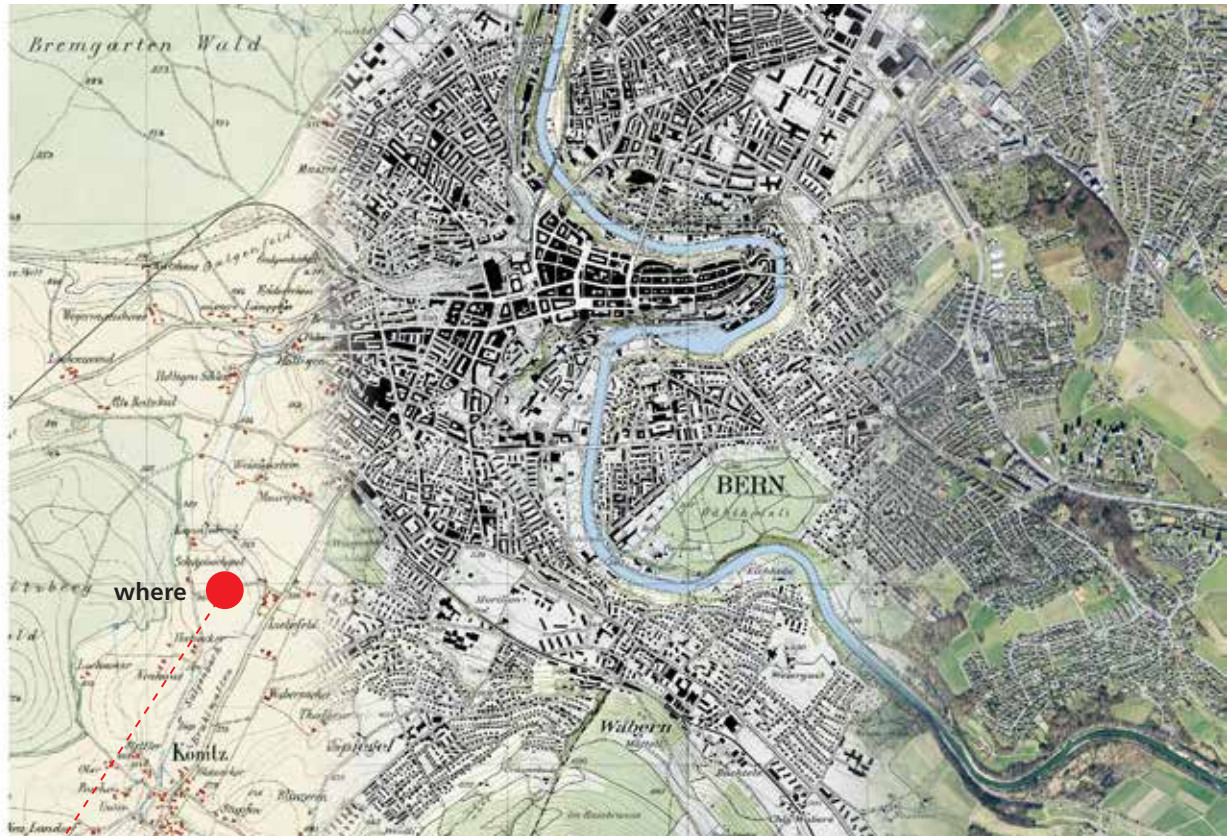


swisstopo – The Landscape Memory of Switzerland



knowing

swisstopo



Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Swiss Confederation

Federal Office of Topography swisstopo
www.swisstopo.ch

A topographic map of a mountain range, likely the Alps, rendered in a color gradient from light yellow to dark brown. The map shows the intricate details of the terrain, including peaks, valleys, and ridges. The shading is based on a digital height model (swissALTI3D).

‘This commemorative publication will take you on a fascinating journey through time!’

Jean-Philippe Amstein, Director of the Federal Office of Topography swisstopo

Aletsch Glacier/Konkordiaplatz
(Canton Valais): Relief shading from
the digital height model swissALTI^{3D}

Contents

Welcoming speech by Ueli Maurer, President of the Swiss Confederation and Head of the Federal Department of Defence, Civil Protection and Sport DDPS	2
<hr/>	
Introduction by Jean-Philippe Amstein, Director of the Federal Office of Topography swisstopo	3
<hr/>	
Nation/state	
Yesterday: Pioneer effort in turbulent times	15
Today: Switzerland has increased in size	16
Tomorrow: Bridging the gap to neighbors	18
<hr/>	
City/living	
Yesterday: The Office of Topography's flying team	21
Today: Geoinformation is keeping up with the times	22
Tomorrow: Making the right decisions	24
<hr/>	
Mountains/leisure	
Yesterday: Ups and downs in the mountains	27
Today: Where humans and chamois meet	28
Tomorrow: The alpine region is changing	30
<hr/>	
Glaciers/water	
Yesterday: When the Ice Age reigned in Switzerland	33
Today: Water makes a difference – to the economy and the people	34
Tomorrow: When climate gets out of hand	36
<hr/>	
Underground/resources	
Yesterday: The heart of the Alps	39
Today: When rocks and minerals are worth their weight in gold	40
Tomorrow: The future is under ground	42
<hr/>	
The Federal Office	
Yesterday: Heading towards the digital age	44
Today: Good people work well	46
Tomorrow: swisstopo is on the move	48
<hr/>	

Dear Readers



'In my opinion, experience, competence and quality are characteristics that swisstopo may without any doubt claim for itself.'

The birth of our Federal Office of Topography was on January 1, 1838, when it was known as the Swiss Topographic Bureau. At that time Switzerland was not yet organized in its present Confederation from 1848, thus making swisstopo older than Switzerland – yet an inseparable part of it. Before swisstopo was founded, a few independent efforts were initiated by cantons, notably Bern and Basel, which wanted to survey their territories at their own expense. Little by little the conviction grew that something in that direction needed to be undertaken on the national level. Even during those days, the significance of an organization representing the entire country was evident.

'Products and services from swisstopo help us find good solutions and meet those challenges affecting all of us.'

Being a division of armasuisse, the Federal Office of Topography is also a part of the Federal Department of Defence, Civil Protection and Sport and fulfills military as well as civil tasks. swisstopo is the competence center for geoinformation in Switzerland. In my opinion, experience, competence and quality are characteristics that swisstopo may without any doubt claim for itself. For 175 years now, swisstopo has been the landscape memory of Switzerland, documenting its topographic development and carrying out surveys for various applications, also in particular for national defence. Then as well as today, swisstopo produces maps and geodata for both military and administrative purposes.

In the course of time, the assignments didn't decrease but increased instead. Unchanged is the vital issue of safety – but also important is the groundwork for spatial planning and development, nature conservation and environmental protection, sports and leisure activities, resources and energy supply. The population density is rising: more and more people live in our country. They all have needs and expectations. The products and services from swisstopo help us find good solutions and meet those challenges affecting all of us.

**President of the Swiss Confederation
Ueli Maurer, Head of the Federal Department
of Defence, Civil Protection and Sport DDPS**

Yesterday, today, tomorrow



'My predecessors and I recently met and talked about 'the old days'. We saw some things coming, others we didn't. The pace of development in communications technology still amazes us today.'

As Director of swisstopo since 2006, I am in a sense standing at the helm of a vessel that has been underway since 1838. During this time it has not only seen a lot, but it has also successfully steered into many a new port. We have and still are reaping great acclaim from all sides. And this is no coincidence: I am convinced that we have earned this recognition because we do good work and we treat each other respectfully – employees, superiors, clients and partners. I am proud to hold this office.

'You don't receive recognition without reason, you earn it. We do it with good work and by treating each other respectfully.'

For this anniversary edition, both of my predecessors and I met and talked about 'the old days'. We saw some things coming, others we didn't. Probably none of us ever imagined that the Internet would become so vast and have such an impact in this short period of time. The pace of development in communications technology still amazes us today. More than ever swisstopo needs flexibility and the necessary leeway, not only to fulfill its mandate, but also to be successful in the market – especially in such a dynamic environment.

Anniversary celebrations are popular occasions for looking back and reviewing the past. We will do the same on the following pages – but we are going a step further: we will not only remember the past, but also highlight the present and the future. What challenges will swisstopo face today? And what is waiting for us tomorrow?

With this commemorative publication we would like to show the enormous importance of the function approaching swisstopo as the 'landscape memory of Switzerland'. We want to take you, Dear reader, on a fascinating journey through time. We would like to express our thanks to all who have contributed to our accomplishments and who support us today so that, also in the future, we can say: 'swisstopo – knowing where'.

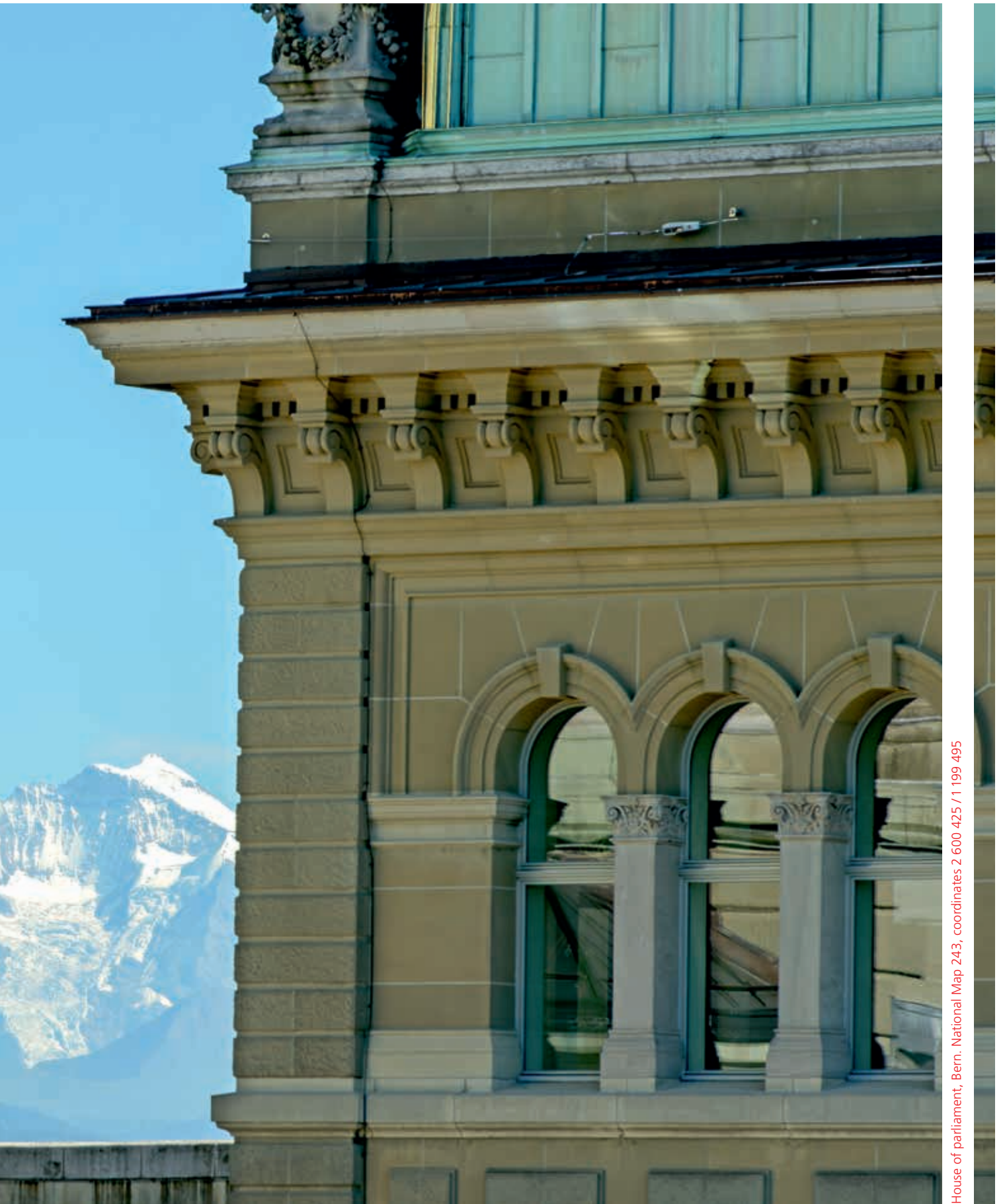
Jean-Philippe Amstein
Director of the Federal Office of Topography
swisstopo

Reference for the nation and society.



