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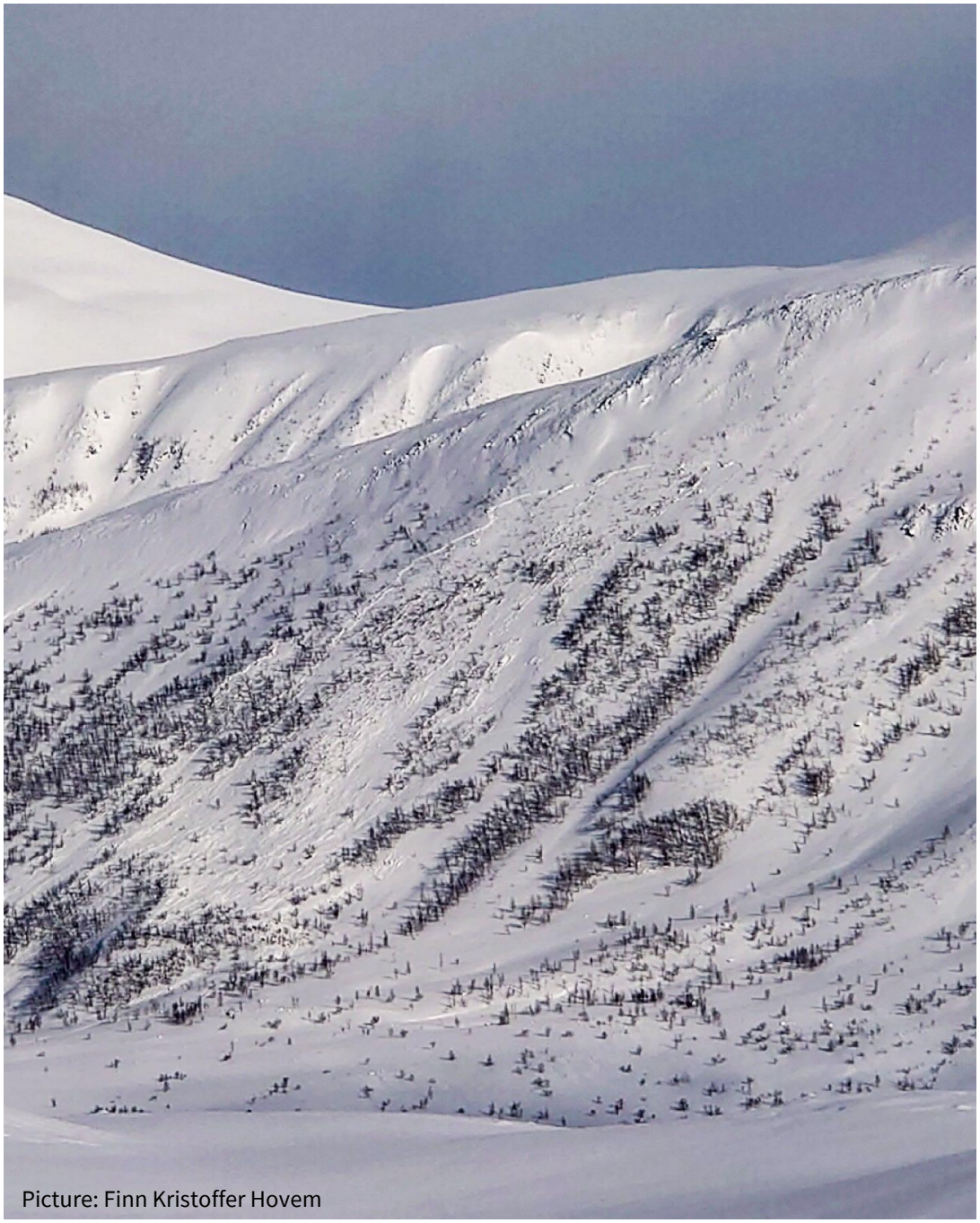
Norges vassdrags- og energidirektorat

Avalanche accident on Erikaksla, Lyngen
30th of March 2022

Accident report



Picture: Finn Kristoffer Hovem

Published 16th of Febuary 2023 on Varsom.no

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Content

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About the report

The report is written by Kristoffer Karlsen, with inputs from Håvard Boutera Toft, Markus Landrø (all from NVE) and Audun Hetland (from UiT) and is based on information provided by those involved in the accident and the rescue service.

Normally the Norwegian Avalanche Warning Service does not write accident reports about single incidents, but in this case, we received a detailed report from the involved and we see a lot of learning points we want to give some attention to, especially considering human factors.

