National Avalanche Warning Service for Norway – established 2013

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ABSTRACT: Norway established a national public avalanche danger warning service on 14 January 2013 based on international standards – a milestone in the Government's public safety efforts. Three years of R&D was required, which included development of a landslide warning service. Avalanches claimed 37 lives in Norway last four winters, mostly in the backcountry. The use of avalanche terrain is increasing, which leads to more accidents. Avalanches also cause significant problems to transport and settlements. The Government established the service in response to these challenges. It was developed by Norwegian Water Resources and Energy Directorate (NVE) in collaboration with Norwegian Meteorological Institute (MET), Norwegian Public Roads Administration (NPRA), Norwegian National Rail Administration (JBV) and Norwegian Geotechnical Institute (NGI). Other stakeholders and avalanche services provided valuable advice, especially SLF, CEN, Parks Canada, CAC and LWZ-Bayern. The service follows European standards and is part of EAWS. Avalanche bulletins were published for 24 regions on www.varsom.no four days a week the first season. Danger levels 4 and 5 are published by 13H to provide early information to emergency authorities, while the rest by 17H based on updated observations throughout the day to the general public. An observer corps and a forecaster group were established and trained. Information and modelling technology was developed (www.regobs.no, www.xgeo.no and www.varsom.no). Main user groups are from transport sector, skiers, snowmobilers, local authorities, police and rescue. Most of the bulletin is in English, as well as Norwegian, to help visitors from abroad.

KEYWORDS: Avalanche, warning, forecasting, public safety.

1 INTRODUCTION

This paper presents the development of a national avalanche warning service for Norway, which started on 14 January 2013 by issuing warnings for 24 regions (Figure 1).

Norway is a mountainous country with a long snow season. Mainland Norway borders the North Atlantic and spans from 59 to 71 degrees north, which gives rise to complex weather and snow regimes. Norway has a population of about 5 million and significant exposure to avalanche terrain in terms of large parts of the road and railway networks, villages and scattered houses, as well as an increasing recreational / backcountry activity.

Norway has a significant avalanche problem, mainly associated with skiing/recreation, transport and buildings. Past four winters (2009/2010-2012/2013) claimed 37 avalanche fatalities, the 1972-2012 average was 5.3 (www.snoskred.no). Nearly 80 % of the fatalities occurred travelling by foot, on skis etc, while the rest are equally split between roads and buildings. The recent increase in ski touring and freeriding gives a dramatic increase in total avalanche danger exposure time. Norway, with its snow-covered mountains dotted along the coastline, offers numerous tourist destinations for skiing in remote mountain areas with spectacular scenery. The increasing number of tourists from abroad adds to the total exposure time.

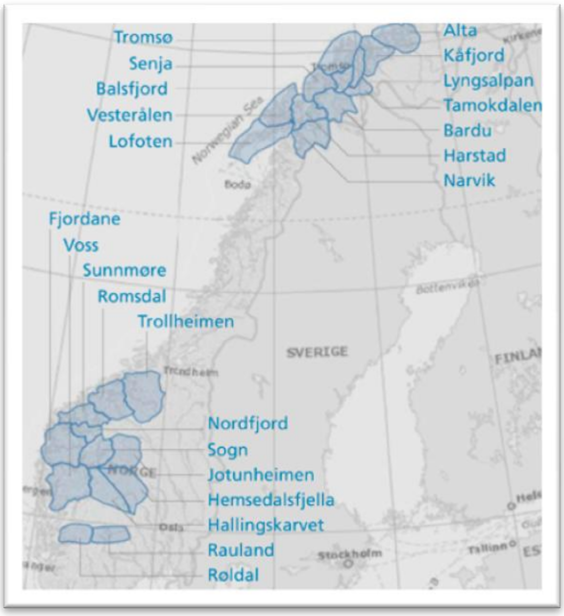


Figure 1. Map of forecasting regions as of January 2013.

Large investments in protection, such as tunnels and deflecting constructions have reduced the avalanche problem on roads and railroad significantly. However, these are costly

(NOK 1-2 billion annually) and time-consuming measures, and the avalanche problem remains significant (Figure 2).

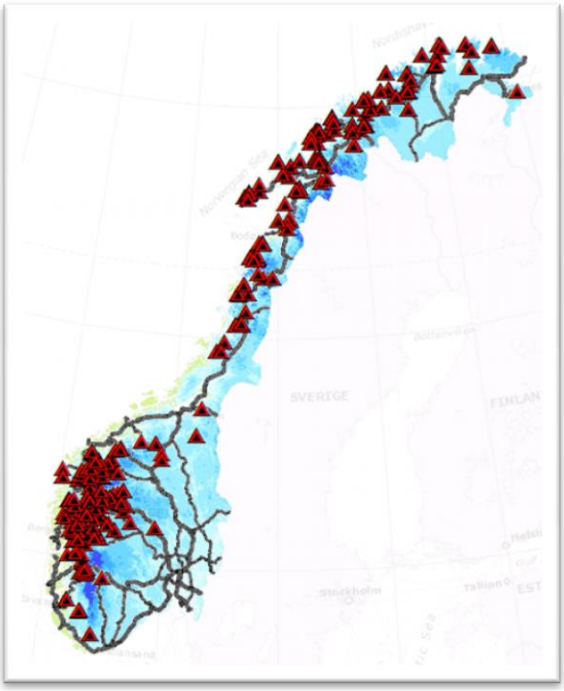


Figure 2. Map of roads closed due to avalanche problems (triangles) during the winters 2011/2012 and 2012/2013.