Geoinformation from swisstopo is the reference and basis for numerous decisions made by political organizations, the economy as well as society and the scientific community. Thanks to the foresight of our previous generation, Switzerland can today fall back on

this infrastructure. It is our job to maintain it at the required quality and at a reasonable cost, and to sustain it for future generations.



House of parliament, Bern. National Map 243, coordinates 2 600 425 / 1 199 495



Living space for today and tomorrow.

Planning for today and tomorrow requires reliable information. Surveying and geological data describe the position, condition, use and legal relationship of our living space. Various products derived from this geoinformation such as aerial photographs, maps

and 3-D models can be used to document complex situations and to actively shape the future.



Boulevard des Philosophes, Genève. National Map 270, coordonnées 2 500 290 / 1 116 930

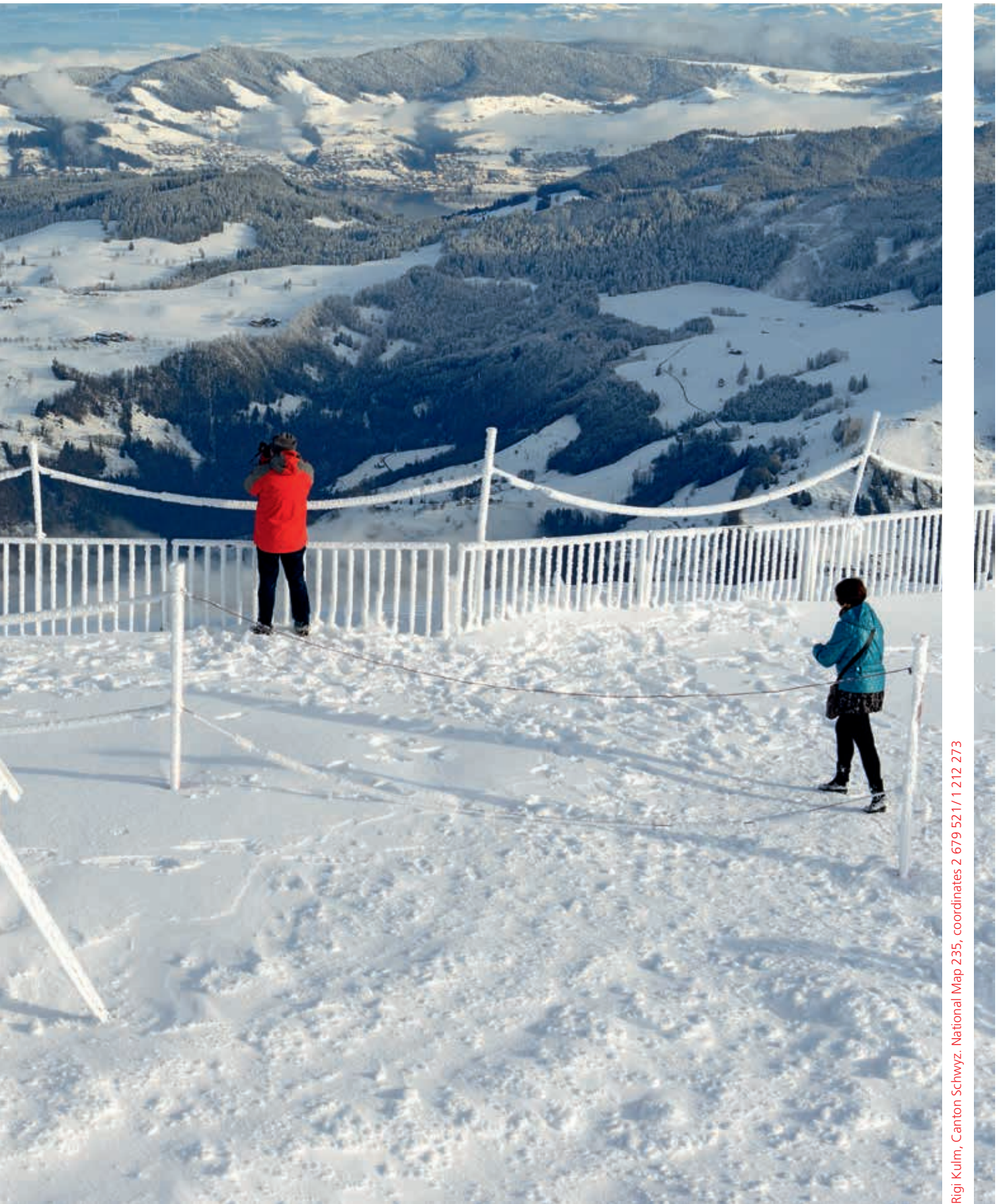


Co-existence of man and nature.



Because nature cannot protect itself from mankind, mechanisms are necessary to promote the co-existence of man and nature. Thanks to digital and printed geoinformation, we can relate to our environment and approach

professional and leisure activities with both consideration and respect.



Rigi Kulm, Canton Schwyz. National Map 235, coordinates 2 679 521 / 1 212 273

Making the past and the future visible.



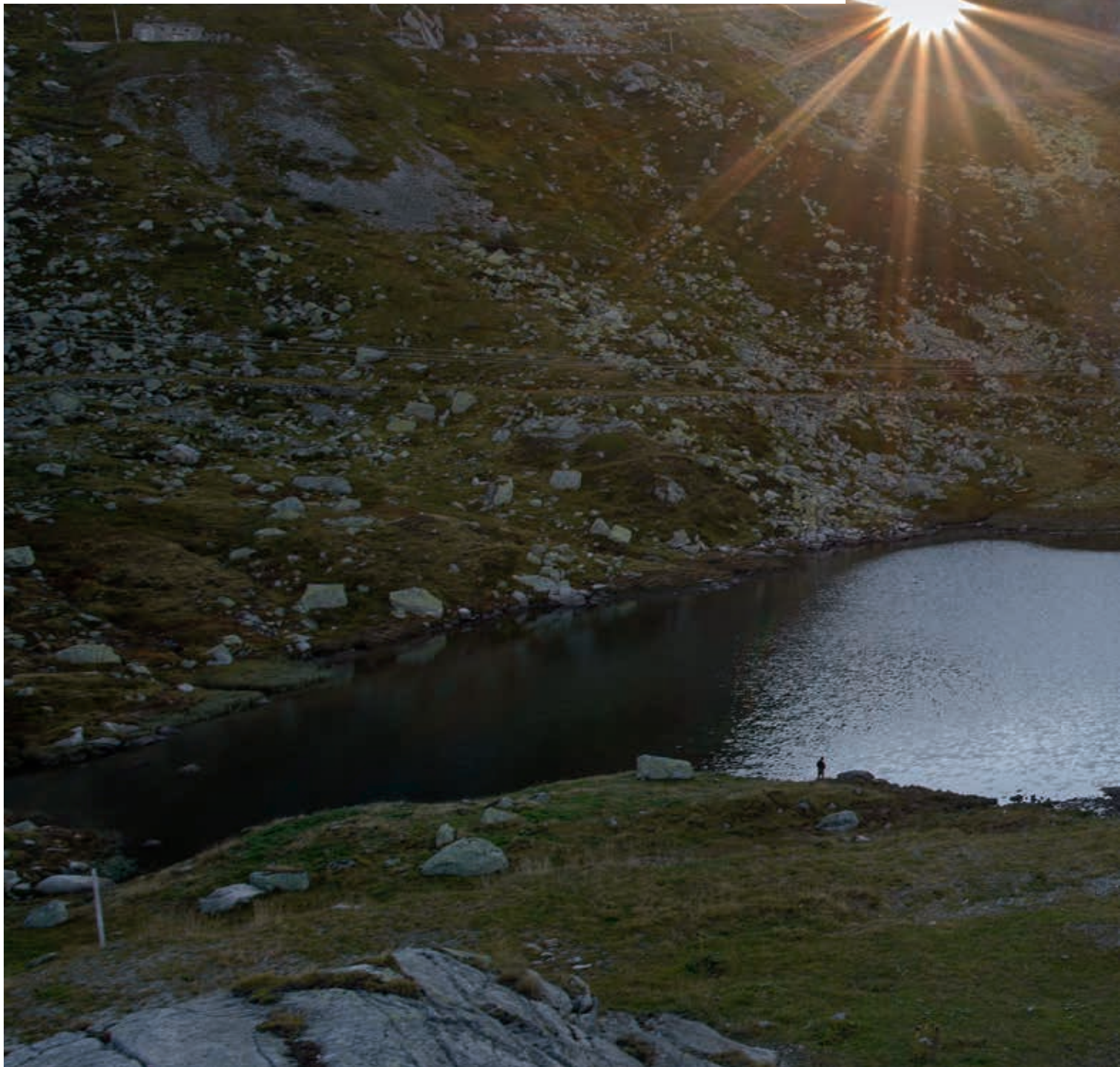
Changes in our environment occur on a daily and subtle basis. Sometimes they only become evident when viewed from a temporal distance. Being the landscape memory of Switzerland, swisstopo has been surveying the landscape for 175 years and

documenting it for posterity. We can now find out how it once was – and how it might be some day.



