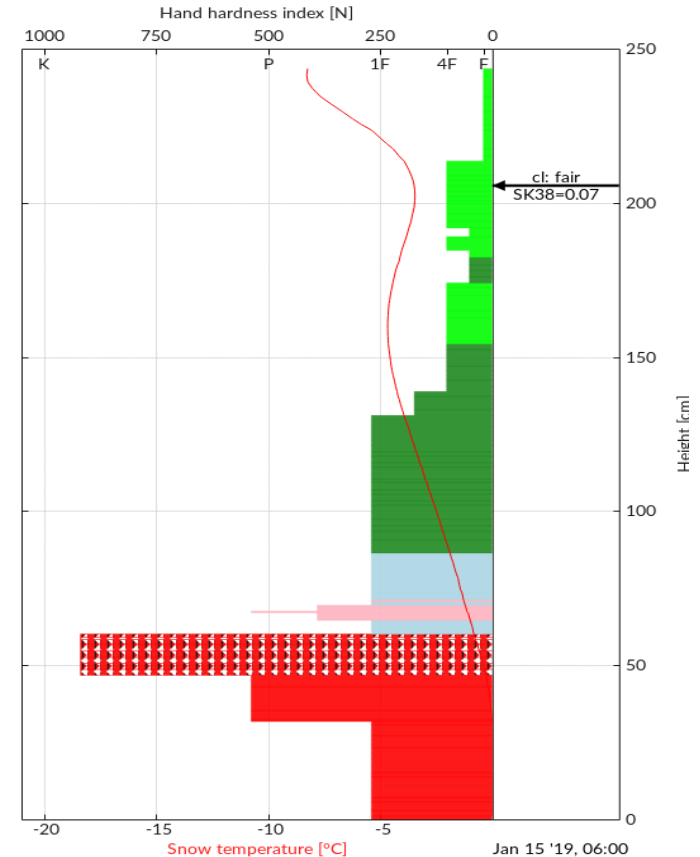
SnowGrid Gesamtschnee: Analyse von Montag 19:00 MEZ



2. Model-based tools for regional avalanche warning

SNOWPACK: Provides detailed information on the vertical structure

- Simulation at various weather stations
➔ Input for regional avalanche forecast
- **Analysis** of important snow cover parameters based on weather station data
- **Forecast** based on ensemble of NWP models

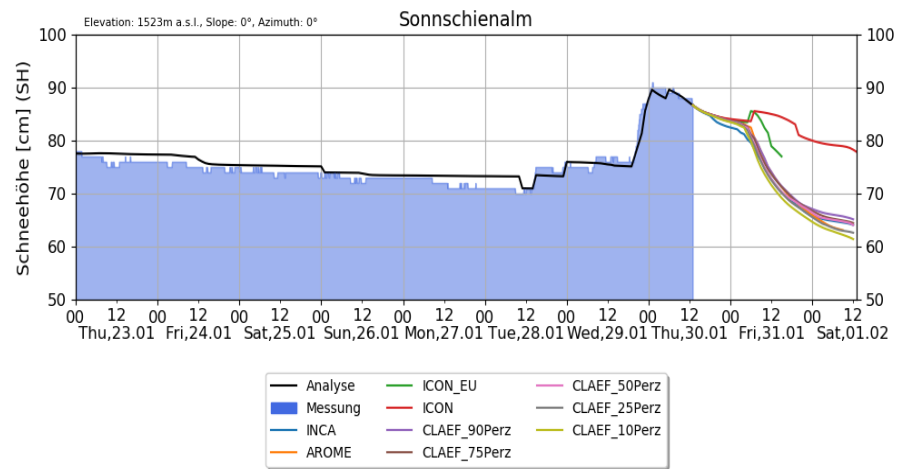
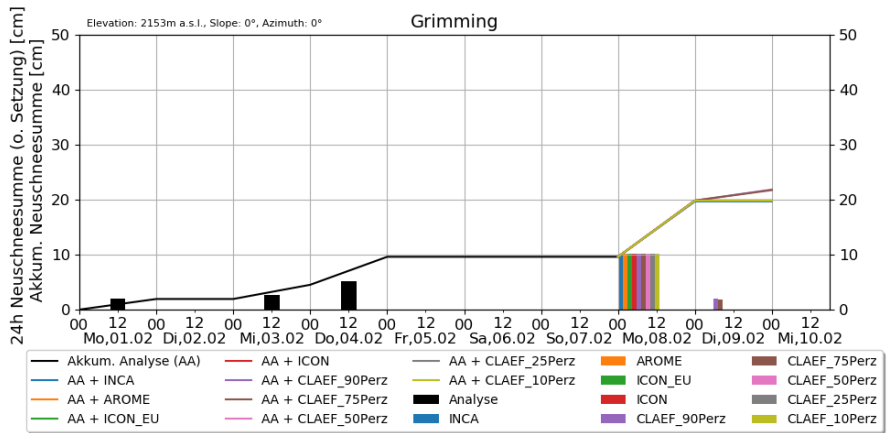
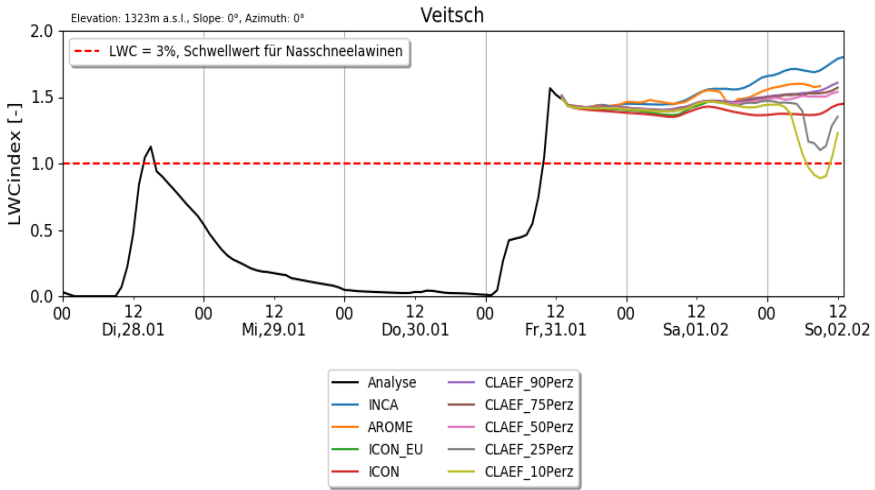




2. Model-based tools for regional avalanche warning

SNOWPACK: Provides detailed information on the vertical structure

- Simulation at various weather stations
➔ Input for regional avalanche forecast
- **Analysis** of important snow cover parameters based on weather station data
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Regional vs. local avalanche warning

Avalanche Report

- **Regional** assessment of avalanche danger
- Information valid for entire region (min. 100 km²):
 - Avalanche danger rating
 - Critical elevation, aspect, time of day
 - Avalanche problem and release type
- **NO** assessment single/individual slopes

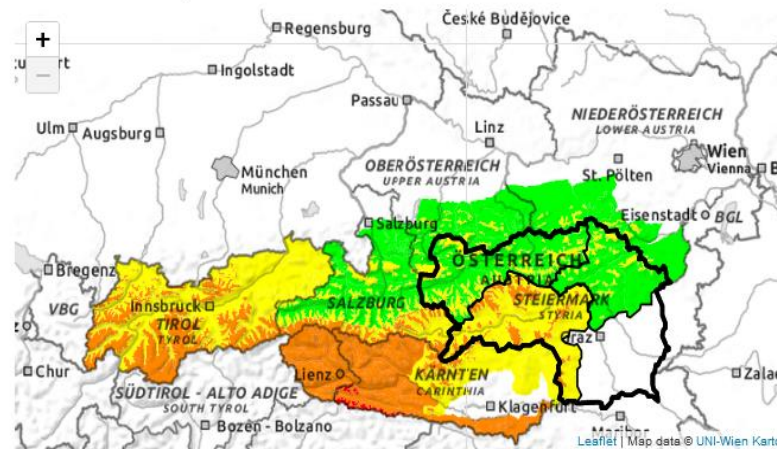
Report for
< **Monday, 08.02.2021** published at 07.02.2021, 18:00
by: Studeregger Arnold

PDF
Version

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Considerable avalanche danger due to fresh snowdrifts in southern regions.
Old-snow problem in northern regions.