2 PUBLIC AVALANCHE FORECASTING

Avalanche forecasting is a widely used tool internationally to reduce avalanche accidents/problems. In Norway, NGI has carried out object-specific avalanche forecasting to support authorities and companies responsible for evacuating houses and closing/opening roads and railroads. MET issued coarse warnings about avalanche danger to the public as a part of their extreme weather alerts. It was based on weather data only, and was triggered by strong wind and/or heavy precipitation suggesting danger level 4 or 5 on provincial scale (administrative unit "fylke").

However, no regular public avalanche warning service was available for Norway before January 2013, when a national avalanche warning service was launched by the Norwegian Avalanche Centre. The Centre is a virtual centre, which produce the avalanche bulletins and supports the public in collaboration between NVE, MET, NPRA, JBV and NGI.

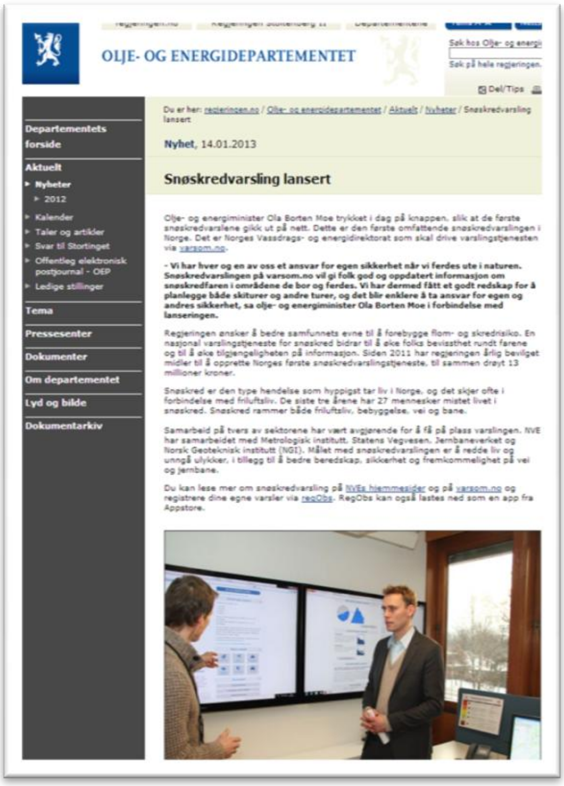
The Norwegian Avalanche Centre launched the first avalanche warnings for Norway on 14 January 2013 (Figure 3). The bulletins and forecasts are published according to international/European standards as part of the European Avalanche Warning Services (www.avalanches.org). The results from the first season are reported in Müller et al. (2013).

The main goal of the Norwegian warning service is to avoid accidents and reduce problems due to avalanches. Our vision is zero avalanche fatalities in a society with active recreational winter sports and well functioning infrastructure.

Our strategy is that a correct, instructive and well-used bulletin increases awareness and triggers interest to learn more about avalanche dangers – making it easier to avoid loss of life and value.

The avalanche warning service contains these components: a forecasting group, a professional observer corps, Information and communication systems, snow and weather models, and automatic hydro-meteorological stations.

In addition, major efforts were put on risk awareness and avalanche education. We have a high focus on the users and user groups, both in order to stimulate safer behaviour and to motivate users to contribute with their observations and assessments through crowd sourcing.



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Snøskredvarsling lansert

Olje- og energiminister Ola Borten Moe trykket i dag på knappen, slik at de første snøskredvarslene gikk ut på nett. Dette er den første omfattende snøskredvarslingen i Norge. Det er Norges Vassdrags- og energidirektorat som skal drive varslingstjenesten via varsom.no.

- Vi har hver og en av oss et ansvar for egen sikkerhet når vi ferdes ute i naturen. Snøskredvarslingen på varsom.no vil gi folk god og oppdatert informasjon om snøskredfaren i områdene de bor og ferdes. Vi har dermed fått et godt redskap for å planlegge både skiturer og andre turer, og det blir enklere å ta ansvar for egen og andres sikkerhet, sa olje- og energiminister Ola Borten Moe i forbindelse med lanseringen.

Regjeringen ønsker å bedre samfunnets evne til å forebygge flom- og skredrisiko. En nasjonal varslingstjeneste for snøskred bidrar til å øke folks bevissthet rundt farene og til å øke tilgjengeligheten på informasjon. Siden 2011 har regjeringen årlig bevilget midler til å opprette Norges første snøskredvarslingstjeneste, til sammen drøyt 13 millioner kroner.

Snøskred er den type hendelse som hyppigst tar liv i Norge, og det skjer ofte i forbindelse med friluftsliv. De siste tre årene har 27 mennesker mistet livet i snøskred. Snøskred rammer både friluftsliv, bebyggelse, vei og bane.

Samarbeid på tvers av sektorene har vært avgjørende for å få på plass varslingen. NVE har samarbeidet med Metrologisk institutt, Statens Vegvesen, Jernbaneverket og Norsk Geoteknisk institutt (NGI). Målet med snøskredvarslingen er å redde liv og unngå ulykker, i tillegg til å bedre beredskap, sikkerhet og fremkommelighet på vei og jernbane.