The report focuses on the event and what happened up to the avalanche, and not the rescue phase.

Sources

Weather data:

https://www.xgeo.no

https://www.yr.no

Snowpack data:

https://www.regobs.no

Avalanche forecast:

https://www.varsom.no

https://www.varsom.no/en

Accident data:

https://www.skredregistrering.no

https://regobs.no

The accident victims

Troms Red Cross Avalanche Rescue Group

1 The event

On the afternoon of Wednesday 30th March 2022 five friends sat out from their Airbnb to do an easy ski tour in Lyngen, Troms County. The group was going out to check on the conditions when they got caught in an avalanche. They were going into Veidalen and up the west slope of Erikaksla. At about 400 meters above sea level (m.a.s.l.) they triggered a slab avalanche which caught the whole group. One stopped in some trees early and was unharmed, three got seriously injured by trees and one died from the injuries he got inflicted by hitting the trees in the avalanche path.

The group was waiting for snow showers to subside and the visibility to improve before they headed out. In the afternoon, around 15:30, they did a beacon check and left their Airbnb and headed into Veidalen. The day before, they had been at Erikaksla but decided to ski an avalanche-safe route down because of poor visibility. The plan for the day was to go out and assess the conditions from an aspect that had not been that affected by the weather the last few days. When they arrived at the bottom of the slope, they did a snow profile and an extended column test with no result. They continued to skin up the slope, and a bit up they discussed doing another beacon check but decided not to. After this, they continue up the slope to about 400 m.a.s.l. where they did a second profile and another column test which showed instability in the snowpack. At the point of the second snow pit, the slope was steeper than 30 degrees, but they had an area where it was locally less steep about 40 meters above them. They decided to skin up to the locally flatter area to turn. On the way up, they triggered the avalanche. The avalanche started about 100 meters above the group, above the locally flat area, and the slab released above, around and to the left of the group. Everybody in the group got caught in the avalanche and was carried down.