Click on region for details >



Predominant danger ratings



Predominant avalanche problems



Wind drifted snow
Persistent weak layer

Westliche Fischbacher Alpen und Grazer Bergland, Stub- und Gleinalpe, Gurktaler Alpen, Seckauer Tauern, Hochschwabgebiet, Ennstaler Alpen, Dachsteingebiet, Totes Gebirge, Eisenerzer Alpen, Mürztaler Alpen, Mürzsteger Alpen, Östliche Fischbacher Alpen und Wechselgebiet, Koralpe, Seetaler Alpen, Schladminger Tauern, Nördliche Wölzer Tauern, Rottenmanner Tauern, Südliche Wölzer Tauern

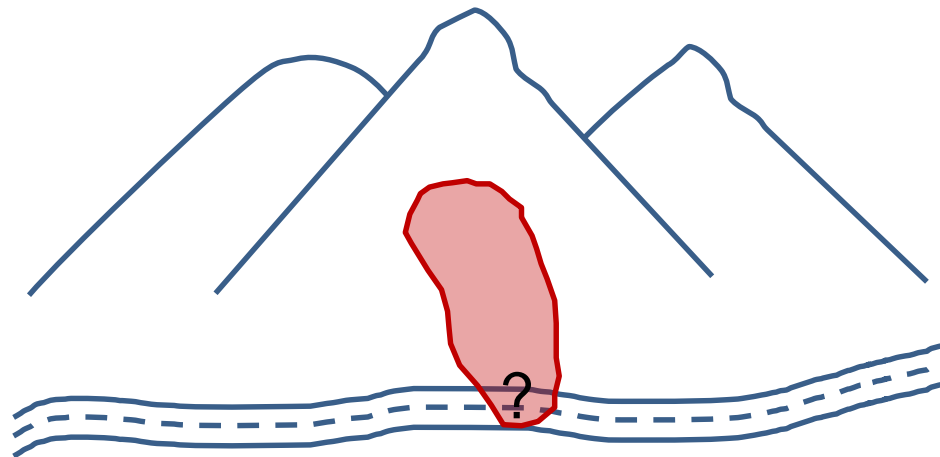
3. Model-based tools for local avalanche warning



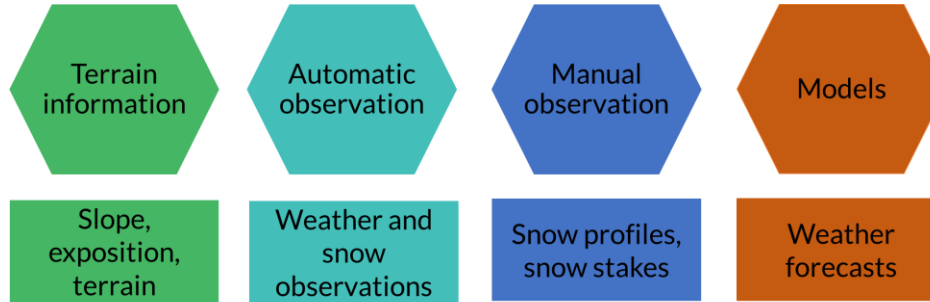
What is local avalanche warning?

Folie 8

- **Local** assessment - slope-scale, avalanche paths
- Local conditions and information are most important
- Regional assessment plays a minor role
- Performed by local experts (avalanche commission)
- **NO** transferability to other avalanche paths/regions



3. Model-based tools for local avalanche warning



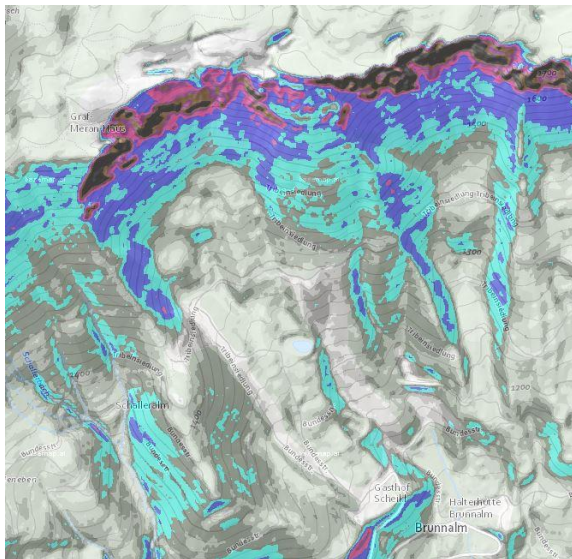
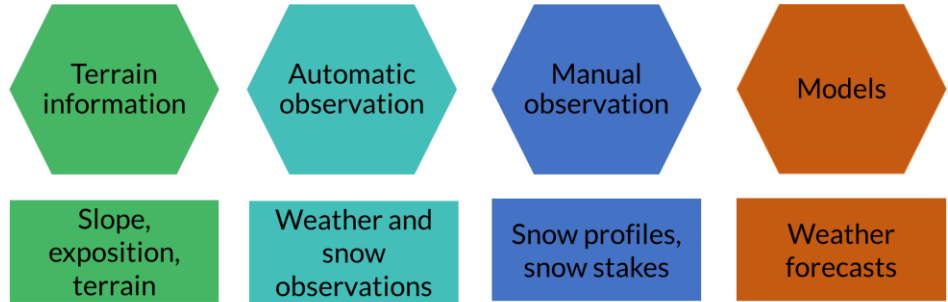
Folie 9



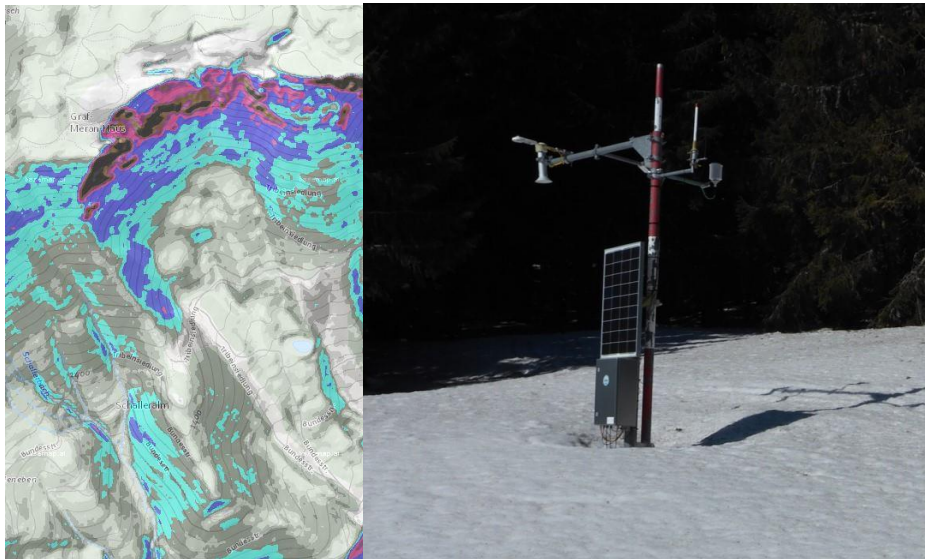
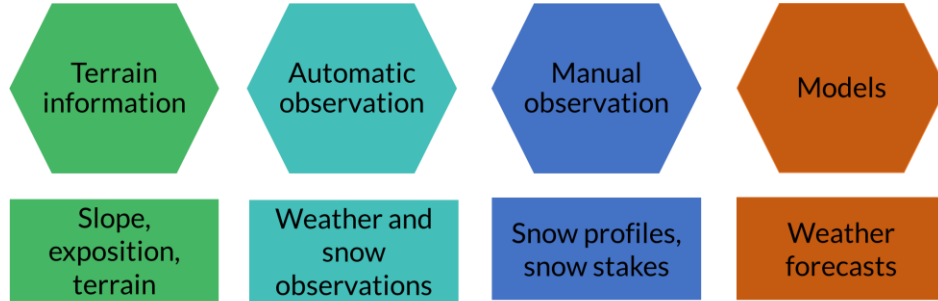
3. Model-based tools for local avalanche warning



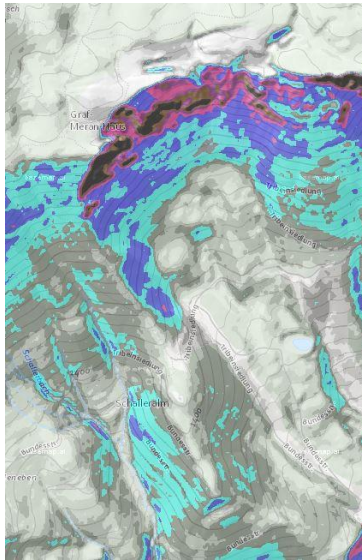
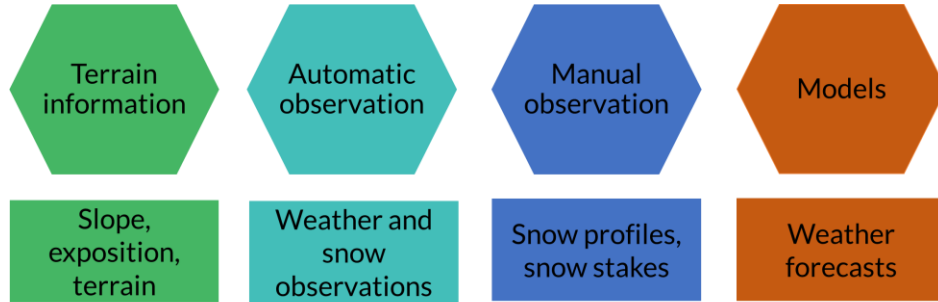
Folie 10