Du kan lese mer om snøskredvarsling på NVEs hjemmesider og på varsom.no og registrere dine egne varsler via regObs. RegObs kan også lastes ned som en app fra Appstore.

Figure 3. Facsimile from a press release from the ministry on the launch of the new public service.

3 THE PROCESS

NVE was tasked to be overall responsible for avalanche and landslide prevention in 2009. Before this time no single government agency was responsible for this sector. NVE assessed the demand, costs and organisational structure of regional warning services for landslides and avalanches (Colleuille and Engen, 2009). The assessment recommended establishing regional warning services for avalanche and landslide danger.

This was followed up by the decision to develop a public service in February 2010, with the aim to launch a fully operational service according to international standards by the winter season 2012/2013. Initial ideas are described in Ekker et al. (2010). The transportation sector (NPRA and JBV) is a major stakeholder in the avalanche sector, and provided considerable interest and capacity for an avalanche service already ahead of the decision. MET is the national weather service, issued weather-related avalanche warnings and is partner with NVEs national flood forecasting service. Thus NVE, MET, NPRA and JBV joined forces to develop this service with a common purpose/goal. NGI with experienced avalanche researchers/professionals was contracted to assist in the development of the service. The role of NPRA is presented in Farestveit et al. (2013).

4 THE APPROACH

The approach was to ask and resolve a question with three considerable challenges: how to fund, design and implement the service? All the steps where taken in close cooperation with twin project, which developed the landslide warning service.

4.1 Funding

Funding was resolved by having a close dialog with the Ministries, demonstrating decent progress in developing the service and by understanding the costs and benefits of national services in comparable countries, such as Switzerland, France and Canada

4.2 Design

Design was resolved by screening comparable service in other countries and listening to their advice, testing many different ways of doing it in Norway and building on the benefits offered by the collaborating partners.

4.1 Implementation

Implementation was done by developing:

- Bulletin templates
- Forecasting group
- Observer corps
- Observation guidelines and handbook
- Observation system on web and app (www.regobs.no)
- Data visualisation system (www.xgeo.no)
- System for writing and publishing bulletins (part of www.regobs.no)
- Snow and weather models
- Web-portal for publishing bulletins and educational material (www.varsom.no)
- Observer and forecaster courses
- Plans for upgrading the network of automatic hydro-meteorological stations
- All according to the principle of open data access on all levels

5 THE SERVICE

5.1 People

People were the key asset to develop the service, which initially consists of 15 forecasters and about 50 observers. In the first season, 4 of the forecasters were from MET, 9 from NVE and 2 from NGI. In addition, 3 of the NVE-contracted observers participated in the forecasting group. 35 of the observers have contracts with NVE, while 17 are NPRA-employees, 3 from JBV and 2 from MET. In addition to the contracted observers, a number of people volunteer observations on www.regobs.no.

Another important source of information is the road operators, who are maintaining the roads on contracts with the NPRA. The service relays on well-functioning information technology, and this is developed and operated by specialists at NVE and MET. Commercial companies were used in the development phase. The service reports to the steering group for avalanche and landslide forecasting.

Kosberg et al. (2013) describes in more detail the combination of theoretical and practical knowhow of the people in the warning service. Many of the observers contracted by NVE are professional IFMGA mountain guides. All observers have been provided thorough training in observations procedures, and many of the observers have also gone through courses in safe travelling in avalanche terrain. Furthermore, annual meetings have been held for all observers and forecasters in order to increase the competence level all over, assure standardisation and build a sound and solid safety culture.

5.2 Observations

The observers and forecasters have all been trained in how to carry out observations, where and what to look for and how to interpret the observations. All observations are entered into regObs, either using the web site www.regobs.no or the app available for iPhones and android smart phones. regObs is also used for observations of flood problems, ice problems and landslide problems.

The most important observations to the forecasting are:

1. Assessment of avalanche danger, including rating of the avalanche danger, identification of the avalanche problem(s), exposed terrain and a description of the current situation and expected development. The structure of this assessment is identically to that of the bulletins.
2. Observations of recent avalanche activity (or lack thereof)
3. Observations of other danger signs, such as whump-sounds, shooting cracks, critical new snow and wind-drifted snow.
4. Reports of accidents or damage, as well as events where accidents or damage could have occurred
5. Observations of instability (weak layers, ECT results) and snow profiles (inserted as images from snow profiling software, such as AvyLab.
6. Pictures from the field

Several other observations are also reported and used. All observations are tagged with geographical coordinates and time. The coordinates are captured by clicking in a map on the web site or captured by the app using the GPS in the smart phone.

Danger levels at a high three and above trigger response from NPRA and JBV, as well as local authorities. Communication with these parties is important and especially the NPRA have been active during the first season with respect to adding more information as well as assessing the hit rate of the bulletins at higher danger levels.

The standard frequency of observations is twice a week, and in some regions three days a week. The observers submit additional observations and assessments according to their capacity or in response to requests from the service. Additionally a significant number of observations are provided by volunteers.

During the first season about 11 000 observations were recorded in www.regobs.no.

