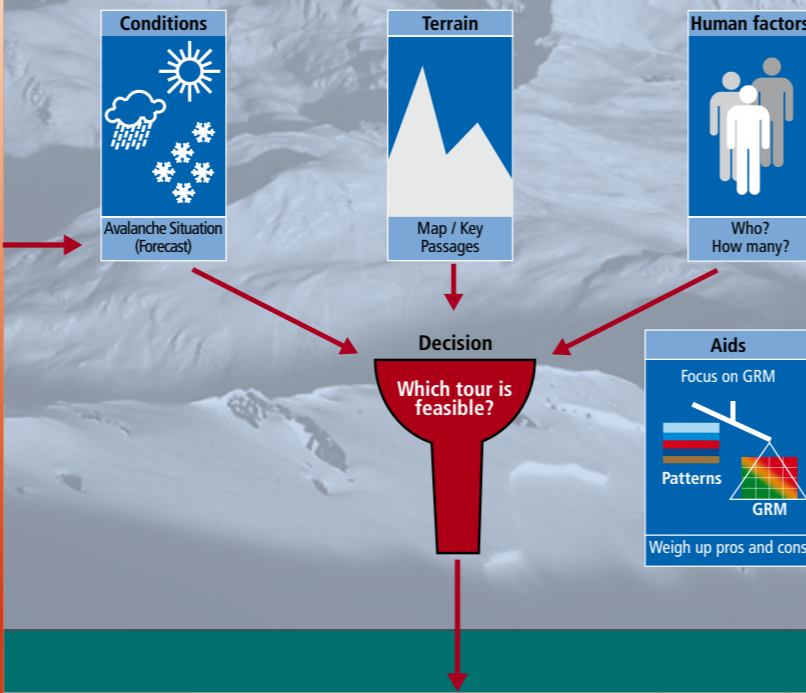


CAUTION - AVALANCHE!

Assessment and Decision Framework 3 x 3

Trip planning - Trip with alternatives and schedule



Avalanche Bulletin

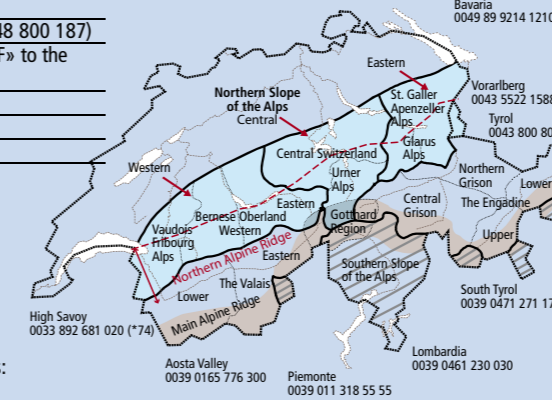
The avalanche bulletin provides information about snow conditions and regional avalanche danger for all regions of the Swiss Alps (local variations are possible). The degree of avalanche danger depends on: the **release probability** (the natural stability of the snow cover and the effects of human activities), the **distribution and frequency** of dangerous slopes, the **size and type** of avalanches (including the mass of released snow layers).

National bulletin (Issue: Daily after 18.30 h)

- Distribution:**
- www.slf.ch
 - Tel. 187 (from outside Switzerland +41 848 800 187)
 - MMS: Send an SMS with the text «LAWCHF» to the number 162
 - Teletext: Page 782
 - wap.slf.ch
 - iPhoneApp «White Risk Mobile»

Regional bulletins (Issue: Daily after 8 h)

- Distribution:**
- www.slf.ch
 - MMS: E.g. Send an SMS with the text «LAWZCH» to the number 162 for the Central Switzerland Avalanche Bulletin.
 - Further keywords available with the text «LAWINE» to the number 162
 - iPhoneApp «White Risk Mobile»



Weather: www.meteoswiss.ch
Avalanche conditions in adjacent countries: www.lawinen.org