3. Model-based tools for local avalanche warning



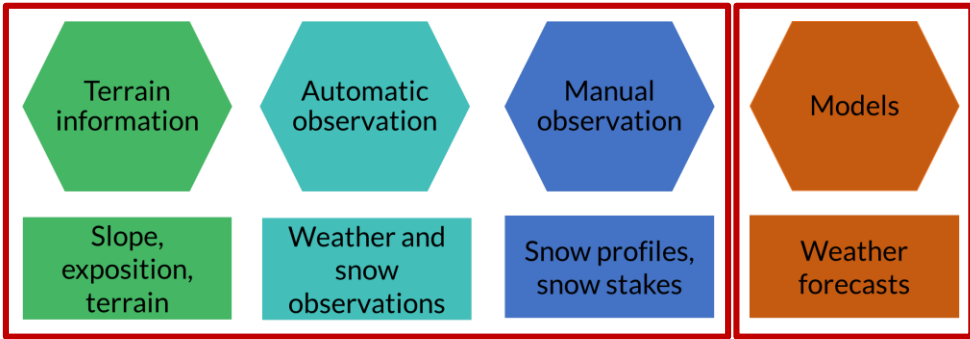
3. Model-based tools for local avalanche warning



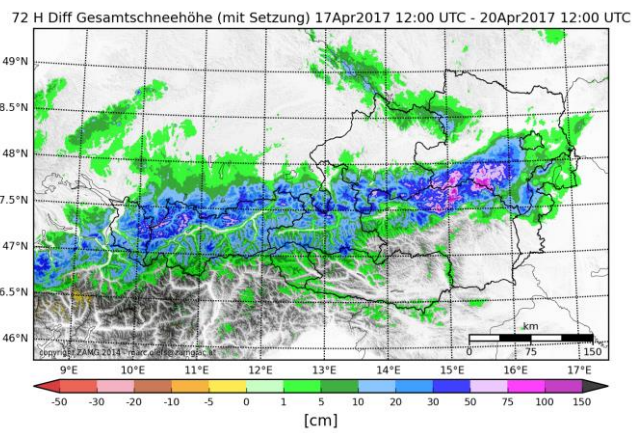
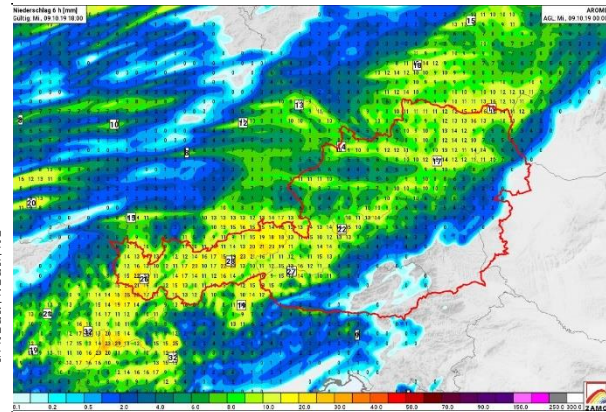
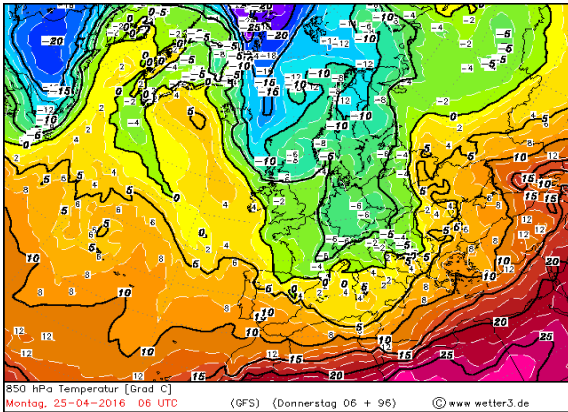