5.3 Stations

Norway has a considerable network of automatic stations measuring parameters relevant to the avalanche warning service (Figure 4). All four governments agencies involved in the avalanche warning service operate their own networks. MET has a network of weather and snow stations for weather prediction and climate monitoring purposes, and practices an open data policy.

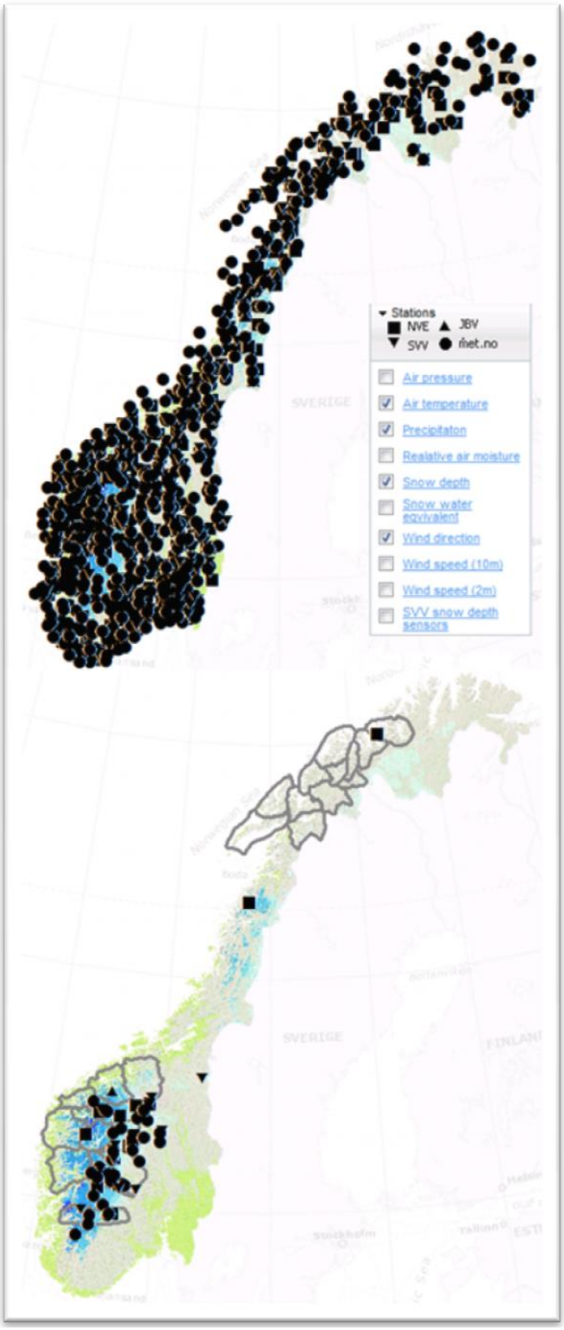

Figure 4. Station map showing all stations (upper map) and stations above 800 m a.s.l. (lower map).

NVE has a network of hydrological and snow stations for the purpose of flood forecasting, hydrology and, hydropower inflow monitoring, and practice an open data policy. NPRA has a network of weather stations along road for the purpose of preparedness and road operations, but has only recently started collaborating with MET with the aim to make data public. JBV has stations along railway lines for the purpose of preparedness and rail operations, and their data is made available through MET.

A basic analysis was carried out in order to define data gaps form the station network. It was concluded that a number of new stations are required and some existing stations needed to be upgraded with new sensors measuring relevant parameters. A working group with members from all partners defined a standard for a basis station and a reference station. A basis stations is one measuring wind, air temperature, snow depth, precipitation and ground water level. A reference station measures all relevant parameters for research on processes and modelling.

The major fault in the current station design is the lack of weather and snow data from the mountain areas. Most existing stations are located below the tree line (see Figure 4). Although the tree line decreases from about 1000 m a.sl. in the South and down to sea level in the North, the maps in Figure 4, showing stations above 800 m a.s.l. illustrates the lack of stations at elevations typical for avalanche release.

Especially wind observations are lacking at higher elevations, but also precipitation, air temperature and snow depth is sparely measured in mountain areas.

A programme was initiated in order to close these gaps, and stations are now being installed according to a common plan. However, considerable time has been required in order to define common standards, common purchasing procedures, agree to ownership and sharing of costs for long-term maintenance. Another challenging point is the maintenance of stations at high elevation with problems due to icing, snowdrift and difficult access during winter time.

5.4 Web, IT and models

Web has been the preferred channel for end-user communication, bulletin production and data collection/sharing. The service decided at an early stage to base its operations on an open data policy, thus all data used or generated by the service are public domain data.

Software development was required to provide for efficient information and communication technology for the service operations:

- Data and bulletins are published on www.varsom.no (Johnsen, 2013).
- Field data are collected, stored and shared using www.regobs.no (Ekker et al., 2013).
- Bulletins and observations are available at api.nve.no. Data analysis is carried out using www.xgeo.no (Barfod et al., 2013), a map-centric visualisation tool for displaying data from distributed sources, currently NVE, MET, NPRA and Norwegian Mapping Authorities.

Both numerical weather prediction (NWP) models and snow models are being used to provide data simulations of the current situation and the prognosis for the coming days. Data from UM4, Hirlam8 and the ECMWF were used. AROME data will be used for forecasting soon and preparations for changing to AROME input to the forecasting and snow modelling system is ongoing.

