VEÐURSTOFA ÍSLANDS

Greinargerð

02008

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Results of the 2D avalanche model SAMOS for Seyðisfjörður

VÍ-ÚR05
Reykjavík
Mars 2002

BACKGROUND

The 2D avalanche model SAMOS, developed by the Advanced Simulation Technologies (AVL) of Graz, Austria, has been run for starting zones in the mountain above the village Seyðisfjörður, eastern Iceland. The runs are intended to shed light on the following aspects of the avalanche hazard situation in the village:

1. The effect of the shelf at Brún in the mountain Bjólfur on the flow of avalanches that are released from the upper starting zones above Brún, in particular the volume of snow that stops on the shelf.
2. The shortening of avalanche runout due to lateral spreading of avalanches. This is particularly relevant for the largely unconfined and partly convex slopes of Bjólfur below the shelf at Brún.
3. The direction of the main avalanche tongues from the starting areas that have been defined in the mountain as a part of the hazard zoning, in particular the influence of the gullies Jókugil and Fálkagil in Bjólfur on the direction of avalanches in the runout area on the northern/western side of the fjord.
4. The likelihood that avalanches, released from the large bowls Efri-Botnar on the south side of the fjord, can reach the bottom of the valley where the village is located.
5. The influence of the complex topography of the mountain Strandartindur on the flow of avalanches that are released on the south/east side of the fjord. In particular, it will be analysed whether avalanche released in the starting areas above Þófi are likely to flow directly over Þófi, rather than follow the gullies where the recorded avalanches are reported to have flowed.

The results of the runs will be used in the delineation of the hazard zones for the village. Similar results have previously been used for the same purpose for the villages Bolungarvík, Neskaupstaður and Siglufjörður (Jóhannesson *et al.*, 2001a,b). The section about the application of the model to the 1995 avalanche at Flateyri is identical to a section in the reports about Bolungarvík, Neskaupstaður and Siglufjörður in order to make the present report independent of the previous reports.

The SAMOS model was developed for the Austrian Avalanche and Torrent Research Institute in Innsbruck by AVL and has recently been taken into operational use in some district offices of the Austrian Foresttechnical Service in Avalanche and Torrent Control. The model is based on similar assumptions regarding avalanche dynamics as other depth integrated 2D avalanche models that are used in Switzerland and France. Friction in the dense flow part of the model is assumed to be composed of a Coulomb friction term proportional to a coefficient $\mu = \tan(\delta)$ with $\delta = 16.0°$ ($\mu = 0.287$) and a turbulent friction term which may be represented by a coefficient $\xi = 446\,\mathrm{m^2/s}$ (Sampl and Zwinger, 1999). Rather than adding the two friction components as is done in the Swiss and French 2D models, the SAMOS model uses the maximum of the two friction terms and ignores the smaller term. This leads to slightly higher modelled velocities than for the Swiss and French 2D models for avalanches with similar runout. The velocities are, also, somewhat higher than corresponding velocities in the same path from the Swiss AVAL-1D model or the PCM model (Sauermoser, personal communication). The model runs are, furthermore, based on an assumed value $\rho = 200\,\mathrm{kg/m^3}$ for the density of flowing snow. The density is used to convert a given mass of snow in the starting zone to a corresponding volume or depth perpendicular to the terrain of the snow that is released at the start of the simulation.

MODELING OF AVALANCHE AT FLATEYRI ON 26.10.1995

The SAMOS model had not been used to model Icelandic avalanches before it was run in connection with hazard zoning of several Icelandic villages in the years 2000 to 2002. The model was first run for the catastrophic avalanche from Skollahvilft at Flateyri on 26 October 1995 (fig. 1) in order to check the applicability of the parameter values that are traditionally adopted for the model in Austria. The values for μ, ξ and ρ listed above were used. About 90,000 tons of snow were released from the starting zone between about 400 and 640 m a.s.l. based on measurements of the mass of the deposit of the avalanche and observations of the fracture height and density of the snow at the fracture line. The starting zone was divided into an upper and a lower area with a larger snow depth in the upper area. The run was defined by the following input data:

Input	Value
Map area of upper starting zone ($10^3 m^2$)	58
Map area of lower starting zone ($10^3 m^2$)	52
Total map area of starting zone ($10^3 m^2$)	110
Area of upper starting zone ($10^3 m^2$)	73
Area of lower starting zone ($10^3 m^2$)	63
Total area of starting zone ($10^3 m^2$)	136
Snow depth, upper area (d_u, m, ρ = 200 kg/m^3)	4.3
Snow depth, lower area (d_l, m, ρ = 200 kg/m^3)	2.0
Snow depth, average (m)	3.25
Mass (10^3t)	89
Volume ($10^3 m^3$, ρ = 200 kg/m^3)	440
Volume ($10^3 m^3$, ρ = 350 kg/m^3)	220
Volume ($10^3 m^3$, ρ = 420 kg/m^3)	210

The snow depth in the table is defined perpendicular to the terrain. The above values of the snow depth in the two subareas correspond to an average of 3.25 m with a density ρ = 200 kg/m^3 over the whole starting zone or 1.85 m with a density ρ = 350 kg/m^3. This higher value of the density may be assumed to have been close to the density of the snow in the fracture line before the release of the avalanche. The average density of the snow in the deposit in 1995 was close to ρ = 420 kg/m^3.

No entrainment was specified and therefore the total mass of the avalanche in the model is smaller than for the real avalanche. This is typical in avalanche models of this kind.

The results of a run of the dense flow model for Flateyri with the above specification of input parameters are displayed as coloured contour plots of the depth and velocity of the flowing avalanche at 10 s intervals (file fl.ppt on the attached CD). The modelled location and geometry of the deposit at the end of the run (denoted as "h6") is in a fair agreement with the outlines of the 1995 avalanche (fig. 1). The eastward margin of the deposit is close to the buildings at Sólbakki, in a good agreement with the observed outline of the avalanche. The western margin extends slightly further to the west than the observed outline. This may be caused by the retarding effect of the buildings in the village on the runout of the avalanche, but it could also be caused by slightly too high modelled velocities as the avalanche flows out of the gully at about 200 m a.s.l. The outline to the east of the gully at about 300 m a.s.l. seems to be too high and too far from the centerline of the gully compared with the measured outline, indicating too high velocities at that location of the path. The maximum velocity of the avalanche below the Skollahvilft gully is close to 60 m/s, which is higher than obtained with the Swiss 2D model for the 1995 avalanche (about 45 m/s). The channelisation of the avalanche as it flows into the gully and the direction of the avalanche out of the gully seem to be well modelled.

A coupled dense flow/powder flow simulation was also made for the 1995 avalanche from Skollahvilft using a rather high grain size parameter (2 mm) which leads to a comparatively little transfer of snow into the powder part of the avalanche. This is believed to be appropriate for Icelandic conditions. The results for the dense core of the coupled dense flow/powder flow model were essentially the same as for the previously described run with dense core model. Maximum powder pressures reached about 10 kPa in the gully at 2.5 m above the avalanche and 2-3 kPa in the uppermost part of the village.

It was concluded from the runs for Flateyri that the same input parameters can be used for the SAMOS model for Icelandic conditions as are traditionally used in Austria. The dense core model can be used without the powder part for modeling the dense core of avalanches without this leading to significant changes in the model results. The model appears to take the effect of the geometry of the avalanche path on the flow of the avalanche into account in a realistic manner. This applies to the channelisation of the flow into the gully, the spreading of the avalanche on the unconfined slope and the deflection of the avalanche when it flows at an angle to the fall line of the terrain. The modelled speed of the avalanche may be slightly too high although it is not possible to determine whether the speeds of the SAMOS model or the Swiss 2D model are more realistic without further analysis.

RESULTS FOR SEYÐISFJÖRÐUR

Avalanche starting zones were defined in the main bowls and gullies above the inhabited area in Seyðisfjörður and also in the mountain immediatedly to the south/west of the settlement where an expansion of the settlement may take place in the future. A total of 45 different subareas were defined, 17 in Bjólfur on the north side of the fjord and 28 in Strandartindur, Efri-Botnar and Grákambur on the south side of the fjord. The areas are numbered from 1-17 and 1-28 on the maps for the respective sides of the fjord.