3. Model-based tools for local avalanche warning

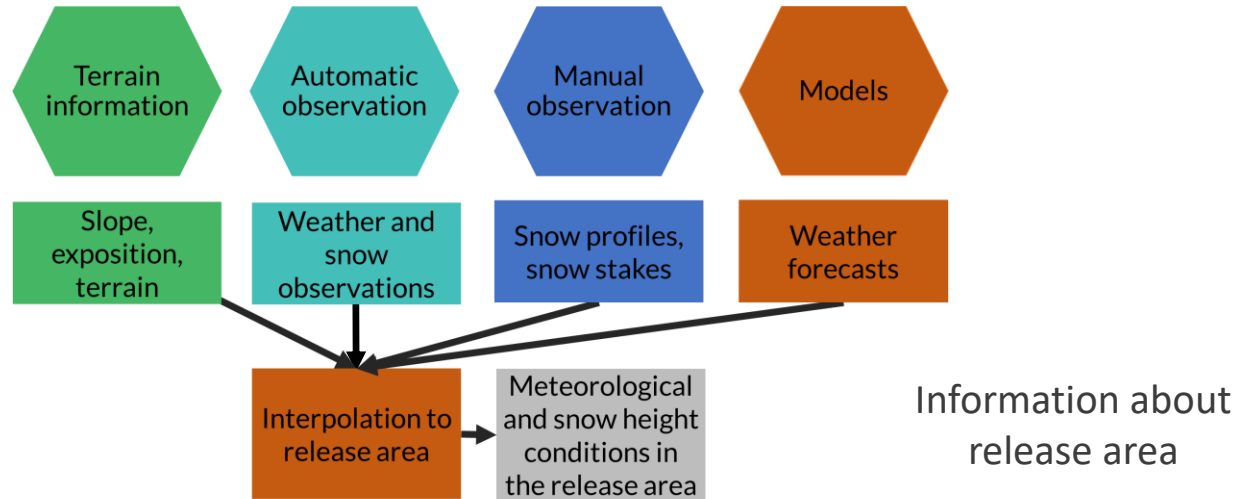
Analysis



Forecast

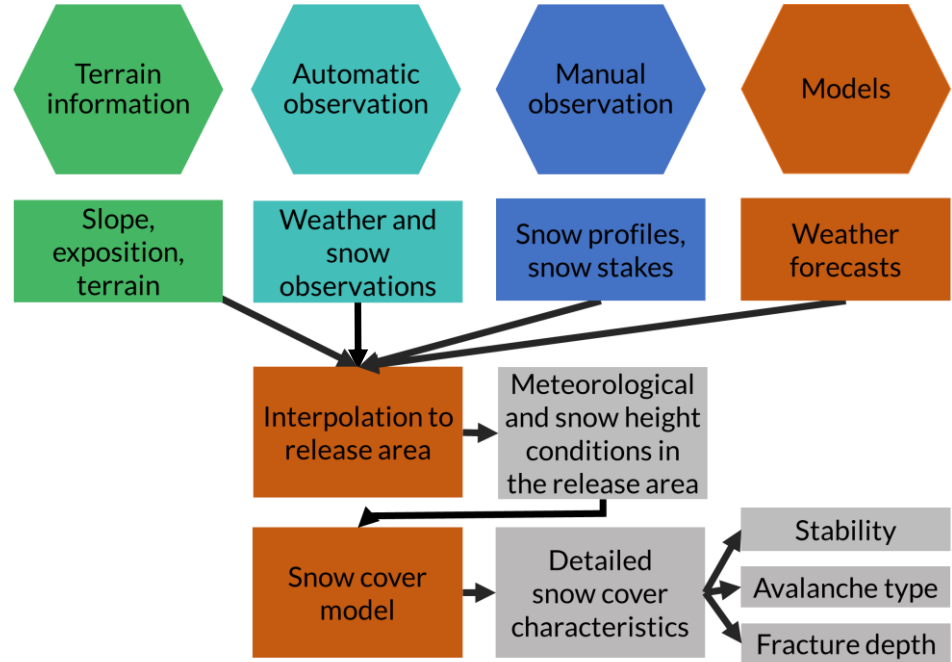


3. Model-based tools for local avalanche warning





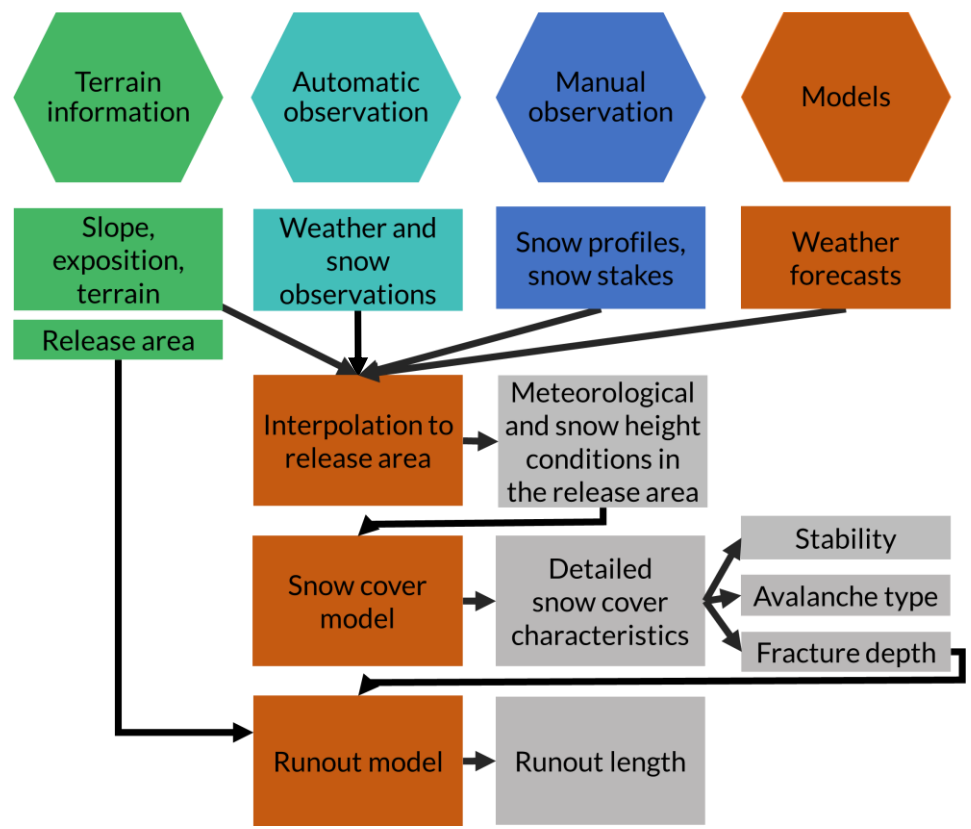
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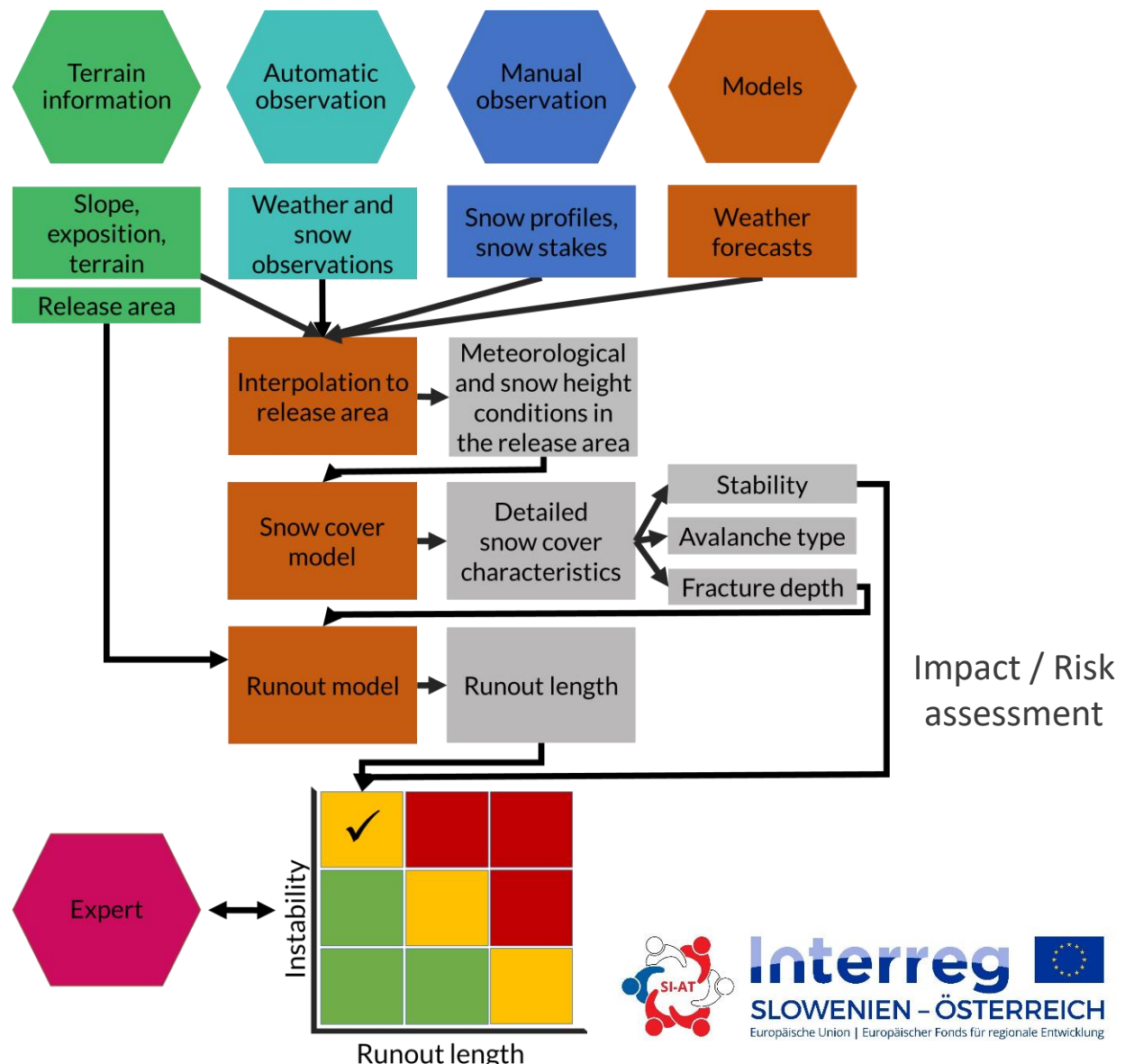
Snow cover indicators