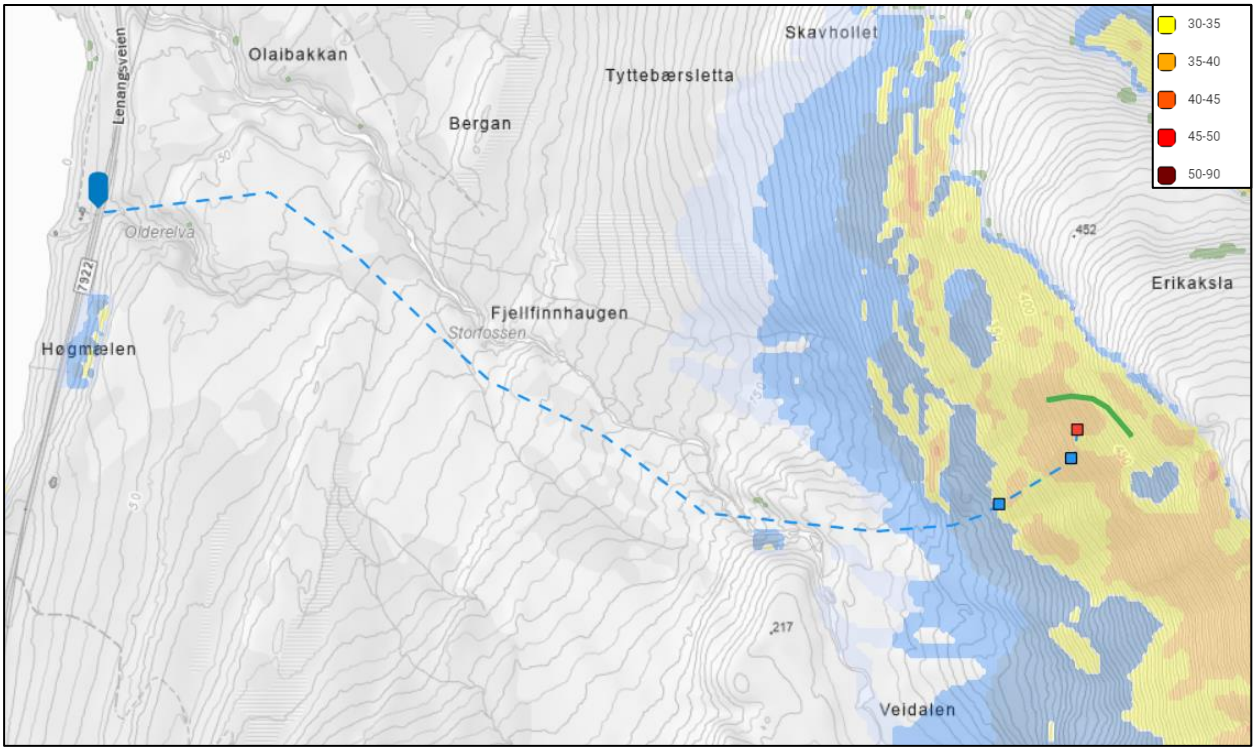

Figure 1 – Track and important points for the group the day of the accident. The blue marker is the starting point of the trip, the blue line is the route followed, the blue squares is the location of the snow pits dug, the red square is the release point, and the green line is the crown of the avalanche. The slope angle colour is found in the top right corner, and the blue areas are runout-sones. All points and lines in this map are approximate positions and based on the memory and description of the event provided by the involved.

1.1 Trip planning and enroute assessments

The group had been skiing in Lyngen the last three days prior to the accident. During these days they had kept track of the weather, read the avalanche bulletin and observations on Varsom Regobs (but not the day of the accident), and used maps from Avenza System showing avalanche stating areas to plan their tours. In the group, two were highly skilled and three has moderate skills in assessing avalanche danger. One in the group also spoke fluently Norwegian, so they had access to all the information in Varsom Regobs and the avalanche bulletin.

The ski tour on the 30th was to check out the conditions after a long day of snow showers, as the group was concerned about the avalanche danger. The group waited to go out until the snow showers had subsided and the visibility was better, which was in the afternoon. When the group reached the bottom of the slope, they dug a snow pit and did a test which showed no results (ECTX). They then skinned up to about 400 m.a.s.l. and did a second profile. Here they got unstable test results and found a weak layer of facets high in the snowpack. At this point, the group decided to continue a little bit further up where they found it more practical to turn. The group evaluated the avalanche conditions and concluded to turn, but ultimately too late.

1.2 Search and rescue

During the avalanche, one had stopped far up in the avalanche path and was unharmed. The first person he came to and freed from the snow was severely injury and could not move. Therefore he notified the emergency services about the accident at 17:51, as the unharmed continued to search for the rest of the group. At his time, another rescue operation was ongoing further south on the Lyngen peninsula, so resources were already called out and relatively close by. The first helicopter arrived at the scene at 18:20 and put down rescue personnel who assessed the situation and began to search for the group. Within a few minutes, they had located everyone, started treatment, and prioritising evacuation of the wounded. In the next 30 minutes, several helicopters arrived at the scene. The next 1.5 hours were used to treat and evacuate the wounded from the avalanche. The last victim was hoisted out together with a doctor and helicopter rescuer at approximately 20:30. The rescue operation was finished at approximately 21:15.

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2 Weather and avalanche forecast

2.1 Avalanche forecast for Lyngen Region on 30th of March 2022

Danger level 3 - Considerable avalanche danger

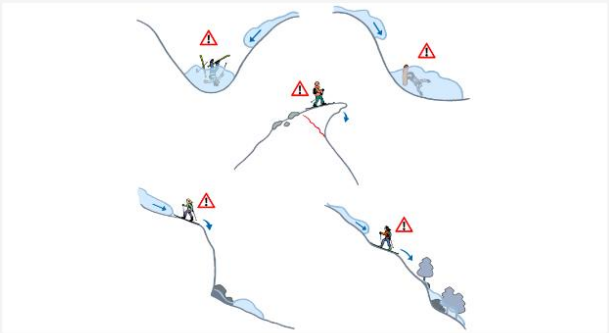
Published: 2022-03-29 03:35 PM

Conditions are difficult. Be careful in lee areas with wind deposited snow, typically behind ridges, ribs and in gullies. Be aware of a persistant weak layer buried by windslabs.

Advice

The bulletin is a planning tool and may differ from the actual situation. Always make your own evaluation. To be 100 % avalanche safe, avoid all avalanche terrain.

Avoid terrain steeper than 30 degrees and runout zones. Remote triggering is likely.

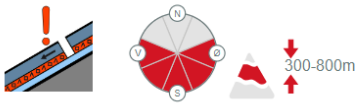


Avoid terrain traps.

Avalanche problems

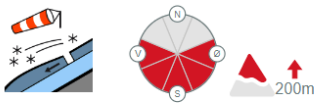
Persistent weak layer (slab avalanches)

You can very easily trigger avalanches on some steep slopes. Avalanches can get large enough to bury a car or destroy a small house (size 3). Remote triggering is possible.



Wind drifted snow (slab avalanches)

You can easily trigger avalanches on some steep slopes. Avalanches can get large enough to bury or even kill you (size 2).



