VEÐURSTOFA ÍSLANDS

Report
03012

Leah Tracy
Tómas Jóhannesson

Results of the 2D avalanche model SAMOS for Bíldudalur and Patreksfjörður

VÍ-ÚR12
Reykjavík
March 2003

Contents

Background

The 2D avalanche model SAMOS, developed by the Advanced Simulation Technologies (AVL) of Graz, Austria, has been run for several starting zones in the mountains above the villages of Bíldudalur and Patreksfjörður, northwest Iceland. The runs are intended to shed light on the following aspects of the avalanche hazard situation in the villages:

1. The shortening of avalanche run-out due to lateral spreading.

2. The difference in run-out between avalanches from the main gullies due to the different sizes of the starting zones and different degree of lateral spreading.

3. The direction of the main avalanche tongues from the gullies.

4. The shape of the main avalanche tongues from the gullies.

The results of the runs will be used in the delineation of the hazard zones for the villages. Similar results have previously been used for the same purpose for the villages Eskifjörður, Neskaupstaður, Seyðisfjörður, Siglufjörður, Ísafjörður and Hnífsdalur and Bolungarvík (Jóhannesson *et al.*, 2001a,b, 2002a,b,c).

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 assumptions regarding avalanche dynamics similar to 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 $\delta = 16.0^{\circ}$($\mu = 0.287$) and a turbulent friction term which may be represented by a coefficient $\xi = 446$ 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 run-out. 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 $\rho = 200$ 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.

The SAMOS model was first run for the catastrophic avalanche from Skollahvilft at Flateyri in order to check the applicability of the parameter values that are traditionally adopted for the model in Austria. The results of the Flateyri simulations are described in the previously mentioned reports about the results of the SAMOS simulations for other villages in Iceland. 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 Skollahvilft 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 Bíldudalur

A total of 14 different avalanche starting zones were defined in the Bíldudalsfjall mountain above the inhabited area of Bíldudalur (Figure 1). Starting zones 4, 10 and 14 are believed to accumulate less snow than the starting zones at higher elevations.

The starting zone classification system below is the same as the one previously used in the other villages where SAMOS similations have been carried out. Only classes II and IV were used for the Bíldudalur runs.

Class	Relative snowdepth	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

Four runs with the SAMOS model were made in Bíldudalur in alternating gullies. The first and third run were started with a uniform snow depth of 1.25 m in class I starting areas and the other runs 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 table above. Because no starting zones were designated as class I in Bíldudalur, the maximum snowdepth used in the model calculations was 2/3 of 1.25 or 2.5 m, which corresponds to an adjusted snowdepth of 0.83 or 1.67 m, respectively.

The following table gives the total mass and volume of snow for each of the runs.

Input	run1	run2	run3	run4
Snow depth in class I areas (m)	1.25	2.5	1.25	2.5
Total mass (10^3t)	22.7	45.4	13.7	27.3
Total volume (10^3m^3, ρ = 200 kg/m^3)	113.6	227.2	68.3	136.6

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 following table summarises the area and the relative snow depth for each of the starting zones in Bíldudalur. 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
1	South of Gilsbakkagil	8.1	11.2	2/3	1,2
2	Gilsbakkagil, southern part	17.5	24.2	2/3	3,4
3	Gilsbakkagil, northern part	23.7	30.8	2/3	1,2
4	Between Gilsbakkagil and Milligil	13.0	16.7	1/4	1,2
5	Southernmost Milligil	13.1	16.9	2/3	3,4
6	Merkigil	13.3	17.2	2/3	1,2
7	Klofagil, southern part	9.4	12.3	2/3	3,4
8	Klofagil, northern part	8.1	10.9	2/3	1,2
9	North of Klofagil	4.0	5.2	2/3	3,4
10	Between Klofagil and Búðargil	16.9	21.4	1/4	1,2
11	Búðargil, southern part	17.1	22.4	2/3	3,4
12	Búðargil, central part	20.7	27.7	2/3	1,2
13	Búðargil, northern part	14.2	18.5	2/3	1,2
14	North of Búðargil	7.7	10.6	1/4	1,2
Total		187.1	246.3	—	—

It should be noted that avalanches from some of the starting zones in Bíldudalur, particularly zones 6 and 8 and zones 12 and 13 in runs 1 and 2 interact with neighbouring avalanches and this leads to longer run-out than would otherwise be obtained. One may expect that several independent avalanches, extending over only one subarea or a part of the area each, will be released rather than a single avalanche encompassing the entire area or more than one subarea. Thus, the run-out indicated by the SAMOS simulations for avalanches from these starting zones may be too long.

As in the simulations for Flateyri, and in the simulations described in separate reports for the other villages where SAMOS simulations have been carried out, 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 real, large avalanches that might be released from the corresponding part of the mountain.

The results of the 4 runs are displayed as coloured contour plots of the depth and velocity of the flowing avalanche at 10 second intervals (files `bi_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. 2-9 (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. They also show strong diverging flow of the avalanches on the large debris cones below Gilsbakkagil and Búðargil, which tends to reduce the run-out of the avalanches below these gullies.

Starting zone		Volume (10^3m^3)		Run-out index	
id	name	run1/3	run2/4	run1/3	run2/4
1	South of Gilsbakkagil	9.4	18.8	13.6	14.9
2	Gilsbakkagil, southern part	20.2	40.4	13.6	14.0
3	Gilsbakkagil, northern part	25.7	51.3	14.7	15.7
4	Between Gilsbakkagil and Milligil	5.2	10.4	13.7	14.6
5	Southernmost Milligil	14.1	28.1	15.1	16.3
6	Merkigil	14.4	28.7	15.1	16.3
7	Klofagil, southern part	10.3	20.6	13.7	14.9
8	Klofagil, northern part	9.0	18.1	—	—
9	North of Klofagil	4.4	8.7	12.9[a]	13.7[a]
10	Between Klofagil and Búðargil	6.7	13.4	12.4[a]	13.6[a]
11	Búðargil, southern part	18.7	37.4	14.0	14.6
12	Búðargil, central part	23.1	46.2	14.9[a]	15.2[a]
13	Búðargil, northern part	15.4	30.9	14.9[a]	15.2[a]
14	North of Búðargil	3.3	6.6	>12.5[b]	>12.5[b]
Total		179.8	359.7	—	—

[a]Run-out index approximated due to interaction with flow from neighbouring starting zone.
[b]The avalanche terminates beyond the computational grid

The release volume (ρ = 200 kg/m^3) and run-out index (Jónasson and others, 1999) for the avalanches from the different starting zones in the mountain for each of the 4 Bíldudalur simulations is summarised in the table above. The columns labeled “run1/3” summarise the results of runs 1 and 3 and the columns labeled “run2/4” summarise the results of runs 2 and 4. The columns labeled “run1/3” correspond to a snow depth of 1.25 m in class I starting zones and columns labeled “run2/4” correspond to a snow depth of 2.5 m in class I starting zones.

A run-out index is not given for starting zone 8 because interaction with avalanches from neighbouring starting zones makes it impossible to determine the run-out of the avalanches from this zone. The avalanches from starting zone 14 north of Búðargil run beyond the computational grid and therefore a run-out index cannot be determined for them in the same way as for the other subareas. A minimum run-out index is only given in this case.

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

Previous simulations for other villages in Iceland (Jóhannesson and others, 2001a,b, 2002 a,b,c) showed that large bowl shaped class I starting zones, for example in Neskaupstaður, release avalanches that reach a run-out index in the approximate range 15.5–16.5 for a snow depth of 1.25 m and run-out 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 run-out 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 run-out similar as the class I zones in Bolungarvík in some cases, whereas other starting zones, for example in Urðarbotn, released avalanches with an intermediate run-out index of about 15 for runs with a class I snow depth of 1.25 m.

The run-out of the simulated avalanches in Bíldudalur is in most cases similar to the run-out from the comparatively small starting zones in Bolungarvík and the class II and III zones in Neskaupstaður, *i.e.* run-out index in the approximate ranges 13.5–15 and 14–16 for snow depths of 1.25 and 2.5 m, respectively.

The avalanches from the Gilsbakkagil and Búðargil gullies reach run-out index in the approximate ranges 13.5-15 and 14.0-15.5, for the small and large SAMOS runs, respectively. Although the flow is initially channelled in the gullies, which tends to increase the run-out, the flow looses momentum when it spreads and thins on the convex debris cones below the gullies. This counteracts the effect of the channelisation in the gullies and the modelled run-out below the gullies is consequently not longer than for other starting zones with similar sizes.

The computations indicate a rather long run-out below the class II starting zones of the southernmost Milligil and Merkigil (subareas 5 and 6). The modelled avalanches are channelised far down the slope and reach run-out index 15.1 and 16.3, respectively, for the small and large SAMOS runs, which is the longest run-out obtained in the Bíldudalur simulations. Similar channelisation was found in the SAMOS simultations for Hnífsdalur as described by Jóhannesson and others (2002c), where it was concluded that the SAMOS model is likely to overpredict the run-out of avalanches in long gullies of this kind due to a deficiency in the model. The modelled run-out below the southernmost Milligil and Merkigil is therefore considered too long.

The modelled avalanches from the other starting zones (1, 4, 7, 9 and 10, and probably also 8 and 14) is comparatively short, *i.e.* in the approximate ranges 12.5–13.5 and 13.5–15 for the small and large SAMOS runs, respectively.

All the Bíldudalur simulations show avalanches that reach well into the settlement and the avalanches from the runs with the larger snow depth reach well beyond the shoreline. The uppermost houses in the settlement are located so close to the mountain that essentially all snow avalanches that are released from the slope pose a threat to the settlement.