3. Model-based tools for local avalanche warning



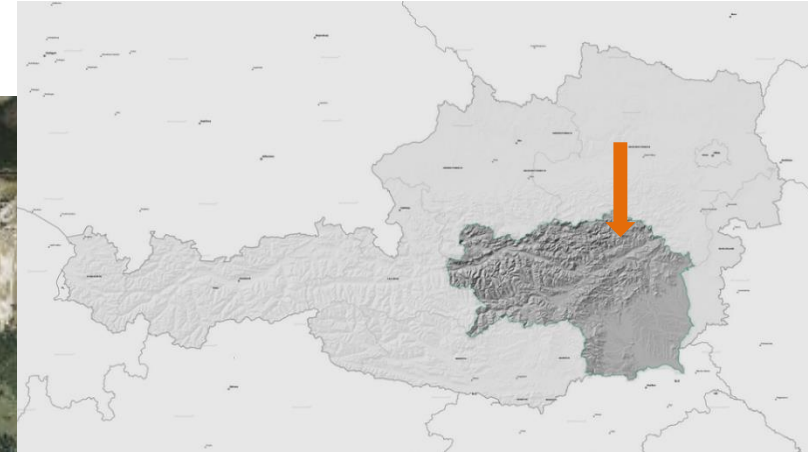
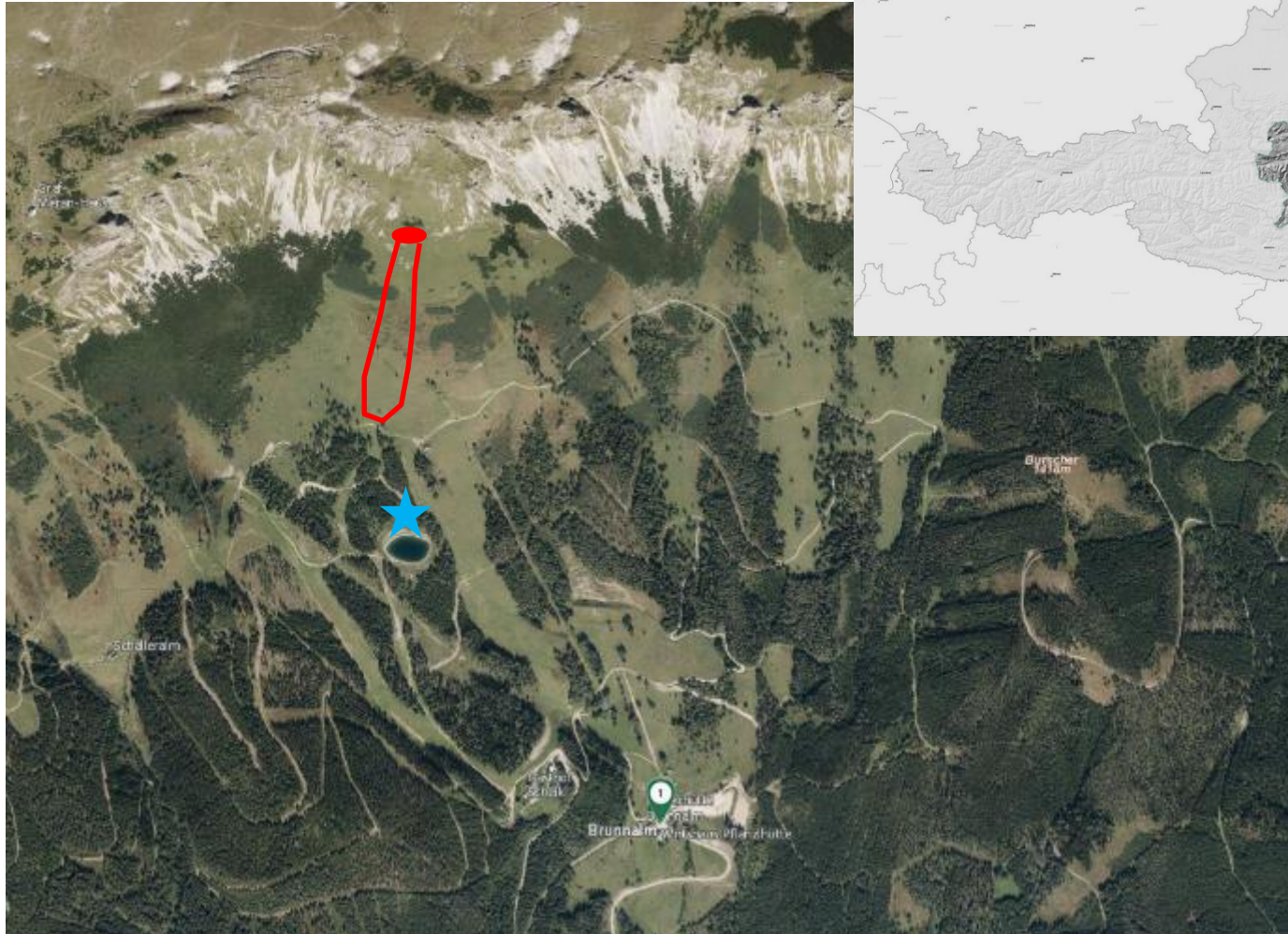
3. Model-based tools for local avalanche warning