The main bowls and gullies near the top of Bjólfur and in Efri-Botnar are believed to accumulate more snow than more shallow bowls and gullies at lower elevations, with the exception of Kálfabotn in Bjólfur which is know to accumulate large amounts of snow. The different snow accumulation conditions in the starting zones were described by classifying the zones into five snow depth classes as defined in the following table. The snow depth is defined relative to the specified snow depth in class I areas which are defined to be large deep bowls or gullies near the top of the mountain.

Class	Relative snow depth	Comment
I+	2	Deep and narrow gullies near the top of the mountain
I	1	Large deep bowls or gullies near the top of the mountain
II	2/3	Shallow bowls or relatively flat areas near the top of the mountain
III	1/2	Small and shallow bowls at comparatively low elevations
IV	1/4	Other parts of the mountain with a small snow accumulation potential

This classification is similar as the classification previously used in Bolungarvík, Neskaupstaður and Siglufjörður. Only classes I and III were used for the Seyðisfjörður runs.

Eight runs with the SAMOS model were made in Seyðisfjörður, four on the north side and four on the south side. The first two runs in on each side were started with a uniform snow depth of 1.25 m in class I starting areas and the last two were started with a snow depth of 2.5 m in class I starting areas. The snow depth in all the runs was determined from the relative snow depth class for the respective areas as given in the above table.

The following table gives the total mass and volume of snow for each of the runs on the north side:

Input	run1n	run2n	run3n	run4n
Snow depth in class I areas (m)	1.25	1.25	2.5	2.5
Total mass (10^3t)	69	58	138	70
Total volume (10^3m^3, ρ = 200 kg/m^3)	344	290	689	351

and the next table gives the total mass and volume of snow for each of the runs on the south side:

Input	run1s	run2s	run3s	run4s
Snow depth in class I areas (m)	1.25	1.25	2.5	2.5
Total mass (10^3t)	93	73	106	146
Total volume (10^3m^3, $\rho = 200\,\mathrm{kg/m^3}$)	463	366	532	732

The mass and volume are total values for all the avalanches that were released simultaneously in the different starting zones. The snow was released simultaneously from the multiple starting zones in each run in order to simplify the model computations and in order to make them more economical in terms of computer time and time needed to set up the runs. This aspect of the simulations should not be taken to indicate that simultaneous release of this kind is likely to occur in nature.

The tables on this and the following page summarise the area and the relative snow depth for each of starting zones in Seyðisfjörður. The last column of the table lists the runs where snow was released from the zone.

Starting zone id	name	Map area (10^3m^2)	Area (10^3m^2)	Relative snow depth	Runs
1n	Bjólfstindur, southernmost	12.1	16.2	1	2,4
2n	Bjólfstindur, south-centre	81.2	104.0	1	2,4
3n	Bjólfstindur, middle	16.8	20.9	1	2,4
4n	Bjólfstindur, north-centre	54.1	69.5	1	2
5n	Bjólfstindur, northernmost	16.9	23.0	1	2
6n	South of Skagi	62.4	79.4	1/2	1,3
7n	Above Skagi, south	10.9	14.1	1/2	1,3
8n	Above Skagi, centre	69.5	85.5	1/2	1,3
9n	South of Jókugil, upper	26.4	31.4	1/2	1,3
10n	Above Skagi, north	10.3	12.9	1/2	1,3
11n	South of Jókugil, lower	35.2	43.2	1/2	1,3
12n	Above Jókugil	14.9	19.0	1/2	1,3
13n	Above Fálkagil	50.8	65.2	1/2	1,3
14n	South of Kálfabotn	15.7	19.8	1/2	1,3
15n	Kálfabotn	35.0	44.8	1	1,3
16n	North of Kálfabotn	57.6	75.7	1/2	1,3
17n	Jókugil	11.1	15.5	1/2	1,3
Total		580.8	740.0	—	—