Results for Patreksfjörður

A total of 9 different avalanche starting zones were defined in the Brellur mountain above the inhabited area of Patreksfjörður (Figure 10). The starting zones are believed to accumulate varying amounts snow with the greatest snow depth expected in zones 2 and 6 while the smallest snow depth is expected in zone 3. The same starting zone classification system was used as described above in the section about the Bíldudalur simulations.

Two runs with the SAMOS model were made in Patreksfjörður simultaneously in all of the starting zones, one with a uniform snow depth of 1.25 m in class I starting areas and the other with a snow depth of 2.5 m in class I starting areas. The snow depth in both runs was determined from the relative snow depth class for the respective areas as given in the snow depth classification table in the previous section.

The following table gives the total mass and volume of snow for each of the runs.

Input	run1	run2
Snow depth in class I areas (m)	1.25	2.5
Total mass (10^3t)	44.3	88.5
Total volume (10^3m^3, ρ = 200 kg/m^3)	221.3	442.6

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 following table summarises the area and the relative snow depth for each of the starting zones in Patreksfjörður. The last column of the table lists the runs where snow was released from the zone (all zones in both runs in this case).

Starting zone id	name	Map area (10^3m^2)	Area (10^3m^2)	Relative snow depth	Runs
1	West of Urðir	39.8	48.7	1/4	1,2
2	Urðir	55.2	75.4	1	1,2
3	Klif	127.3	155.2	1/4	1,2
4	East of Klif	27.7	33.3	1/2	1,2
5	West of Geirseyrargil	13.8	17.3	1/2	1,2
6	Geirseyrargil	8.1	11.1	1	1,2
7	Sigtún, westernmost part	1.8	2.4	2/3	1,2
8	Sigtún, central part	7.6	9.7	2/3	1,2
9	Sigtún, easternmost part	4.9	6.2	2/3	1,2
Total		286.2	359.4	—	—

As described in the previous section about Bíldudalur, 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 real, large avalanches that might be released from the corresponding part of the mountain.

The results of the 2 runs are displayed as coloured contour plots of the depth and velocity of the flowing avalanche at 10 second intervals (files `pa_run1-2.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. 11-14 (the flow depths are in m and the maximum pressure in kPa on the figures).

Starting zone		Volume ($10^3 m^3$)		Run-out index	
id	name	run1	run2	run1	run2
1	West of Urðir	15.2	30.4	≈12.5[a]	≈13.5[a]
2	Urðir	94.3	188.6	16.7	17.7
3	Klif	48.5	97.0	11.0	12.7
4	East of Klif	20.9	41.7	12.4	14.1
5	West of Geirseyrargil	10.8	21.6	12.1	13–14[a]
6	Geirseyrargil	13.9	27.7	14.4	15.4
7	Sigtún, westernmost part	2.0	4.1	—	—
8	Sigtún, central part	8.1	16.2	12.7	14.0
9	Sigtún, easternmost part	5.1	10.3	12.6	13.5
Total		218.8	437.6	—	—

[a]Run-out index approximated due to interaction with flow from neighbouring starting zone.

The release volume (ρ = 200 kg/m^3) and run-out index (Jónasson and others, 1999) for the avalanches from the different starting zones in the mountain for each of the 2 Patreksfjörður simulations is summarised in the table above. The “run1” column corresponds to a class I snow depth of 1.25 m and the “run2” column corresponds to a snow depth of 2.5 m in class I starting zones.

A run-out index is not given for starting zone 7 because interaction with avalanches from Geirseyrargil makes it impossible to determine the run-out of the avalanches from this zone.

As noted in the section about Bíldudalur, the volumes given in the table are not completely consistent with the volumes given in the previous table that summarises the mass and volume of snow in each run due to small discretisation errors in the computational grid.

The simulated run-out at Urðir (zone 2) is comparable to the modelled run-out from large bowl shaped class I starting areas in some of the other communities where SAMOS simulations have been carried out, for example in Neskaupstaður (Jóhannesson, 2001a), in spite of the fact that the starting zone at Urðir is somewhat smaller and located at a lower altitude. This is most likely due to the concave shape of the upper part of the path that leads to converging flow and reduces the spreading and the thinning of the flow in the run-out area. This underscores the already well know fact that there is a danger of avalanches with long runout from the starting zone above Urðir.

The avalanches from Geirseyrargil reach the sea for both runs with run-out indices of 14.4 and 15.4 for the small and large SAMOS runs, respectively. The avalanches from the starting zones immediately to the east and west of the gully combine with the Geirseyrargil avalanches and may exaggerate the run-out from the gully some small amount.

The run-out of the simulated avalanches from the other starting areas in Patreksfjörður is comparatively short, *i.e.* the run-out index is in the approximate ranges 11–13 and 13–14 for the small and large SAMOS runs, respectively. This is shorter than the run-out from the comparatively small starting zones in Bolungarvík and some class II and III zones in Neskaupstaður which produced run-out index in the approximate ranges 13.5–14 and 15–15.5 for starting snow depths of 1.25 and 2.5 m, respectively (Jóhannesson, 2001a).

All the Patreksfjörður simulations, with the exception of starting zone 7, show avalanches that reach well into the settlement and the avalanches from the runs with the larger snow depth reach well beyond the shoreline in some cases. Although the avalanches from Urðir and Geirseyrargil are by far the largest and most dangerous of the simulated avalanches, the uppermost houses in the areas west of Urðir and between Urðir and Geirseyrargil are located so close to the mountain that essentially all snow avalanches that are released from the slope pose a threat to the settlement in these areas. The houses below starting zones 7, 8 and 9 in the Sigtún area are located slightly farther away from the mountain and the avalanches do not reach as far into the settlement there as elsewhere in the village. The simulations, nevertheless, indicate that avalanches with a slab thickness less than 1 m may reach the uppermost part of the settlement in the Sigtún area.

References

Jóhannesson, T., Þ. Arnalds and L. Tracy. 2001a. *Results of the 2D avalanche model SAMOS for Bolungarvík and Neskaupstaður.* Reykjavík, Icel. Met. Office, Rep. 01011.

Jóhannesson, T., Þ. Arnalds and L. Tracy. 2001b. *Results of the 2D avalanche model SAMOS for Siglufjörður.* Reykjavík, Icel. Met. Office, Rep. 01019.

Jóhannesson, T., Þ. Arnalds and L. Tracy. 2002a. *Results of the 2D avalanche model SAMOS for Seyðisfjörður.* Reykjavík, Icel. Met. Office, Rep. 02008.

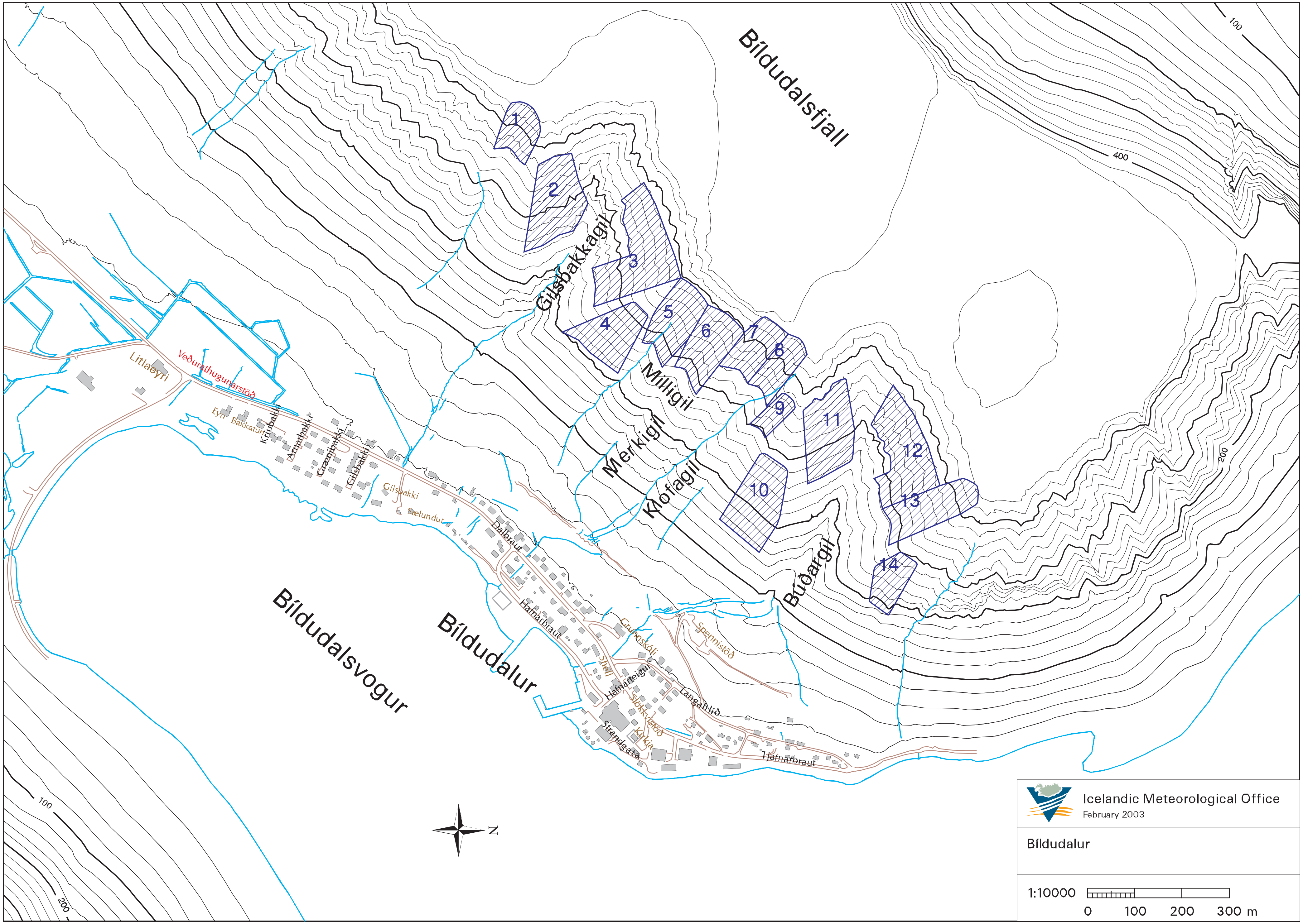
Jóhannesson, T., Þ. Arnalds and L. Tracy. 2002b. *Results of the 2D avalanche model SAMOS for Eskifjörður.* Reykjavík, Icel. Met. Office, Rep. 02013.