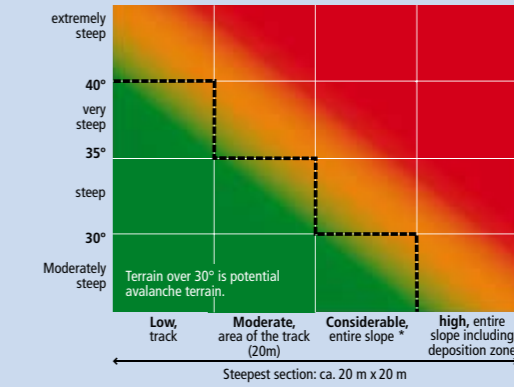
Graphical Reduction Method (GRM)

Simple risk check combining the factors of danger level, slope angle and aspect (favorable/unfavorable). Dangerous expositions are often:

- Shady slopes
- Wind loaded slopes
- Expositions and altitudes specifically mentioned in the avalanche bulletin.

If we do not know the conditions, if we can't make observations, or if the unfavourable slopes are not specified in the bulletin, we assume all slope aspects to be unfavourable. If there is a difference, we may assume a lower danger for the slopes of favourable aspects (typically about one degree lower).

Avalanche risk in unfavorable aspects:



- High risk** Snowsport not recommended!
- Elevated risk. Caution! Experience necessary!**
 - Patterns, weigh up pros, cons with the focus on the avalanche risk on the individual slope.
 - Intelligent route choice and intelligent behaviour
 - Inexperienced riders should avoid this area
 - Training and experience necessary
- Low risk** Relatively safe if no particular danger signs are present
- Inexperienced skiers and boarders should stay below this line.

* If at considerable danger remote triggering or large avalanches are unlikely (often the case with constantly travelled off-piste runs/popular tours), then it may be possible that not the entire slope must be considered.

Graphical Reduction Method (GRM)

Edited by:

The «Snow Sport Avalanche Accident Prevention» core training team (www.slf.ch/kat), consisting of: WSL Institute for Snow and Avalanche Research SLF, Davos • Swiss Alpine Club (SAC) • Federal Office of Sports, Magglingen (BASPO) • Association of Swiss Mountain Guides (ASMG) • Swiss Army (Cen exce A mtn tng) • Swiss Ski • Swiss Snowsports • Swiss Association of Mountaineering Schools (SAMS) • Swiss Cableways (SCW) • Friends of Nature Switzerland (FNS) • Alpine Rescue Switzerland (ARS) • Swiss Council for Accident Prevention (bfu) • Suva

With the support of:

MeteoSwiss • Swiss Commission for the Prevention of Accidents on Snowsport Runs SKUS • Swiss Air Rescue (Rega) • Swiss Foundation for Alpine Research (SFAR) • Rescue Organisation of the Canton of Valais (KWRO/OCVS) • Swiss Association of Snowboarding Schools (SSBS)

Where to order:

The Editors

Sixth completely revised edition: © 2009

Authors: Stephan Harvey (SLF, Editorial) • Jürg Schweizer (SLF) • Hansueli Rhyner (SLF) • Paul Nigg (Core Training Team Principal) • Bruno Hasler (SAC)

Concept/Graphics: faktorplus und neuweiss communications, Bern

Translation: Levi O'Neil

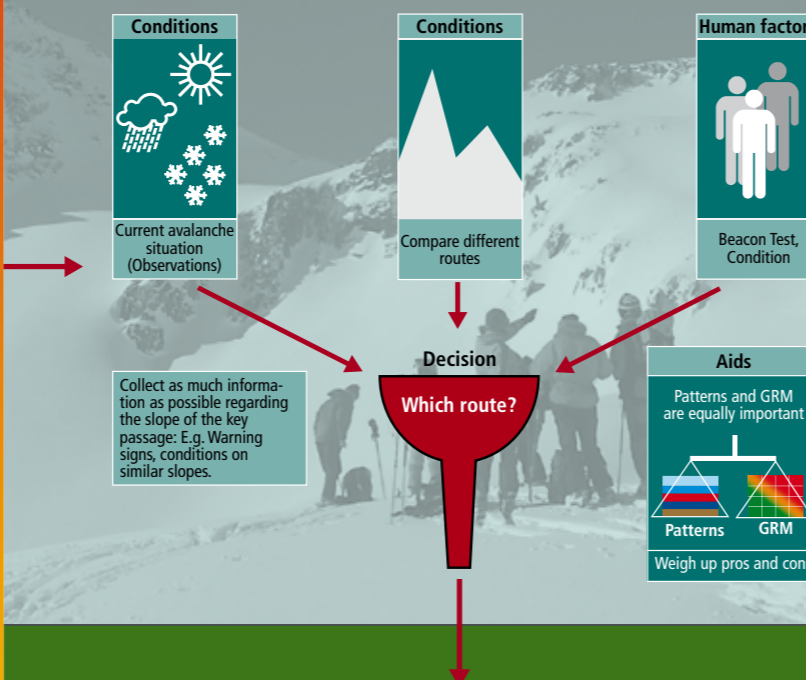
Reflection: Expansion of experience base through hindsight following each tour / descent. Would I make the same decisions again?

