

REVISION OF ROCK, SCREE AND GLACIER IN A DATA-BASED CARTOGRAPHIC SYSTEM

TOPOGRAPHIC MAP SERIES OF SWITZERLAND: ROCK, SCREE AND GLACIER REPRESENTATIONS NEED TO BE UPDATED

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IS IT NECESSARY TO REVISE TERRAIN AT 1:25 000 SCALE?

The continuous above-average temperatures caused by global warming melt glaciers away and unveil rock and scree areas. Furthermore, the melting of permafrost areas and the increased occurrence of thunderstorms with above-average precipitation cause landslides. As a result, the appearance of the earth's surface is strikingly changed with respect to perimeters and terrain features. The quality standard defined for our topographic maps 1:25 000 demands terrain revision in such cases.



Fig. 1 Aletschgletscher taken from Belalp: Left around 1900, right in the year 2005

Source: <http://www.gletscherarchiv.org/>

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TODAY'S TERRAIN REVISION, SCALE 1:25 000

Method of terrain representation

Rock is represented by traditional hachures. Modulated index contours (100 m) in rock areas are part of the rock representation. Glacial features such as crevasses and ice-cliffs are also represented by hachures.

At first, the rock and glacier features are outlined and finally hachured. Scree areas, on the other hand, are screened patterns of modulated dots. Contour lines and conventional signs for topographic small features complete the terrain representation.

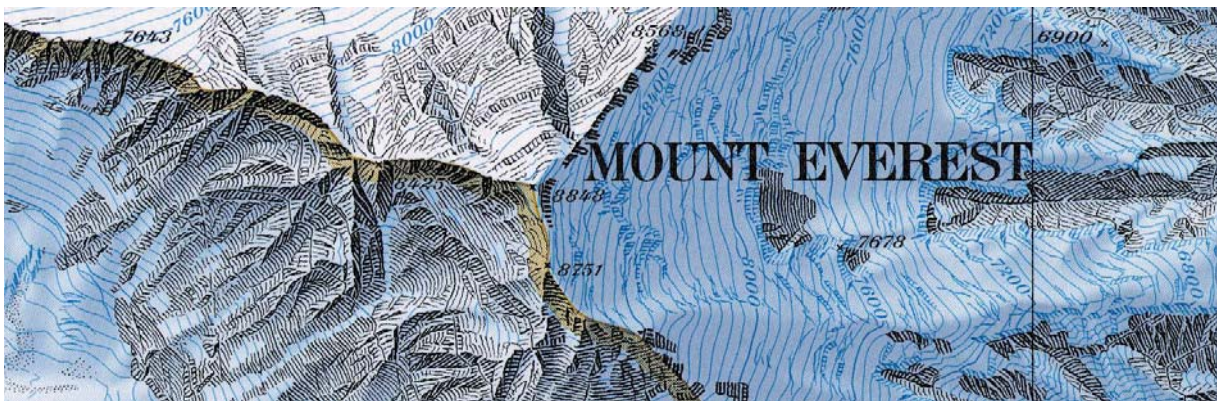


Fig. 2 Rock, scree and glacier representation by Swiss Federal Office of Topography (swisstopo)

Bases of terrain revision

The latest edition of the map, the photogrammetric plot and the stereoscopic, aerial photographs are the bases for rock, scree and glacier revision.