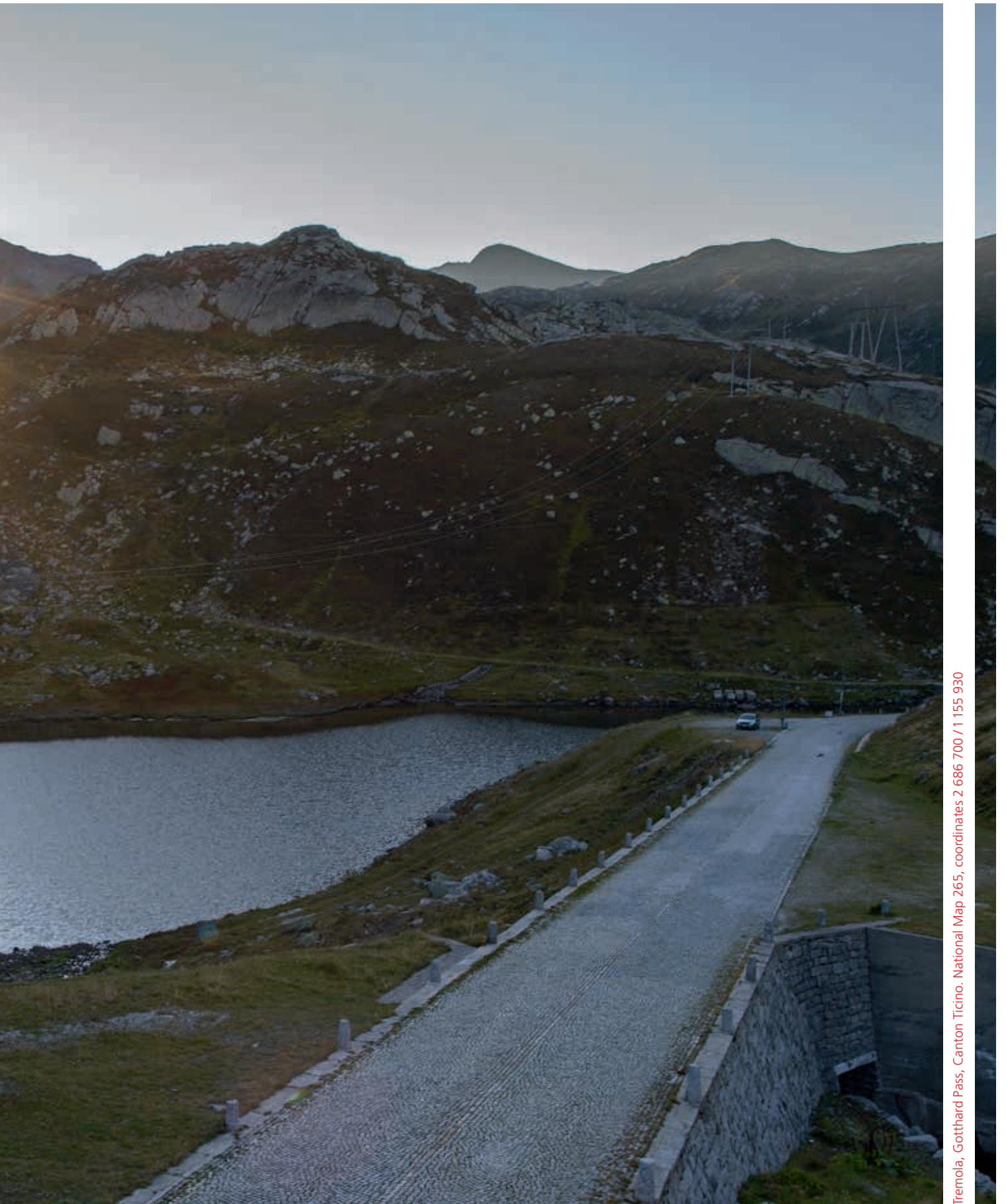
Morteratsch Glacier, Canton of Grisons. National Map 268, coordinates 2 791 680 / 1 145 005

Exploiting and protecting resources.

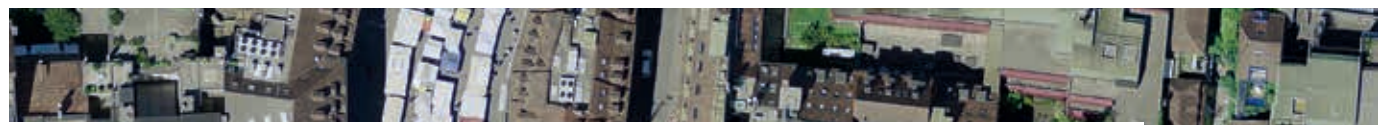


Nature provides Switzerland with raw materials above and under the ground. Moreover, the underground of our country is increasingly being used for traffic routes and energy production. Exploiting the underground, searching for and conserving resources requires

knowledge which can often only be gained through the interpretation of geoinformation. Geodata from swisstopo can for example also be used for establishing a solar cadaster or for exploiting hydro and geothermal energy.



Tremola, Gotthard Pass, Canton Ticino. National Map 265, coordinates 2 686 700 / 1 155 930



‘Even in the digital world where everything must happen quickly, quality is still indispensable.’

Kathy Riklin, Dr. Sc. nat. ETH, member of the National Council



The rectified aerial photographs SWISSIMAGE from swisstopo cover the entire area of Switzerland at a consistent quality. The heart of Swiss politics is shown here: the House of parliament.

Pioneer effort in turbulent times

Turbulent times prevailed in September 1832 when the engineer Guillaume-Henri Dufour took over the Office of the Quartermaster-General.

He had been named Chief of the General Staff already the previous year. At that time Switzerland was not yet organized as a federal state. The cantons formed a loose legislative assembly called 'Tagsatzung' which met from time to time and had commissioned trigonometric surveys already a few years after the Helvetic Republic was founded in 1798. These surveys should serve as the premise for a map of the entire country and make the represented geographic space 'tangible'. The significance of maps for security and military command had already been recognized during the Napoleonic era. However, financial means as well as clear leadership were missing.

32 years of hard work

The newly named Quartermaster-General Guillaume-Henri Dufour was also in charge of producing the Swiss map – a project which would occupy him for the next 32 years. Under his supervision, the first nationwide network of triangles, the survey network, was developed. First of all, the length of one side had to be known. This 'baseline' was surveyed in the 'Grosses Moos' between Walperswil and Sugiez. It was 13 kilometers long, and by using angle measurements was then transposed to the side Chasseral–Rötiflüh measuring 38 kilometers. Just before the observations were finished in the fall 1834, they ran out of funds and the 'Tagsatzung' refused to make further means available. Two senior staff members then contributed an advance of eight Louisdor from their personal funds. As the story goes, some of the employees even had to pawn their watches to pay their way home!

All good things ...

All the surveyors troubles and efforts were finally crowned with success: Dufour founded the 'Federal Topographic Bureau' which went into production at the beginning of 1838. Between 1845 and 1865, the Topographic Map of Switzerland at the scale of 1:100,000 was published. This so-called Dufour Map was the first official work of maps representing all of Switzerland. It was honored by numerous international awards and established the worldwide reputation of the Federal Office of Topography.

The cost of a map

Did you know that a copper engraver's labor was used to calculate the cost of the first Dufour maps in 1848 and amounted to 6 or 7 Swiss francs? In today's terms, a single map would now cost CHF 80! Several price reductions were required over the years to make the Dufour map affordable also for the ordinary citizen. Now they can be viewed free of charge with the geoportal supported by the federal administration and printed. Today, a sheet of the National Map at the scale of 1:100,000 – the successor of the Dufour map – costs CHF 14.

Switzerland has increased in size

Switzerland's national boundary is 1958.73 kilometers long and is shared with five neighboring countries. Even though we are in the midst of globalization, each nation must know the exact course of its sovereign boundary.



The national boundary markers are monumented by swisstopo together with our neighboring countries and are witnesses of the past and present, like the one on the Monte Generoso (Canton Ticino).

The national boundary is at the same time a cantonal, district, municipal and a private property boundary. Therefore, the identification for each type of boundary must be identical in the cadastral survey. Boundaries that are clearly defined by coordinates provide legal security and guarantee the right of property – both for the state as well as for private citizens.

New coordinates for Switzerland

The prerequisite for working with coordinates is a geodetic reference frame into which the coordinates can be adjusted. The reference frame that has been used in Switzerland for the past 100 years is called LV03 and is based on control points surveyed during that time. Today, however, coordinates are determined with satellite-assisted survey methods such as GPS (Global Positioning System). Comparing the results from this method to those from the national survey (LV) from 1903, differences up to two meters can occur. Therefore, swisstopo decided to modernize Switzerland's more than a century old reference frame.

The new geodetic reference frame, called LV95, was observed between 1989 and 1995 using satellite-assisted survey methods. It provides a fundamental network that guarantees the accuracy of position and height for all of Switzerland to the centimeter. In fact, the accuracy of the LV95 network is approx. 100 times greater than that of the LV03 network, a precision that even allows the detection of tectonic movements. Based on these new coordinates, the area of Switzerland has increased by 0.3 square kilometers.



7000 witnesses of history

Did you know that over 7000 markers line the Swiss national boundary? They are regularly controlled, maintained and renovated. Many of these markers are minor historical monuments, some of which date from the 16th century. They constitute a part of our cultural heritage and are witnesses of history.



GPS observations in front of the Muttsee hut (Canton Glarus). Nation-wide, high-precision GPS surveys can be carried out thanks to the new national surveying network LV95, the permanently operated reference stations of the Automated GPS Network of Switzerland (AGNES) and the positioning service swisstopo established and operated by swisstopo.

The national boundaries are changing

There are other reasons why Switzerland has become larger: watersheds often pass over glaciers, and when these melt, the course of national boundaries is also involved. When a new chairlift was built to the Furggsattel in 2003 in Zermatt, the construction permit had to be obtained from Italy since the top station was on Italian territory. However, the top station now lies on Swiss territory because the Theodul glacier has in the meantime receded.

André Blattmann, Commander-in-Chief of the Armed Forces

'I primarily associate "swisstopo" with topographic maps. They are of paramount importance to our jobs. It isn't presumptuous to claim that Switzerland makes the best maps. Being the "landscape memory", they so to speak store our spatial knowledge and are a true and exact representation of the topography. As far as maps are concerned, quality is first and foremost – and it has its price.

Especially important to the armed forces are of course those maps specifically tailored to military needs. We are also grateful to the domain Military Cartography which provides us with the geodata that we need. The time series of settlement development indicate quite clearly that the deployment of security forces and especially the armed forces needs to be modified.

Should administrative data from the public sector be accessible to anyone? Being liberal-minded, I support the easy access to public data – however, only if the security of Switzerland and its institutions or its citizens is not endangered.'

Bridging the gap to neighbors

After two years under construction, everyone was very pleased with the inauguration festivities of the Hochrhein Bridge in mid-December 2004. It connects the Swiss and German parts of the village Laufenburg.



The Hochrhein Bridge in Laufenburg (Canton Aargau). With the help of internationally uniform coordinates from the national survey, bridges connect across and even past borders.

Actually, the bridge had already been finished much earlier, but it was unfortunately impassable: the height of the access to the bridge on the German side was calculated 54 centimeters too low. The reason for this embarrassing mishap was, among others, the fact that both countries use different parameters for determining their heights. The water level of the Mediterranean Sea is the reference for Switzerland's height system, whereas Germany uses the North Sea for its reference. This difference of 27 centimeters was of course a known value, but regrettably the responsible engineer used the opposite sign to correct it. Therefore, the access on the German side had to be raised by 54 centimeters to make the bridge traversable.

Uniform coordinates on both sides of the boundary

The case 'Hochrhein Bridge' clearly illustrates what can happen when neighboring countries use different reference systems for working with geodata. Only their universal consistency will guarantee that uniform data are used on both sides of the boundary. This is also paramount for the railway network, e.g. to ensure that the different sections on both sides match exactly.

