

## **MOUNTAIN MAPS IN THE WEB-BASED "SWISS WORLD ATLAS INTERACTIVE" – CHARACTERISTICS AND ADDED VALUE FOR GEOGRAPHIC EDUCATION**

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### **ABSTRACT:**

All modern school atlases contain topographic or thematic maps about mountainous regions. They are mostly used to teach specific landscape shapes or to show relations between thematic objects, distribution patterns or processes connected to the terrain. The new "Swiss World Atlas interactive", the online version of the established printed "Swiss World Atlas", provide also different representation types for such teaching purposes. We will give a brief overview on the geographic education in Switzerland and the current circumstances, teachers and students are faced with. Afterwards we present the "Swiss World Atlas interactive" and further related aspects of the project. In the main part we discuss different types of interactive mountain maps and representations, their functionality, and their potential educational use and added value. By using the new atlas with the relevant representations, teachers could instruct their students in an additional and attractive way about mountain related subjects.

**Keywords:** *Thematic maps, "Swiss World Atlas interactive", online version, geographic education.*

### **1. PRINTED SCHOOL ATLASES WITH INTEGRATED MOUNTAIN MAPS**

All early printed school atlases contain a collection of classic topographic or thematic maps in different scales depicting mountainous regions. "Mountain maps" can be described as cartographic representations in orthogonal perspective which are presenting the topographic situation within a mountainous area, supplemented with other thematic and mountain related data (e.g. alpine vegetation, geology, rural land use). Relief shading and/or contour lines are often the adequate kind of terrain representation to support the perception. Besides classical maps, also perspective views could be created with computer-based modelling and rendering methods to represent the same cartographic content. When covering mountain-related topics, we may call such representations "3D mountain maps".

Representations of mountainous landscape sections in printed school atlases are often large to mid scaled. Thus, point objects (e.g. houses, mountain cabins, mountain peaks, and terrain points) and line features (e.g. river network, geological faults, and boundaries) can be shown in detail. Additionally, mountain maps often contain a complex pattern of areal objects (e.g. for the land cover, or for the geological situation). By integrating additional relief shading or contour lines, the whole map content could be rather complex. The interpretation of the mountain map or the recognition of the different object classes become a challenging task for students.

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## 2. GEOGRAPHIC EDUCATION IN SWITZERLAND

### Education system and secondary school levels

In Switzerland, the secondary school (from 7th to 13th grade) consist of two succeeding school levels. Concerning the school system however, every of the 26 different Swiss cantons (political and administrative states of the Swiss Confederation) have their own laws and regulations. The first secondary school level ranges from age 12 to 15 years, the second level from 16 to 19 (high school) (*Wikipedia, 2010*).

### Social and technical changes in teaching situations

Beside the school level, the particular teaching situation has also been changed massively over the past years (*Marty, 2007*). The applied teaching formats have been expanded. The classic formats like ex-cathedra teaching or individual studies with additional home work are still practised. However, according to teachers on the secondary school level, teamwork and group discussions are more common in daily teaching situations than some years ago (*Marty, 2007*). By introducing of computers in many classrooms and exercise laboratories, the students can practise their acquired computer skills. Moreover, the knowledge transfer among students is supported. Concerning information technology, teachers are often no longer the only experts in the classroom.

### Required student competences today

Today in many countries, teaching standards provide a guideline for teachers to compile and to organise their lessons (*DGfG 2007, EDK 2010*). In modern geographic education, the identification and the analysis of system processes and interrelations in our environment are more teaching objectives within the priority than the pure geographic knowledge about places and geographic features. In advanced classes, students have to recognise of distributions and complex patterns such as agricultural cultivation and climatic conditions within a specific region. Additionally, they must be able to interpret a geographic situation (e.g. potential questions: "What circumstances are responsible for the actual or future situation?", "Which specific physical or anthropogenic process causes what kind of impact on the environment?").