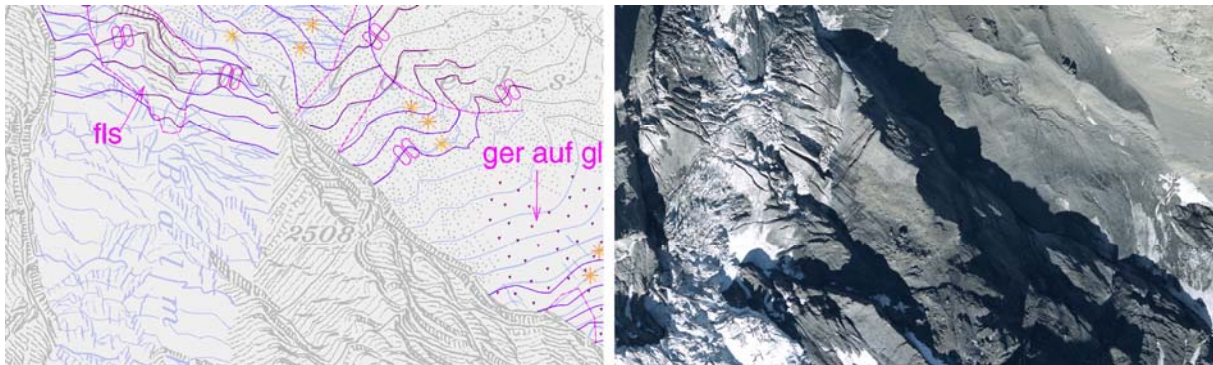


Fig. 3 Bases of today's terrain revision

Left: Raster data in pale colours = latest map edition; vector data in dark colours = photogrammetric plot. Right: Stereoscopic, aerial photograph
Extract of sheet 1267 Gemmi, scale 1:25 000, enlarged

Problem

In map revision, the cartographer must always keep in mind to update the map content correctly. Newly added information has to match the existing map content. Particularly the shaping of topographic features and the degree of map generalisation have to be executed correctly.

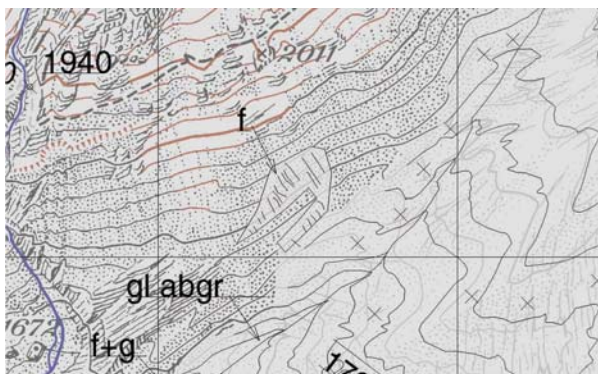


Fig. 4 f = rock, gl abgr = perimeter glacier to scree, f+g = rock and scree

Map content of the year 1993, black = photogrammetric plot, dated 1999
Extract of sheet 1269 Aletschgletscher, scale 1:25 000, enlarged



Fig. 5 Topographic features can be recognised. However, an accurate distinction of different types of terrain is difficult even for highly qualified craftsmen!
Aerial photograph, black-and-white, LK 264 SE JUNGFRAU, 1269, LIN 139, 3636, year of photo: 1999

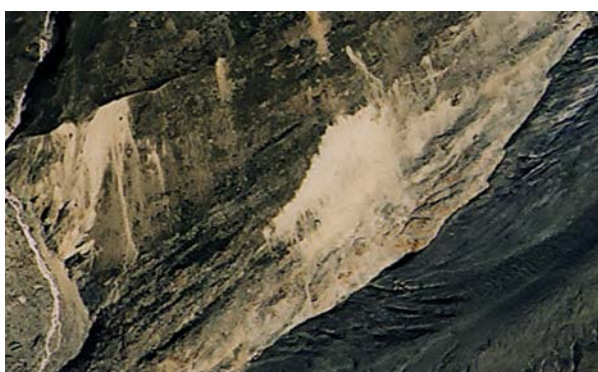


Fig. 6 Topographic features are not or only hardly recognisable. The outline of rock, scree and glacier may be assumed but is not clearly distinguishable
Aerial photograph, colour, LK 264 SE JUNGFRAU, 1269, LIN 139, 6576, year of photo: 1999