It should be noted that avalanches from some of the starting zones in Seyðisfjörður, particularly for zones 9, 11, 12 and 17 on the north side and the upper starting zones in runs 2n and 1s, interact with neighbouring avalanches and this leads to longer runout than would otherwise be obtained. It should also be noted that starting zones 2, 3 and 4 in run 2 on the north side and zones 1 and 2 in run 1 on the south side cover a large area with some protruding cliffs and ridges. One may expect that several independent avalanches, extending over a part of the area each, will be released rather than a single avalanche encompassing the entire area. Thus, the runout indicated by the SAMOS simulations for these runs for avalanches from these starting zones may be somewhat too long.

As in the simulations for Flateyri described above, and in separate reports for Bolungarvík and Neskaupstaður and Siglufjörður, snow entrained in the lower part of the path is not considered in the computations. Therefore, the volume of the avalanches from each starting zone is smaller than for

Starting zone id	name	Map area ($10^3 m^2$)	Area ($10^3 m^2$)	Relative snow depth	Runs
1s	Ytri-Dagmálabotn, north	105.2	132.7	1	1,3
2s	Ytri-Dagmálabotn, south	79.7	99.7	1	1
3s	Fremri-Dagmálabotn, north	46.2	56.5	1	1,3
4s	Fremri-Dagmálabotn, south	48.2	58.0	1	1
5s	Strandartindur, above Þófi	91.6	110.2	1/2	2,4
6s	Strandartindur, above Skuldarlækur, uppermost area	11.4	13.7	1/2	2,4
7s	Strandartindur, above Hörmungarlækur	11.8	13.8	1/2	2,4
8s	Strandartindur, above Skuldarlækur, middle area	15.2	17.6	1/2	2,4
9s	Strandartindur, above Skuldarlækur, lowermost area	22.7	27.5	1/2	2,4
10s	Strandartindur, above Stöðvarlækur	9.3	11.4	1/2	1,3
11s	Strandartindur, above Búðará	9.6	12.1	1/2	1,3
12s	Above Neðri-Botnar	18.5	21.6	1/2	1,3
13s	Botnabrún, north of Búðará	9.8	11.2	1/2	2,4
14s	Botnabrún, south of Búðará	8.4	10.3	1/2	2,4
15s	Botnabrún, above Austurvegur	6.3	7.1	1/2	2,4
16s	Botnabrún, north of Nautaklauf	2.7	3.1	1/2	2,4
17s	Botnabrún, just north of Nautaklauf	1.7	1.9	1/2	2,4
18s	Nautaklauf, north	3.5	3.9	1/2	2,4
19s	Nautaklauf, south	3.5	4.1	1/2	2,4
20s	Botnabrún, just south of Nautaklauf	1.9	2.2	1/2	2,4
21s	Botnabrún, above Botnahlíð, north	3.1	3.6	1/2	2,4
22s	Botnabrún, above Botnahlíð, centre	7.6	8.8	1/2	2,4
23s	Botnabrún, above Botnahlíð, south	3.6	4.1	1/2	2,4
24s	South of Dagmálalækur	18.2	22.6	1/2	2,4
25s	Grákambur, northernmost	21.0	25.1	1/2	2,4
26s	Grákambur, north-centre	26.3	33.5	1/2	2,4
27s	Grákambur, south-centre	71.0	86.8	1/2	2,4
28s	Grákambur, southernmost	142.3	175.9	1/2	2,4
Total		800.3	978.8	—	—

real, large avalanches that might be released from the corresponding part of the mountain. Also, avalanches from the upper starting zones in Bjólfur in runs 2 and 4 do not entrain snow from the large starting zones below the shelf at Brún. This may be expected to lead to an underpredicted runout for avalanches from the upper starting zones in Bjólfur.

The results of the eight runs are displayed as coloured contour plots of the depth and velocity of the flowing avalanche at 10 s intervals (files sebj_run1-4.ppt, sest1_run1-4.ppt and sest2_run1-4.ppt on the attached CD. The CD also contains similar files for other Icelandic villages where SAMOS computations have been carried out). Plots of the maximum dynamic pressure (given by $p = \rho u^2$) along the paths were also made (also on the CD). Some of the results are shown on figs. 2-21 (the flow depths are in m and the maximum pressure in kPa on the figures).