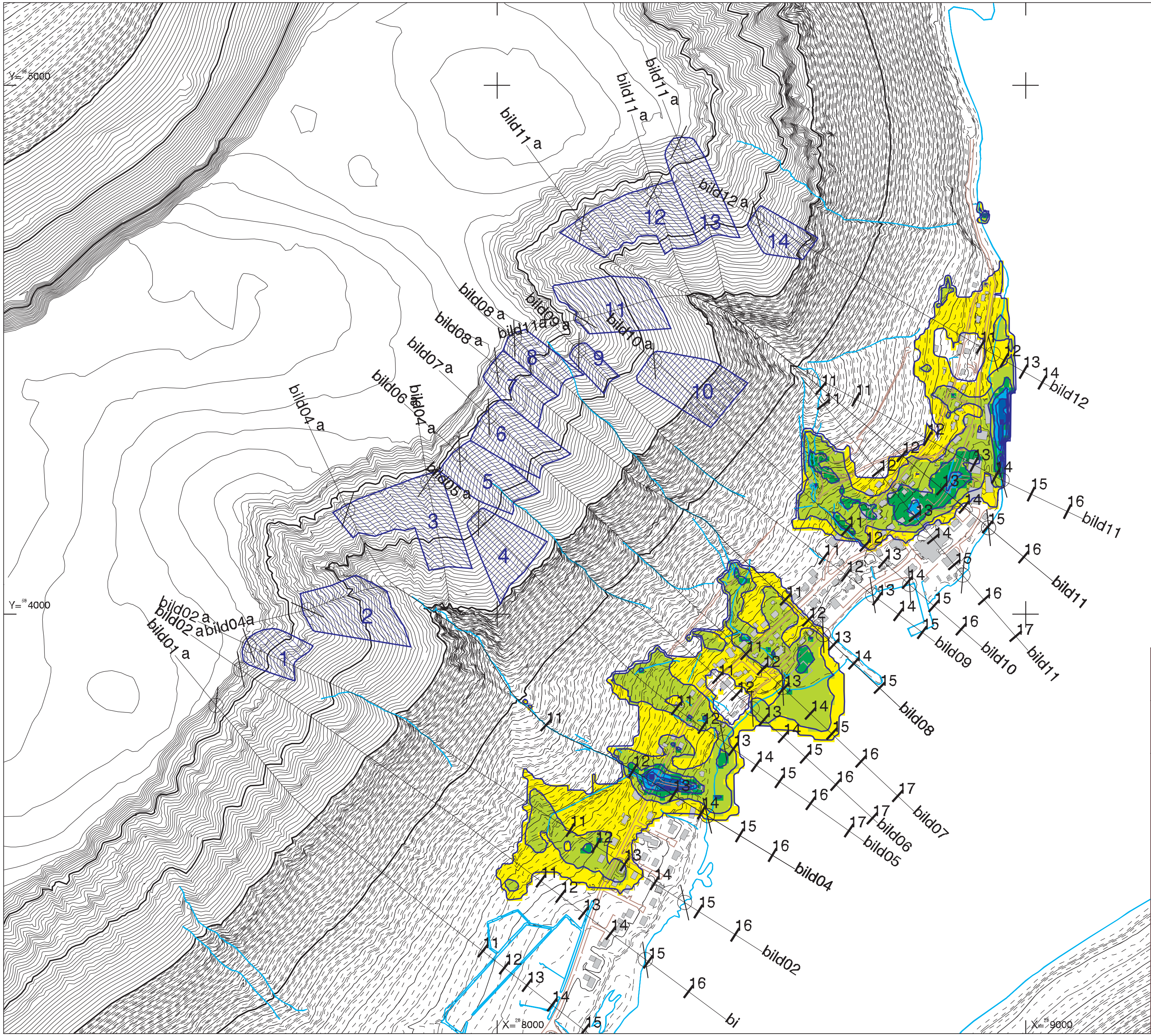
Jóhannesson, T., Þ. Arnalds and L. Tracy. 2002c. *Results of the 2D avalanche model SAMOS for Ísafjörður and Hnífsdalur.* Reykjavík, Icel. Met. Office, Rep. 02018.

Jónasson, K., S.Þ. Sigurðsson and Þ. Arnalds. 1999. *Estimation of avalanche risk.* Reykjavík, Icel. Met. Office, Rep. R99001.

Sampl, P. and T. Zwinger. 1999. *A simulation model for dry snow avalanches.* A paper presented at the 1999 IAHR meeting.

Figures


Icelandic Meteorological Office
February 2003
Bíldudalur
1:10000
0 100 200 300 m
Bíldudalsfjall
Bíldudalur
Bíldudalsvogur
Gilsbakkagil
Milligil
Merkigil
Klofagil
Búðargil
1
2
3
4
5
6
7
8
9
10
11
12
13
14
Veðurathugunarstöð
Litlaeyri
Dalbraut
Hafnarbraut
Hafnarteigur
Langahlíð
Strandgata
Tjarnarbraut
Kirkja
Slökkvistöð
Shell
Grunnskóli
Spennistöð
Gilsbakki
Sælundur
Grænibakki
Arnarbakki
Kríubakki
Eyri
Bakkatún
N
100
200
400



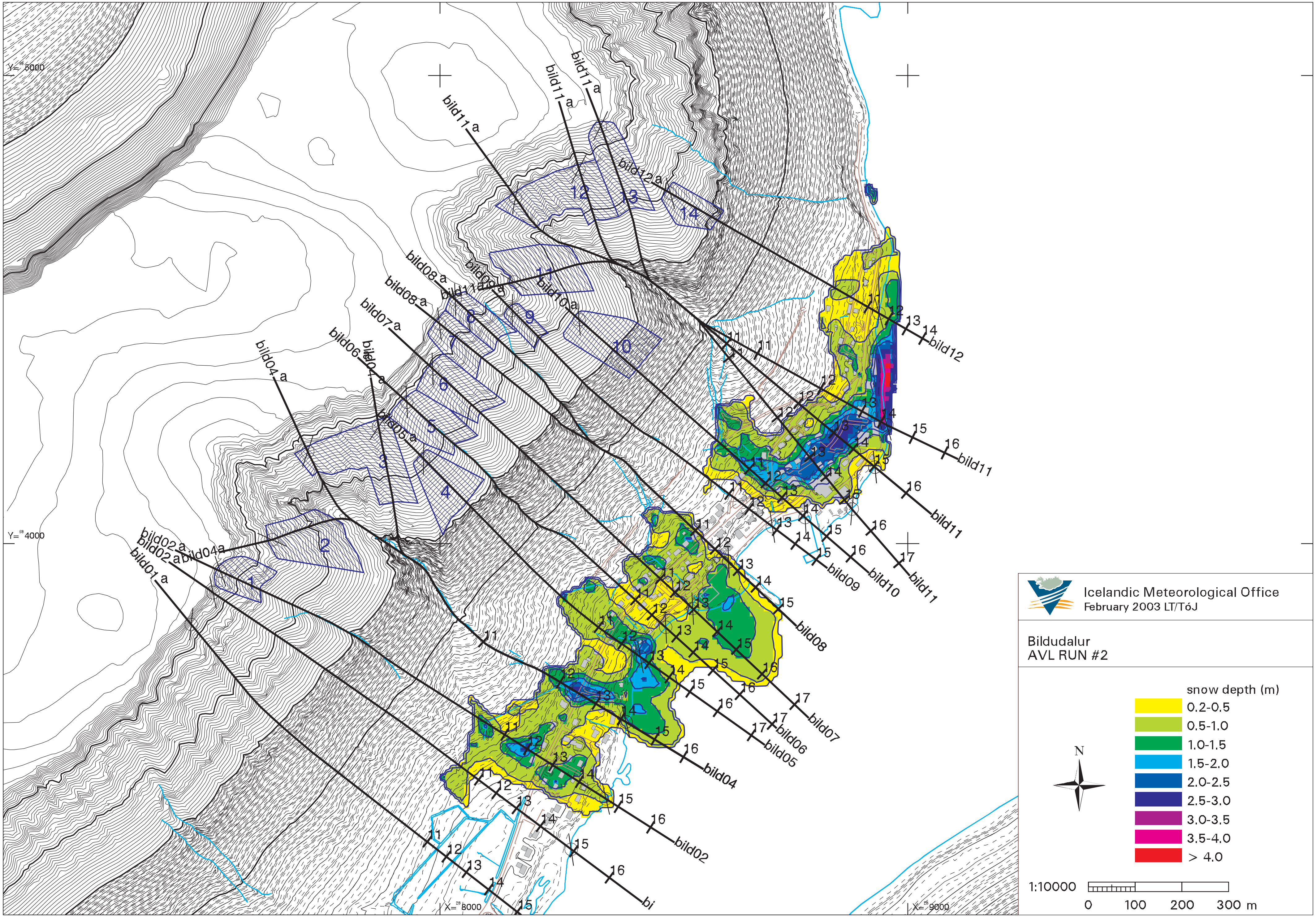
Icelandic Meteorological Office
February 2003 LT/TóJ