Case Study: Test Area

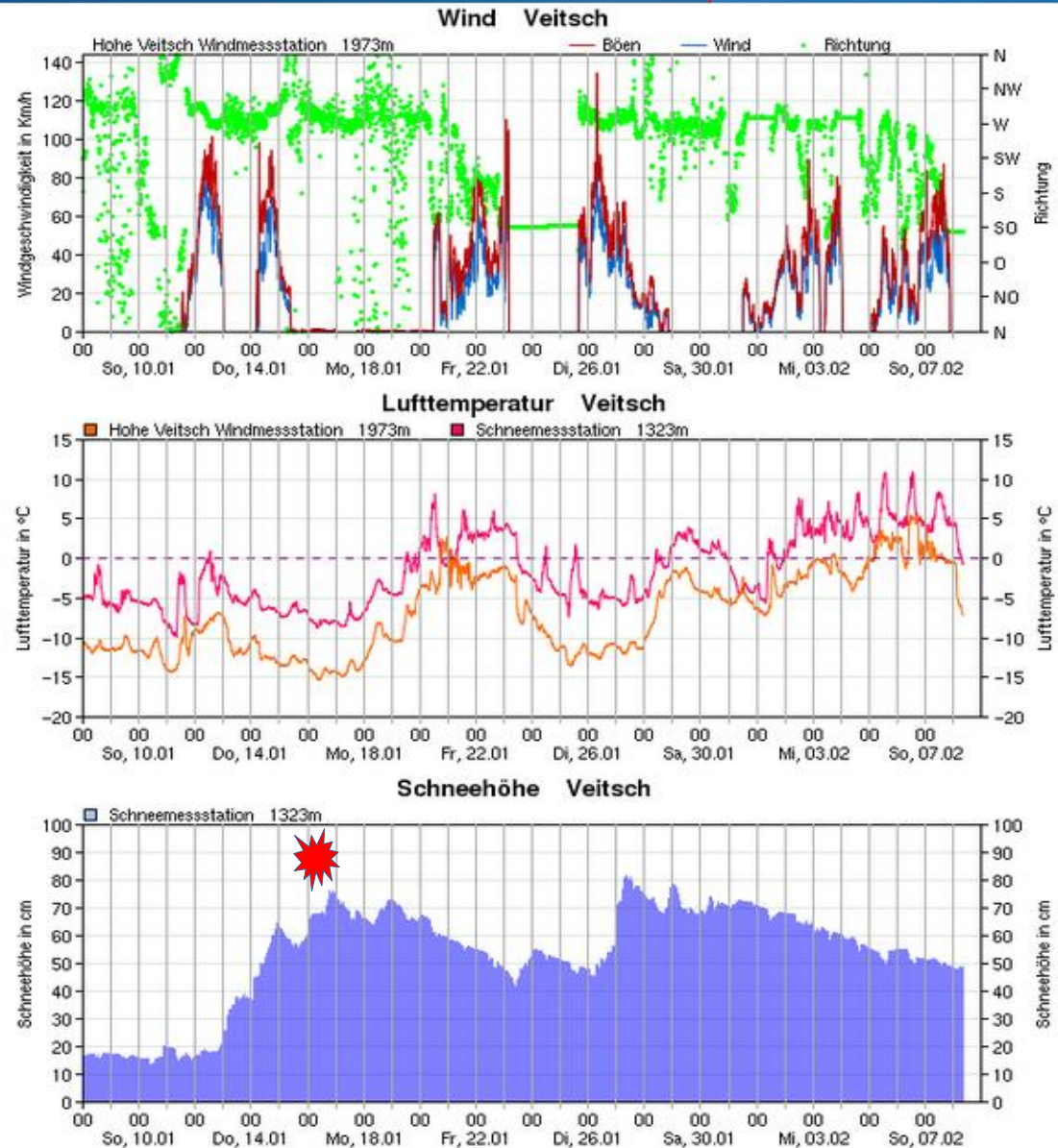


Case Study: Test Area



Case Study: Avalanche 16.01.2021

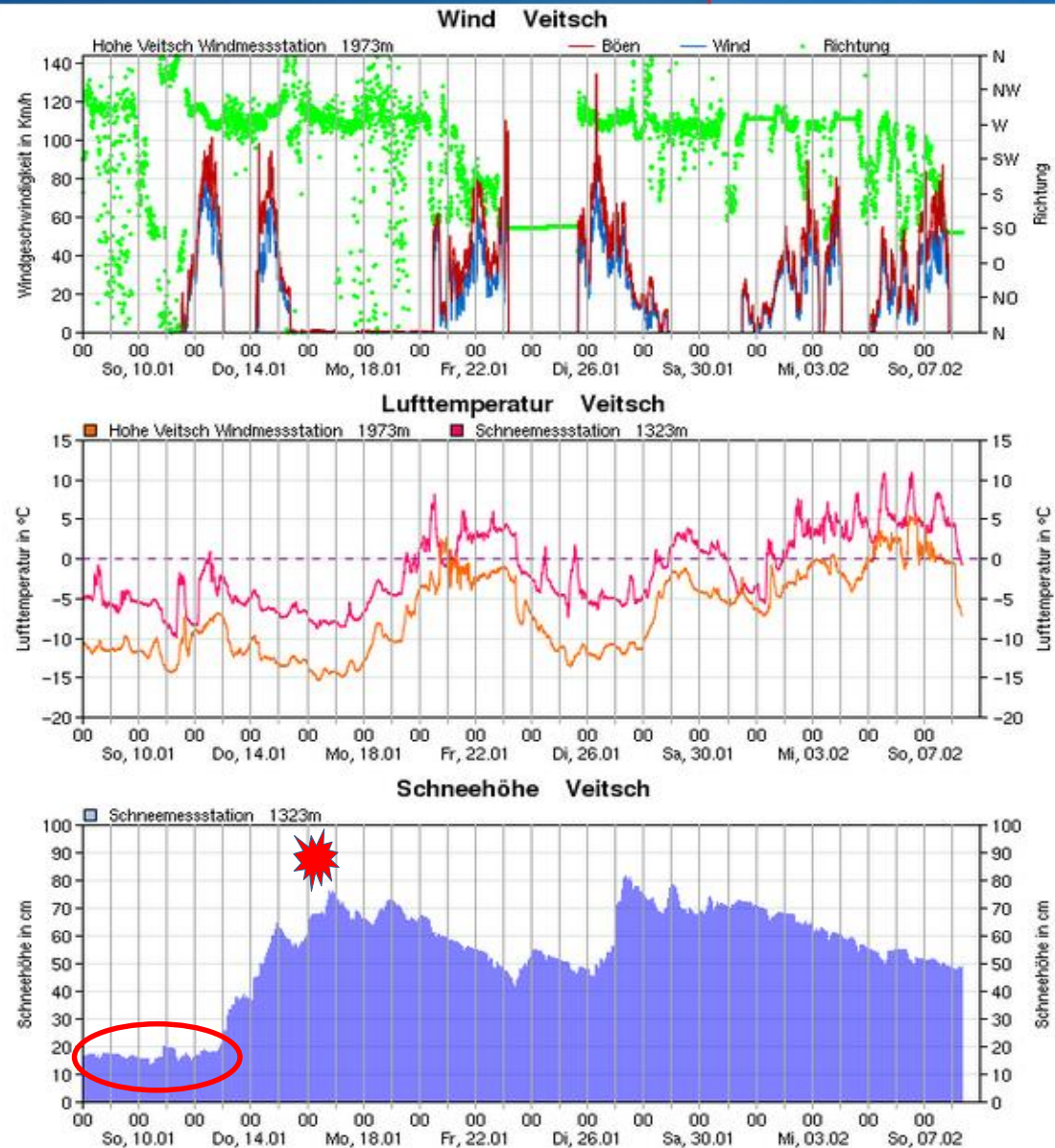
Preceding weather:



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Preceding weather:

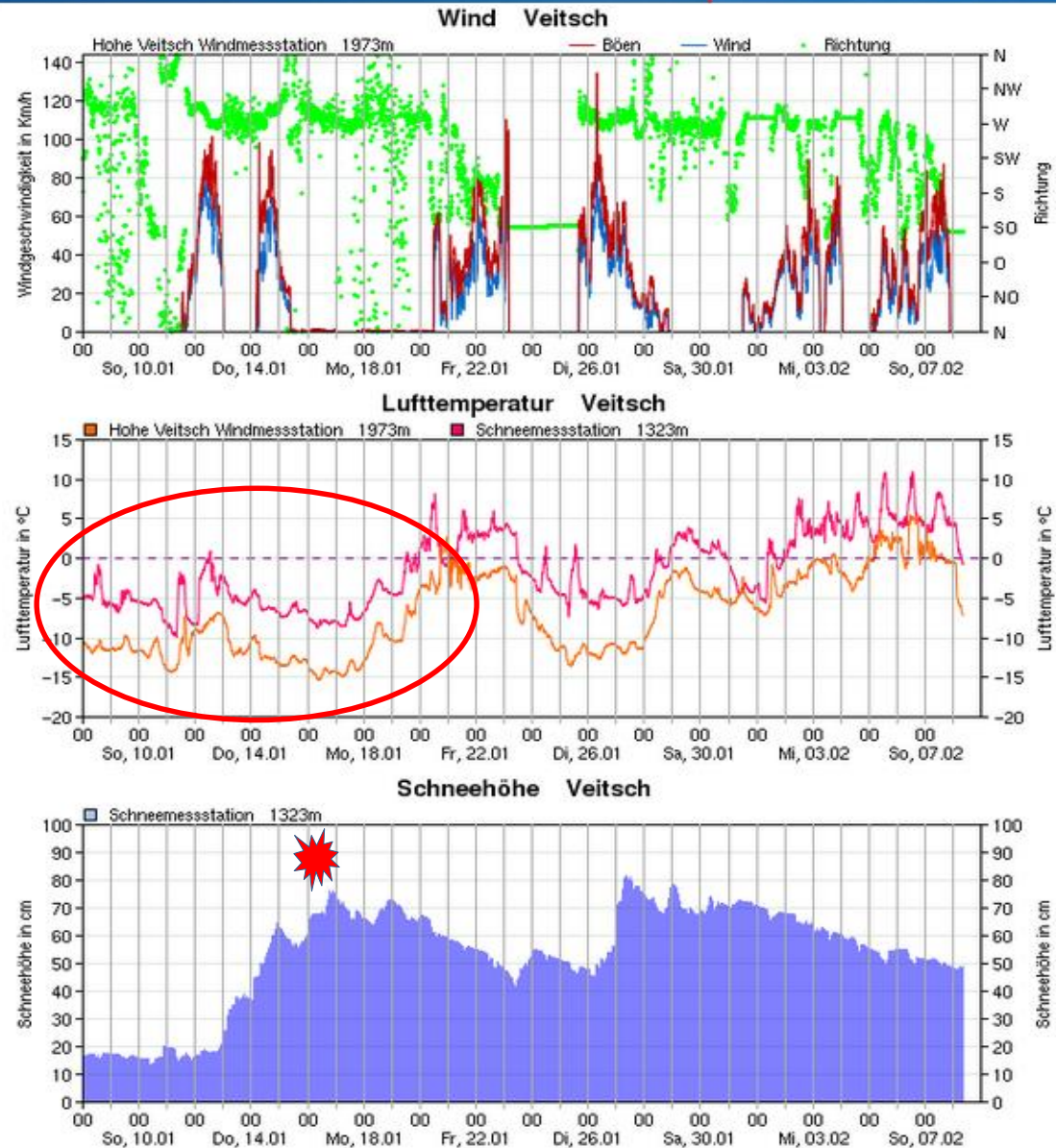
- Small snow height



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Preceding weather:

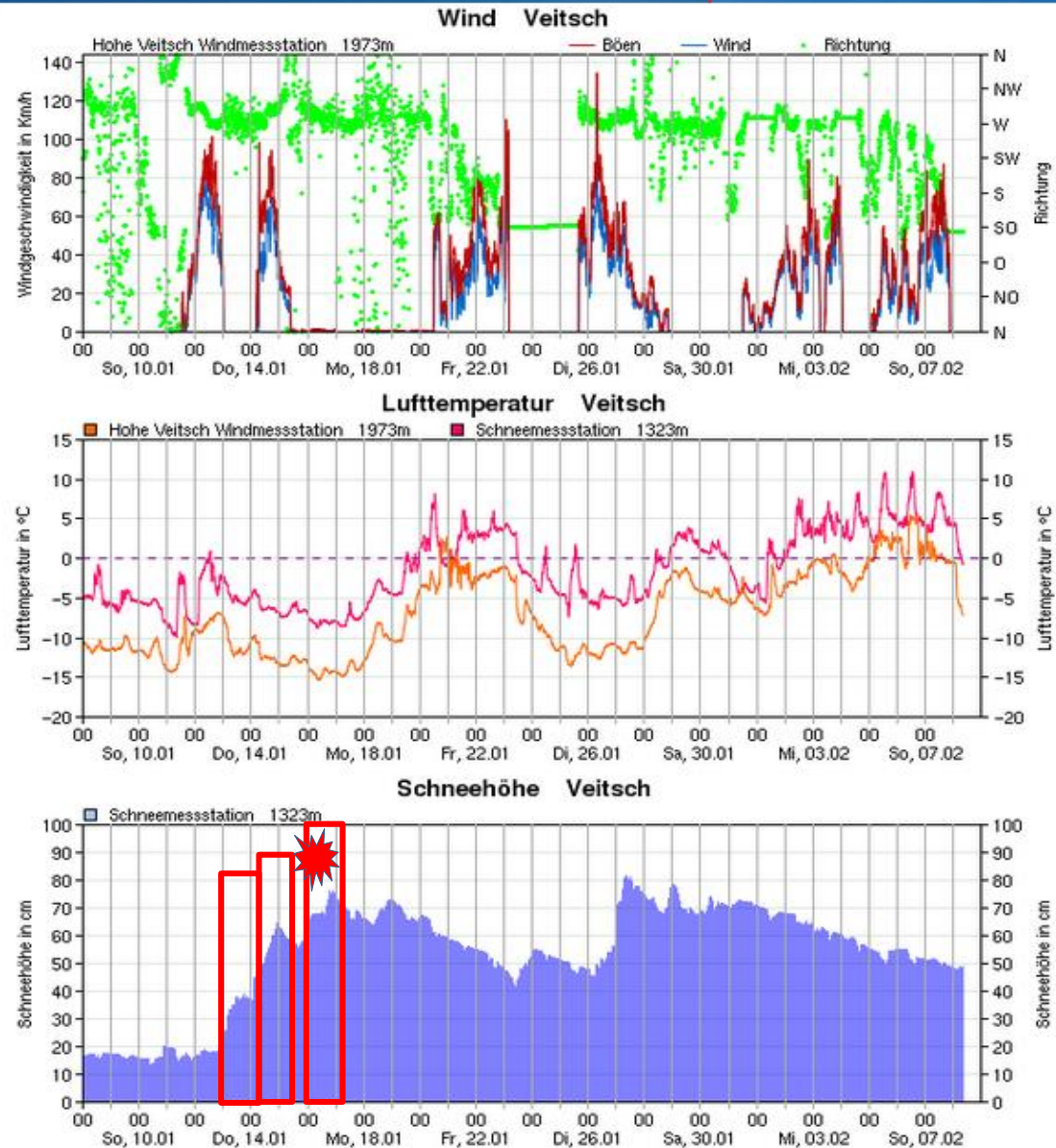
- Small snow height
- Temperatures below 0°C before and during snowfall events



