# The new 1:10 000 national map – defines new scales

There is an increasing need for increasingly precise and up-to-date geoinformation. For the first time, a new national map will be produced entirely automatically each year for the whole of Switzerland. It will be published online at the beginning of June 2016 with data from the latest swisstopo topographic landscape model (TLM). This high-quality cartographic product will be an ideal basis for applications in the fields of public administration, the economy, science and applications intended for the general public.

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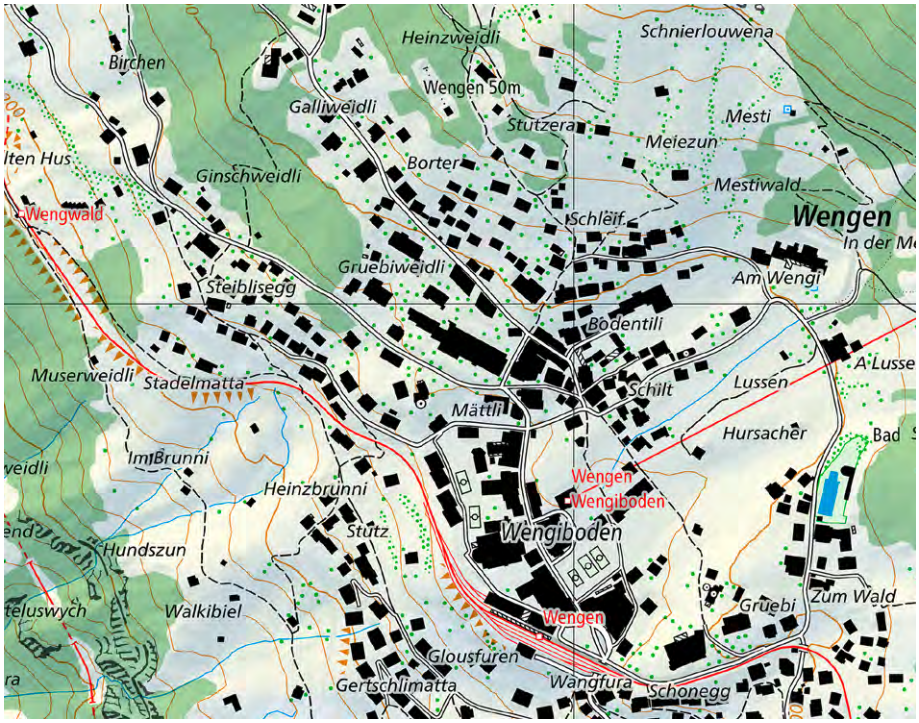
The new 1:10 000 national map is a milestone in the history of Swiss cartography and the focus of swisstopo's commitment to the International Map Year organised with the support of the UNO. It combines the unique qualities of traditional maps with the latest processes. What began more than 175 years ago with intaglio engraving continues today with fully automated digital processes.
With these innovations, swisstopo takes into account the increasing importance of geodata in our ever-changing society.

## Principle and goals

By setting up the TLM, swisstopo has implemented the modelling of the entire Swiss landscape using ultra-precise three-dimensional vectors. Meanwhile, the office guarantees the changeover in map production to digital cartographic models (DCM) using vectors, in different scales.
The precision and updated status of the landscape model were until now the sole domain of specialists. This precise data was not directly available to the many users looking for good visualisation in the presentation of national maps.