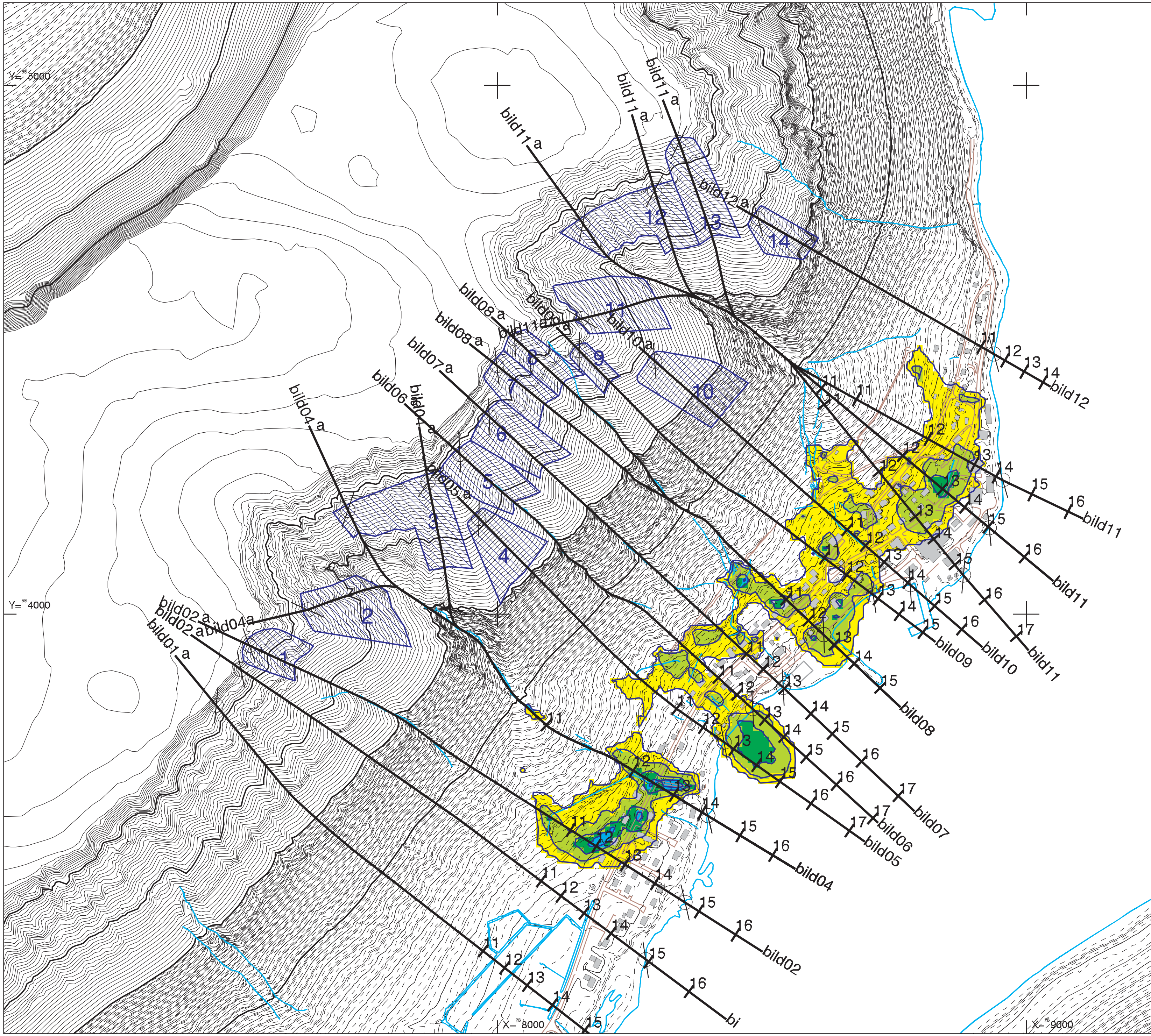
Bildudalur
AVL RUN #1

snow depth (m)
0.2-0.5
0.5-1.0
1.0-1.5
1.5-2.0
2.0-2.5
2.5-3.0
3.0-3.5
3.5-4.0
> 4.0

N

1:10000
0 100 200 300 m


Icelandic Meteorological Office
February 2003 LT/TóJ
Bildudalur
AVL RUN #2
snow depth (m)
0.2-0.5
0.5-1.0
1.0-1.5
1.5-2.0
2.0-2.5
2.5-3.0
3.0-3.5
3.5-4.0
> 4.0
N
1:10000
0
100
200
300 m



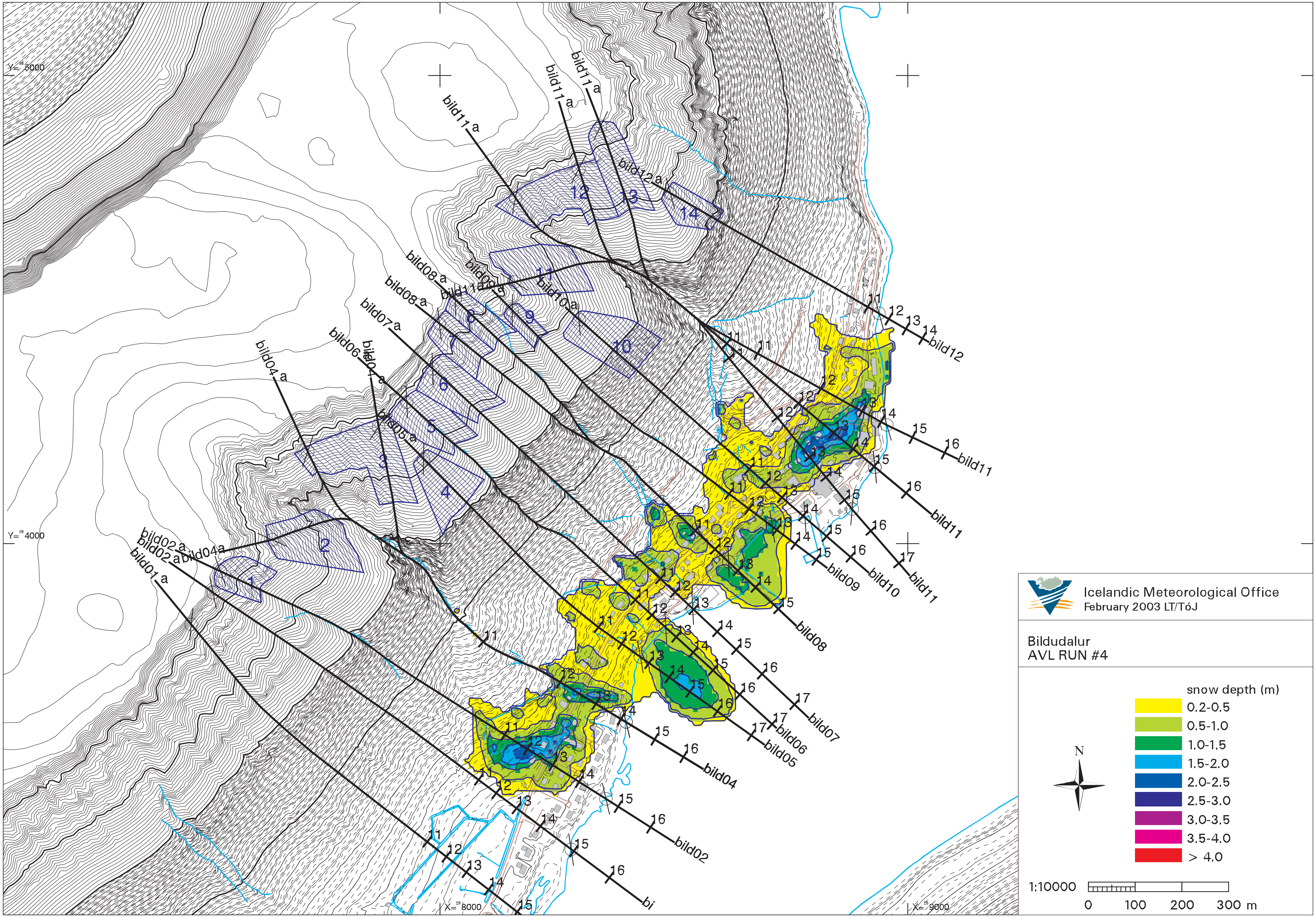
Icelandic Meteorological Office
February 2003 LT/TóJ