Typical Avalanche Situations (Patterns)

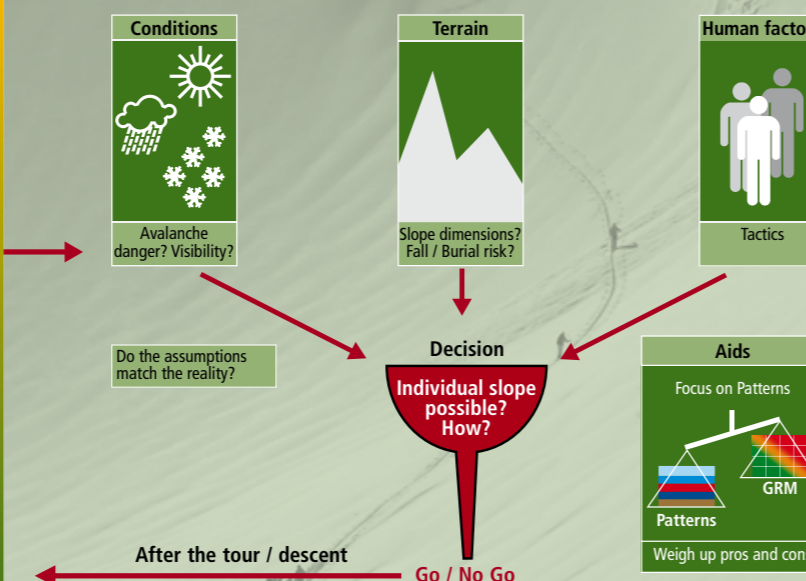
Characteristics and distribution

<p>New snow → wait 1 – 3 days</p>	<p>Wind loading → avoid 1 – 2 days</p>	<p>Wet, heavy snow → go early, return early hours</p>	<p>Old snow → ride defensively days or weeks</p>
The new snow may release as a slab	Recent drifts may release as a slab	Water weakens the snowpack	
There are weak layers in the snowpack covered with older slabs. Difficult to recognise!			

2. Assessment in the terrain - Observations made over the entire day



3. Individual slope - Final risk assessment, trail selection, safety measures, turning back



Estimating Avalanche Risk ☹️/😊

Decide

- Conditions**
- What is the nature of the avalanche problem (pattern) in the key passage?
 - How serious is the risk?
- Terrain**
- Where exactly are the dangerous points? What will occur if a slab releases (size, snow volume, falls, burial)?
- Human Factor**
- Can the risk be mitigated to an acceptable level by using the appropriate strategy (choice of route, cautious behaviour)?

Besides slope angle, aspect, altitude and pattern there are additional factors that are critical for the decision making process:

☹️ Increasing Risk:	😊 Decreasing Risk:
Poor visibility	Small group
Large group	Small impact on snowpack
Shock loading of snowpack (jump, fall)	Convex terrain / Undulating terrain
Danger of falling	Small slopes and run outs
Steep slope above or terrain trap: danger of deep burial	Slope is below
Large slope	Defensive route selection
	Frequently skied slope

Risk Reduction Measures

General Precautions:

- Keep track of the weather and avalanche situation, plan adequately
- Keep others informed of your intentions and route choices
- Always have your beacon set to TRANSMIT (function tests), always carry shovels and probes
- Constant reassessment of: weather, snow, terrain, schedule and human factors

Conditions:

- Critically assess recent snow drifting
- Consider the variations in temperature depending on the time of the day and the impact of radiation
- In foggy or low visibility conditions be prepared to turn back if you find yourself in steep, unknown terrain or critical conditions!