Mountain weather, 29.03.2022

10 mm precipitation, up to 20 mm in the most exposed areas. Precipitation as snow. Strong breeze from north. -13 °C to -7 °C at 1100 m a.s.l. Cloudy.

Mountain weather, 30.03.2022

10 mm precipitation, up to 15 mm in the most exposed areas. Precipitation as snow. Fresh breeze from north. -12 °C to -5 °C at 1100 m a.s.l. Cloudy.

The following two sections of text is also included in the avalanche forecast, but in the Norwegian version only (what follows has been translated for this report):

Avalanche danger assessment

Weak layer with small facets observed high in the snowpack. Observations shows that the layer varies in how well developed it is but be aware that there can be large differences over short distances. In areas where the snowpack receives additional accumulation of fresh snow or wind drifted snow, it can be very easy to trigger avalanches, and there is a risk of remote triggering. The weak layer is probably most developed where dry snow has laid over wet snow, probably up to 800 meters above sea level. Fresh snow and wind can also lead to unstable wind slabs with a weak layer of low-density new snow in leeward areas.

Snow cover

Above the forest line, winds from the east and north in recent days have moved much of the snow into lee areas. The snow cover is dominated by wind drifted snow, and in some areas, it has blown away snow down to an old melt-freeze crust. Below 6-800 meters above sea level, large parts of the old snowpack have been transformed by melting, but higher up in the mountains the snow cover has only been affected by the mild weather for short periods and the melt layer is thin.

On Saturday, whupmf sounds, shooting cracks and a small skier-triggered avalanche at around 400-500 m.a.s.l. were observed at Lakselvbukt. This is probably a weak layer of facets that have formed high in the snow cover during the last few days.

On Saturday morning, some naturally triggered avalanches were observed at Breivikeidet and in Holmbuktura. On Sunday morning, several naturally triggered large (size 3) avalanches were observed in Lavangsdalen, which have probably occurred during the last 24 hours.

2.2 Moderate to considerable avalanche danger

Two weeks prior to the accident, the avalanche forecast for Lyngen was mostly varying between danger lever 2 – moderate and 3 – considerable. Figures 2 and 3 show how the danger level ranged from 1 (green), 2 (yellow) to 3 (orange). From the group arrived in Lyngen and started skiing it had been considerable and moderate avalanche danger with persistent weak layers in the bulletin every day.

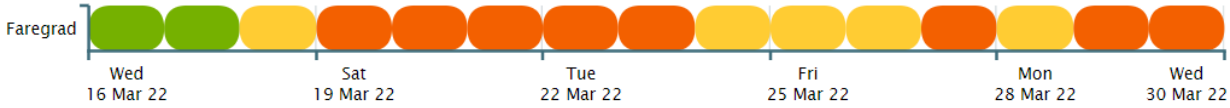


Figure 2 - The avalanche danger level for Lyngen two weeks prior to the accident.

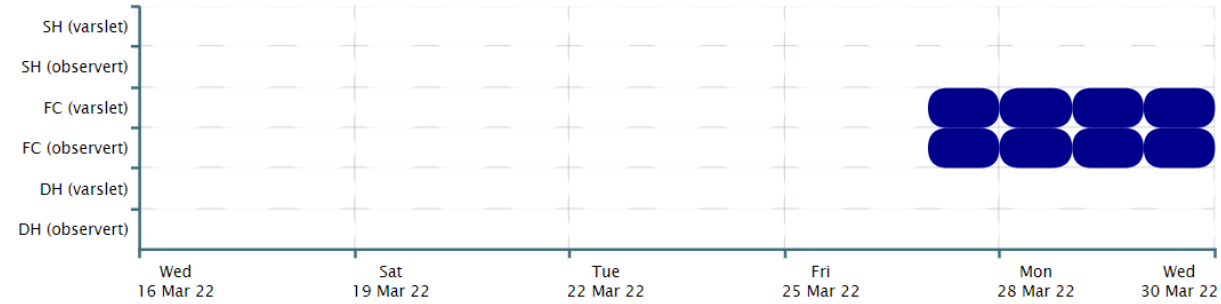


Figure 3 - A figure showing how faceted crystals (FC) had been observed and included in the bulletin (as persistent weak layer) three days prior to the accident.

2.3 Weather in advance of the accident

March 2022 was an unusually warm month in Lyngen. From early in the month the temperature was above freezing, and it was not until the 23rd of March the temperature at sea level dropped below freezing (Figure 4). The mild temperature peaked on the 21st of March with 9.5 degrees Celsius measured at 45 m.a.s.l. The average temperature for March in this area is -1,6 degrees Celsius, while in 2022 the average was 1.2 degrees Celsius.