Bildudalur
AVL RUN #3

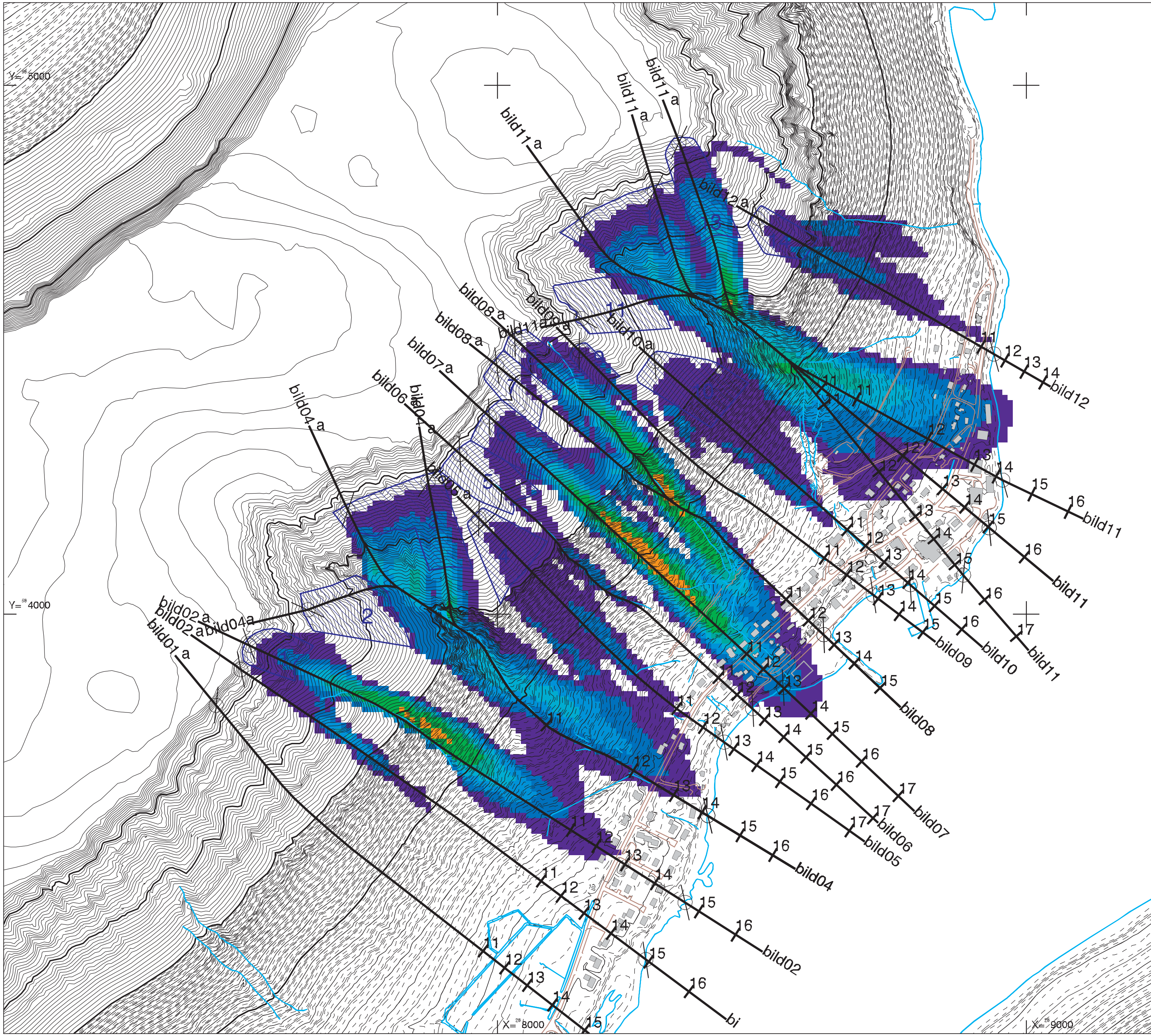
snow depth (m)
0.2-0.5
0.5-1.0
1.0-1.5
1.5-2.0
2.0-2.5
2.5-3.0
3.0-3.5
3.5-4.0
> 4.0

N

1:10000
0 100 200 300 m



Icelandic Meteorological Office
February 2003 LT/TóJ
Bildudalur
AVL RUN #4
snow depth (m)
0.2-0.5
0.5-1.0
1.0-1.5
1.5-2.0
2.0-2.5
2.5-3.0
3.0-3.5
3.5-4.0
> 4.0
N
1:10000
0 100 200 300 m
bild01 a
bild02 a
bild04 a
bild05 a
bild06 a
bild07 a
bild08 a
bild09 a
bild10 a
bild11 a
bild12 a
bild02
bild04
bild05
bild06
bild07
bild08
bild09
bild10
bild11
bild12



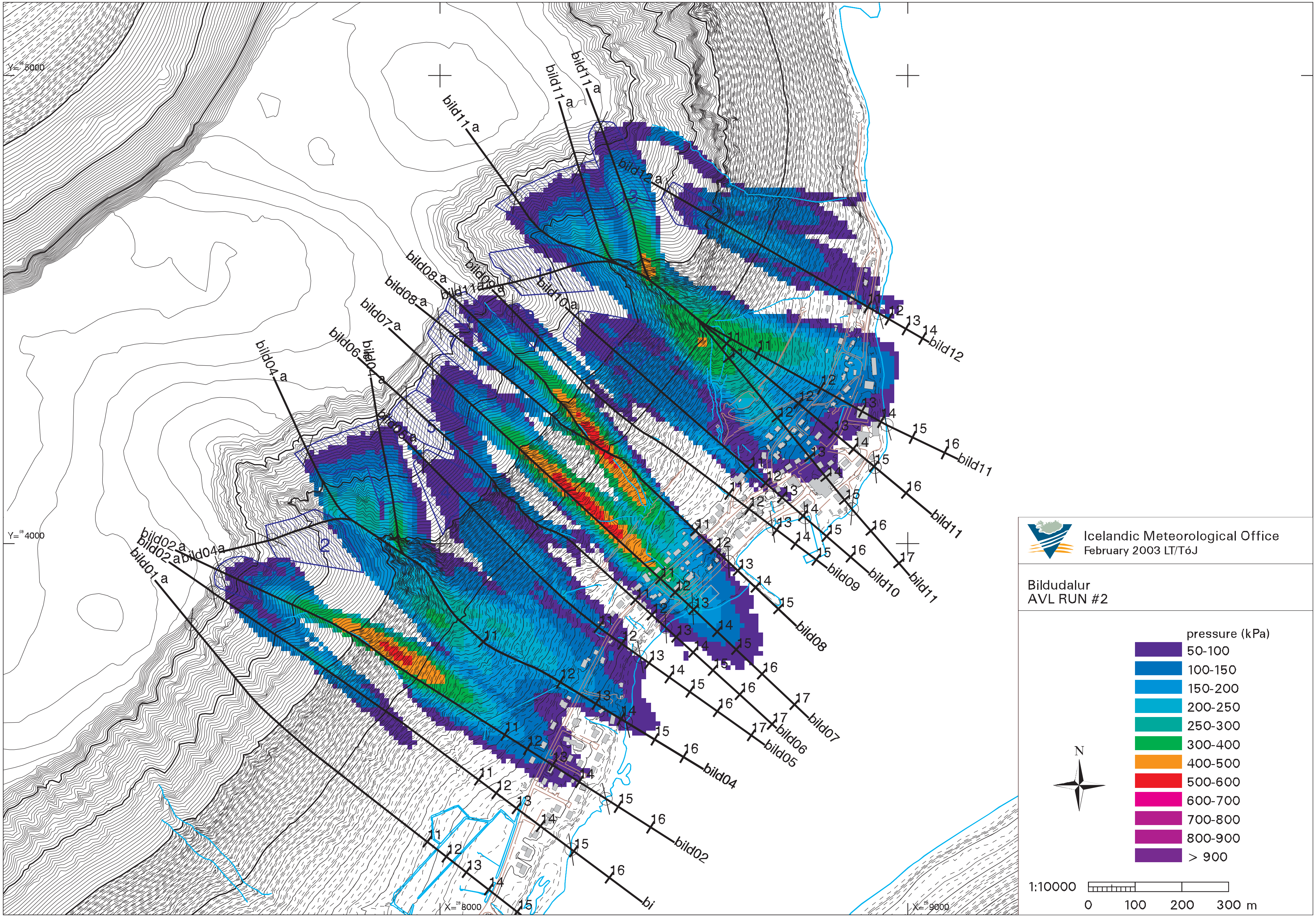
Icelandic Meteorological Office
February 2003 LT/TóJ