Terrain:

- Descend extremely steep slopes and key passages one at a time
- Avoid the steepest sections of any given slope
- Avoid steep, rocky outcrops and gullies

Human Factors, Behaviour

- Maintain distance between riders/skiers (ascent 5–10 m, more by descent) or descend one at a time
- Define a descent corridor, ride (ski) carefully, avoid falls
- Stop and regroup on «islands of safety»

Typical Avalanche Situations (Patterns)

Risk Reduction Measures

Avalanche Danger Scale (abbreviated)

	CHARACTERISTICS (RELEASE PROBABILITY, DISTRIBUTION AND FREQUENCY OF DANGEROUS SLOPES, TYPE OF AVALANCHES)	CONSEQUENCES AND RECOMMENDATIONS FOR RECREATIONISTS OUTSIDE OF CONTROLLED SKI AREAS
1 LOW GERING, FAIBLE, DEBOLE	Triggering is generally possible only with high additional loads (e.g. groups without intervals) and on very few locations in steep extreme terrain. Only a few sluffs and small natural avalanches are possible. Forecasted for about 20% of the winter season. About 7% of the recreational fatalities.	Generally favourable conditions. Ski one by one on extremely steep slopes. If possible avoid recent accumulations of wind-driven snow on extreme slopes. Beware of the danger of falling and of possibly unfavourable conditions in high alpine terrain.
2 MODERATE MÄSSIG, LIMITE, MODERATO	Triggering possible in particular with high additional loads, particularly on the steep slopes indicated in the bulletin. Large natural avalanches not likely. Forecasted for nearly 50% of the winter season. About 34% of the recreational fatalities.	Favourable conditions, for the most part. Routes should be selected with care, in particular on steep slopes of the aspect and altitude indicated in the bulletin. Avoid all extremely steep slopes of the aspect and altitude indicated in the bulletin and recent accumulations of wind-driven snow. Ski one by one and with caution on very steep slopes.
3 CONSIDERABLE ERHEBLICH, MARQUÉ, MARCATO	Triggering possible even with low additional loads (e.g. single person), particularly on the steep slopes indicated in the bulletin. In some conditions, medium and occasionally large natural avalanches may occur. Frequently alarm signals exist (whumpfs, natural releases). Forecasted for nearly 33% of the winter season. About 47% of the recreational fatalities.	Partly unfavourable conditions. Critical situation. Experience in avalanche hazard assessment and in selecting good routes required. Avoid very steep slopes of the aspect and altitude indicated in the bulletin if possible. Pay attention to remotely triggered avalanches. Proceed with caution on traverses or when travelling into unknown terrain.
4 HIGH GROSS, FORT, FORTE	Triggering probable even with low additional loads on many steep slopes of all aspect. In some conditions, many medium and several large natural avalanches are likely. Forecasted for a few days only of the winter season. About 12% of the recreational fatalities.	Unfavourable conditions. Acute Situation. Lines of transport might be endangered. Sound experience in avalanche hazard assessment required. Stay in moderately steep terrain; beware of runout zones. Remotely triggered avalanches are typical, even over large distances.
5 VERY HIGH SEHR GROSS TRÈS FORT, MOLTO FORTE	Numerous large natural avalanches are likely, even in moderately steep terrain. Avalanches run to the valley bottom. Rarely forecasted, on average for one day of the winter season. No recreational fatalities.	Very unfavourable conditions. Catastrophic situation. Parts of villages endangered, evacuations might be necessary. Travel in avalanche terrain not recommended.

Slope Angle Classifications: **moderately steep terrain:** slopes flatter than about 30° **very steep slopes:** slopes steeper than 35°
steep slopes: slopes with an angle of more than about 30° **extreme slopes:** steeper than 40° and slopes that are inherently dangerous due to terrain profile or close proximity to ridges.