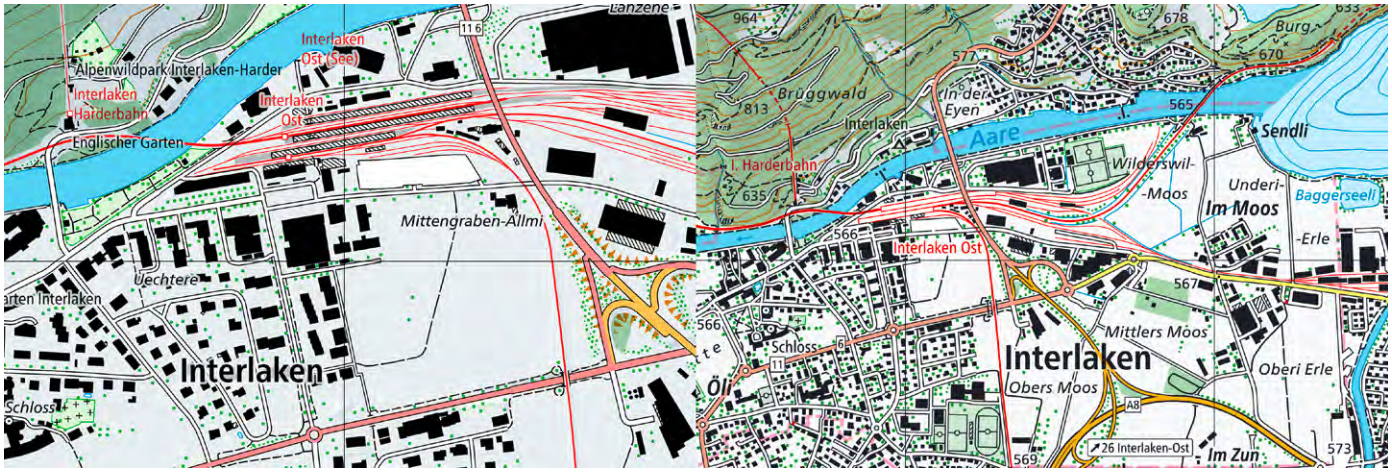



Ill. 1: Extract from the new 1:10 000 national map.

In the spring of 2012, a first unrevised DCM cartographic presentation, the swissTLM-Map, was put online at the highest zoom levels on the Swiss Federal geodata portal, www.map.geo.admin.ch, to complement the national maps. A version with the new conventional symbols, similar to the national map, was then published in October 2013[1].
Following the positive experience with the new mapping processes and the highly precise DCM data, it was decided to replace the swissTLM-Map with a 1:10 000 national map as a background map for higher zoom levels on map.geo.admin.ch. The goal is to combine the precision of TLM data with the quality of representation of the national map and with standardised processes to meet the widest variety of needs. At graphic design level, the new map is fully in keeping with the national maps in other scales, allowing ideal use together in digital office and mobile device applications.

## Principles of national map production processes

1:10 000 national map production processes using DCMs are based on the global architecture of all cartographic products and thus guarantee an ideal synergy between system management tasks and past and future maintenance. There are interfaces with the topographical landscape model and the swisstopo centralised data collection system, the "Geodata Warehouse". Initial valuable experience of the new production processes for the national map was gained in 2011 with the 1:1 million map. The first sheets of the 1:25 000 national map using the DCMs were published in early 2014. For the first time, this map was produced semi-automatically: only cases impossible to resolve automatically were dealt with manually. From 2016, this method will also apply to the 1:50 000 national map in order to satisfy not only the high demands of graphic design, but also the legibility requirements for the map's detailed contents. Contrary to other national maps, subsequent manual work




Ill. 2: Typical extract from the 1:10 000 national map compared with the 1:25 000 national map.

was excluded from the beginning for the 1:10 000 map.

## 1:10 000 scale national map production process

Production of the 1:10 000 national map is based on a quality-controlled version of the topographical landscape model and on its relevant update status.

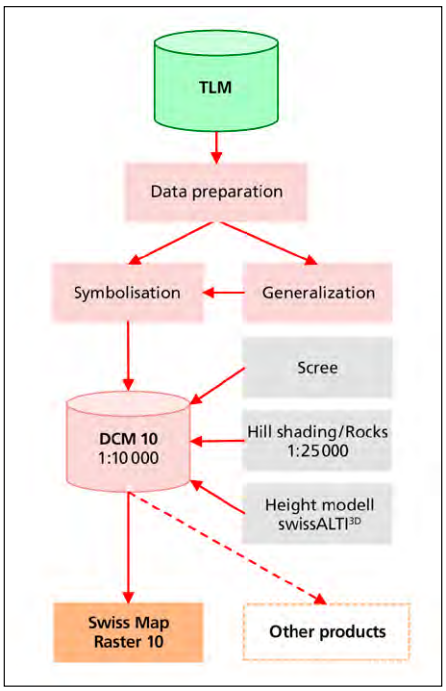
### Data preparation

At the data preparation stage, TLM data is converted using FME Workbench, geomatic and script tools, into a cartographic reference model with the same model structure as the DCMs. This model generalisation simplifies and standardises later processing by means of automatic and downline systems. Conversion of the TLM into BCM is carried out for the entire TLM perimeter. With a few exceptions, the reference model has the same number of functions, the same unique object identifiers (UUID) and the same geometries as the TLM; however, there are differences in attributions and classes compared to the TLM. During this stage, TLM buildings (roof surfaces in 3D) are converted into 2D building footprints without Z-value. For each scale, a cartographic line width is calculated for watercourses, information that the TLM does not directly contain, but which can be deduced from the mesh geometry. In a second step, contour lines and depressions from the digital terrain model are derived for each national map and the quality is checked. This solution is already used to produce the DCM25. It is then enough, for each new scale, to adapt and configure a few process details and to implement the changes to the reference model and DCM models in a coordinated manner. There are also plans to automate quality control.

### Generalisation

The need for automatic generalisation mainly results from the density of the data and the size of the conventional symbols. Because of the closeness of the entry and representation scales, at a scale of 1:10 000, vegetation elements (trees, wooded areas) are generalised and buildings are grouped via model generalisation during a first stage. Implementation is carried out using ArcGIS (ESRI) software with ModelBuilder components and Python scripts, chosen during the development of the generalisation for the 1:50 000 and which only needed minor changes for the 1:10 000.