Bildudalur
AVL RUN #1

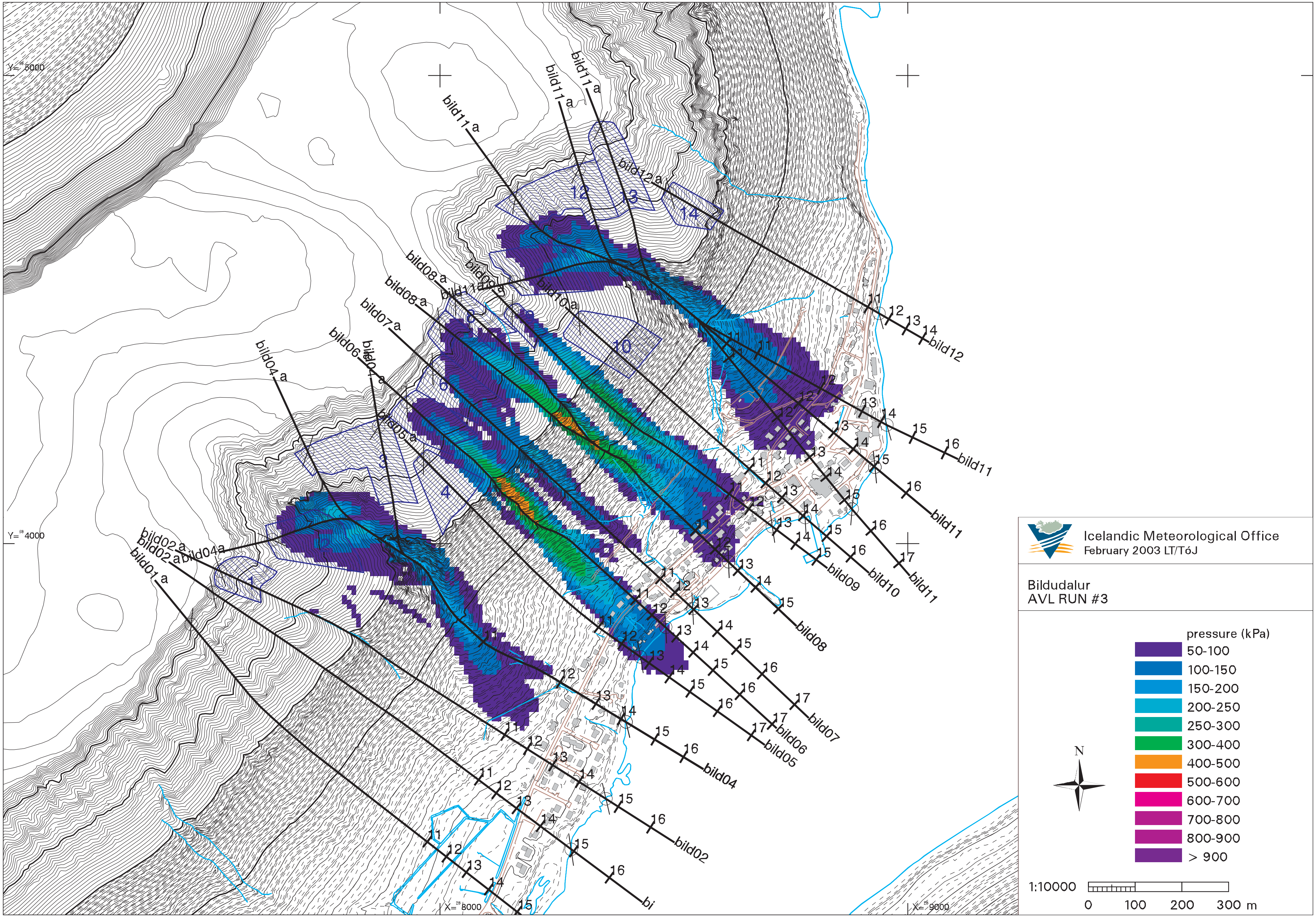
pressure (kPa)
50-100
100-150
150-200
200-250
250-300
300-400
400-500
500-600
600-700
700-800
800-900
> 900