There was a significant drop in temperature between the 21st of March to the 28th of March, from 9.5 to -6.9. On the evening of the 22nd of March, it was reported 20 cm of new snow in the north-western part of Lyngen, while the temperature rose again on the 23rd of March. The assessments from the avalanche forecasters were that the mild temperatures moistened up the top of the snowpack up to 800-1000 meters above sea level. When the temperature then dropped, it did so in combination with further snow showers from north and northeast east. In the days before the accident the wind also picked up in strength. This resulted in snow drift in exposed places as shown in picture 1.

Picture 1 – A group of avalanche forecasters and observers on the ridge of Erikaksla on the 29th of March and experienced heavy winds and snowdrift from north-east. Photo by Martin Venås/SVV (https://www.regobs.no/Registration/298245)

During the night to the 28th and 29th of March the surface temperature dropped significantly below air temperature (Figure 4). This is a result of clear skies and high outbound radiation from the ground. The warmer, moist snow from the 23rd and 24th was buried under cold, new snow from the 26th and the 27th. When the surface temperature dropped the nights before the accident the temperature gradient between the warmer and colder snow was large and this resulted in fast forming facets high in the snowpack.

Warm air holds more energy and moisture than cold air and is less dense compared to cold air. Therefore, warm air will rise and cold air sinks. When warmer air rises and meets the cold air, energy is released as it cools down. The way warm air release energy is by creating water vapor. When the water vapor is released in the cold air it freezes to ice. When this is happening in the snowpack, the water vapor from warmer snow will freeze and create faceting crystals in the cold new snow on top.

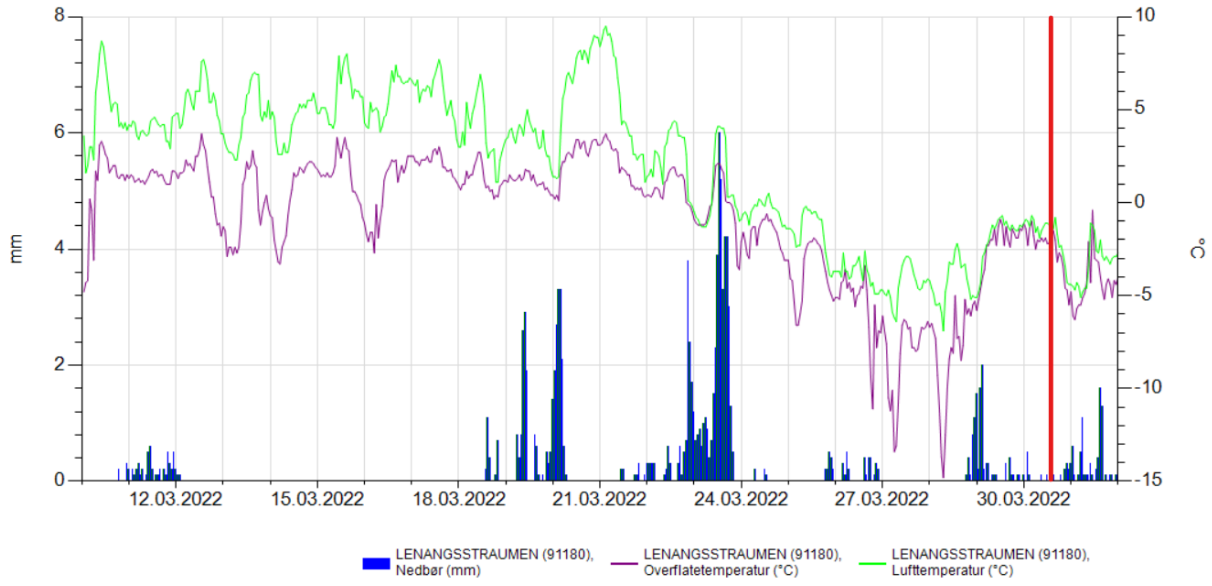


Figure 4 - The air temperature (green" line), surface temperature (purple line) and precipitation (blue columns) for 10-31 March 2022. Data from a weather station 15 km away from the accident site. The red line marks the time of the accident.

2.4 Snowpack with persistent weak layers and wind slabs

The crown of the avalanche was not inspected in the field, the assumption of the release mechanism and a weak layer is based on the avalanche forecast, weather in advance of the event, information from observations in the vicinity in the days before and information provided by the accident victims themselves.