Avalanche Hazard Evaluation → Conditions

NEW SNOW

Critical new snow depth = at least considerable avalanche danger

- 10-20 cm when conditions are unfavourable
- 20-30 cm when conditions are fair or mixed
- 30-50 cm when conditions are favourable

Favourable:

low to moderate winds, air temperature close to 0°C, highly irregular old snow surface, frequently skied slope

Unfavourable:

high rate of precipitation (heavy falls within a short time), strong winds (>40 km/h, roaring wind), low temperature (below -5 to -10°C), smooth or loose old snow surface, rarely skied slope

Alarm signs

(typical for danger levels of considerable and above)

Recent, natural and remotely triggered slab avalanches. Whumpf sounds and cracking.



NOTE!

- Avalanche danger prevails with:
 - Wind and new snow.
 - Rapid and intense warming.
 - Weak layers in the snowpack.



WIND

Wind is the architect of slab avalanches through the creation of wind slabs. Conditions for wind slab formation:

- Sufficiently strong wind
- Erodible snow surface or new snow

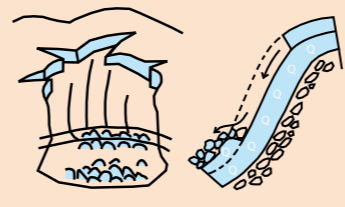
Wind slabs may be hard packed or soft, often displaying highly uneven distribution in lee areas.



NOTE! Recent wind slabs are easily triggered.

Avalanche Formation

TYPES OF AVALANCHES (DRY OR WET)



Snow slab avalanche



Loose snow avalanche



NOTE! About 90% of all avalanche victims have triggered the fatal avalanche themselves.

SNOW SLAB AVALANCHES

Cohesive snow on top of a weak layer: The slab breaks away as a unit. Dry snow slabs are the most dangerous avalanches for snow sport. They are also possible when the surface layers seem to consist of cohesionless powder snow. Typical dry snow slab avalanche situations:

- Unstable new snow (new snow situation)
- Unstable wind slab (wind loading situation)
- Old snow on top of a weak layer (old snow situation)

Terrain

Critical steepness: (steepest slope section, ca. 20 m x 20 m in crown area): 30°. The majority of slab avalanches release at a slope angle between 35° and 45°. A slab may also be released from adjacent flat terrain (remote triggering)

Beware of runout zones!

Avalanche release (spontaneously or artificially) by either an increase in stress (e.g. by a skier) and/or a decrease in strength (e.g. by warming or rain).

LOOSE SNOW AVALANCHE

Loose snow avalanches often release in terrain steeper than 40°. They travel slowly in comparison to slab avalanches. Loose snow avalanches are often formed from cohesionless new snow or wet snow.



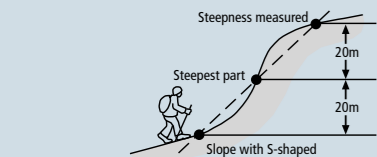
NOTE! The first sunny day after a snowfall tends to be especially dangerous.

Avalanche Formation and Types

Avalanche Hazard Evaluation → Terrain

Steepness

Measure the slope angle with an inclination scale on the map (1:25'000). Attention: S-shaped terrain profiles are always steeper in reality



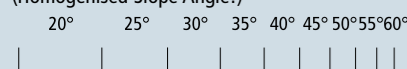
During the trip, estimate or measure the inclination of the steepest part of the slope (ca. 20 m x 20 m). Also consider steep slopes above and below the route, in particular from considerable danger on upwards.

Shape of slope and type of terrain

- Most accidents occur on steep, shady slopes near ridge tops
- Hilly ground allows for better selection of a safe route.
- Sparse woods do not protect from avalanches.
- Ridges are generally safer than gullies.

Steepness averaged over 100m vertical

(Homogenised Slope Angle!)

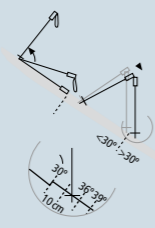


Class of steepness

30° 35° 40°



If the suspended pole contacts the snow surface below the mark the slope is steeper than 30°. 10cm of difference to the initial mark represents some 3° of slope angle.