Switzerland lies in the center of Europe – an 'island' that really isn't one, considering the numerous connections to our neighbors. Internationally compatible geodata are more important today than ever, and this requires a uniform reference frame for coordinates. For this reason, the European Union introduced the European Terrestrial Reference System 1989 (ETRS89). Practically all European countries are in the process of adjusting their coordinates to ETRS89, as is Switzerland through the implementation of its reference frame LV95.

Geodetic instruments, ...



Theodolite 1837



Levelling instrument
1865

INSPIRE: Switzerland is taking part – with swisstopo as coordinating center

INSPIRE is an E.U. directive for establishing a European geodata infrastructure. This will primarily be implemented for supporting the environmental policy in Europe. At the same time it should facilitate future access to geodata: geodata should be easily available (via Internet), at a uniform standard and at minimal cost – or even free of charge. Switzerland is not obliged to participate in INSPIRE, however, the directive is being applied in the interest of our own country, for example in matters concerning environmental protection. Therefore, swisstopo operates a National Point of Contact for INSPIRE on the E.U. level.

Geodata and privacy

Protecting the right to privacy has not played a major role in processing geodata up to now. Today, however, 'geodata and privacy' is a current topic of discussion: localization services using mobile communications and satellite navigation systems are gaining significance. Location-based services can not only be used to find various businesses such as hotels or other service providers, but they can also be used to determine the position of certain persons. In many cases that might be a blessing – and in others maybe not. swisstopo adheres to the federal data protection specifications which guarantee the right to privacy for its citizens.

... from the theodolite to permanent GPS stations



Theodolite 1930



**Levelling instrument
1965**



GPS receiver 1998



Tachymeter 2010



GPS antenna 2012



'Geoinformation helps us to visualize our living space.'

Michèle Künzler, Council member of Canton Geneva, Department of Interior, Mobility and Environment



The combination of a 2-D national map with the data set swissBuildings^{3D} from the landscape model provides unusual perspectives. The data from swisstopo are flexible and serve to visualize our living space in various applications.

The Office of Topography's flying team

The first attempts at taking photographs for surveying purposes were undertaken by the Office of Topography in 1913 from a balloon.



The first observation aircraft was a 'Zepp' which had an opening in the floor for making vertical photographs. The oblique photographs were taken by leaning overboard the aircraft with a hand-held camera.

Since flying with aircraft was still in its infancy, a military captive balloon from the Swiss balloon company came into use, carrying an Austrian test camera. For obvious reasons this vehicle was soon nick-named the 'federal or heavenly sausage'. Despite an enormous investment of time and personnel, these first efforts were not very successful.

The Office of Topography has its own flight crew

New attempts were initiated in 1922 with aircraft from the Swiss flight squad which was called into life during the First World War. The results were satisfactory and thus the Federal Office of Topography decided to engage its own permanent flight crew. The first aircraft flew more than 1000 hours in over 800 flights, and the operators were able to collect thousands of aerial photographs to revise the Siegfried Map and to create the new National Map Series.

Those magnificent topographers and their flying machines

The Office of Topography acquired its first airplane in 1935. The Messerschmitt BFW-M-18d was built under license at the Federal Construction Plant in Thun at the cost of CHF 90,000. It was equipped with respect to the wishes of the survey pilots and was considered as one of the most modern surveying aircraft of its time. The Messerschmitt proved worthwhile and worked optimally until it was retired from service at the end of 1949.

Accomplishments and tragedies

The ensuing developments brought not only more sophisticated surveying methods, but also increasing demands on the aircraft. Tragedies were regrettably unavoidable: over the years, a number accidents cost the lives of pilots and crew members. Indeed, on February 19, 1952, one of the three Beechcraft C-45 of the Office of Topography shattered on the flanks of the Galmihorn and all four passengers lost their lives. On July 24, 1957 the Cadastral Survey – which at that time ran its own flight service – was also struck by a tragic accident. An unsuccessful emergency landing cost the life of the camera operator, and both the pilot and technician suffered injuries. In 1954 this independent flight service was abolished and its function delegated to the Swiss Air Force. This decision was worth it: up until the present day swisstopo aircraft are flown by airforce pilots.

Geoinformation is keeping up with the times

The Swiss federal geodata portal www.geo.admin.ch was launched in 2010. It provides public access to a wealth of geoinformation from the most important walks of life.



Expanding reality with geoinformation helps to orient oneself, as shown here in a mobile application.

For the first time the federal administration used the so-called 'cloud computing' technology for realizing this project. The application and data are no longer stored in a local or in-house server but literally in a cloud in the Internet. swisstopo had a pioneering role in the application of this breakthrough technology, clearing the path for other federal offices in using this modern method.

Geodata have become mobile

Today, many people want to be able to use geodata en route, that is, on mobile end devices. Their numbers are increasing: already at the end of 2014 there could be more web surfers using mobile devices than conventional equipment. Geodata can be used on smart phones and tablets with the mobile versions of 'Swiss Map Mobile' and 'mobile.map.geo.admin.ch'.

Making decisions based on geoinformation

The geoportal is popular: more than 20,000 hits are registered daily for the map viewer alone. It can be used to view, print and download geodata for further applications. Besides data for leisure activities and hiking maps, information such as contaminated waste sites, hazard maps and cadastral maps are in great demand when dealing with real estate and property ownership. This is not surprising when taking into consideration that 80% of all decisions we make are of a spatial nature and have something to do with geoinformation.

Looking at the future with information from the past

Geodata serve as the basis for sustainable urban planning and for promoting rural and urban areas. They are indispensable for spatial and landscape planning, for optimal land use and for developing mobility concepts. Documenting past developments such as various aspects of urbanization and overdevelopment is fundamental for drawing conclusions concerning the future advancement of our living space and environment. Based on known values and givens, we can show what a specific region might look like some day. In its function as the 'landscape memory' of Switzerland, swisstopo is documenting these developments as a time series. The result is an animated illustration – in the form of maps from different epochs – showing how Switzerland has changed in the course of time.

Knowing what's allowed

Together with the cantons, swisstopo is compiling the most important restrictions that apply to land ownership (PLR cadastre). Switzerland is one of the first countries to provide the public with a systematically built up PLR-cadastre that is also easy to understand. Information from different sources is collected and centrally published.

Michèle Künzler, Council member of Canton Geneva, Department of Interior, Mobility and Environment

'Already today geoinformation plays a major role in making a host of decisions, an interaction that will continue to grow. In order to make the right decisions, we have to understand what we are talking about – and this holds true not only for specialists but for laypersons as well. Uniform and high-quality data are just as important as an open architecture and universal interfaces. Anyone should be able to access data and work with them, even if they are not specialists. User interfaces and functionalities must be user-friendly and compatible with mobile technologies.'

I see the development of our biosphere and its continual change as a kind of stream – it isn't static. We can not only use geoinformation to localize particular points or places, it also allows us to visualize movement – for instance for innovative traffic and mobility concepts.

The constructive and seminal collaboration of our administration with swisstopo has enjoyed a long tradition in Geneva. We will continue to tackle and master future challenges together.'

Making the right decisions

The increasing demand for geodata and its availability is posing new challenges for swisstopo. The amount of data as well as the number of sources is growing.

More and more data is being used more often and more intensively – not only by specialists familiar with geoinformation systems, but also by people from other walks of life as well as by private users. Consequently, the importance of user-friendliness is gaining ground: representations and visualizations of data and their applications have to be easy to handle.

Conflict between ‘public service’ and operating efficiency

The trend is clear: in the future, more data will be used through direct services rather than data carriers – more frequently and spontaneously on mobile devices. Geodata from different sources will be combined and networked. For example, spatial planners can get an on-the-spot idea of what a particular solution might look like. Three-dimensional analyses will become standard because most geographical information systems are based on 3-D models. The development of an official 3-D land ownership cadastre is also being investigated.

The call for ‘open data’ is becoming louder: Clients not only want to be able to look at geodata, they want to use them for their own applications – and if possible free of charge. As a provider of geodata and geo-services, swisstopo is caught in the conflict between ‘public service’ and economic cost, an issue relating to customers, the office itself as well the federal administration. How much should good data and services cost? How should the development of new products and the frequent updates of existing data be financed? There are many possibilities – but do they make sense economically?

Consolidating the needs of man and environment

The increasing use of geodata is directly correlated with the development of our society: an growing number of people exist on a limited amount of space. We have to lay the foundations to meet our needs in the fields of safety, living, working, traffic and leisure. Together with the cantons, swisstopo manages and coordinates activities in cadastral surveying pertaining to the legal guarantee of property ownership and its detailed representation. Topics such as environ-

A selection of swisstopo surveying aircraft ...



1913:
Captive balloon
from the Military
Airship Division



1924–1927:
Zepp LZ C-II



1929–1936:
BFW-M-18c



1935–1949:
BFW-M-18d



1952–1957:
Percival Prince



1967–1993:
Grand Commander
680 FL



The solar power plant and two wind turbines on Mont Soleil (Canton Bern) can be seen on an aerial photograph from SWISSIMAGE.

Solar cadastre: knowing where the sun shines

Power supply in our increasingly 'electrified' society is one of the great challenges of our times. Whereas the sources of fossil energy are slowly drying up, the demand for renewable energy is rising. To be able to use this potential, one has to know where it is. The solar cadastre is an inventory of all rooftops of a city, municipality or region with respect to their potential for producing heat and electricity from solar energy, including solar radiation calculated by independent experts. Solar cadastres can be calculated using the high-resolution surface model from swisstopo or one of the 3-D city models. Other factors such as the inclination and orientation of roofs, shadows cast by other buildings, vegetation or surrounding terrain are also included in this project.

mental protection and the conservation of natural resources are likewise dealt with. We need sustainable spatial planning and mobility concepts – and the knowledge of how our living space is changing, for example through climate change.

In order to make the right decisions, we have to know what is where – above and below the earth's surface. Information can be obtained from geodata and from topographic maps from the last 175 years, available to the public at swisstopo. Being the 'landscape memory' of Switzerland, swisstopo is documenting the past and establishing foundations for shaping the future – including future generations.



since 1976:
Twin Otter DHC-6-300



since 1993:
Super King Air 350C



'In the Alpine region we encroach on an area of conflict between exploitation and protection. swisstopo helps us in finding solutions.'

Frank-Urs Müller, President of the Swiss Alpine Club SAC

The challenging topography in Switzerland can only really be appreciated in the high-precision height model swissALTI^{3D}. In winter, hikers should preferably orient themselves by means of the routes described in the Snowshoe and Ski Tour maps.

Ups and downs in the mountains

Seen from a distance, our proud mountain peaks appear to us as monuments of eternity. However, the figure indicating their height above sea level is by no means carved in stone: snow, ice and modern surveying methods lead to changes – sometimes with consequences.

The height of the 'Repère Pierre du Niton' in the port of Geneva, which serves as the 'mother of all height references in Switzerland', was redefined to 373.6 meters above sea level. This value is still used as the reference for all heights in Switzerland.