The runs illustrate a persistent tendency of the avalanches to form tongues below the gullies and bowls that constitute the main starting zones in the mountain. This is particularly evident for the avalanche from Kálfabotn (starting area 15 on the north side) and also for the gullies in Strandartindur on the south side of the fjord.

Starting zone		Volume ($10^3 m^3$)		Runout index	
id	name	run1/2	run3/4	run1/2	run3/4
1n	Bjólfstindur, southernmost	20	41	13.7	13.8
2n	Bjólfstindur, south-centre	130	260	14.3	14.4
3n	Bjólfstindur, middle	26	52	—	—
4n	Bjólfstindur, north-centre	87	—	13.5	—
5n	Bjólfstindur, northernmost	29	—	14.5	—
6n	South of Skagi	50	99	13.3	15.0
7n	Above Skagi, south	9	18	—	—
8n	Above Skagi, centre	53	107	12.5	13.5
9n	South of Jókugil, upper	20	39	15.0[1]	16.0[1]
10n	Above Skagi, north	8	16	13.5	13.8
11n	South of Jókugil, lower	27	54	15.0[1]	16.0[1]
12n	Above Jókugil	12	24	15.0[1]	16.0[1]
13n	Above Fálkagil	41	82	13.3	14.7
14n	South of Kálfabotn	12	25	14.4	14.5
15n	Kálfabotn	56	112	14.6	16.0
16n	North of Kálfabotn	47	95	14.0	15.3
17n	Jókugil	10	19	15.0[1]	16.0[1]
Total		636	1042	—	—

[1]Avalanches from starting zones 9, 11, 12 and 17 are mixed into one tongue in the runout area. The runout indices for all these zones are therefore identical. The potential runout for avalanches from these zones is likely to be overpredicted by the SAMOS computations.

The release volume (ρ = 200 kg/m^3) and runout index (Jónasson and others, 1999) for the avalanches from the different starting zones in the mountain for each of the eight Seyðisfjörður simulations is summarised in the tables on this and the following page. The columns labeled "run1/2" summarise the results of runs 1 and 2 and the columns labeled "run3/4" summarise the results of runs 3 and 4. The first of each pair of these columns corresponds to a snow depth of 1.25 m in class I starting zones and the second column corresponds to a snow depth of 2.5 m in class I starting zones.

A runout index is not given in a few cases where interaction with avalanches from neighbouring starting zones makes it impossible to determine the runout of an avalanche from the starting zone in question.

It should be noted that the volumes given in the tables are not completely consistent with the volumes given in the previous tables that summarise the mass and volume of snow in each run. This discrepancy, which is in all cases less than 1-2%, is caused by discretisation errors in the computational grid because the delineation of the starting zones does not run along grid cell boundaries.

Previous simulations for Bolungarvík, Neskaupstaður and Siglufjörður (Jóhannesson *et al.*, 2001a,b) showed that the large bowl shaped class I starting zones in Neskaupstaður release avalanches that reach a runout index in the approximate range 15.5-16.5 for a snow depth of 1.25 m and runout index in the range 17-18 for a snow depth of 2.5 m. The much smaller class I starting zones in Bolungarvík produced shorter avalanches that reached runout index 13.5-14 and 15-15.5 for snow depths of 1.25 and 2.5 m, respectively. The class II and III starting zones in Neskaupstaður produced avalanches with a runout similar as in Bolungarvík in some cases, whereas other starting zones, for example in Urðarbotn, released avalanches with an intermediate runout index of about 15 for runs with a class I