Avalanche Hazard Evaluation → Human factors

Human factors often play a deciding role in avalanche accidents. Recognition of dangers, the decision making process and behaviour may be influenced by perceptio failures and lack of communication.

Illusions/Limits of perception:

- Slope steepness is underestimated when looking from above or on sunny slopes.
- Hard packed snow feels safer than soft snow.
- It is difficult to estimate terrain forms in low visibility.
- Storm winds mask whumpf sounds.
- Travelling in a group offers a false sense of security.
- Tracked out slopes appear to be safe.

Communication:

- Have the goals and expectations been discussed?
- Have group members clearly understood directions from the group leader and will they be followed?
- Can I rely on my touring partners?

Perception traps:

Commitment / Wishful Thinking:

We often only see what we expect and want to see. We tend to filter information in favour of our plan.

Familiarity/Positive reinforcement:

Familiar terrain feels safe. («there has never been a slide here.» «It has been fine until now.»)

Scarcity:

We experience an urge to ride or ski an unriden slope. The euphoria of exclusivity often hinders our ability to think clearly.

Group:

Tendency of groups to take higher risks: risky shift effect, group/peer pressure, competition within and between groups. Presence of other groups or ski tracks.

NOTE! Always take a bad feeling seriously. Continuously weigh up your good feelings against new observations and facts: do not be led astray.

Avalanche Release – Rescue

IF CAUGHT

Try to escape out of the avalanche area, let go of your ski poles, try to open bindings (rarely possible), pull your knees toward your chest and hold your arms in front of your face. **Fight like hell!**

IF NOT CAUGHT



- Watch the avalanche flow and the persons caught (note the last seen point)
- Gain an overview – think – act. Assess your own safety, avoid further accidents
- Determine primary search area (in the direction of flow below the last seen point)

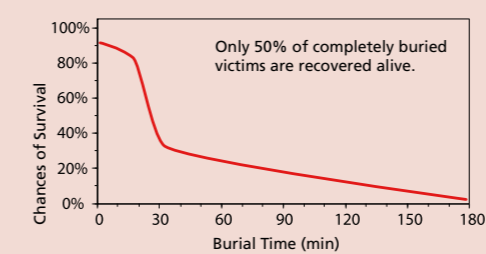
- Begin searching immediately with eyes, ears and transceiver (turn off transceivers that are not in use)
- Pinpoint search with avalanche probe
- Alert rescue service. (Telephone, Radio, Runner (when possible in pairs))

(* Search strip widths: Minimum 40 m with analog devices. Follow manufacturer recommendations for digital devices.)

If transceivers are not available:

- Search with eyes and ears
- Alert rescue service
- Systematic repeated improvised probing

BURIAL BY AVALANCHE = DANGER OF DEATH!



First Aid Following Avalanche Burial

- Methodical, V-shaped digging
- Uncover head and chest as fast as possible, clear the breathing passages, check if there is a breathing cavity in the snow (Snow filled airway = No breathing cavity)
- Start artificial respiration (mouth-to-nose), if circulation has stopped, start cardiopulmonary resuscitation simultaneously; continue resuscitation until a medical doctor takes over
- Prevent further cooling
- Position the victim according to injury
- Watch and take care of the victim very carefully
- Careful evacuation by helicopter

ALARM

Phone: Swiss air rescue (Rega): 1414 (all of Switzerland, except in Valais); International Emergency: 112, KWRO/OCVS: 144 (Valais)
Radio: 161.300 MHz (E-channel)
 158.625 MHz (K-channel, police)

ACCIDENT REPORT

Who is calling (Name, phone number, location)
What happened?
Where is the accident location?
When did the accident happen?
How many completely buried victims, helpers?
Weather in the area?
Transceiver, Recco?

AIR RESCUE

Do not approach the helicopter before the rotor has stopped. Only embark or disembark in the company of a crew member when the rotor is turning. Always stay in contact with the pilot.

Landing Place Hazards

- Ensure no loose objects are left lying in the area
- Pay attention to skis, avalanche probes, etc.



NOTE! Concise report = Effective help

Avalanche Hazard Evaluation → Conditions

Rescue and First Aid