Switzerland is lowered by 3.26 meters

Already Dufour had adopted this boulder as the reference height for his maps, however, with a height of 376.86 meters. With the introduction of a new height reference, Switzerland was practically degraded by 3.26 meters – which had consequences for many proud peaks who lost their 3000-meter status.

Pizzo Centrale's destiny

Pizzo Centrale, the highest peak in the Gotthard Massif, was on record with a height of 3003 meters until the last edition of the Siegfried Map in 1936. When the summit of Pizzo Centrale was surveyed and determined as a new trigonometric point in 1874, a 1.6-meter iron pipe had been mounted in a pillar of stacked up rocks (cairn) and its height was actually determined to be 3004.6 meters. It was only thanks to this circumstance that the Pizzo retained its 3000-meter status even after the 'Repère Pierre du Niton' was redefined and all heights reduced by 3.26 m. However, the glee didn't last forever: during a general maintenance inspection in 1984, the rock pillar was dismantled and the iron pipe was replaced by a bronze bolt. This act practically 'decapitated' the Pizzo Centrale and from then on it was degraded to a 'profane hill' of merely 2999.2 meters.

The peak Mönch has grown

That mountains not only shrink but can actually grow is illustrated by the Mönch: in 1935 its height was determined to be 4099 meters. In 1993 new observations were carried out using state-of-the-art aerial photogrammetry – and lo and behold!: the result was 4107 meters, which not only provoked heated discussions in Grindelwald among the mountain guides but also triggered international news coverage. And the Office of Topography was also confronted with the situation. In their free time, a group of swisstopo employees climbed to the summit of the Mönch at the end of August 1997 and redetermined the height of the peak using GPS technology. Their findings confirmed the new height from 1993. The bottom line is: not only snow and ice have altered the topographic height of the Mönch, but also surveying techniques; for decades the old height values had just been copied.

Where humans and chamois meet

Formerly cartography was instrumental mainly in the service of national defense, in the meanwhile the tourist industry has greater demands as to content, precision and up-to-dateness of the products.

Today, hardly anyone goes hiking or on a ski or snow-shoe tour without serious preparation. An up-to-date map – be it on paper or digital – is a must.

Being mindful of fauna and flora

With the increasing exploitation of mountains for leisure and sport, exact maps are becoming more important also for other themes such as nature and game conservation. Being in the mountains today not only means looking out for oneself, but also looking out for and respecting fauna and flora. Snow-shoe hikers, for example, can adapt perfectly to the gentle slopes in forests or along the timber line. These sensitive areas used to remain mostly undisturbed – along with their inhabitants such as various types of grouse and chamois.

Mountaineers and nature lovers are invading these alpine areas where exploitation and protection are in conflict: consideration is called for. Therefore, all existing wildlife and nature sanctuaries as well as protected zones are marked in snow-shoe and ski tour maps. The Federal Office for the Environment (FOEN) provides swisstopo with the data to update the maps, and these are compared to the most recent trail guides in collaboration with mountain guides from the Swiss Alpine Club (SAC).

Still a great team: cartography and alpinism

Speaking of the Swiss Alpine Club: there is no getting around the SAC when talking about surveying and mapping the Alps. Since its founding in 1863, the SAC has been a key player for swisstopo – and the teamwork is as close as ever. The claim that the topographic survey of the Alps was promoted through mountain climbing is entirely justified, and seen from this angle, there is definitely mutual interaction between cartography and alpinism. Incidentally, by far not all mountain guides or tourists are equipped with electronic devices such as GPS: the training program for mountain guides still includes learning how to read maps – and it's a good idea to have both along. And by the way, a printed maps works even without electricity.

A nation of hikers

According to a survey 'Wandern in der Schweiz 2008' (Hiking in Switzerland in 2008), at least a third of the Swiss population hikes at least once in a while. The possibilities are immense: the Swiss hiking network consists of a total of 62,000 km of marked paths. The Hiking Maps from swisstopo are still the most popular source of information: 70% of the respondents indicated that they used the maps.



A carefully planned and coordinated route is essential in sensitive regions, especially in protected zones such as here in Sörenberg (Canton Lucerne).

Movement in the Alps

Did you know that the Alpine uplift has not yet come to an end? Repeated observations of the first order levelling network have shown that the mountain ranges in the Alps are growing by up to 1.5 millimeters a year with respect to the Central Plateau. In addition, permanent GPS observations on control points indicate that Switzerland as a whole is being uplifted by another millimeter with respect to the European lowlands. The uplift is caused on the one hand by the collision between the African and Eurasian continental plates, and on the other hand by long-term isostatic movements to compensate decompression due to glacial melting and erosion.

Frank-Urs Müller, Chief Justice of Canton Solothurn, President of the Swiss Alpine Club SAC

'The changes in the Alps are a major issue for the Swiss Alpine Club SAC. Glacial melting has a direct impact on various routes and consequently on maps and guides describing these routes. The documentation of these changes in the Alps as well as the quality and up-to-dateness of the data are vital to us – they are the key to safety. We have to know what is where, not only for the safety of hikers and climbers, but also in the interest of the environment – wildlife sanctuaries, for instance, come to mind.

Should there be a charge for the data? I think that they should be made public and accessible to everyone free of charge. However, if third parties use these data for their own applications to earn money, they should cost something. Quality has its price.

Being the landscape memory of Switzerland, swisstopo documents our past as well as the development of the habitat in which we live. This not only has a nostalgic aspect for me: it enables us to anticipate future developments and adjust to changes.'

The alpine region is changing

The increasing exploitation of the alpine region also has an impact on the demands of modern visualization and representation techniques.



A 3-D visualization of the alpine foothills around Gruyères (Canton Fribourg) using geodata from the Topographic Landscape Model swissTLM^{3D}.

With the aid of digital landscape and height models, various applications and situations can be visualized to create impressive and easily comprehensible images. In planning infrastructures for the tourist industry such as lifts or buildings, architects and planners can use these models to see how the objects can be incorporated in the landscape. The objects can be viewed from all sides to obtain a better idea of what the finished product will look like. This also applies to structures used in energy production such as wind turbines or dams.

This kind of spatial representation is important not only for specialists, but also for the layman, since not everyone who uses geodata for making decisions is an engineer. Also politicians, administrators, business people, and thousands of nature lovers and recreational sports enthusiasts benefit from these applications.

Particularly the graphic 3-D height models from swisstopo are popular for calculating profiles or slope inclinations.

Height models for (almost) any purpose

Representing the topography on a map has always been a true challenge. Because of its mountainous landscape, Switzerland has of course been fertile ground for developing innovative solutions for years. During the 1990s, the digital height model DHM25 was derived from the height information in the topographic maps 1:25,000. The most recent generation height model, swissALTI^{3D}, was developed in the year 2000 and is available for all of Switzerland since 2013. Aerial laser scanning was used to develop this newest model. For comparison: whereas the mesh size for the DHM25 is a full 25 meters, the one for swissALTI^{3D} is only 2 meters.

Surface and height models describe the three-dimensional form of the earth's surface, with or without vegetation or built-up areas. Their range of application is wide: calculating profiles, simulating avalanches, building relief models, making visibility studies, site planning, visualizing landscapes, etc. Three-dimensional visualizations are derived from height models. Examples are panoramas showing the view from a selected point in Switzerland, or simulated 3-D flights through a particular area.

Knowing how it was – and how it might once be

The future has already commenced. Today we are talking about 4-D models which include the dimension 'time': how did an area or situation develop in the past? And what might happen in the course of the next year or even decades? In times of climate change, such questions are crucial – for the tourist industry as well as for nature conservation and disaster control. For, if the environment is changing, man must adapt.

New standards for modernizing the national survey

Since 2010, the Topographic Landscape Model TLM is being developed in view of the long-term and extensive modernization of the national survey. It represents the landscape with all its natural and artificial objects, in three dimensions and at a very high resolution. This data is the foundation for various digital applications, and at the same time the basis for the newest generation of national topographic maps. The data is derived to a large part automatically, assuring that they are captured only once but can be used repeatedly and efficiently.

A series of map titles documents the development in design and content



1950
First edition of the National Map with Ski Routes



1958
First edition of the National Map with Ski Routes with a blue title cover



1980
National Map with Ski Routes on Syntosil (synthetic material)



1993
National Map with Ski Routes is changed to Ski Tour Map

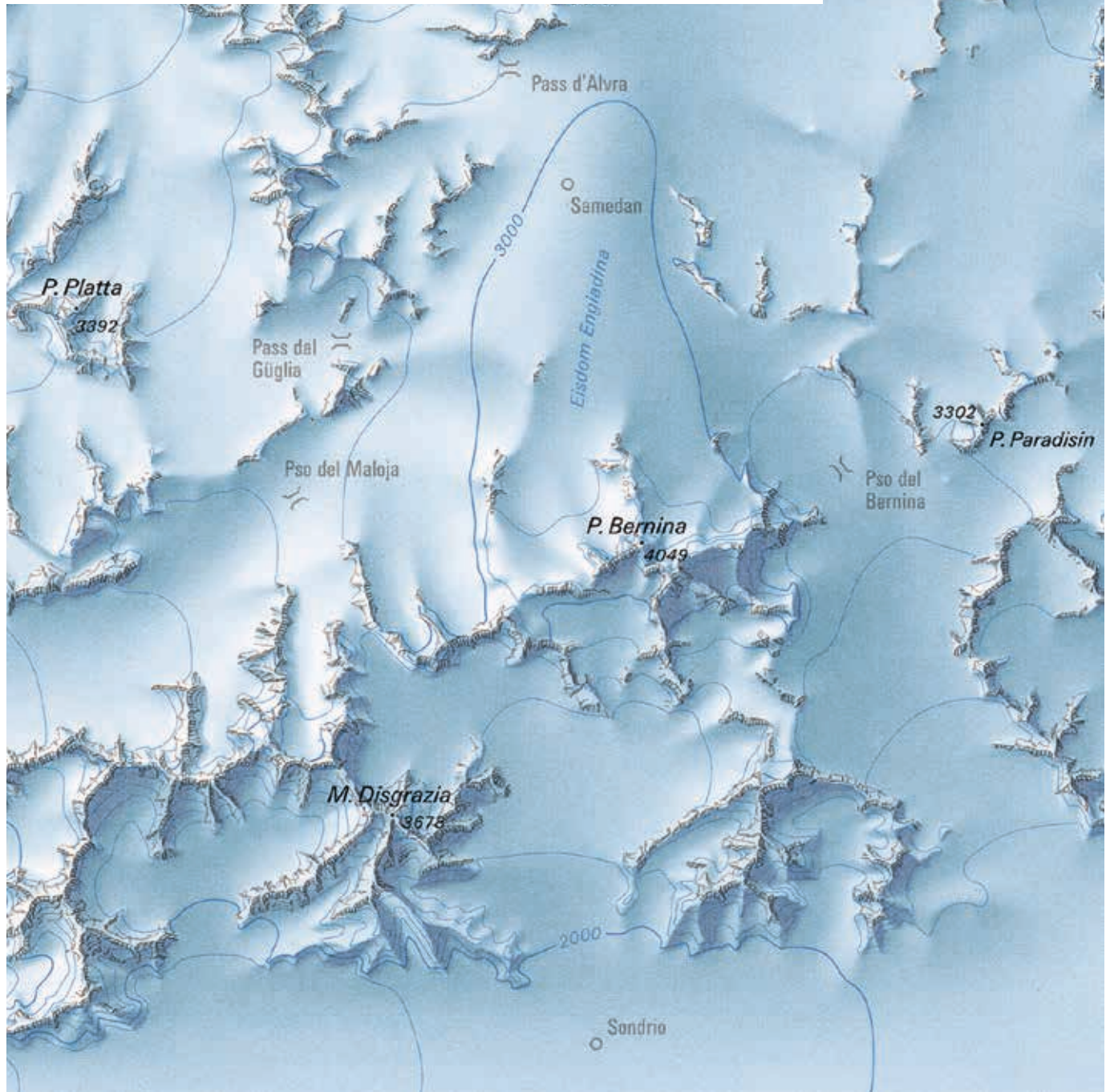


2014
Ski Tour Map is complemented with snowshoe routes



'Just keep your eyes open, the past is visible.'