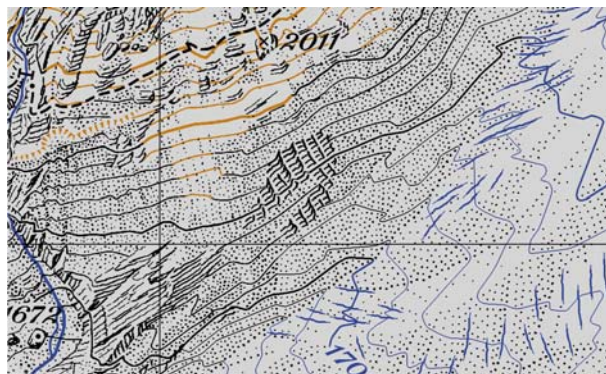


Fig. 7 Incorrectly revised rock and scree representation. The map revision was based only on the photogrammetric plot and the aerial photographs
Extract of sheet 1269 Aletschgletscher, scale 1:25 000, enlarged



Fig. 8 Compared to the aerial photographs, the topographic features are clearly more distinguishable
Terrestrial photograph of reality, year of photo: 2002

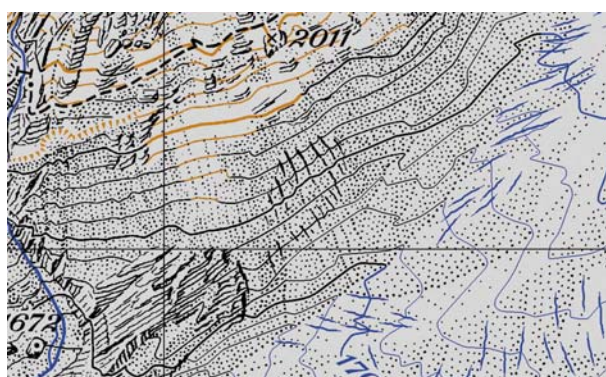


Fig. 9 Correct revision of terrain. Rock and scree were updated according to the photogrammetric plot, the aerial and the terrestrial photographs
Extract of sheet 1269 Aletschgletscher, scale 1:25 000, enlarged

Technique of terrain revision

The representation of rock, scree and glacier is presently being revised with a CAD application software. The contour lines are digitized. The time-consuming and sophisticated editing is executed interactively in the vector mode.

TERRAIN REVISION IN THE FUTURE, SCALE 1:25 000

The Swiss Federal Office of Topography (swisstopo) is planning a new data-based edition of its topographic maps.

Chosen method of terrain representation

In the scope of this project, the present rock, scree and glacier representation was critically questioned and alternatives were discussed.

However, the search for a different, simple, efficient and realistic rock representation for the newly structured maps did not produce any satisfying results. Therefore, it was decided to keep the existing, widely accepted and yet still convincing rock and glacier representation of swisstopo's maps. The new scree representation is – in

contrast to the present map – roughly screened patterns of modulated dots. Contour lines and conventional signs for small topographic features will complete the terrain representation.