Starting zone id	name	Volume ($10^3 m^3$) run1/2	run3/4	Runout index run1/2	run3/4
1s	Ytri-Dagmálabotn, north	166	332	14-15	14-15
2s	Ytri-Dagmálabotn, south	125	—	14-15	—
3s	Fremri-Dagmálabotn, north	71	141	—	—
4s	Fremri-Dagmálabotn, south	73	—	—	—
5s	Strandartindur, above Þófi	69	138	15.6	16.6
6s	Strandartindur, above Skuldarlækur, uppermost area	9	17	—	—
7s	Strandartindur, above Hörmungarlækur	9	17	12.0	13.5
8s	Strandartindur, above Skuldarlækur, middle area	11	22	13-14	15.0
9s	Strandartindur, above Skuldarlækur, lowermost area	17	34	13-14	15.0
10s	Strandartindur, above Stöðvarlækur	7	14	13.8	13.9
11s	Strandartindur, above Búðará	8	15	—	—
12s	Above Neðri-Botnar	14	27	—	—
13s	Botnabrún, north of Búðará	7	14	13.0	14.7
14s	Botnabrún, south of Búðará	6	13	14.3	15.3
15s	Botnabrún, above Austurvegur	4	9	13.9	14.9
16s	Botnabrún, north of Nautaklauf	2	4	13.8	14.4
17s	Botnabrún, just north of Nautaklauf	1	2	14.2	14.5
18s	Nautaklauf, north	2	5	14.5	14.8
19s	Nautaklauf, south	3	5	14.5	14.8
20s	Botnabrún, just south of Nautaklauf	1	3	14.0	14.5
21s	Botnabrún, above Botnahlíð, north	2	4	14.2	14.8
22s	Botnabrún, above Botnahlíð, centre	5	11	14.0	14.5
23s	Botnabrún, above Botnahlíð, south	3	5	14.1	14.2
24s	South of Dagmálalækur	14	28	13.9	14.6
25s	Grákambur, northernmost	16	31	13.0	14.0
26s	Grákambur, north-centre	21	42	12.5	13.8
27s	Grákambur, south-centre	54	109	13.4	15.0
28s	Grákambur, southernmost	110	220	≈14.0	≈16.0
Total		829	1263	—	—

snow depth of 1.25 m. No avalanches in the Seyðisfjörður simulations reach a similar runout to avalanches from the large, confined avalanche paths in Neskaupstaður. This is in part due to the modelled lateral spreading of the avalanches in the lower part of the mountainside. The shelves in the middle of several of the paths, where a large part of the volume of avalanches from the upper starting zones stops, also lead to a reduction in the modelled runout.

The runs from the upper starting zones on both sides of the fjord leave a large volume of snow on the shelves at Brún and Efri-Botnar, but a part of the avalanches flows across the edge of the shelves and continues down the lower part of the slope. The part of the avalanches that overflows the shelves does not entrain any additional snow from starting areas further down the slope as a consequence of the design of the SAMOS model. This may be expected to lead to too short runout for avalanches from these starting areas, in particular for the avalanches from Bjólfstindur in the upper part of Bjólfur. The model computations indicate that avalanches from the large starting areas in Bjólfstindur have a shorter runout than avalanches from the lower starting areas below Brún. This may be assumed to be misleading. Avalanches from the upper starting areas will entrain additional snow from Kálfabotn and other starting areas below Brún and may thus be expected to have a longer runout than avalanches that are release from starting areas below Brún only.

The model computations indicate a relatively long runout below Jókugil. This is partly due to interaction of avalanches from neighbouring starting areas. The modelled runout below Fálkagil is also comparatively long. This is not due to such interaction between starting areas and indicates a concentration of avalanche flow towards the Bakkahverfi area. One may assume that the total modelled volume of the interacting avalanches from starting zones above Jókugil is on the order of up to twice too large compared with the volume of an avalanche from the largest of these areas. From the difference between the runout of the two SAMOS runs from these areas one may conclude that the runout potential from individual starting areas above Jókugil and Fálkagil is similar for both gullies, with the runout below Jókugil perhaps slightly longer than for Fálkagil. Taking into account the interaction of avalanches from neighbouring starting areas in the case of Jókugil, the runout below these gullies corresponds to runout indices in the ranges 13-14 and 14.5-15.5 for the small and large SAMOS runs, respectively.