Christian Schlüchter, Prof. of Geology, in the 'TagesAnzeiger' from March 26, 2010



New insights into the past, such as the ice domes in the Upper Rhine Valley (Canton of Grisons) on the map of the last ice age maximum, can be gained through interpreting the current geological situation.

When the Ice Age reigned in Switzerland

About 19,000 to 25,000 years ago, at the peak of the last ice age, large parts of Switzerland were covered by hundreds of meters of ice.

At that time there were already people living in Central Europe, also in Switzerland. Evidence for this is the discovery of human bones in caves in the Jura Mountains in the Canton of Basel-Land, an area which was not iced over during the last glacial period.

A new ice age map for Switzerland

Glacier research has provided answers to what it might have looked like in Switzerland during the last ice age. The first map of the glacial period published in Switzerland was the so-called Jäckli Map from the 1950s. This same map was integrated in the Atlas of Switzerland as Sheet No. 9. Since then, glacier research has won some important new insights, primarily through precise field surveys and new dating methods. Therefore, swisstopo decided to publish a new ice age map in collaboration with renowned glaciologists. The GeoMap 500 entitled 'Switzerland during the maximum of the last ice age' at the scale 1:500,000 appeared in 2009.

The secret of the ice domes

The most significant change with respect to the previous map is the reconstruction of so-called ice domes, mighty ice shells with a height of up to 3000 meters above sea level, to the south of the main Alpine ridge, in particular in the Inn Valley, the Upper Rhine Valley, the uppermost region of the Rhone Valley and in the Matter Valley. When they were first discovered, there was no explanation to their existence.

A comparison with today's precipitation records sheds more light on the subject: In contrast to today's predominant west to southwest wind directions, pronounced Foehn winds in ancient times brought enormous amounts of precipitation from the Mediterranean region to the southern

side of the Alps and deposited it on their southern flanks.

Based on the reconstruction of the extent of glaciers, conclusions can be drawn regarding the atmospheric circulation during the height of the last ice age. This map is also a major contribution to discussions about climate-related environmental changes in the most recent history of the earth.

Cartographic gags



Cartography is a fairly straight-forward and rather sober occupation, which, however, doesn't mean that cartographers don't have a sense of humor. An exceptional gag was the 'fish', masterly engraved in a coordinate cross near the shores of a marshy lake. The camouflaged fish made it through all of the proof-readings, but finally got caught in the net of the next update and had to be thrown out ...

Water makes a difference – to the economy and the people

Did you know that 6% of Europe's fresh water supply is found in Switzerland?

This small country with its glaciers, rivers, streams and lakes is Europe's water reserve. The sources of the Rhine, Rhone, Ticino and Inn Rivers are all in the Alps from where they flow towards four different oceans and seas. The Rheinfall in Schaffhausen measuring 150 meters in width and 23 in height is Europe's largest waterfall. There are more than 1500 lakes in Switzerland, among them the two largest ones, the Lake of Constance and the Lake of Geneva, both of which we share with our neighbors. The Lake of Geneva is in fact the largest fresh water supply of the continent.

Dams under observation

Water is an important natural resource in Switzerland and is of economic significance, not only for the tourist industry and the water supply but also for the production of electricity. Currently, 56% of the water power goes into the production of electricity. More than 200 dams and barrages are under the supervision of the confederacy. Just like tunnels and bridges, dams have to be permanently monitored in order to detect the slightest indication of slips and subsidence, rock and ice displacements or tectonic movements of the earth's crust. swisstopo is one of the institutions that carry out monitoring as a part of its program of engineering surveys. For these special surveys, engineers at the Office of Topography developed classical geodetic surveying methods at the beginning of the 20th century. During the 1990s, swisstopo once again acted as a pioneer by 'anchoring' monitoring control points in geologically stable areas using GPS (Global Positioning System) surveying methods.

Safeguarding the supply of electricity

The data and results from swisstopo are not only used for monitoring existing dams, they also serve as a basis for constructing new ones. 'Lagobianco', 'Linthal2015' and 'Nant de Drance' are currently being built as subterranean pump storage plants which will also guarantee an optimal supply of power in the future. About 4% of the hydroelectric power plants in Switzerland are pump storage plants. Water is pumped from a low-lying source up to a higher artificial lake where it is stored for the production of electricity. This is an ideal method for compensating the supply and demand of the electricity grid. Geodetic, topographic and geological bases, reference data as well as models are essential for both the planning and constructing of these structures.



High-precision GPS observations in the three-dimensional control network for the pump storage plant 'Linthal2015' (Canton Glarus).

Water: a resource and a hazard

Water is a valuable resource, but it also carries with it the potential hazard of flooding. For this reason the water gauges of rivers and lakes are permanently monitored. Relevant for these observations carried out with levelling instruments are the control points of the national vertical control network of swisstopo. Using these points as a reference for installing their staff gauges, the Hydrology Division at the Federal Office for the Environment (FOEN) can determine all of the water gauges in Switzerland with an accuracy of half a centimeter. An interesting aside: levelling has been used since antiquity for height determination and, despite GPS surveying techniques, it remains unparalleled for determining relative precision.

Kathy Riklin, Dr. Sc. nat. ETH, member of the National Council

'When I think of "swisstopo", the first thing that comes to my mind is quality maps. I was already confronted by these during school when we learned to read maps for orienteering. Even today I prefer a printed map. I place great value on detailed accuracy, something I miss in products from other suppliers because they are sometimes fairly abstract. Even in the digital world, where everything has to go fast and information has to be available at all times and all places, quality is still indispensable.

That's why the high-quality data and products from swisstopo are an important issue for me. We depend on them for orienting ourselves on mountain tours, for educational purposes at schools, just as we need them in spatial planning, for accurate ownership structures in real estate, and of course for the national control survey itself.

We can't do without swisstopo. I wish that our Federal Office of Topography will continue to assert itself in the future, especially in view of the conflicting interests of availability and quality, expenses and earnings, service for the common good and profitability.'

When climate gets out of hand

The climate is changing – and Switzerland is also affected, as temperature tables from the last century show.

The reason for climate change is the increase of the greenhouse effect in the earth's atmosphere, and we humans are to blame. Year after year the production of CO₂ (carbon dioxide) has increased: in 2010 it was almost 32 billion tons worldwide.

Glaciers are shrinking

Climate change causes a rise in the earth's temperatures and an increase in heavy precipitation. The rising temperatures are literally closing in on glaciers: since 1850, at their peak level of approx. 1600 km², the iced-over areas have decreased by around 600 km². This means that the total area has decreased by about a third during the last 150 years. The Laboratory of Hydraulics, Hydrology and Glaciology (VAW) at the Federal Institute of Technology in Zurich (ETHZ) compiles annual glacier monitoring from geodata gathered by swisstopo on special survey flights.

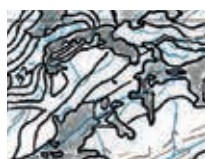
Geodata for prevention and damage control

Floods, storms, landslips, forest fires, and snow and rock avalanches are the most prevalent natural hazards in Switzerland. Climate change has a direct influence on the extent and frequency of extreme climatic incidents. Even though there is no absolute safeguard against these, their risk and damage potential can be reduced. swisstopo provides data for compiling damage profiles, forecasts and hazard maps, among others in the form of digital terrain models, aerial photographs and geological maps. With this information, specialists can, for instance, combine the potentially endangered landslide layers taken from the Geological Atlas of Switzerland with the slope inclinations from the Digital Height Model DHM to obtain first indications for mapping potentially hazardous landslips.

Safety – even tomorrow

A mountainous country such as Switzerland is subjected to a multitude of natural hazards. With data and products from swisstopo, risks can be ascertained and their negative consequences reduced, thereby ensuring sustainable spatial development.

Interpreting the past from the present – the development of the map of the last ice age maximum



Manuscript map



Separating valley glacier and firn areas



Constructing contour lines on the valley glacier



Distinguishing between 'thick' and 'thin' firn



Masking rock under 'thick' firn



No damage assessment without reference data: aerial photograph of Wiler in the Lötschental (Canton Valais) before and after the storm in October 2011.

'We don't wait, we start!'

Should a natural disaster occur, fast and easy access to the newest aerial photos right after the incident is essential for dealing with it. Often a survey flight has to take place within a very short time in order to document the situation and assess the damage in the disaster area. swisstopo has two of its own aircraft, each with a high-resolution camera on board. The cameras and their operators are always on standby for emergency response. In case of large-scale disasters, the old pilots' proverb is still legitimate for the swisstopo flight service: 'We don't wait, we start!'. Of course the aircraft, pilots, cameras and observers are not only on duty for natural disasters. Their daily work consists of collecting data used in national surveying as well as for the production of the nationwide orthophoto SWISSIMAGE.