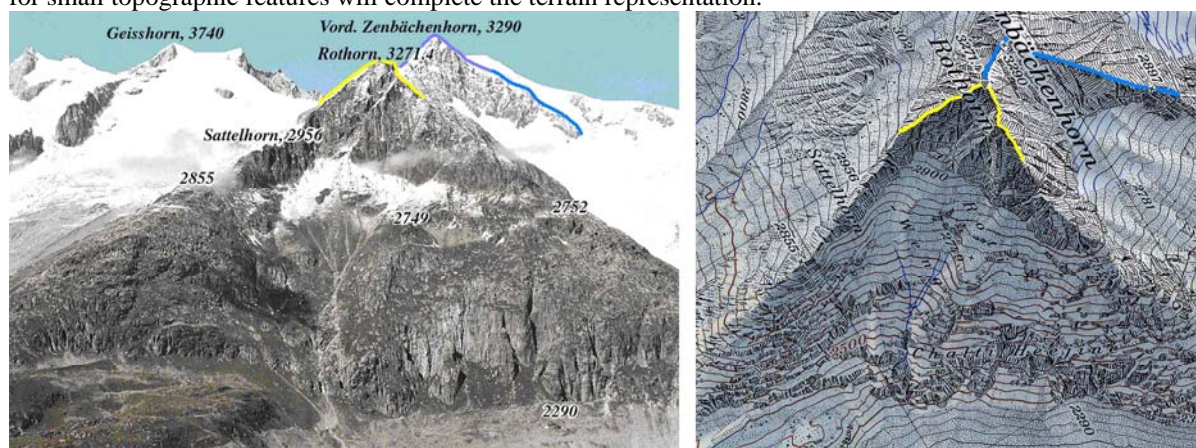


Fig. 10 Comparison of terrestrial photograph with map. Our conclusion: Rock, scree and glacier are convincingly represented in today's maps
 Left: Terrestrial photograph, taken in the year 2002. Right: Extract of sheet 1269 Aletschgletscher, scale 1:25 000, issue 1999

Future bases of terrain revision

In the future, rock and glacier revision will be based on the latest map content in the raster mode. The perimeters of rock and glacier areas and the contour lines will be another part of these bases which will be stored in the database in the vector mode. Finally, stereoscopic, aerial photographs will be consulted. Within the perimeter of scree areas, modulated screened dots will be derived from the hillshading.

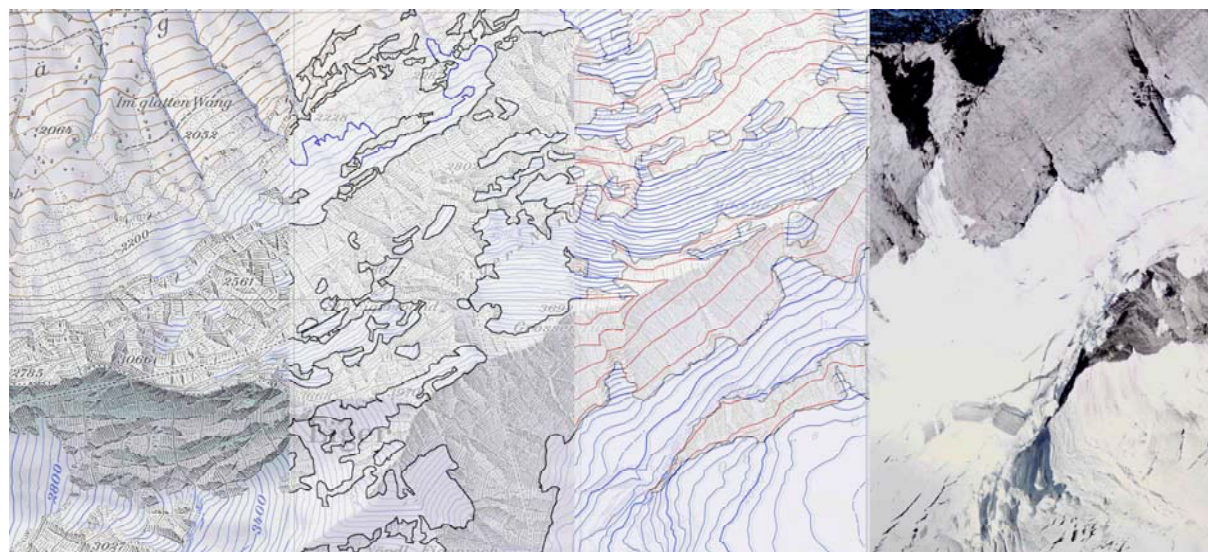


Fig. 11 Bases of future rock and glacier revision
 Left: Raster data in pale colours = latest map edition. Centre left: Vector data in dark colours = perimeters of rock and glacier areas. Centre right: Contour lines from the database. Right: Stereoscopic, aerial photograph