## 3. MOUNTAIN MAPS IN THE NEW DEVELOPED "SWISS WORLD ATLAS INTERACTIVE"

### The project of a web-based school atlas in Switzerland

Until today, the printed "Swiss World Atlas" plays an important role in geographic education in Switzerland and is often declared as a basic teaching aid. Based on an exemplary approach, over 400 maps and other representations of different geographic extent, scale, and thematic content are disposable (*Swiss World Atlas, 2008*). Even the atlas is not a mandatory schoolbook in the different secondary school systems of the Swiss cantons; it has a market share of more than 90% (*Marty, 2007*). Developed over the last decades, the atlas offers a wide range of large and small scale mountain maps depicting many regions all over the world. However, many of the maps in the printed atlas have at least two drawbacks:

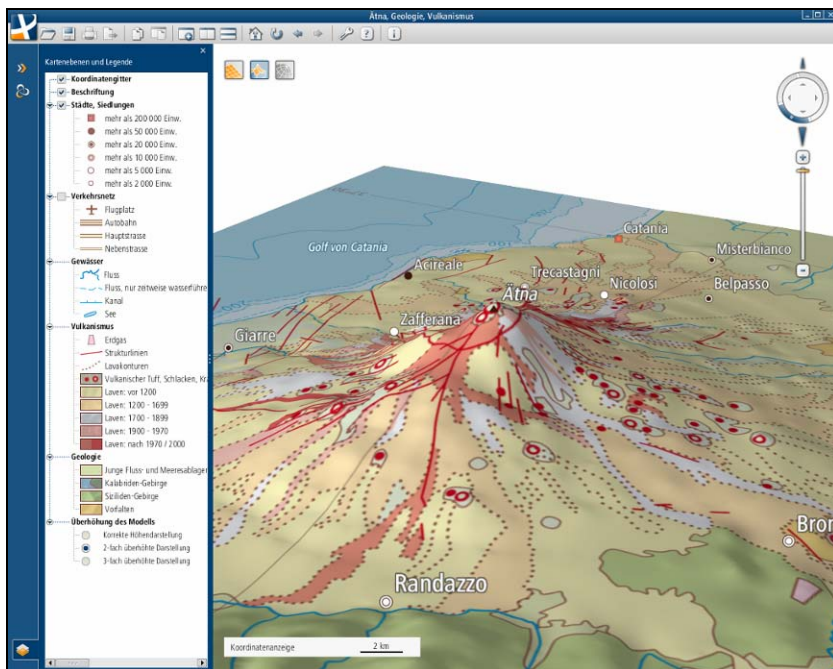
(1) The depicted region is represented in an orthogonal projection. Only contour lines, relief shading, and some height points allow students to perceive a mountainous region with its different terrain shapes (e.g. peaks, ridges, valleys, and gorges, smooth or steep slopes).

(2) The topographic and thematic content of the maps is often very complex. Especially geological situations combined with the topographic situation are difficult to be interpreted by students.

These two deficits are in conflict with the educational requirements of the printed "Swiss World Atlas" which should serve to both levels of the secondary school system. To face this dissatisfactory situation, an interactive version was developed by the Institute of Cartography at ETH Zurich in the last four years (Haerberling and Baer, 2005). This new web-based "Swiss World Atlas interactive" was launched in October 2010 as a free accessible web application (Swiss World Atlas interactive, 2010).

### Types of representations

The "Swiss World Atlas interactive" provides different types of map and related representation. A number of the printed mountain maps were adapted and integrated in the web atlas with almost the same map content. However, the graphic appearance had to be optimised for displaying on screen. This means for example that the used map font had to be chosen as sans-serif text. Additionally, the line geometry and thickness had to be drawn more generalised and distinctively.



**Fig. 1** Screen shot of the new "Swiss World Atlas interactive" showing a block diagram of Mount Etna in Sicily (Italy), embedded in a functional and user-friendly graphic user interface

Furthermore the colour contrast had to be enhanced. In addition to the classic topographic and/or thematic mountain maps, a new, innovative type of interactive block diagram should attract the students' attention (**Fig. 1**). Limited sections of diverse digital terrain models serve as basis. By combining and draping different thematic layers over a digital terrain model, these 3D mountain maps present the different physical phenomena or

anthropogenic structures in a perspective view. Due to their dimensional compactness, they are predestined to be explored in detail. In the "Swiss World Atlas interactive" also a new virtual globe is integrated. However, it is less suitable for detailed mountain representations, but better suited to present world wide structures or phenomena (Marty *et al.*, 2009).