Incorporating relief shading (for valley glacier)

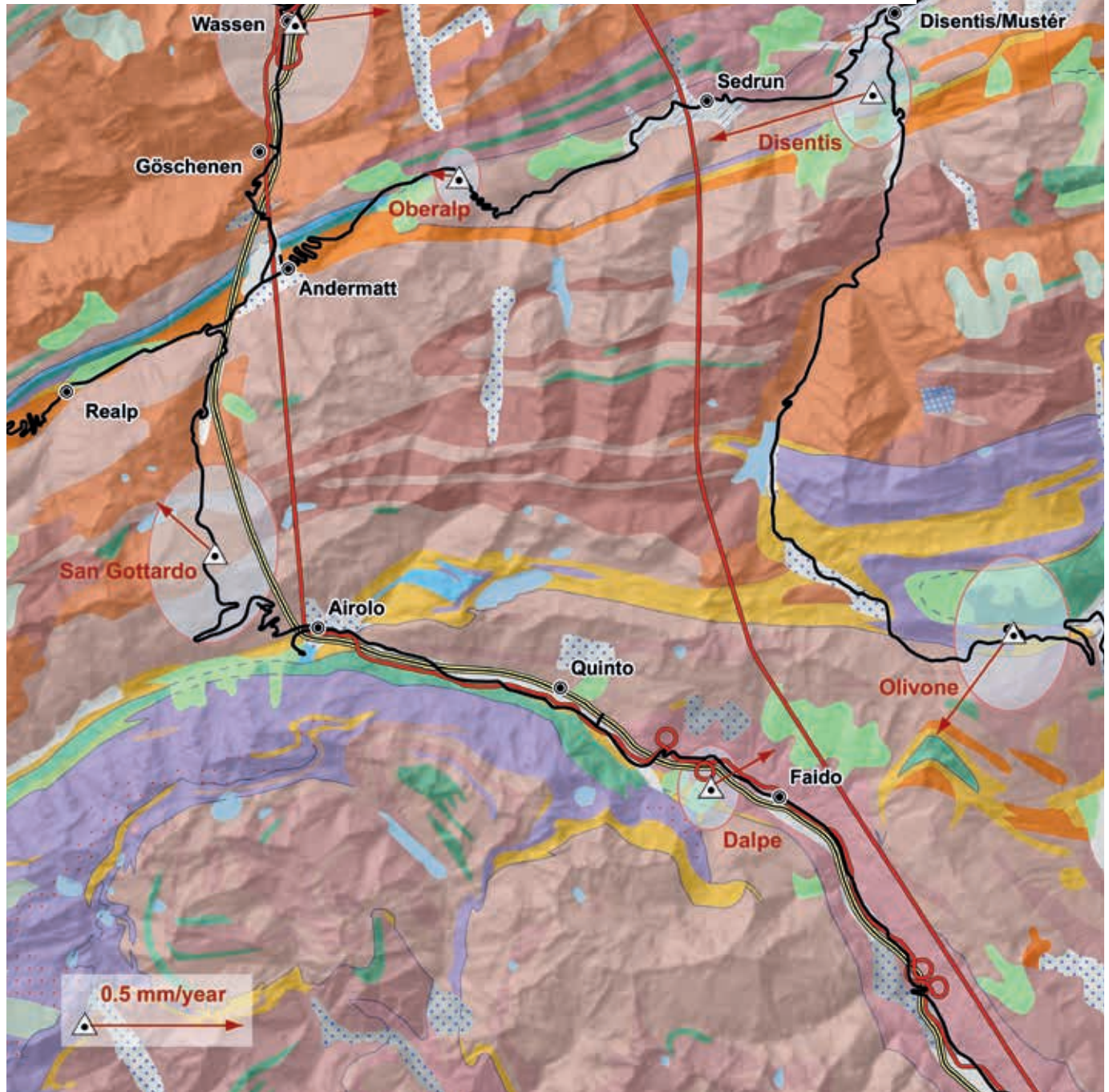


Fitting relief shading (transition valley glacier-firn) and lettering



'The Gotthard is an ambivalent place where the past and the future meet.'

Excerpt from the introduction to the themed exhibition 'Sasso San Gottardo'



Whereas transportation routes used to lead from the north into Ticino in the south over the Gotthard Pass, underground passages are of more significance today. The geologic maps from swisstopo provide information about the traversed regions. In addition, the image

shows relative movements (in mm per year) of a few LV95 control points monitored over the past 20 years together with the range of uncertainty of these movements.

The heart of the Alps

Not all that long ago the Gotthard was thought to be the highest mountain in the world. This honor – albeit that the Gotthard is a pass and not a mountain – was bestowed by Julius Cesar.

He considered the Lepontine Alps (including the Gotthard massif) to be the highest elevations in the Alps. This Latin idea remained uncontested for centuries. Of course we know better today. Even though the Gotthard has long since been dethroned as the highest mountain in the world, there remains something special about it: it is considered the heart of the Alps. The cornerstone for its reputation as a significant traffic route was laid already in the year 1200 when the Schöllenen Gorge was made passable. Subsequently, the Gotthard Pass quickly developed into one of the major Alpine passages.

A challenge for surveying

In Faido in 1997, the first surveying pillar was built for the 57-km-long Gotthard Base Tunnel, the longest railway tunnel in the world. Following the instructions from surveying engineers, the miners worked their way through the Gotthard Massif for 17 years. They also relied on geodata and models from swisstopo. The main breakthrough was celebrated on October 15, 2010. The north and south tunnels met at a hand's breadth: 8 cm in width and 1 cm in height. The capacity of highly modern geodetic survey methods and the quality of the required geodata provided by swisstopo were once again underscored by this successful operation.

From 'hard as granite' to 'soft as butter'

The Gotthard Base Tunnel also posed a particular challenge for geologists: the miners had to drill through different layers of rock that they described as 'hard as granite and soft as butter'. Geological base data from swisstopo such as maps, bores and profiles were instrumental for mastering these challenges as well. And even though the construction project in itself is

finished, the job continues. Special geodetic surveying stations were installed for a number of dams and barrages along the Vorderrhein (Anterior Rhine). From long-term monitoring observations on these stations, possible movements or changes due to the construction of the tunnel can be registered.

A site of myths and legends

On August 25, 2012 the themed exhibition 'Sasso San Gottardo' was opened. The challenges facing us today in dealing with our resources are the subject of this exhibition located in the galleries and caverns of a former underground fortress – illustrated by water, weather and climate, mobility and habitat, energy and safety. The initiators and proprietors of the theme world, the Sasso San Gottardo Foundation, consider the Gotthard to be 'a site of myths and sagas, of legends and national identity, where man built the Devil's Bridge and nature presents its elemental force'. swisstopo acknowledges the Gotthard's prominence with the map 'Sasso San Gottardo' from the series 'Once and Today'.

When rocks and minerals are worth their weight in gold

Whether for toothpaste, coffee cups, smart phones or computers: mineral resources are a key part in the production of a variety of articles we use in daily life.

And our consumption is on the rise: since 1950 mankind has used more natural resources than in its entire history.

Billion-dollar industry with raw material from Switzerland

The rock and minerals used in Switzerland's domestic construction industry comes mainly from its own open rock quarries. The supply of table salt and special clays also comes mostly from mines in Switzerland. Interest in the occurrence of raw materials spurred the production of the first geological maps. These provide detailed information about the distribution and nature of rocks and soil close to the earth's surface. The different types of rocks are distinguished through their formation, color and composition.

Today, specialists consult geological maps from swisstopo for finding large occurrences of different materials such as gravel, sand, calcium and marl as well as natural stones. These are the natural resources used in cement, brick and plaster factories, in sand and gravel plants and in other branches of the construction industry. These manufacturing processes accumulate to a billion-dollar market and are the backbone of the Swiss construction industry, providing a significant contribution to the economy.

Gold in Switzerland?

When speaking of raw material and mining, one question is often asked: Is there a natural occurrence of gold in Switzerland? The answer is yes, but only in very small quantities. And these are more relevant to the tourist industry than to the economy. The oldest known gold deposits in Switzerland are probably those in the valleys and rivers around the Napf. There are reports that already Helvetians and Romans were looking for gold in the Napf area. The largest gold finds in Switzerland are actually not from natural gold veins but – completely unromantic – from the slag of waste incineration plants: each year approx. 250 kilograms of gold worth over 10 million Swiss francs are recovered from waste.



Geologic outcrop in a stone quarry is a witness of the past: geology students are introduced to the history of the origins of rock.

‘Urban Mining’: raw material for today and tomorrow

On behalf of swisstopo, the Swiss Geotechnical Commission keeps an inventory of the natural occurrence of raw materials in Switzerland. In addition to these classical, primary raw materials, secondary raw materials are gaining significance. Large cities are today’s ‘modern mines’. Winning raw material from the demolition and dismantling of buildings and infrastructures and recycling them as secondary raw material or in road construction is called ‘urban mining’. As a supplement to the classical primary raw materials, these secondary materials will play a major role in warranting the supply. The occurrence of raw materials can be documented with the aid of geodata from swisstopo – because you have to know where they are before you can use them.

Renzo Simoni, Dr. Sc. techn., civil engineer ETH, Chief Executive of AlpTransit Gotthard AG

‘The term “landscape memory” brings to my mind the immense changes in our habitat during the last decades which can be reconstructed and visualized using older maps. Thanks to topographic maps we can also follow mutations in nature – for example glacial melting, the extent of forests, or modifications in the flow of rivers.

swisstopo is a key player in our project AlpTransit Gotthard. Without the geodetic models from swisstopo, the 57-km-long base tunnel under the Alps could never have been realized with such a high accuracy. And considering a construction time of more than 20 years, the time series derived from the geodata were also eminent for this project.

As far as I’m concerned, the Swiss national maps can still be considered to be the best in the world. And thanks to the outstanding quality of swisstopo products, I have never experienced any unpleasant surprises with geodata, either professionally or privately.’

The future is under ground

If we live under ground one day, as many science fiction movies suggest, remains to be seen – yet one thing is clear: managing the deep underground is becoming more relevant, for instance for geothermal energy or for long-term storage.

Underground energy for heat and electricity

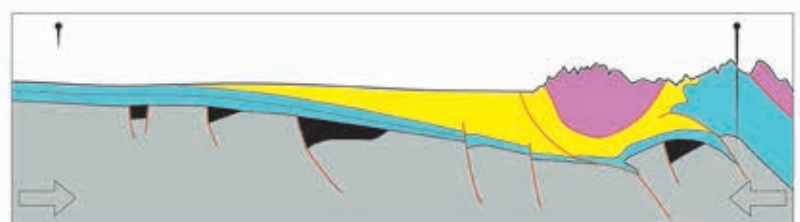
After the nuclear disaster in Fukushima in 2011, the Federal Council and Parliament resolved to harness renewable energies for supplying power in the near future. Geothermal energy is one of these. There are different methods for exploiting underground heat, for example, geothermal probes combined with heat pumps for heating buildings. These probes are normally installed at depths up to 400 meters.

Electricity can also be harnessed from the underground. However, this requires drilling down to 2000 to 5000 meters, since the required temperatures of over 100 °C can only be found at those depths. It is assumed that in the long term, a significant proportion of the electricity used in Switzerland can be supplied by geothermal energy. Together with other renewable energies, Switzerland would not have to rely as heavily on imports but instead become more energy independent.

Visualizing the underground with geological 3-D models

The underground can not only be used to supply heat and electricity but also as a depository for waste material. Traffic routes are built underground, and groundwater is tapped. The greater the exploitation of the underground, the more important it is to resolve certain issues: To whom does the underground belong? Where are conflicts in its use – and where are which resources? To answer these and other questions and to coordinate the exploration and use of the underground, the Geological Survey at swisstopo establishes three-dimensional geological models for visualizing the complex circumstances in the underground. These 3-D models are based on geological maps, natural outcrops, drilling cores and seismic data.