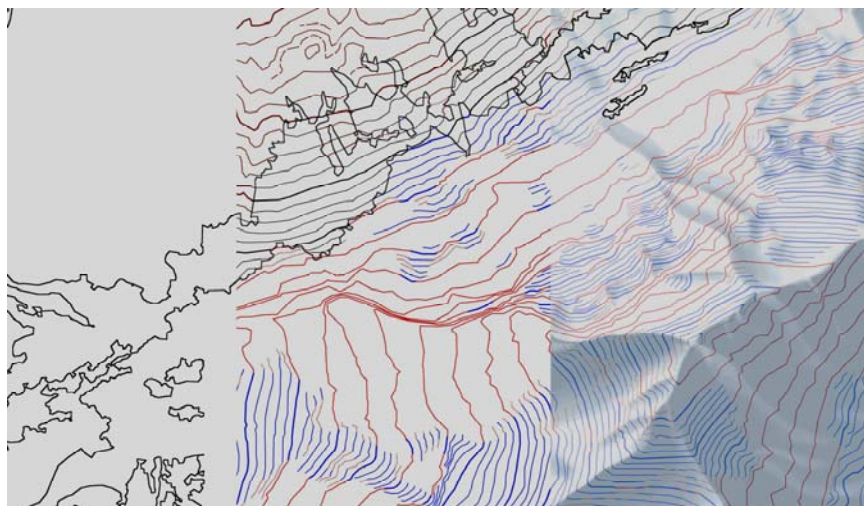


Fig. 12 Bases for the new, automatically generated scree representation
Left: Scree perimeters. Centre: Contour lines. Right: Hillshading

Problem

Retaining today's rock and glacier representation runs the risk of human error in terrain revision. That is to say, rock and glacial features might be characterised incorrectly. Moreover, the revised terrain representation might unwillingly differ from the existing one. Finally, the degree of map generalisation might also not match the old map content.

Preliminary work before the transition to the new map production

The present rock and glacier representation of our topographic maps, which will be taken over in the data-based maps, is already stored in the raster mode. The rock drawing is in today's planimetric representation (black items in map) and glacial features such as crevasses and ice-cliffs are part of today's hydrographic representation (blue items in map). Both of these elements have to be separated from the rest of the map content, and the missing details due to masking (lettering, heights and other map elements) must be completed.

New technique of terrain revision

The retained rock representation with integrated index contours in rock areas will be revised in a raster-oriented application software. The glacial features such as ice-falls and crevasses will be updated in the same way as the rock drawing.

Contour lines and perimeters will be stored and revised in a vector database.

The scree representation is a screened pattern of roughly modulated dots derived from the hillshading data and the perimeter of scree which serves as a mask. The contour lines are derived from a digital terrain model and will automatically mask out the unnecessary dots of the screened pattern.

Conclusions

The accepted solution is that the expensive rock and glacier representation of today's topographic maps will be retained and revised in the future. Consequently, the skills of a sufficient number of cartographers specialized in rock drawing must be guaranteed. The new, scree representation will reduce costs in future map production and revision compared to the present, time-consuming method.

SUMMARY

In the new data-based map, ...

- the existing rock and glacier representation will be retained and interactively revised
- there will be a combination of vector (e.g. contour lines and escarpments) and raster data (rock and glacier representation, hillshading)
- an automatic generation of the map content is partly possible (e.g. contour lines)
- the correct revision of rock and glacier is still a challenge to cartographers
- rock and glacier representation is still pictorial
- the scree representation, on the other hand, is a roughly modelled, screened pattern of dots

OUTLOOK

The prototype of the new topographic map 1:25 000 is going to be produced in the year 2006.