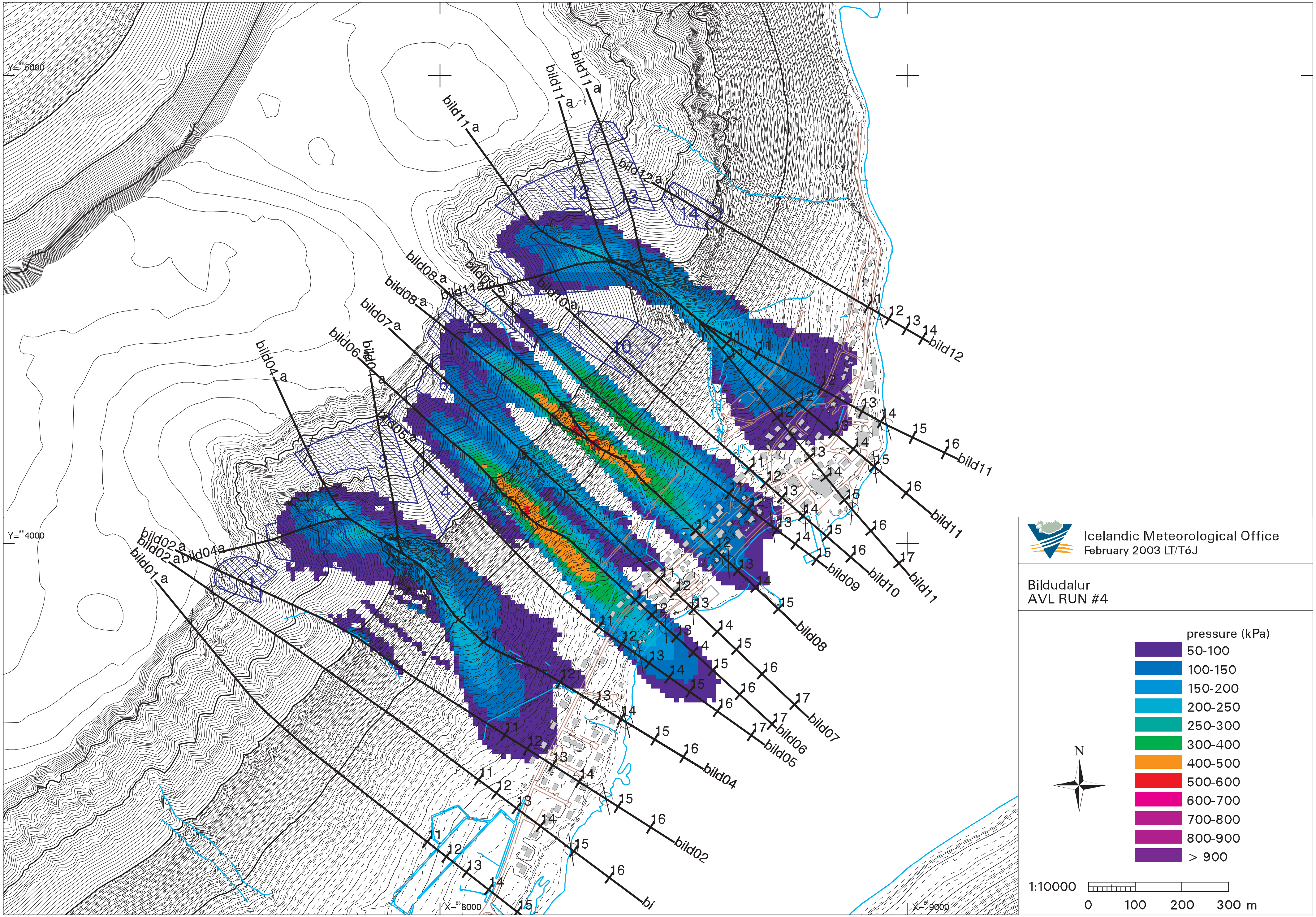
N

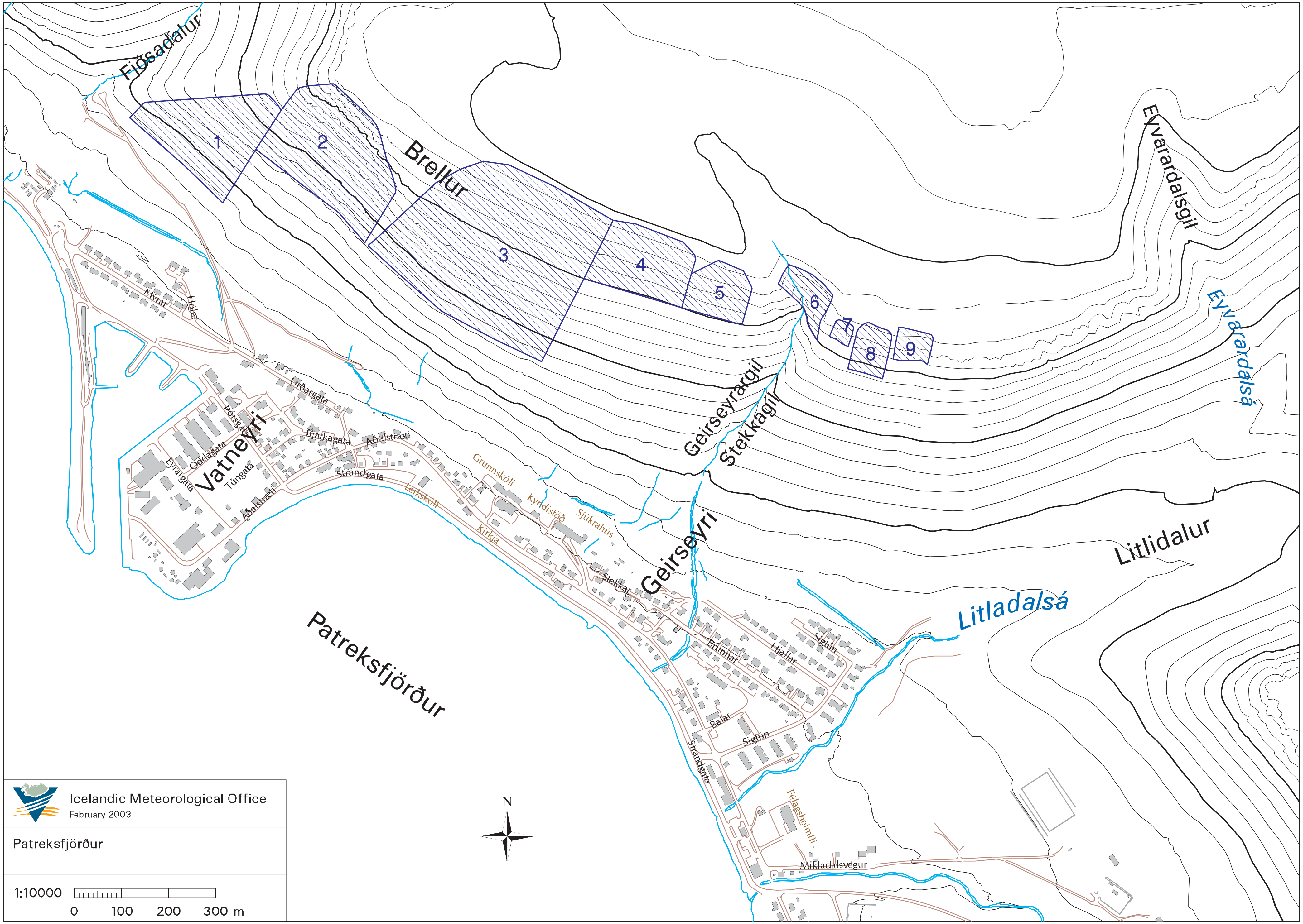
1:10000 0 100 200 300 m

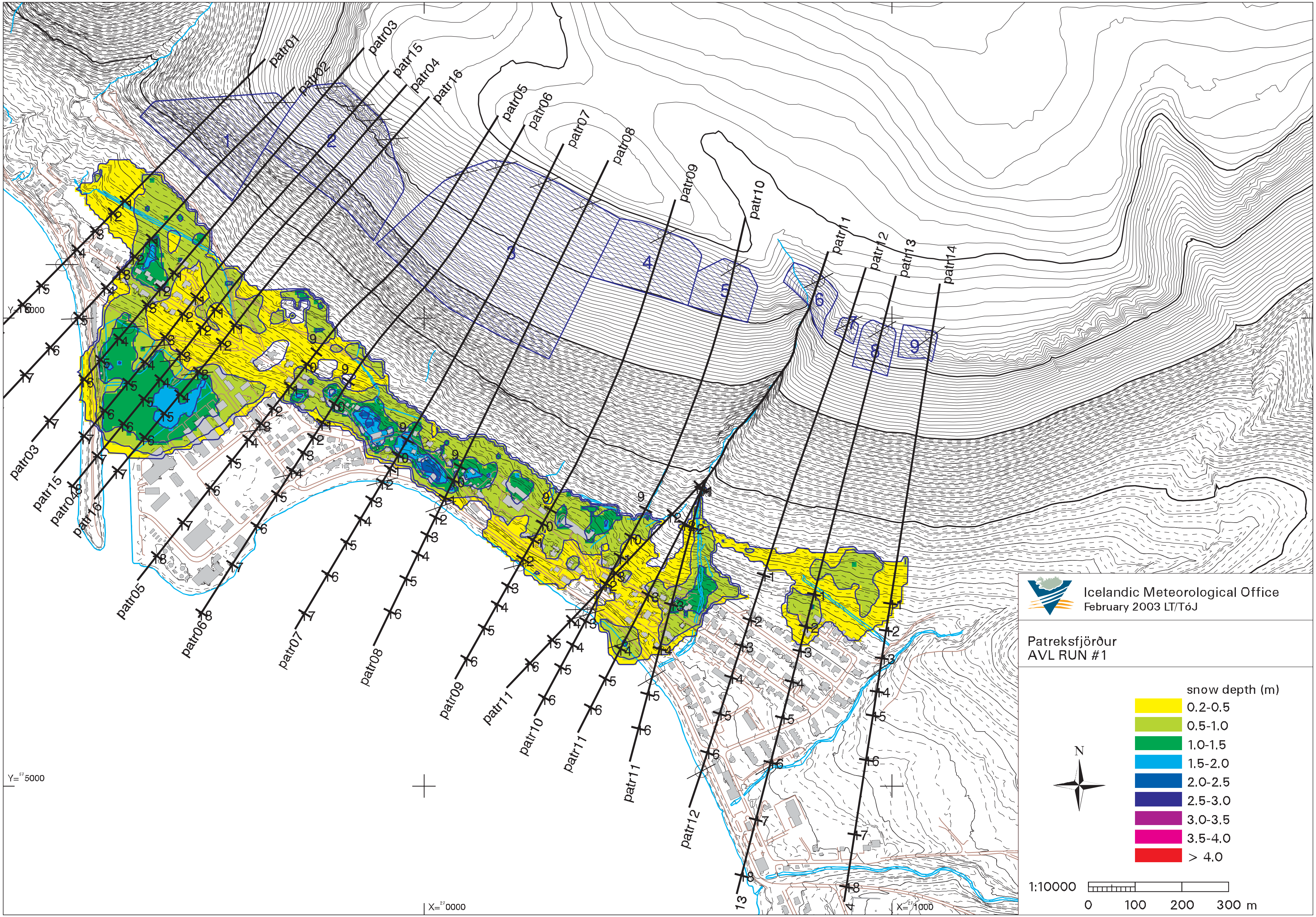


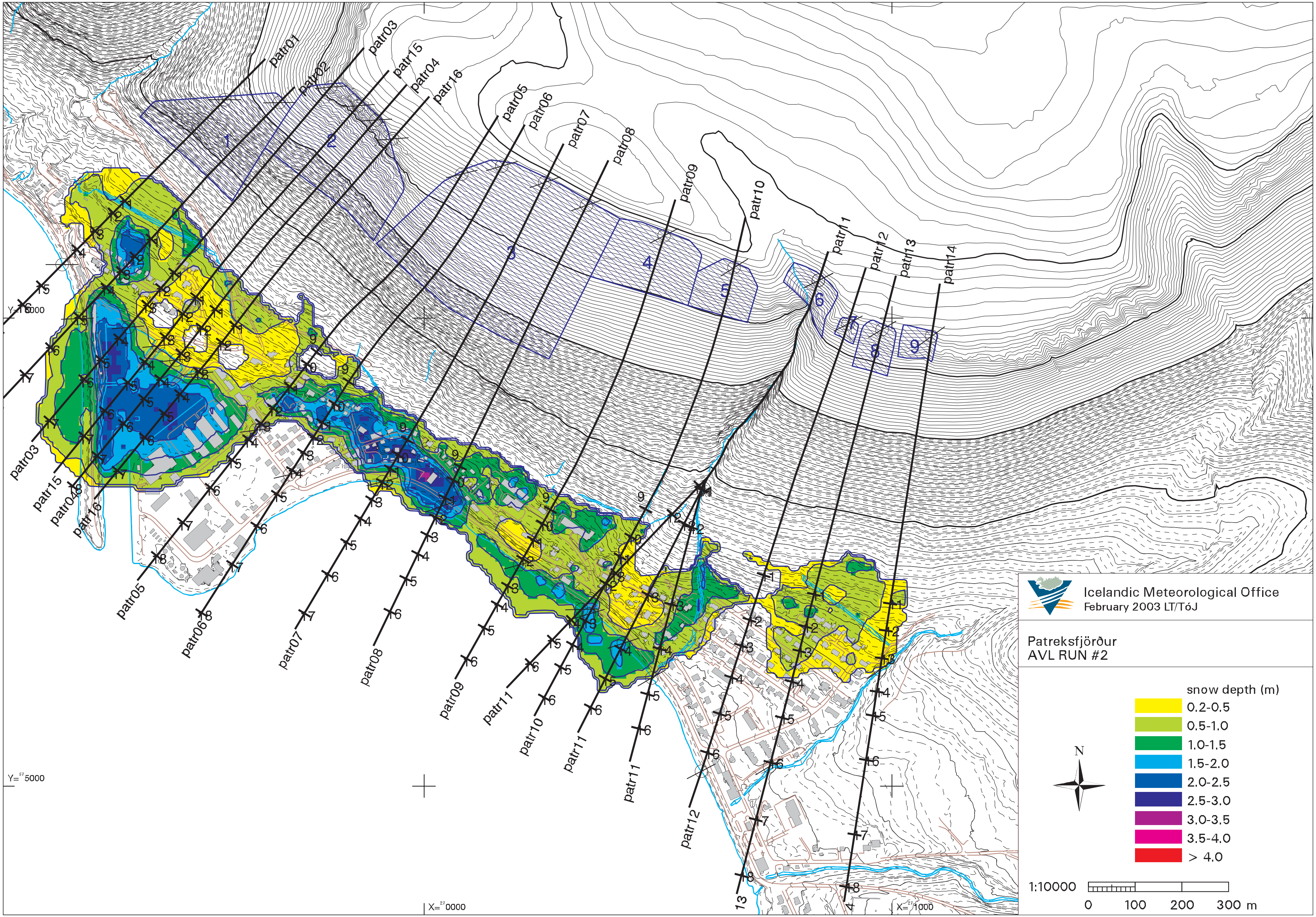
Icelandic Meteorological Office
February 2003 LT/TóJ
Bildudalur
AVL RUN #2
pressure (kPa)
50-100
100-150
150-200
200-250
250-300
300-400
400-500
500-600
600-700
700-800
800-900
> 900
N
1:10000
0
100
200
300 m
bild01 a
bild02 a
bild04 a
bild06
bild07
bild08
bild09
bild10
bild11
bild12