Snow model data come mainly form the www.senorge.no SNOWMAP system (Saloranta, 2012). The SNOWMAP system produce historical and forecasts of relevant parameters on a 1km by 1 km by 24 hour resolution for mainland Norway: new snow water equivalent, snow water equivalent, snow depth, new snow depth, snow wetness, snow runoff, etc.

Experiments were carried out to develop models for a snow load index and a depth hoar index, but his work is to be completed and published at a later stage. Experiments and tests with the Crocus and SNOWPACK models were also carried out, including a sensitivity study of the Crocus model to input forcing data (Vikhamar-Schuler, 2011).

5.5 Bulletins

Bulletins are the main products of the service, along with observations displayed directly in www.regobs.no. The bulletins present information according to importance, and are based on EAWS standards. A Norwegian version of the EAWS danger scale is used to communicate the danger levels (Figure 5).

A bulletin contains five main elements (Figure 6):

1. Danger level,
2. Main message,
3. Exposed terrain (elevation, orientation, coastal/ continental),
4. Avalanche problems (up to three problems in order of importance), and
5. Assessment of avalanche, snow and weather situation.

The main message is consider the heading of the bulletin, and is typically used to communicate the main problem or the main advice to the main user group, for example back country skiers, road authorities or local authorities.

Up to three avalanche problems were included in each bulletin, these are described in Landrø et al. (2013).

All elements, but element number 5, a textual assessment, are automatically translated to English and available in the English version of www.varsom.no.

An observation feed (continuously updated, like a news feed) from www.regobs.no is displayed next to the bulletins in order provide the users with as up-to-date information as possible. Updated weather radar animations are also displayed next to the bulletin as is the latest weather forecasts from MET. A map of the region is displayed below the bulletin.

5.6 Production

Bulletins are normally produced on Monday, Wednesday, Friday and Saturday during the winter season (December-May) for 24 regions in Norway (Figure 1). The regions vary from about 1500 to 8500 km2 in size.

Each bulletin is valid for a calendar day, i.e. from 00H to 24H. Bulletins are produced for three days at the time: A nowcast is produced for the day of production, and forecasts are produced for the next two days. This amounts to a production of a minimum of 72 bulletins four days a week (normally 288 bulletins a week) and a total of 6234 the first season.

The bulletins are produced by a team of four forecasters (3 on Saturdays). On Tuesdays, Thursdays and Sundays, only one forecaster is on duty. During these days, updating the bulletins is considered by the forecaster. This typically occurs when danger levels approach or equal 4 or 5, or when weather/snow forecasts change significantly or deviates significantly from observations.

Bulletins for regions with danger level 4 or 5 are normally published before 12:00 and regions with danger level 1-3 are published before 17:00. This provides early information about high danger levels to preparedness and emergency authorities, while the general public receives warnings on lower levels based on updated observations throughout the day.

The observers are encouraged to provide observations from the day before the forecasting day, or even better, before 12:00 on the forecasting day.

The information flow in the production of the bulletins is illustrated in Figure 7. The chronological layout of a typical forecasting day is as follows:

07:30-09:00: The meteorologist analyse the current and forecasted weather situation, and prepares DIANA screen-dumps of the synoptic situation and analysis, as well as prognosis from the most relevant weather prediction models (typically UM4, HIRLAM8 and EC fields). The meteorologist also participates in the daily brief between MET's three forecasting centres at 08:00. The avalanche forecasters normally start work between 08:00 and 08:30 by analysing the observations at www.regobs.no in addition to the recent media monitoring log, which captures articles about avalanches in the media.

09:00-09:30: Daily weather and avalanche brief, where the weather and snow situation and forecasts are presented and major issues are discussed. During this brief, the regions are ranked according to priority and assigned to the forecasters. Regions where the danger level may be 4 or 5 are always given highest priority in order to publish these bulletins during the morning session. The landslide and flood forecasters participate in the brief on a need-to-know basis.

09:30-12:00: The meteorologist finishes the weather analysis and produces a standard mountain weather information package for each region. Analysis of relevant SNOWMAP and field observations are done using www.xgeo.no and www.regobs.no. Danger level 4 and 5 bulletins are quality assured by another forecaster in the group and published. The need for issuing special warnings is also considered. The avalanche forecasters analyse the situation and produces the bulletins they are assigned. Communication between observers and forecasters is frequent during this period of day.

12:00-17:00: All bulletins are normally produced by 15:00, but in complex situations the last bulletin may be produced as late as 17:00. Reassignment of regions is done when required in order to spread the work load evenly. The last hour of work is dedicated to quality assurance and publication, which normally occurs between 16:00 and 17:00.

Mountain weather information is compiled by the meteorologist on duty and includes expected wind speed and direction, precipitation, 0-isotherm level, air temperature at 1500 m a.s.l. and cloud cover in 12 hours periods for each region during the forecasting period.

Special warnings are typically published ahead of potential accident-prone weekends or holidays, when large volumes of traffic in the back country are expected and particular avalanche problems are to be respected and handled. Special warnings are published on varsom.no and issuing press releases or news articles to NTB (a major Norwegian press agency), which are then picked up in most national and local media.