### Technology and Functionality

The "Swiss World Atlas interactive" is programmed in Java and implemented using the Java Web start technology. The specially designed graphic user interface guarantees an easy access to the atlas and an intuitive handling (Cron *et al.*, 2009). The atlas consists of a wide range of functions, which are implemented and structured for users at the aimed school levels. The functions are programmed flexibly for all representations for future developments, so even for every mountain map. The whole atlas functionality can be divided in three main function groups as follows (Cron *et al.*, 2009):

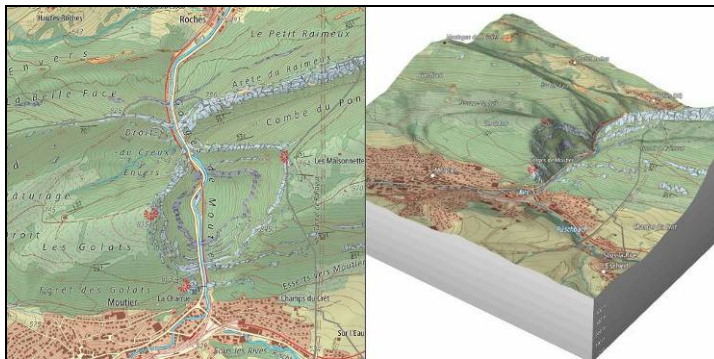
(1) Functions to search and select a representation (map search by different methods e.g. selection of region; map frames; geographic or thematic key words).

(2) Functions to display the map model with its thematic content (e.g. layer control; geographic information display) and to navigate (e.g. mode selection; zoom-in; zoom-out; panning; rotating; tilting).

(3) General functions and tools to control the atlas application (e.g. atlas start; language selection; saving function; printing function; export function with added map elements; copying function; adding new map windows; arranging open map windows; loading saved maps; help; system information; atlas exit).

### Examples of implemented mountain maps

In the current version of the "Swiss World Atlas interactive", maps of selected mountainous regions with special thematic issues are already included. In the following, five examples are described in order to highlight special characteristics and the added value of the interactive representations.



**Fig. 2** Comparison of an interactive topographic mountain map with thematic layers and a corresponding block diagram, both depicting the region of Moutier in the Swiss Jura Mountains

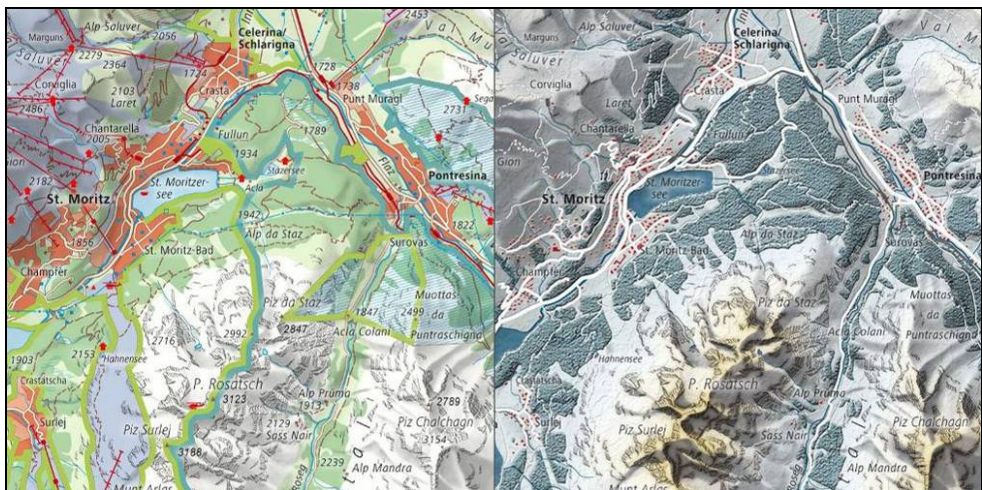
The Swiss region of Moutier in the Jura Mountains is a topographic situation of a typical limestone mountain range. It is presented by a map with thematic layers depicting also some geologic features. In order to present the distinctive, narrow gorge better, a

corresponding block diagram, which can be viewed from all angles, is included (**Fig. 2**). As speciality of this 3D model, different thematic layer groups can be switched on and off.

The region of Oberengadin (Switzerland) is presented in three different views: as classic topographic map, as naturally-looking summer situation, and as naturally-looking winter situation. All three views – available as classical maps and as 3D maps – point out the differences between a symbolised and abstracted map situation in comparison to different seasonal appearances in a naturally-looking map style (**Fig. 3**).