Case Study: Avalanche 16.01.2021

Preceding weather:

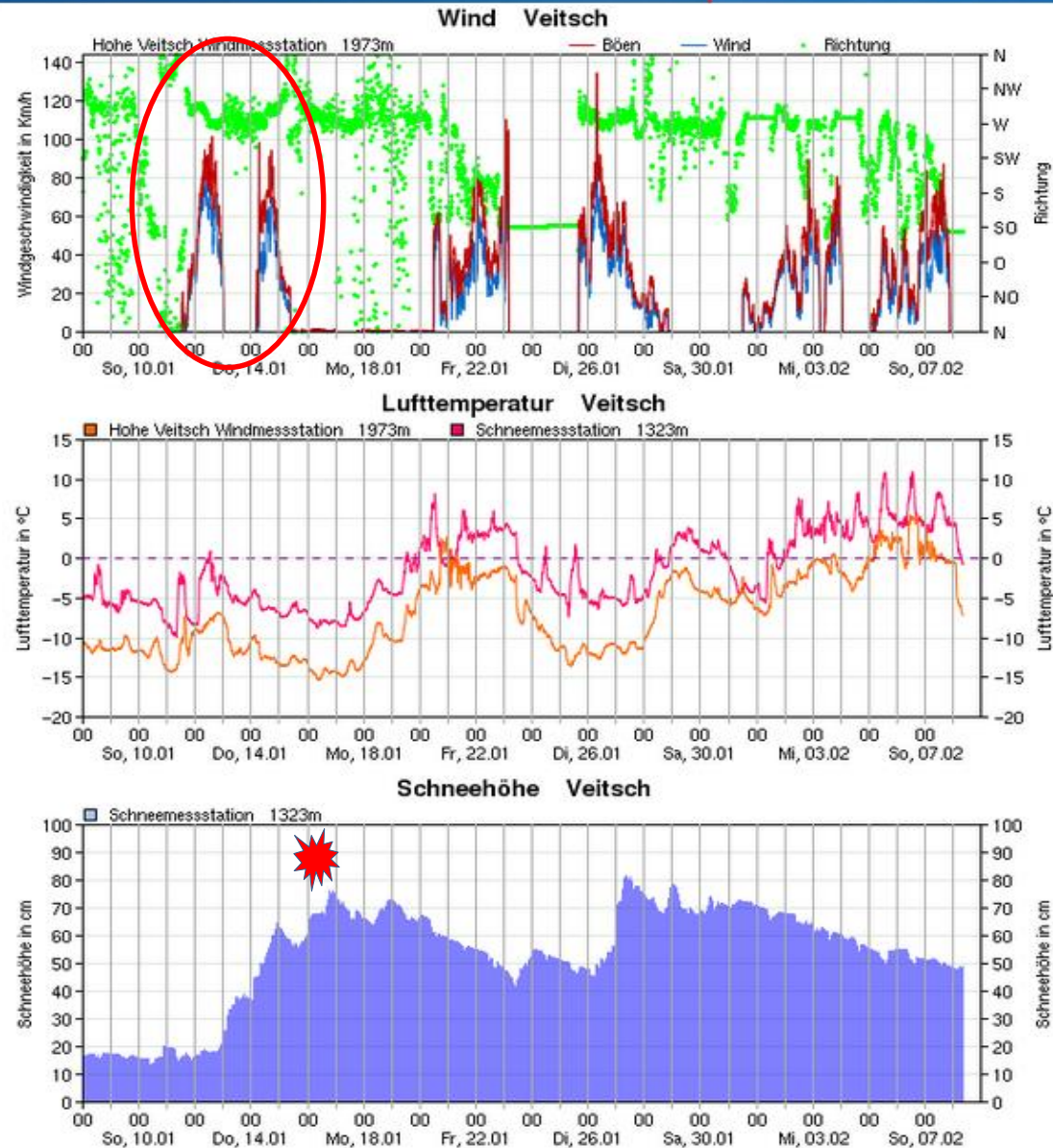
- Small snow height
- Temperatures below 0°C before and during snowfall events
- 3 snowfall events on 13.01, 14.01, 16.01



Case Study: Avalanche 16.01.2021

Preceding weather:

- Small snow height
- Temperatures below 0°C before and during snowfall events
- 3 snowfall events on 13.01, 14.01, 16.01
- Strong WNW winds during snow fall events
- Favourable conditions for slab avalanche formation



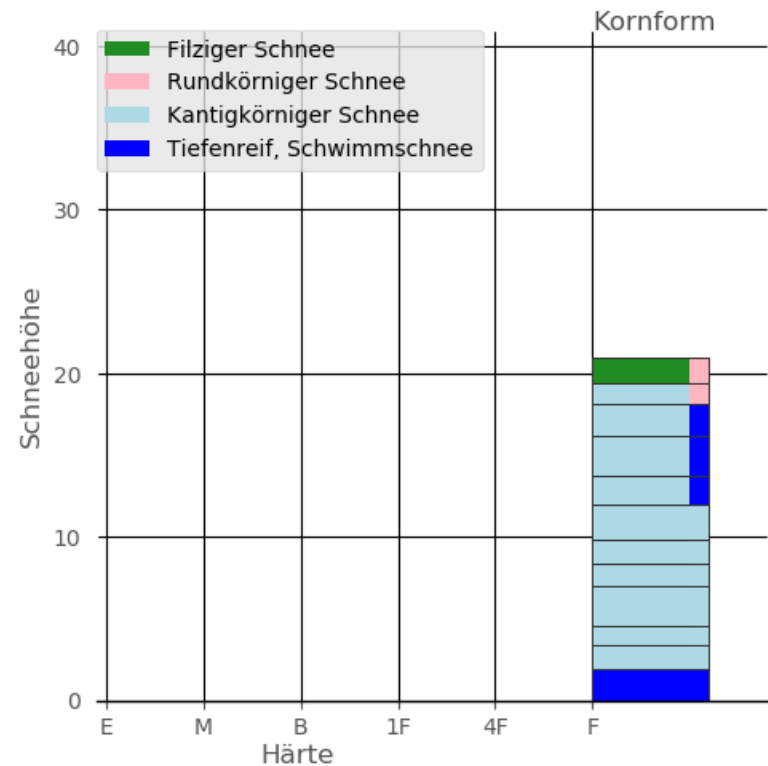
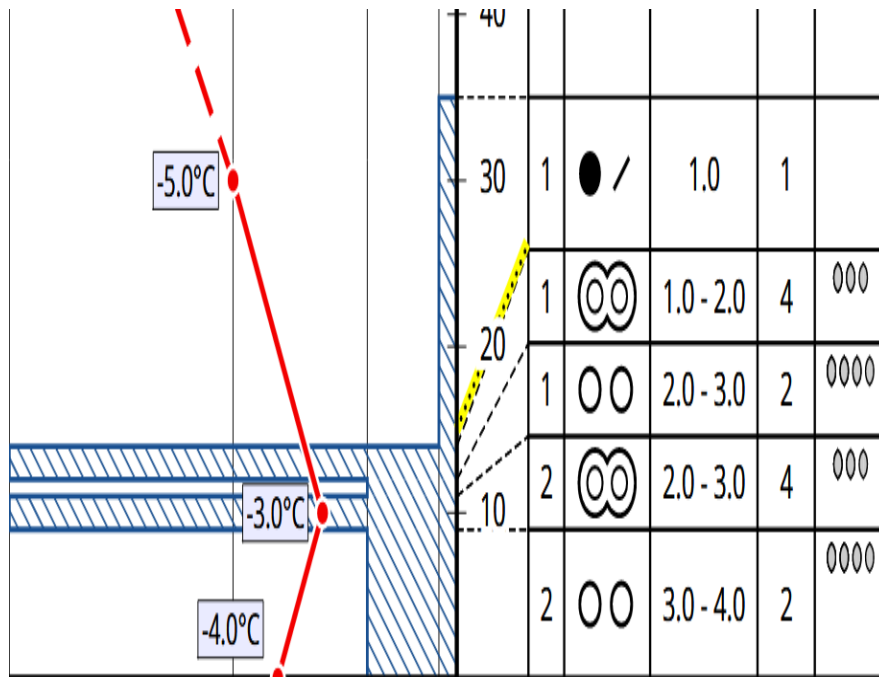
Case Study: Avalanche 16.01.2021