The runout from the Kálfabotn starting area is long compared with the neighbouring starting areas to the north and south. This is to be expected since the initial snow depth in Kálfabotn is specified higher than for other starting areas below Brún. Avalanches from the upper starting zone are, furthermore, channelised towards Kálfabotn. They may, as mentioned above, be expected to entrain additional mass as they flow over Kálfabotn, but this is not included in the model computations. Therefore, one may, based on these computations, assume quite long avalanche runout in the area below Kálfabotn. Taking both the upper and lower starting zones into account in an approximate way, the runout below Kálfbotn corresponds to runout indices 15.5-16 and about 17 for the small and large SAMOS runs, respectively. This is similar to the modelled runout from the large, confined avalanche paths in Neskaupstaður.

The avalanches from the starting areas above Fremri-Dagmálabotn are in both cases modelled to stop on the large shelves and bowls in the mountainside before reaching the lowland.

Narrow tongues of the avalanches released from the starting areas above Ytri-Dagmálabotn are modelled to flow down the gullies of Búðará, over Botnabrún south of Búðará and down Nautaklauf. The potential for large snow accumulation in starting areas 1-4 above Dagmálabotnar is difficult to ascertain. The aspect of these areas is not as favourable for snow accumulation as for south-west to south-east facing areas such as the starting zones in Bjólfur. The computations indicate that most of the volume of avalanches from the areas above Ytri-Dagmálabotn stops on the shelves Efri- and Neðri-Botnar, but the possibility of narrow tongues reaching the settlement cannot be ruled out. This is, however, considered unlikely.

Avalanches released from starting zones 5-12 in Strandartindur are strongly channelised into the gullies of the mountainside. They are able to flow straight over the Þófi shelf at 100 m a.s.l. indicating that danger due to snow avalanches is not confined to the gullies Imslandsgil, Strandargil, Þófagil, Hæðarlækur, Hörmungarlækur and Skuldarlækur where snow avalanches have been recorded.

Avalanches from starting zones 13-23 in Botnabrún reach runout index 13-14.5 and 14-15, respectively for the small and large SAMOS runs, respectively. This is similar to avalanches from small starting zones in other villages where SAMOS simulations have been carried out. These starting areas are, however, quite small and have slopes close to or even below 30°. The probability of the release of avalanches from these areas is considered to be rather low.

The modelled snow avalanches from the Grákambur area south of Dagmálalækur reach runout index 12.5-14 and 14-16, respectively for the small and large SAMOS runs, respectively. The longest runout is reached for avalanches released from starting zone 28 which is very large and where avalanches extending over the entire area are considered unlikely.

The following conclusions may be drawn from the model results for Seyðisjörður:

1. Avalanches from the upper starting areas in Bjólfstindur, flowing over Brún and entraining additional snow in Kálfabotn have the longest potential runout of the avalanche paths in Seyðisfjörður. Such avalanches may be expected to reach almost the same runout as the modelled runout from the large, confined avalanche paths in Neskaupstaður.
2. The model computations indicate a comparatively long runout in the areas below Jókugil and Fálkagil, although shorter than from Kálfabotn. The modelled runout on the north side of the fjord is shortest between the farm at Fjörður and Bakkahverfi.
3. Avalanches from the starting areas above Fremri-Dagmálabotn are not modelled to reach the valley bottom.
4. Narrow tongues of avalanches from the starting areas above Ytri-Dagmálabotn are modelled to flow over Efri-Botnar and Neðri-Botnar and reach the lowland.
5. Avalanches are modelled to be able to flow directly over the Þófi shelf in Strandartindur and thus endanger the industrial buildings at the shoreline in this area.

The persistent location of the main tongues in all the runs indicates that the simulated form of the tongues may be used to determine tongues in hazard lines in a hazard zoning of the village as was previously done for Bolungarvík, Neskaupstaður and Siglufjörður. Nevertheless, one should be careful not to overinterpret the tongue forms in the hazard zoning. Thus only an appropriate fraction of the runout differences between the central tongues and the intermediate areas indicated by the simulations should be used in the hazard zoning. The appropriate fraction to use is a matter of subjective judgement, but a value of about 1/2 could be used.

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