In contrast to lower scales, however, generalisation is less relevant for 1:10 000 national map.




Ill. 3: 1:10 000 national map production process.

### Conventional symbols

Data is automatically converted into symbols and signatures on the basis of the catalogue of objects, whereas automatic geomatic tools are integrated to obtain an ideal cartographic representation.

### Combination of DCM vector data and raster data for a quality representation of national maps

1:10 000 national map vector data is combined with raster data from the swissALTI$^{3D}$ elevation model and with that of 1:25 000 national map terrain representation (rocks, relief, yellow colouring) using an automated process.

In line with swisstopo's long-term tradition and in order to meet users' high expectations of terrain representation, many tests have been carried out to optimise the visual design. The goal was to

make best use of existing bases and to avoid time-consuming manual tasks. An innovative technique was used to represent relief, this being a combination of high-resolution swissALTI data3D and the relief representation from the 1:25 000 national map, originally compiled manually. This solution means the smallest details can be depicted while preserving large groups that make up the terrain. Use of the yellow colouring from the 1:25 000 national map also reinforces the visual effect of relief.

As for the representation of rocks, traditional black cross-hatching was rastered and the pixels were reduced using Photoshop. This trick avoided having to redraw rocks and resulted in a map design where rocks do not overwhelm the mountain regions and names and altitudes remain perfectly readable. In future, rock updating tasks on the 1:25 000 national map, which remain manual, will also be used for the 1:10 000.

The semi-transparent, automatically-generated text masks make text entries easy to read as well as the elements underneath. This is a great advantage, especially for digital applications that use the zoom function.

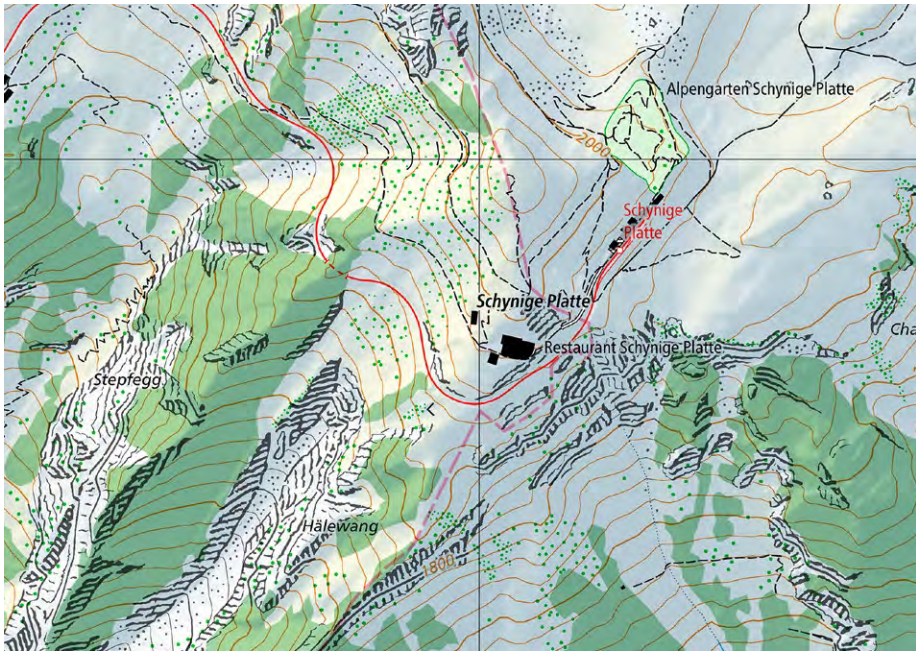
## Products and possible uses

From now on, an updated version of the 1:10 000 national map will be published each year under the name Swiss Map Raster 10. Thus all the changes integrated in the TLM during the year will be added and represented directly.

Integration will be carried out at the highest zoom levels of the Swiss Federal geodata portal, map.geo.admin.ch. All functions (e.g. offline, drawing, measuring and integrating into a website) will be available. The map can also be printed up to format A3.

For the 1:10 000 national map to be usable in 3D viewers, it will be possible to select the necessary raster data individually on map.geo.admin.ch.

Data will also be made available to users through the Swiss Map Raster 10 product. With the 1:10 000 digital cartographic model composed of topologically precise vector data complemented by raster data, geodata will be available in a much higher quality than that of today's national maps for spatial and visual analyses, e.g. in SIG systems. The preparation of this data can in future be developed for the other national maps according to demand, using identical processes.




Ill. 4: Detailed terrain representation on the 1:10 000 national map (combination of swissALTI[3D] and the relief of the 1:25 000 map).