Most communication between the field and the office is using www.regobs.no, but also phone and Skype are used extensively. Forecasters were given a two weeks training course in December and carried out several test days in order to provide a common platform for team work and standard work procedures, after two years of testing different methods and practices.

Forecasters are located in different parts of the country, currently in Oslo, Gol, Sogndal, Molde, Narvik and Tromsø. Web-based tools for data analysis, production/publication of bulletins and communication with field staff and other forecasters makes a distributed solution possible. Distances between the forecasting regions are considerable, and the distributed set-up provides for an excellent degree of flexibility and closeness to stakeholders. A challenge for the future may be to preserve homogeneity and collaborative spirits as people are to a certain degree scattered around. However, this is regarded a low risk and is probably by far outbalanced by the benefits. The service is based out of Oslo at the NVE head quarters, collocated with the flood and landslide warning services.

5.7 Budgets and costs

As discussed earlier, the service was developed in parallel with securing funding for the service. Visiting comparable services in other countries was very useful in order to appreciate the costs, competence and organisational structures required.

Funding is provided from two Norwegian Ministries. Budgets were provided annually and increased gradually from the start in 2010 to the first operational year in 2013. The development costs 2010-2012 were about NOK 40 mill., the total annual budget for the first operational year is about NOK 20 mill. These figures include investments in automatic weather stations, software development, salaries, travelling and consultants.

6 CONCLUSIONS

The service was well received by the public and the main user groups. Many people appreciated the launch of the new service, saying it was about time to get such a service in Norway. It was appreciated by many that the service is also available in English. www.varsom.no received very positive critics, pointing out that it is visually presenting the message in a clear and easy to use way, even on smart phones. Many users appreciated that the avalanche danger levels and problems presented in the bulletins were in line with observations and assessments in the field. Many users liked that www.regobs.no was developed for real-time sharing of observations and assessments without restrictions on data access. Open data access and web-based production tools allow users to view the basis for the bulletins, and enables forecasters to work from anywhere.

It was possible to establish a service with decent quality and spatial coverage within the timeframe of three years. Three major achievements were required to succeed: (1) establishing a skilled network of observers, (2) developing efficient information systems for sharing and analysing data as well as producing and publishing bulletins, and (3) the government provided the resources required for the task. A collaborative environment made the task possible – the partners shared data, competence and resources.

Our ambition to develop a better network of automatic hydro-meteorological stations and better models for simulating relevant snow properties and weather was not fully met during the three-years of development, but remains as a long-term ambition.

7 FUTURE PERSPECTIVES

From next winter we plan to produce bulletins daily, instead of four times a week. This will increase quality and availability, while reducing the work intensity which was too high the first season to be sustainable.

The main question met during the first winter has been “why do you not have a bulletin for my region?” We have another seven regions in the pipeline, but we will have to consider capacity and cost-benefit before extending the service. Plans for including another six to seven regions are in place, but implementation will depend on available resources and capacity. Another discussion point is the current system, where bulletins are produced by a forecasting group, and a special weather alert is issued by MET if danger levels reach 4 and 5. It would be preferable to issue all avalanche-related warnings in the same system, and plans for this are made.

Furthermore, the elements of the bulletin, the level of detail and the publication platform (www.regobs.no and www.varsom.no) will be evaluated and developed as needed.

The process of analysing data from multiple sources and writing the bulletin relies heavily on manual time-consuming labour. Automating processes, improving data compilation, snow models and weather data are strategically important goals in further work.

Further focus is on user needs: testing the use of ATES in Norway and producing even more relevant warnings to key stakeholders, such as transportation authorities/operators and local authorities/police. On www.varsom.no, we plan to produce better bulletins, include more illustrative film and offer a subscription service.

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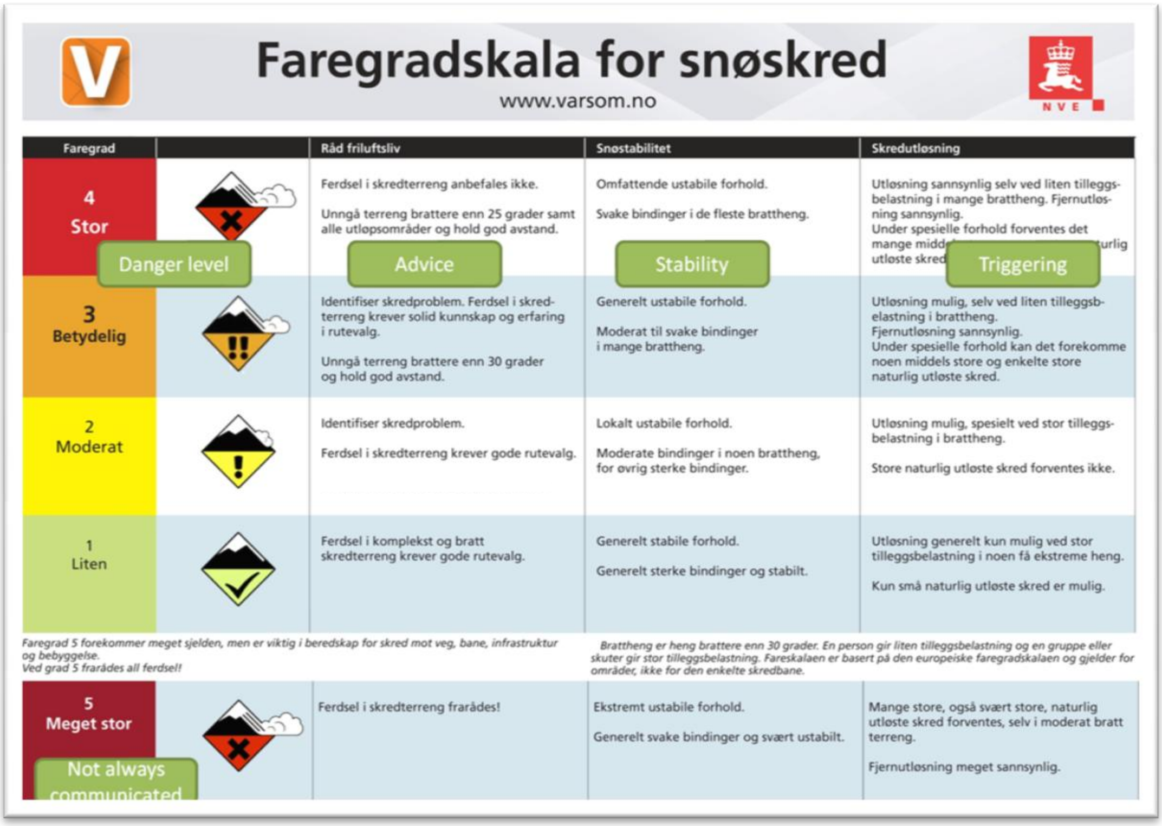