Folding of the Alps as a geological journey in time

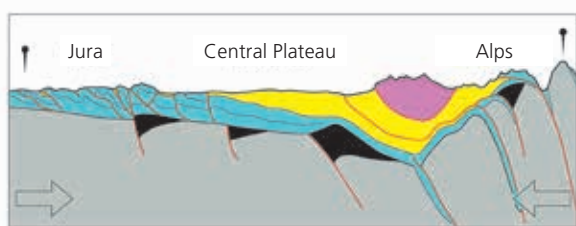


15 million years ago

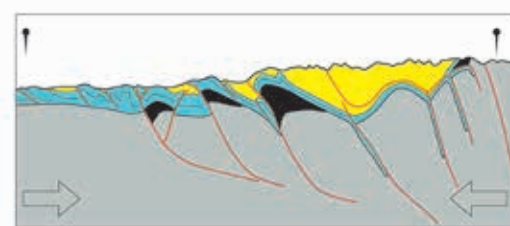


Researchers from the Federal Institute for Geosciences and Natural Resources in Hannover, Germany (Bundesanstalt für Geowissenschaften und Rohstoffe BGR), make a boring in the Rock Laboratory Mont Terri (Canton Jura) to extract opaline clay cores.

Research at the rock laboratory Mont Terri
 swisstopo operates the Mont Terri rock laboratory near St-Ursanne, where a research program has been running since 1996. An international research team is investigating the characteristics of opaline clay 300 meters into the mountain. The Swiss Federal Council declared this type of formation as the preferred host rock for storing highly radioactive waste material. Mont Terri also serves as a laboratory for non-nuclear research such as CO₂ storage, shale gas and geothermal energy. Since 2011, an exhibition in the visitors' center provides information about the activities of the laboratory and answers questions concerning the long-term depository.



today



in 15 million years

Heading towards the digital age

When Francis Jeanrichard became Director of swisstopo in 1981, it was called 'Federal Office of Topography' and had about 150 employees. One of his major challenges was the introduction of computer-assisted cartography and the digitization of topographic maps in the 1980s.



Witnesses to history in a conversation. Two former and the present Director of swisstopo. From left to right: Jean-Philippe Amstein, Erich Gubler, Francis Jeanrichard

'swisstopo has a legal and binding mandate. Just because screws were selling better than nails didn't mean that we would start producing only screws.'

Francis Jeanrichard,
Director of swisstopo
1981–1998

The first GPS satellite receivers were tested for the national control survey in 1987, and in the same year, swisstopo purchased four geodetic receivers and introduced operational GPS surveying. The new GPS reference network for the national control survey (LV95) was established during a number of observation campaigns.

In 1989, the first digitized map revision was tested on Sheet 1168, Langnau im Emmental, at the scale 1:25,000. In 1992, several computers were acquired for revising thematic maps, and an in-house network (LAN) as well as an exposing device were installed. At the turn of the year 2000/01, engraving on glass was finally replaced by digital cartography.

'When are we going to jump on the bandwagon?'

The last 25 years have witnessed rapid development not only in technology, but swisstopo has also experienced far-reaching changes in a short time. In his term of office from 1998 to 2005, Erich Gubler dealt with the fusion of swisstopo and the Cadastral Survey, and the launch of COGIS (Coordination, Geo-Information and Services in the federal administration). Technological development offered and still offers new possibilities – but also challenges, not least the cost. Of burning interest was always the question: When do we jump in with new technologies? Once GPS was introduced, it became clear for swisstopo: 'Now it's interesting: this is the technology of the future!'

Management with a performance mandate and the right instinct

The responsible managers at swisstopo had the right instinct for potential technologies, then as well as now, and invested resources and time accordingly. Flexibility has always been written in capital letters at swisstopo. With the start of FLAG (management with a performance mandate and a global budget) in 1997, swisstopo seized the necessary elbowroom to fulfill its legal mandate as well as to keep up with the free market enterprise. With FLAG, swisstopo was able to prioritize its tasks, and the global budget made it possible to implement financial means where most needed.

‘You can make good products with good people – and if you make good products, you get good people.’
Dr. Erich Gubler,
Director of swisstopo
1998–2005

Present on the Internet

The triumph of the Internet also had far-reaching consequences for swisstopo. The website swisstopo.ch was introduced in 1997. Further websites for different topics followed, such as: ‘cadastre.ch’, the portal to the official cadastral survey, the PLR cadastre and land register; or ‘geologieportal.ch’ for the information platform to the world of geology in Switzerland. By the way, our office adopted its current name from its website: the term ‘swisstopo’ was chosen for the Internet address because it was conventional in all languages in Switzerland. Since 2002, ‘swisstopo’ is the abbreviation for the still official designation ‘Federal Office of Topography’.

The new geoinformation act: a milestone

On July 1, 2008, the new Geoinformation Act (GeolG) came into force. For the first time in its history and as one of the first countries in Europe, Switzerland has a modern legal basis with future prospects. The aim is to make the most recent geodata available for broad application by administrative authorities, the economy, society and science – sustainably, quickly and easily accessible, at an adequate quality and affordable prices. Geodata from the federal administration are publicly accessible and can be used by anyone as long as there are no conflicting public or private interests. The Geoinformation Act is the legal basis for all activities at swisstopo.

Good people work well

In the year of its anniversary in 2013, approx. 350 employees are pursuing their various tasks at swisstopo. Today, as then, they account for swisstopo's most important asset.

With their professional expertise and personal commitment, they warrant the high quality of the products and services also in the future.

The rapidly developing market for geodata requires not only a high degree of flexibility, but also a good amount of innovation: if you want to be at the forefront, you have to recognize trends and potential developments early on and act on them. Or in other words: you have to know what clients want before they themselves know. This is only feasible with good people and the corresponding leeway made possible by FLAG, i.e. management with a performance mandate and a global budget.

Interesting tasks – and perspectives

swisstopo is seen as a 'dynamic institute' and an attractive employer offering interesting tasks and perspectives for qualified and motivated personnel. More than a third of the employees follow a part-time work schedule. Some share

a position and others work from home one day a week. The often-cited work-life balance is an important topic at swisstopo – for all levels: modern work schedules are popular for all employees, even on the management level.

Drawing motivation from that which comes into being

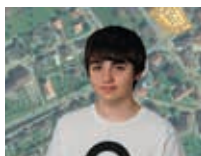
Periodical personnel surveys confirm that a large part of the employees is satisfied with the working conditions and atmosphere at swisstopo. Not only the working environment acts motivating: swisstopo is and always has been a production facility. Those who work there take part in the development of innovative products and create something that has a market value.

The spirit of the times is also influential: today, geodata is an extremely valuable commodity. And its value is steadily increasing with the growing individualization of applications on the Internet. Exciting projects and long-term perspectives open

The future begins with today's youth. What are their prospects?



Lukas Bögli,
First-year apprentice, geomatician majoring in cartography
'In my job I can be creative as well as engage in technical work.'



Aljoscha Keller,
Second-year apprentice, geomatician majoring in geoinformation
'I love the diversified and challenging tasks in geoinformatics.'



Lena Strauss,
fourth-year apprentice, cartography
'One day I would like to travel around the world through maps.'



Yaël Breuleux,
Second-year apprentice, commercial business
'I chose this profession because it is very versatile.'



Thashvitha Bavanantharajah,
Fourth-year apprentice, computer sciences
'My strong suit as a computer scientist: being helpful and working precisely.'



Midge Mathur,
First-year apprentice, print technology
'I like working in a team and appreciate the teamwork at swisstopo.'

up for those who are involved with geoinformation. The reputation of swisstopo as a competence center for geoinformation has been carried far out into the world and also contributes to a good working atmosphere: the staff is proud of its work – and of its employer.

Vigorous and savvy apprentices at swisstopo

About 30 young people are completing their vocational training as geomaticians, IT specialists, printing technicians and print media specialists, or commercial employees. Apprentice positions for geomaticians are popular: the attractive combination of technology and design is very appealing. The number of apprentices engaged by swisstopo amounts to 8%, which is clearly above the average of 4% to 5% for the federal administration.

The vocational teachers at swisstopo profess a high degree of motivation and responsibility among their students. The young people trust their abilities and their instructors. They know about the market – and also that they will not be the only ones to have to assert themselves. Many are aware of their further education even during their apprenticeship. A life of continuous learning is already self-understood for many: 'We don't have one profession – we have several'.



Valon Fazlija,
First-year
apprentice, print
media specialist

'My favorite job is with the folding machine because there you have to be extremely precise.'

Vocational teachers at swisstopo

'We not only want to help our apprentices in learning a solid profession, we also want to promote their creative and innovative potential. Education and performance are of course significant, however, we also value the attitude and conduct that these young people show towards their work and their clients. Our apprentices should take responsibility for their jobs and what they do. We can show them the meaning of good management and how they can creatively and effectively meet problems and challenges.'

Practical experience is highly rated in the training program. Our prospective professionals should know how the market works and be able to perceive trends and demands. Those who do their training here aren't restricted to their "own four walls" but gain in-depth access to all domains of swisstopo. No wonder that our apprentices are known for "being on the ball" in our profession. And their opportunities in the job market are accordingly.

We have come to know and appreciate our apprentices as being interested, alert and motivated. They reason critically and want to achieve their goals. The training at swisstopo is their first big step in their professional lives.'

Stefan Arn, Michael Pfanner, Marlyse Ritter,
Heinz Weber

swisstopo is on the move

Since the Geoinformation Act came into force in 2008, perspectives have changed: in addition to commercial point of view, the economic use has come into focus.

Geoinformation should be available for a wide range of applications and generate added value. swisstopo is caught in the conflict between 'public service' and returns: Should good data and their maintenance (upkeep and harmonization) cost something? And if so, how much? Today geodata can be viewed and printed as maps and plans under geo.admin.ch. Yet the call for 'open data' is becoming louder: especially corporations are demanding that not only access to geoinformation and geodata should be inexpensive or even free of charge, but also their acquisition for different applications.

The future is mobile

swisstopo is on the move – and is being moved: technological revolutions and advancements in society will pose challenges for swisstopo also in the future. Mobile technologies are going to play an even greater role – coupled with expectations by users. Already many expect that changes are captured immediately, published and viewable on smart phones or tablets. At this time, most of the geodata at swisstopo are updated in a 6-year cycle. Is this too slow for our dynamic society?

Promote collaboration, master complexities, exploit leeway

Challenges can also be found in other domains. One of our major concerns is about promoting collaboration – between the federal administration and the cantons, between various kinds of professions, different cultures and mentalities. swisstopo wants to do its part to meet the expectations of the numerous geoinformation user communities – thereby keeping cultural diversity alive.

Furthermore, developments of vectorized maps and models for 3-D and 4-D representations and analyses are pending on the technical level. The impact of partnerships and 'crowd sourcing' will continue to grow, in that external and private offices will also collect and process geodata, thus increasing the complexity factor. Freedom and leeway will become more important than ever: managing human resources must include the most modern methods and not rest on personnel figures.

Knowing where – in the future as well!

Approximately 80% of all decisions made by the public have to do with geoinformation. It constitutes the basis for planning, enactments and decisions of all kinds – in the administration just as in politics, the economy and science and in the private sector. The products and services from swisstopo provide indispensable information for making decisions and allow a glimpse into the future: 'swisstopo – knowing where' stands for swisstopo's legal mandate and its visions, for the next 25 years and beyond.



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Title image: Region around Bern represented as a journey in
time with products from swisstopo. From the base data of the
Dufour Map to the National Map to the aerial photograph.