Ill. 5: Example of selective masking.

The use and advantages of the 1:10 000 national map will increase even more if the efforts of various offices to create a data set of official street names for all Switzerland succeed.

The 1:10 000 national map will also be useful for official cadastral surveys because it will cover areas for which there is currently no large-scale data.

## The large scale map – long awaited

The precision of the cartographic representation of Switzerland was a subject of discussion as early as the beginning of the 20th century. At that time, the development of new survey methods based on photogrammetry played a determining role. The graphic quality of the Dufour and Siegfried maps no longer satisfied requirements as to precision, thus launching a debate on the relevance of the map scales to be published and a subsequent seven-year "map war". The Swiss Federal topographical office already favoured a maximum representation scale of 1:10 000 at the time. However, it was finally the current set of scales, starting at 1:25 000, that won the day, with the support of E. Imhof (of the ETH Zurich), of the Swiss Alpine Society and the Swiss Society of Natural Sciences. The Swiss Federal Military Department also approved this version on condition that the 1:50 000 national map be published first as a compromise[2].

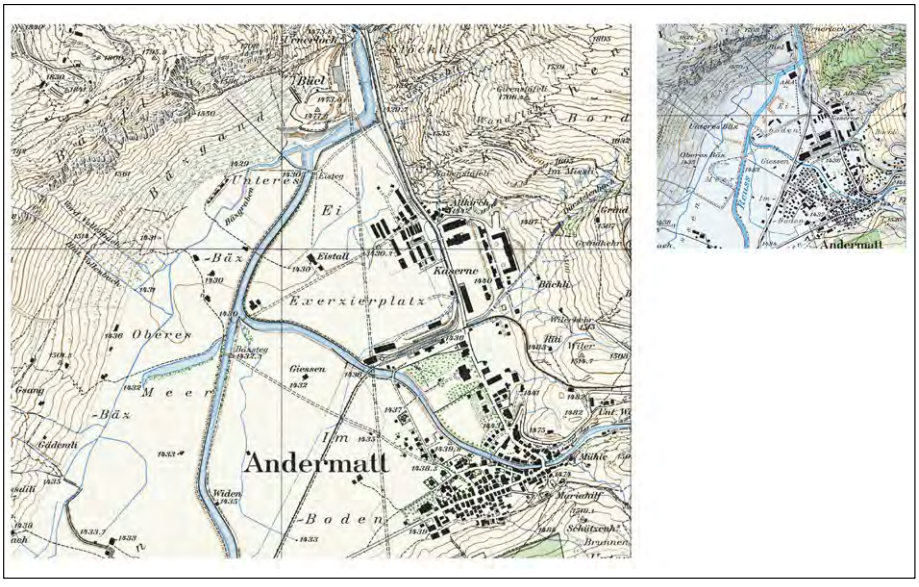

**Ill. 6: Visualisation example of the 1:10 000 national map, simulated within the perimeter of sheet 1229 Grindelwald on the 2,5D viewer of the Swiss Federal geoportal.**

The importance of large-scale maps for the army had nevertheless been recognised well before this decision concerning the national map and was closely linked to fortification mapping. At the Gotthard, topographical surveys for large scale maps had already begun in 1888/1889. At the end of the 1940s, maps of fortifications, sometimes repeatedly updated at great cost, covered almost 3,050 sq. km of Swiss territory at 1:10 000, or approximately 7.5 % of the country's area. These maps were classified until a few years ago. They are a feat of the map-making art. In terms of quality of representation, they are as good as national maps, whose development they significantly influenced, and are even superior when it comes to scale of precision[3].

## Conclusion

The new 1:10 000 national map makes it possible to combine both the need for precise and updated geodata and for quality cartographic representation. For the first time, data already entered and available for the whole Swiss territory is being made available as national maps by means of fully-automated processes. Integration into a standardised representation system coordinated with the other national maps offers a homogenous spatial representation of Switzerland. The new map thus opens up the way to many new uses by all types of users.

WE LOVE MAPS – With its new 1:10 000 national map, swisstopo is contributing actively to International Map Year and focusing on the growing importance of maps and geoinformation in our modern societies.




**Ill. 7: Comparison of the map of fortifications and the national map.**

*Links:*
Swiss Federal geodata portal:
www.map.geo.admin.ch
swisstopo 1:10 000 national map:
www.swisstopo.ch/lk10
International Map Year:
www.swisstopo.ch/imy

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Swiss Map Raster 10 will be available for orders from late 2016.

[1] swisstopo, geodata-news 30, 2014.

[2] Pierre Gerber and Thomas Klöti, cartographic collection of the Federal Office of Topography to commemorate Switzerland's landscape, 2004.

[3] Martin Rickenbacher, Fortification maps – maps for the national defence of Switzerland, 2004.