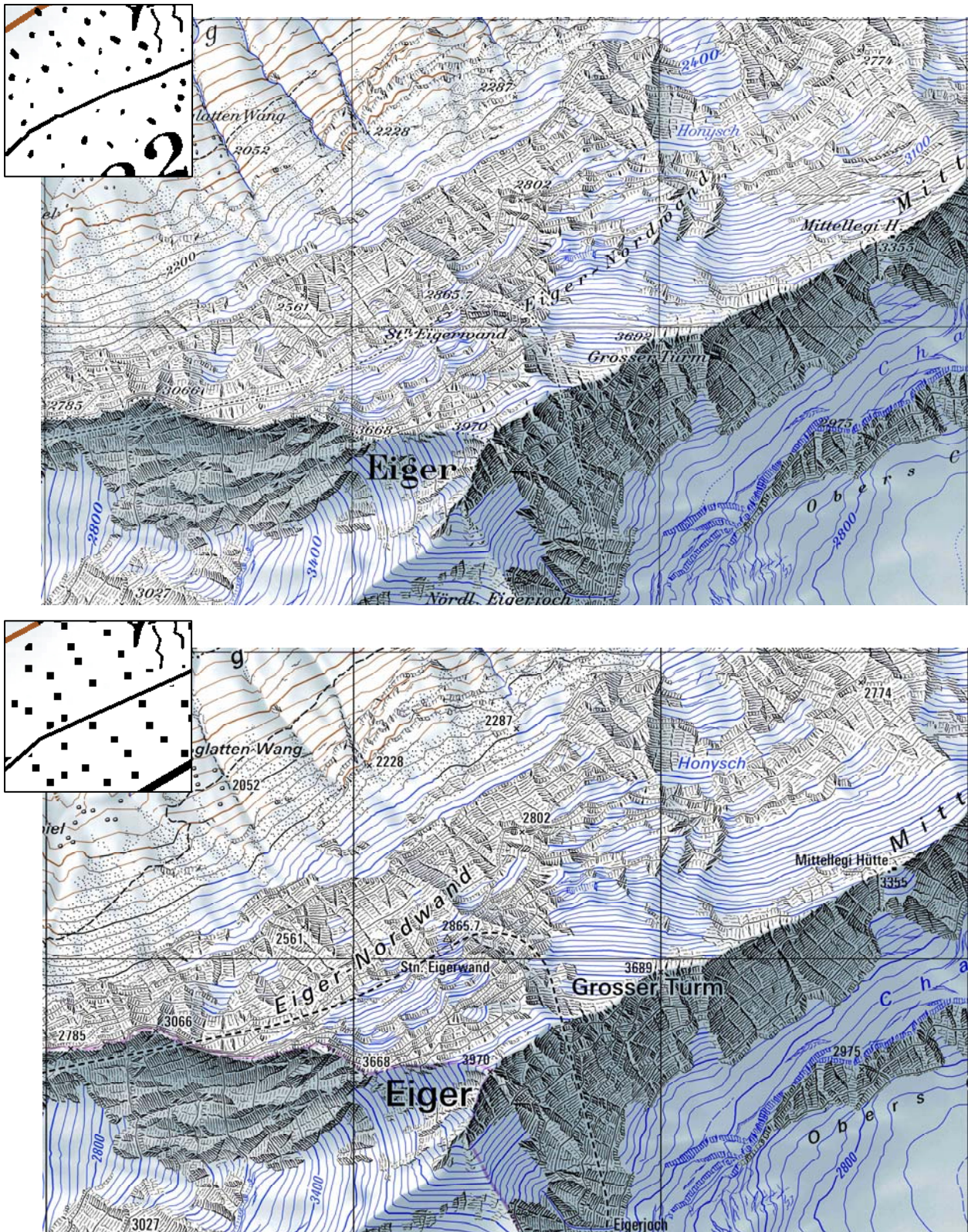


Fig. 13 Comparison of today's map with the new, data-based one
 Top: Extract of sheet 1229 Grindelwald, scale 1:25 000; enlarged. Down: Extract of sheet Kartenprobe Alpen, Neuaufbau des Landeskartenwerkes; 2005/2
 Small pictures: Enlarged extracts showing the difference in screened pattern of dots

Biography of Author



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SWITZERLAND