The team of forecasters and observers on Erikaksla dug snow pits in west and northwest-facing slopes. They found a layer of facets developing in the new snow from the evening of the 22nd of March. The weak layer was moistened and compromised by the warming weather on the 23rd of March. The weak layer developed quickly and had different characteristics over short distances on the 29th of March. These observations were done about 1.2 km away from the accident site.

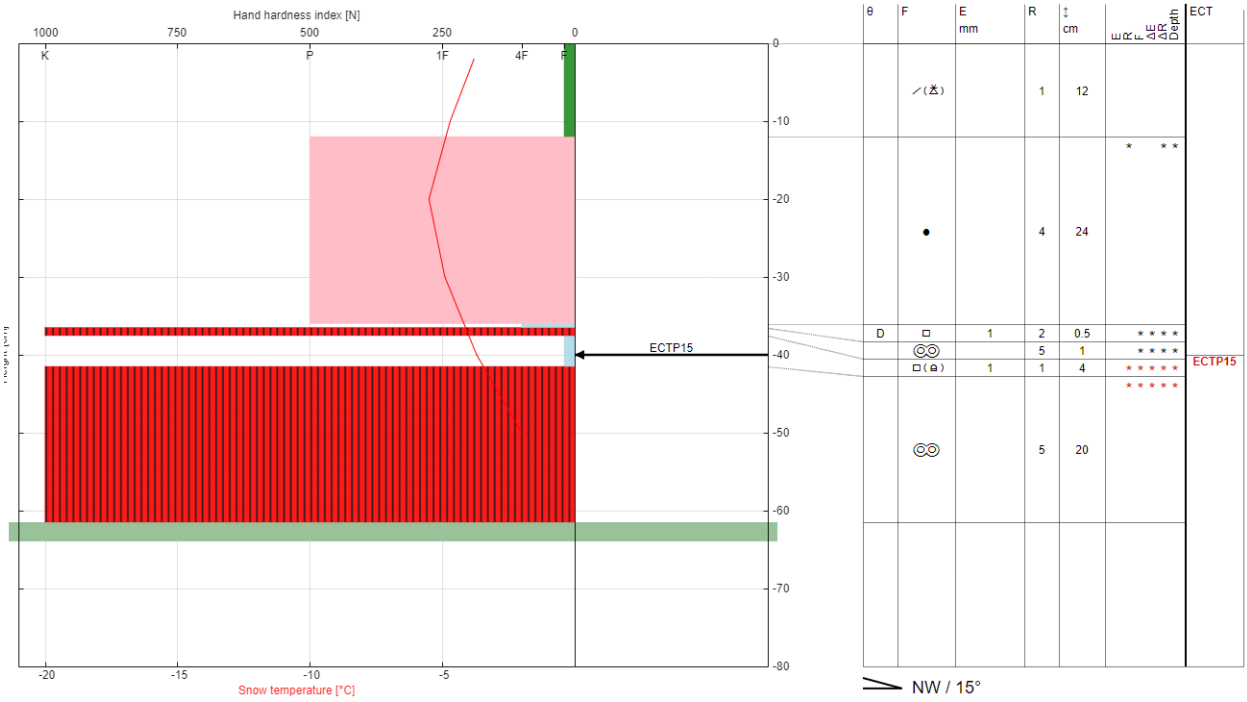


Figure 5 - A snow pit dug in a northwest facing slope, at 233 meters above sea level and 1.2 km away from the accident site on the 29th of March.

As described in the avalanche bulletin, there were probably two avalanche problems present on the slope that the avalanche released on. In addition to the persistent weak layer discussed above, it came snow showers from from the north and northeast in combination with which likely built-up wind slabs from drifting snow in the west-facing slope.

3 Terrain and the avalanche

The avalanche was released underneath the ridge of Erikaksla in the northwest part of the Lyngen peninsula. On the southwest side where the avalanche released, the terrain consists of sparse forest.

Figure 6 – Location of the avalanche accident.

3.1 Size 3 dry slab avalanche in complex terrain

Information about the avalanche is provided by the rescue team that was present on the site. None of them was in the vicinity of the crown, but they made some assumptions.

The avalanche was a dry slab avalanche of size 3 – large. The crown was between 20 to 50 cm thick and about 150 to 200 meters wide. When the avalanche was released at about 450 m.a.s.l it ran about 390 meters through sparse forest and trees. It stopped at about 220 m.a.s.l. where the terrain flattened out. The runout was approximately 145 meters wide.

Using observations from the nearby terrain, information from the involved and talking with the rescuers on site, it is highly likely that the avalanche released on a weak layer of facets high in the snowpack.