Faregradskala for snøskred

www.varsom.no

Faregrad	Råd friluftsliv	Snøstabilitet	Skredutløsning
4 Stor	Ferdsel i skredterreng anbefales ikke. Unngå terreng brattere enn 25 grader samt alle utløpsområder og hold god avstand.	Omfattende ustabile forhold. Svake bindinger i de fleste brattheng.	Utløsning sannsynlig selv ved liten tilleggsbelastning i mange brattheng. Fjernutløsning sannsynlig. Under spesielle forhold forventes det mange midd[…]urlig utløste skred[…]
3 Betydelig	Identifiser skredproblem. Ferdsel i skredterreng krever solid kunnskap og erfaring i rutevalg. Unngå terreng brattere enn 30 grader og hold god avstand.	Generelt ustabile forhold. Moderat til svake bindinger i mange brattheng.	Utløsning mulig, selv ved liten tilleggsbelastning i brattheng. Fjernutløsning sannsynlig. Under spesielle forhold kan det forekomme noen middels store og enkelte store naturlig utløste skred.
2 Moderat	Identifiser skredproblem. Ferdsel i skredterreng krever gode rutevalg.	Lokalt ustabile forhold. Moderate bindinger i noen brattheng, for øvrig sterke bindinger.	Utløsning mulig, spesielt ved stor tilleggsbelastning i brattheng. Store naturlig utløste skred forventes ikke.
1 Liten	Ferdsel i komplekst og bratt skredterreng krever gode rutevalg.	Generelt stabile forhold. Generelt sterke bindinger og stabilt.	Utløsning generelt kun mulig ved stor tilleggsbelastning i noen få ekstreme heng. Kun små naturlig utløste skred er mulig.

Faregrad 5 forekommer meget sjelden, men er viktig i beredskap for skred mot veg, bane, infrastruktur og bebyggelse. Ved grad 5 frarådes all ferdsel!

Brattheng er heng brattere enn 30 grader. En person gir liten tilleggsbelastning og en gruppe eller skuter gir stor tilleggsbelastning. Fareskalaen er basert på den europeiske faregradskalaen og gjelder for områder, ikke for den enkelte skredbane.

5 Meget stor	Ferdsel i skredterreng frarådes!	Ekstremt ustabile forhold. Generelt svake bindinger og svært ustabilt.	Mange store, også svært store, naturlig utløste skred forventes, selv i moderat bratt terreng. Fjernutløsning meget sannsynlig.

Figure 5. Public danger scale at www.varsom.no. Labels in English explain key elements in the table. The English version of the bulletin uses the table provide by www.avalanches.org.