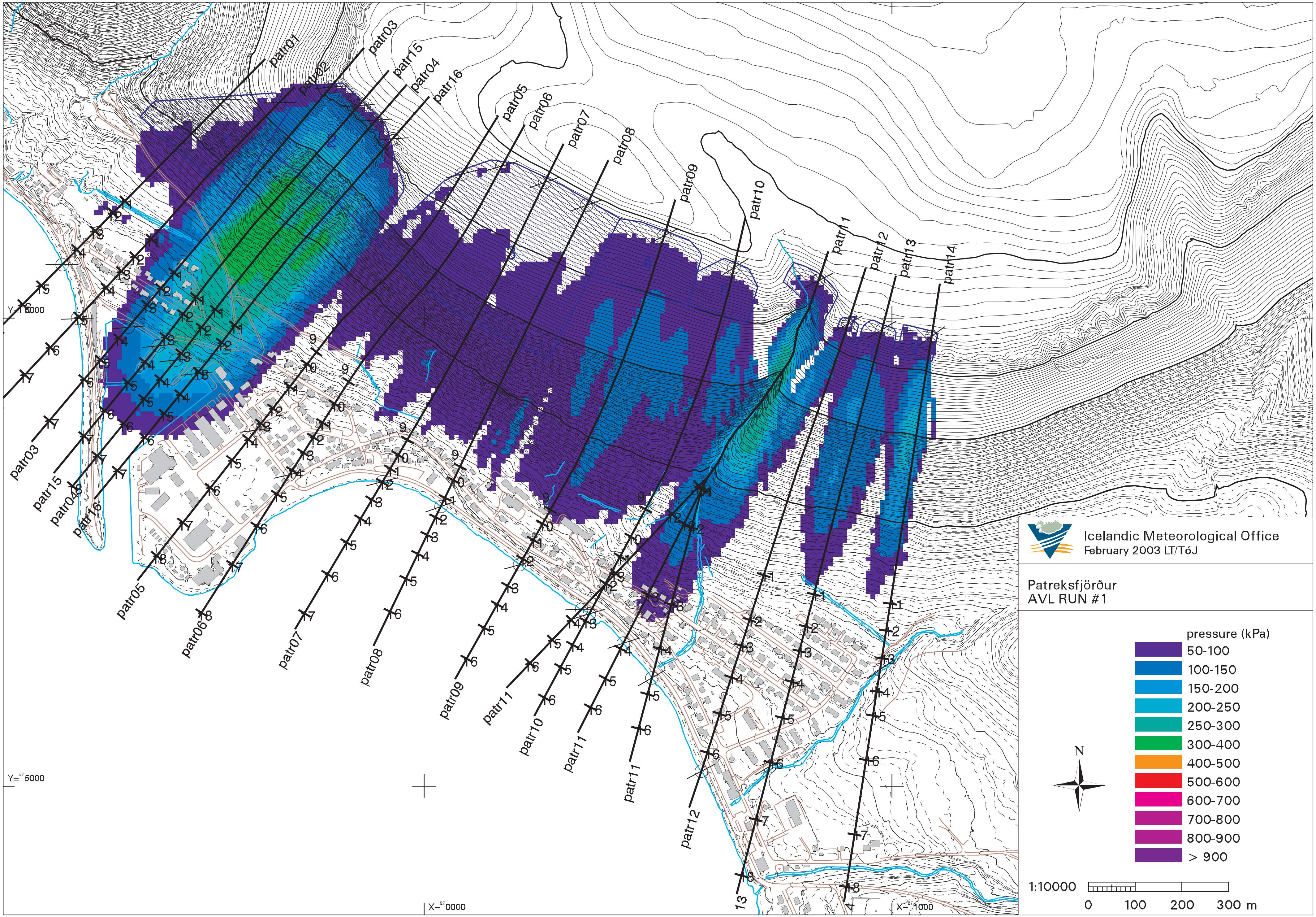

Icelandic Meteorological Office
February 2003 LT/TóJ
Bildudalur
AVL RUN #3
pressure (kPa)
50-100
100-150
150-200
200-250
250-300
300-400
400-500
500-600
600-700
700-800
800-900
> 900
N
1:10000
0 100 200 300 m

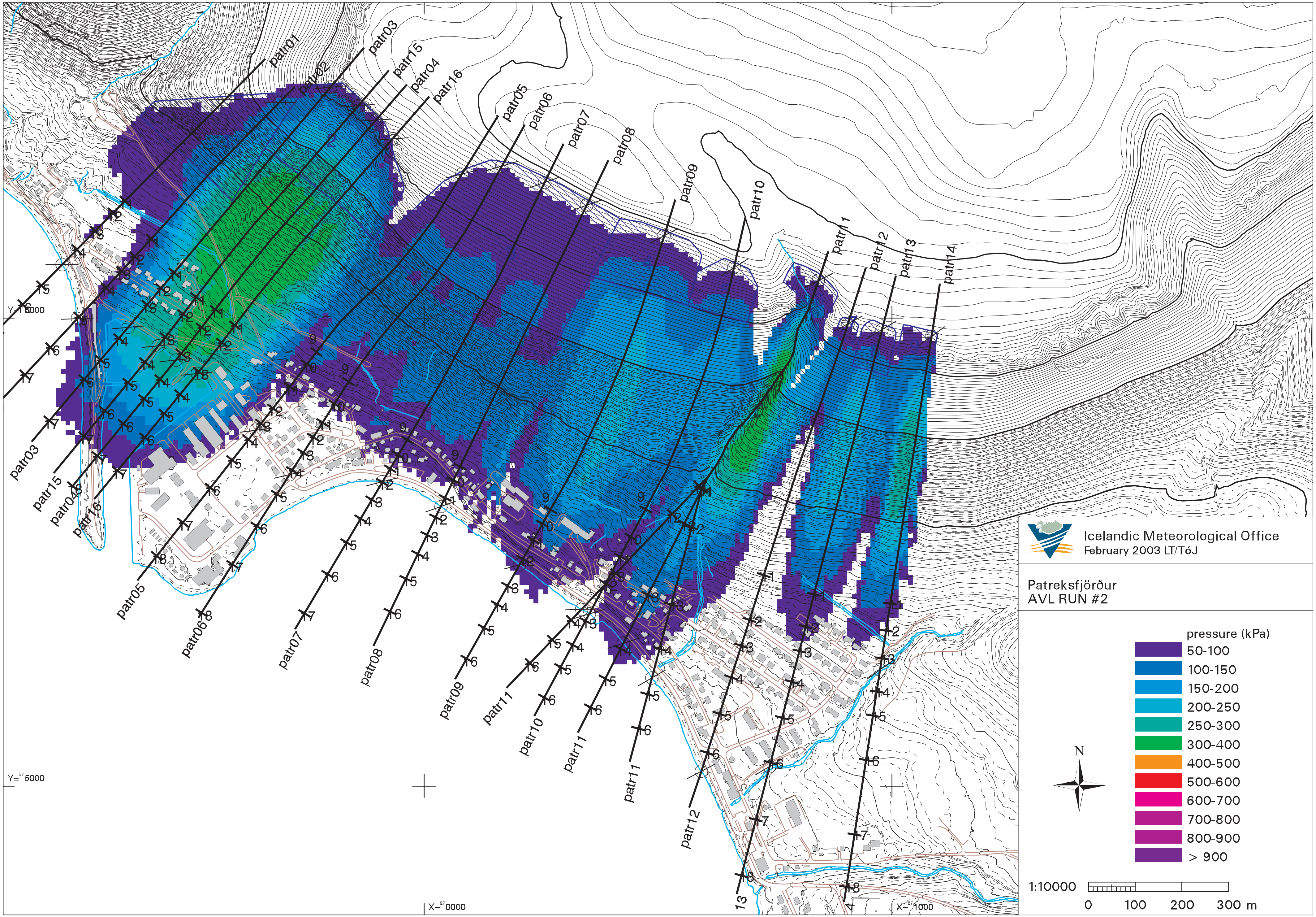

Icelandic Meteorological Office
February 2003 LT/TóJ
Bildudalur
AVL RUN #4
pressure (kPa)
50-100
100-150
150-200
200-250
250-300
300-400
400-500
500-600
600-700
700-800
800-900
> 900
N
1:10000
0 100 200 300 m


Fiðsadalur
Brellur
Eyvarardalsgil
Eyvarardalsá
Geirseyrargil
Stekkagil
Litlidalur
Litladalsá
Geirseyri
Vatneyri
Patreksfjörður
Grunnskóli
Kyndistöð
Sjúkrahús
Leikskóli
Kirkja
Félagsheimili
Mýrar
Hólar
Urðargata
Þórsgata
Oddagata
Eyrargata
Túngata
Aðalstræti
Bjarkagata
Strandgata
Stekkar
Brunnar
Hjallar
Sigtún
Balar
Mikladalsvegur
1
2
3
4
5
6
7
8
9
N
Icelandic Meteorological Office
February 2003
Patreksfjörður
1:10000
0 100 200 300 m


Icelandic Meteorological Office
February 2003 LT/TóJ
Patreksfjörður
AVL RUN #1
snow depth (m)
0.2-0.5
0.5-1.0
1.0-1.5
1.5-2.0
2.0-2.5
2.5-3.0
3.0-3.5
3.5-4.0
> 4.0
N
1:10000
0 100 200 300 m
patr01
patr02
patr03
patr04
patr05
patr06
patr07
patr08
patr09
patr10
patr11
patr12
patr13
patr14
patr15
patr16


Icelandic Meteorological Office
February 2003 LT/TóJ
Patreksfjörður
AVL RUN #2
snow depth (m)
0.2-0.5
0.5-1.0
1.0-1.5
1.5-2.0
2.0-2.5
2.5-3.0
3.0-3.5
3.5-4.0
> 4.0
N
1:10000
0 100 200 300 m
patr01
patr02
patr03
patr04
patr05
patr06
patr07
patr08
patr09
patr10
patr11
patr12
patr13
patr14
patr15
patr16
Y=^57 5000
X=^27 0000
X=^27 1000


Icelandic Meteorological Office
February 2003 LT/TóJ
Patreksfjörður
AVL RUN #1
pressure (kPa)
50-100
100-150
150-200
200-250
250-300
300-400
400-500
500-600
600-700
700-800
800-900
> 900
N
1:10000
0 100 200 300 m


Icelandic Meteorological Office
February 2003 LT/TóJ
Patreksfjörður
AVL RUN #2
pressure (kPa)
50-100
100-150
150-200
200-250
250-300
300-400
400-500
500-600
600-700
700-800
800-900
> 900
N
1:10000
0 100 200 300 m
patr01
patr02
patr03
patr04
patr05
patr06
patr07
patr08
patr09
patr10
patr11
patr12
patr13
patr14
patr15
patr16