The accident occurred in ATES (KAST) class three – complex terrain.

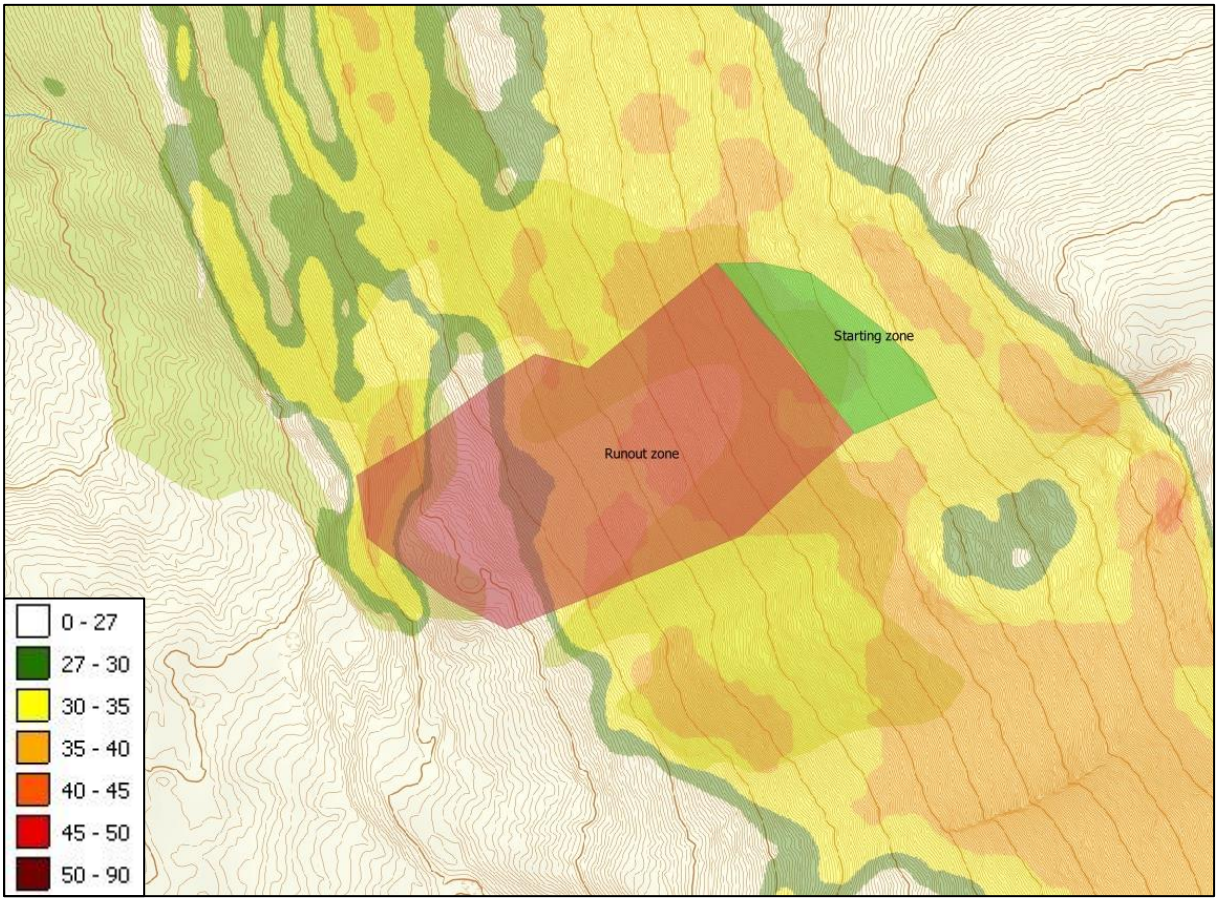


Figure 7 – Approximate drawn path of the avalanche based on observations. The legend to the left is steepness of the slope.

3.2 Trees in the avalanche path increased the consequences

Four of the five people that were taken by the avalanche, kept their heads above the snow with free airways. The last skier was completely buried and lost his life because of trauma injury. Three of the four survivors suffered from severe injuries.

Trees in the avalanche path are considered a terrain trap because it increases the consequence of being taken by an avalanche. In this case, it increased the consequence for all the skiers involved. The skier that lost his life died of trauma injury, likely from hitting trees on the way down the avalanche path.

4 Learning points

There are some learning points that could be inferred from this accident.

4.1 High motivation – avoid the holiday trap

The group was on a skiing vacation in Lyngen for seven days. This provides them with a limited window of opportunity and like everybody else they wanted to get the most out of every day with as much skiing as possible. The day of the avalanche and the day before, there had been snow showers in combination with wind. This is a combination that usually increases the avalanche danger. Even though the group was aware of this, they still went skiing in avalanche terrain.