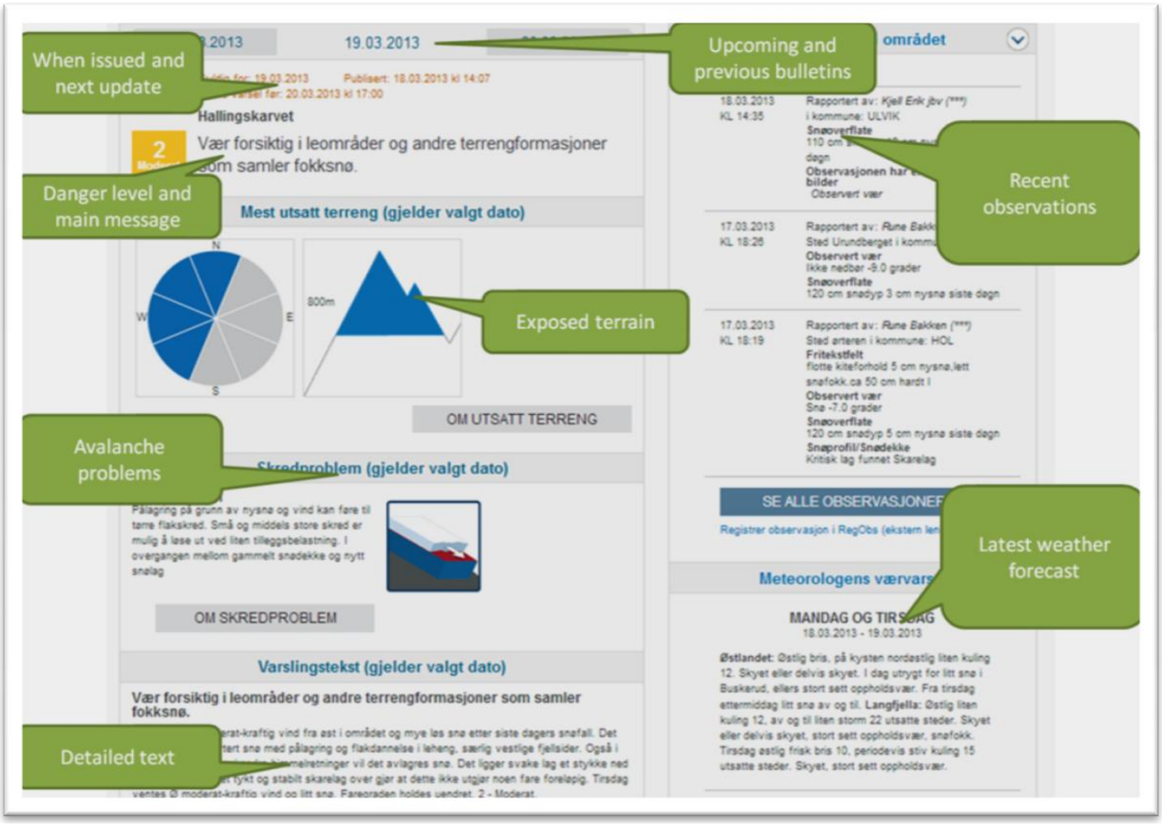

Figure 6. An example of the bulletin from www.varsom.no. Labels in English explain key elements.

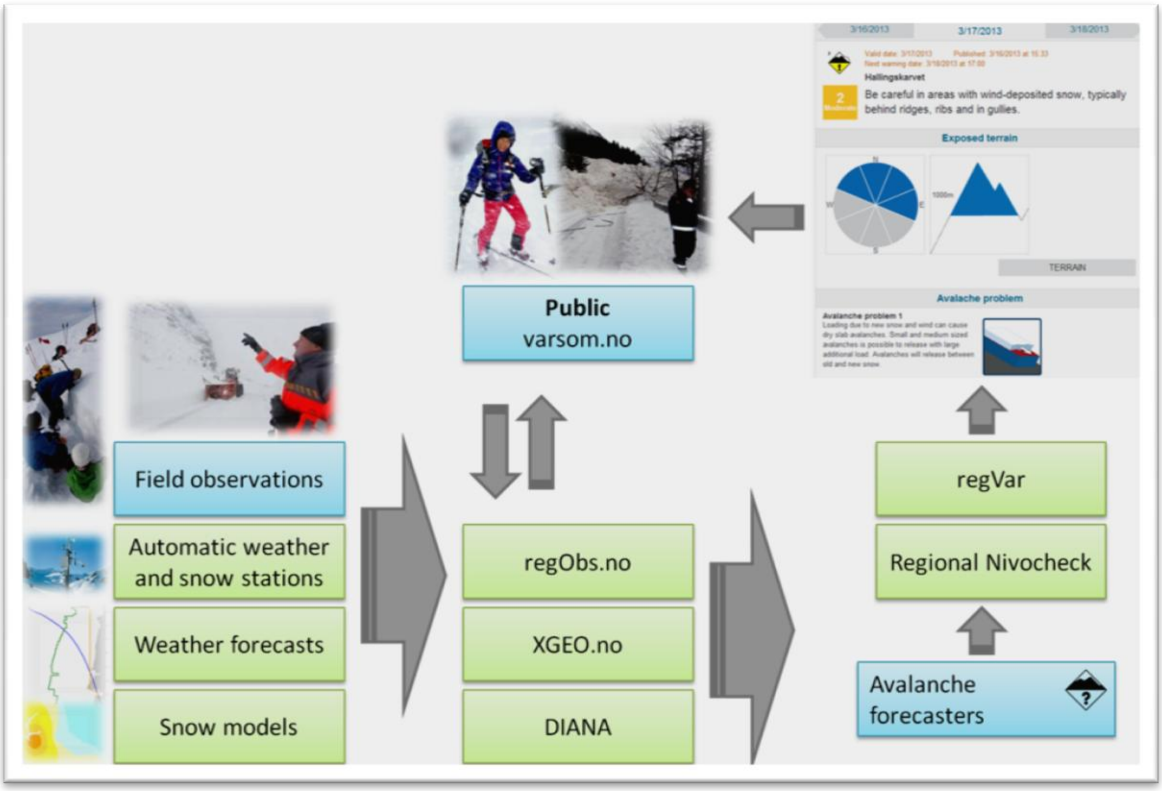

Figure 7. The information flow (arrows), people (blue boxes) and data/IT (green boxes) used to produce the bulletins.