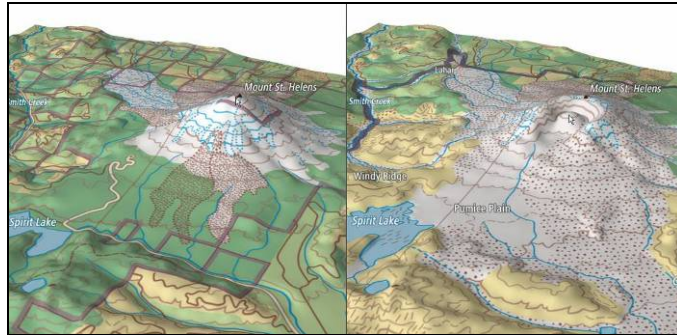
The representations of the region of Mount St. Helens volcano (USA) depict the changes in landscape morphology and in land use before and after the eruption in 1980 (**Fig. 4**). The simultaneous display of the two block diagrams show impressively the enormous power of volcanic activities in vulnerable regions leading to massive landscape changes.

The map of Mount Etna in Sicily (Italy) can be displayed showing the terrain either combined with the land use cover or with the geological and volcanic surface information (**Fig. 1**). On the one hand, both representations are ideal to demonstrate the structure of classic thematic maps by using layer techniques. On the other hand, the two block diagrams show the interdependency between the surface cover with the underlying terrain in a memorable way, especially when exaggerating the digital terrain model interactively.

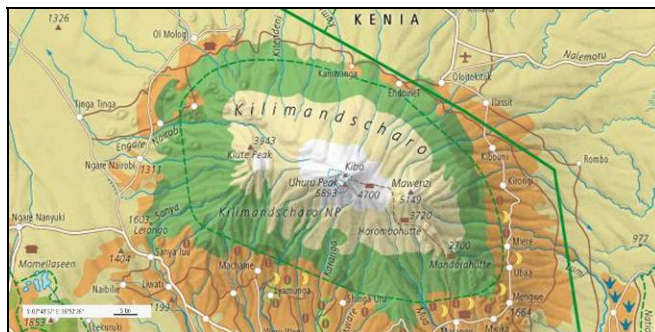


**Fig. 3** Sections of interactive maps presenting different situations of the Oberengadin region (Switzerland): classical topographic map (left), winter map in a naturally-looking style (right)

The map of Mount Kilimanjaro (Tanzania) (mid scale 1: 1'000'000; depicted area of 110 by 85 kilometres) shows the settlement situation, the road and trail network, and other infrastructure object, combined with the land use pattern and the political and national park boundaries (**Fig. 5**). Students can very quickly analyse the object classes and the underlying digital terrain model. By mouse-over functions and by selection of a zoom level, the geographic information is displayed in an additional map window. There, the geographic coordinates and the height above sea level are indicated. Furthermore, a variable scale bar for distance estimation is presented. The visibility of this interrelation will be enhanced if the map and the block diagram are displayed simultaneously in two or more atlas windows.



**Fig. 4** Block diagrams of the region of Mount St. Helens volcano (USA) before (left) and after (right) the eruption of 1980



**Fig. 5** Section of the interactive map of Mount Kilimanjaro with additional geographical information in the map window (geographic coordinates, variable scale bar for distance estimation) (bottom left)

#### 4. CONCLUSIONS AND FUTURE DEVELOPMENTS

By using the "Swiss World Atlas interactive", which also includes maps and block diagrams about mountainous regions, geography teachers get a wider range of possibilities to create an attractive teaching situation, especially by using the beamed representations as wall maps and by displaying the mountain related aspects step-by-step. Additionally, students can individually explore the focused geographic regions, if they are able to manipulate and navigate the maps and block diagrams interactively. Their attention for tasks concerning specific mountain related aspects will certainly be raised.

The gained experiences out of first tests of the "Swiss World Atlas interactive" in school classes were very promising. Responsible teachers told that especially the students' sense of orientation was activated, when they used perspective views of mountain maps. Furthermore, maps and the according block diagrams could be handled very easily. Generally, comparisons of two maps with different map content were designated as very valuable to recognise the interrelations of mountainous aspects. In the near future, the added value of the interactive mountain maps and 3D mountain maps will be evaluated more in detail. The results of these upcoming investigations will help to improve the content and the functionality of the atlas with its implemented mountain related representations.

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