A closing window of opportunity may leave people in a “now or never” state of mind, where the feeling of losing out or not getting a return (nice skiing) from the investment (time and resources) may lead to an increased tolerance for risk.

To counter-balance this effect, it may help to ask, “Would I go skiing in avalanche terrain in these conditions if I had another week here?”. If the answer is no, it is wise to reconsider the plan.

4.2 Communication

During the debrief, the group reported that they discussed doing a second beacon check halfway up the slope. Even though the author of the report does not have information as to why, this might indicate that one or several skiers in the group experienced the conditions as challenging. Further up the slope they stopped to dig another snow pit as planned and decided to turn. Unfortunately, they were caught in the avalanche before they were able to return.

Studies of professional rescue services, such as police, fire fighters and rescue helicopters, stress the importance of open and continuous communication before, during and after the event. In addition, each member of the crew has a veto obligation, meaning that if one or more of the members has a bad feeling or experience uncertainty regarding the safety of the operation, the crew will stop and re-evaluate the operation.

For what we know, this might have been just what happened in the group – too late.

4.3 Use safe terrain to assess conditions

When assessing the conditions in the field after a storm or during uncertain conditions, it is a good choice to travel and collect information in safe non-avalanche terrain. There could be large differences in the snowpack from down in the valley to further up and above the treeline.

When assessing the avalanche situation of an area, it is recommended to do so in safe terrain at all elevations and in the same aspect as you are planning to ski.

4.4 Think consequence and beware of terrain traps, they increase consequences

The type of terrain can alter the consequences of being caught by an avalanche. Features like cliffs, rocks, gullies or as in this case, trees, increase the chance of physical injuries or being deeply buried. The avalanche in this report released just above the tree line and forced the victims in high speed through a sparsely forested area. The only skier that was unharmed was the one lucky enough not to be carried through the forest.

Terrain features, commonly known as terrain traps, may dramatically increase the consequence of an avalanche. It is therefore important to be aware of obstacles in the fall line from your location. One idea is to always think consequence. What will happen in an avalanche release? Can I be caught? Will it harm me, and can it take me into a terrain trap which will increase the consequence?

4.5 Travel with distance in the group

The group toured with distance up the slope and tried to keep some distance at all times. Even though they did this, everyone was caught in the avalanche. This can indicate that they did not keep sufficient distance in the conditions and terrain they were touring.

When travelling in avalanche terrain it is always a good idea to keep distance between the participants. Firstly, it can decrease the consequence of an avalanche by making sure the entire group is not caught by a single avalanche. Secondly, it decreases the load on the snowpack so that triggering is less likely. For this reasons, the group traveling together should only gather at spots where there is no danger for being taken by avalanches.

4.6 Always check Varsom for new information

Varsom is continuously updated with onsite reports from the avalanche observers or other skiers. Particularly during challenging conditions, it is a good idea to check for new available information before heading out into avalanche terrain. In this case, observations from the same mountain the day before indicated that there was unstable snow in the area.

There may be cases where the danger level increases because of new information and the avalanche bulletin is updated during the day, appose to the end of the day, which is normal. To get this information as soon as possible it is possible to subscribe to get notified about these updates on SMS and e-mail. You can subscribe to these updates on https://abonner.varsom.no.

4.7 Norwegian bulletins contain more info than the English

Most of the crucial information available in the Norwegian bulletin was also available in the English version. It said that it was easy to trigger an avalanche in the aspect and elevation the accident occurred. Both the avalanche problem and travel advice are automatically translated into English and the main message is written in English by a forecaster. However, the complementary avalanche danger assessment and snow cover description are exclusively in Norwegian. In this case, information about the persistent weak layer's characteristics and possible large differences over short distances was not included in the English version. Even though there was someone in the group who spoke fluently Norwegian, and the group also had access to this information, this is a reminder for the forecasters to always include essential information in the English version of the main message, especially in regions with many visitors who do not read Norwegian.

If one wants to make sure they get all the possible information, it is possible to use translation tools like google translate to access information in the bulletin and observations that are not in English.

5 Concluding remark

It is important to recognise the complexity and large degree of uncertainty inherent in avalanche assessments, especially under conditions with persistent weak layers. Also, the human factors which affects our decision. Looking back after an accident it is always possible to point to crossroads where another decision would have prevented the accident. However, during the situation looking forward - without knowing the outcome of the trip, things might look completely different.