Snow cover situation 13.01.2021

Observation:
1433 m a.s.l.
SW aspect

Simulation:
1630 m a.s.l.
S aspect








Case Study: Avalanche 16.01.2021



Date	13.Jan	14.Jan	15.Jan	16.Jan	17.Jan
Regional Forecast	Yellow	Orange	Orange	Orange	Orange
	Green	Yellow	Yellow	Yellow	Orange






Case Study: Avalanche 16.01.2021



Date	13.Jan	14.Jan	15.Jan	16.Jan	17.Jan
Regional Forecast					

Case Study: Avalanche 16.01.2021



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Case Study: Avalanche 16.01.2021



Avalanche event:

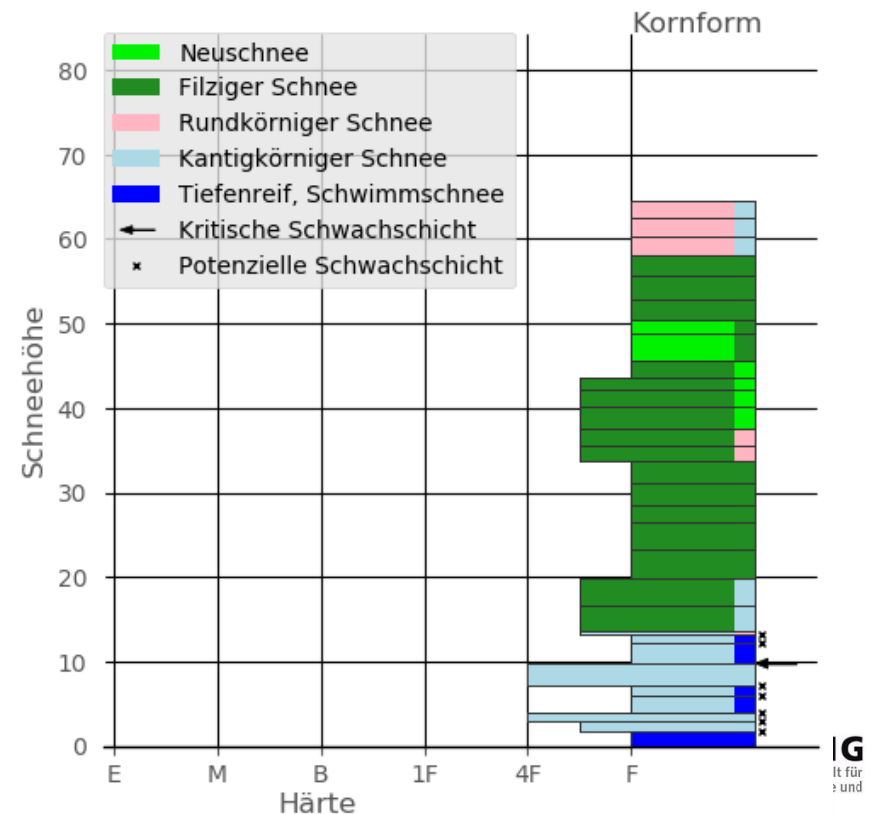
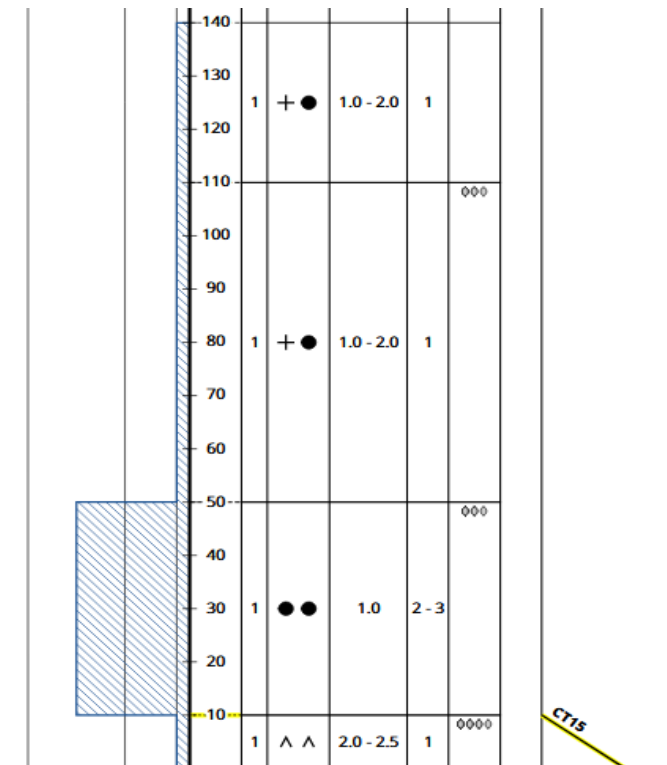
Slab avalanche, ca. 1600 m a.s.l, 35° slope, SO aspect, 60cm fracture depth

Observation: 17.01.2021

S aspect, 34° slope, 1740m a.s.l

Simulation: 17.01.2021

S aspect, 35° slope, 1630m a.s.l



Risikoeinschätzung

Auswertung vom 08.02.21 16:30:00

Analyse

08.02.21 16:30 Uhr



Tagung der Lawinenkommission nicht unmittelbar notwendig.

Details

Vorhersage

Bis 05 Uhr, 09.02.21



Tagung der Lawinenkommission nicht unmittelbar notwendig.

Details

Vorhersage

Bis 17 Uhr, 09.02.21



Tagung der Lawinenkommission nicht unmittelbar notwendig.

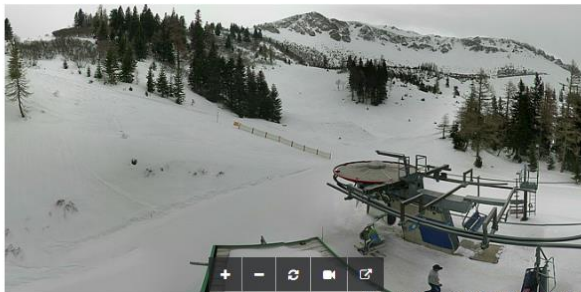
Details

Gebietsübersicht



Nützliche Links

- [Lawinenwarndienst Steierm.](#)
- [Zentralanstalt für Meteorol. Geodynamik](#)
- [CROSSRISK](#)
- [Skigebiet Brunnalm/Hohe V](#)



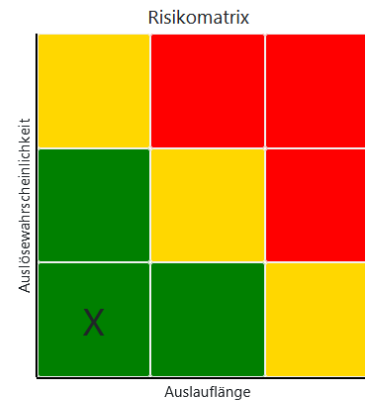
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Vorhersage bis 05:00 Uhr, 09.02.21

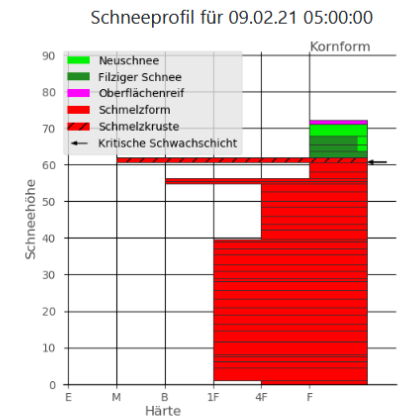
<<< Analyse

Vorhersage Untertags >>>

Empfohlene Maßnahme: Tagung der Lawinenkommission nicht unmittelbar notwendig.



<<< Analyse



Vorhersage Nachmittag >>>



The End

Questions?



Andreas Gobiet



Veronika Hatvan

