

VISUALISATION OF MOUNTAIN-RELATED TOPICS IN THE “ATLAS OF SWITZERLAND 3”

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ABSTRACT:

This paper demonstrates new innovative functions in the Atlas of Switzerland 3. A special focus is laid on mountain-related topics. The atlas offers a unique possibility to not only look at single topics and phenomena, but allows also for a comparison of different themes. The various analytical and visualisation tools enabling such studies are demonstrated.

Keywords: *Innovative functions, Atlas of Switzerland 3, different themes, mountain-related.*

1. ATLAS OF SWITZERLAND: FROM PRINTED TO DIGITAL ATLAS

Since its foundation in 1925, the Institute of Cartography, the oldest academic institution for cartography world-wide, has constantly been involved in designing and editing atlas projects. The illustrated map topics and forms of visualisation were always manifold and adapted to the atlas type in question. In particular, the institute's map authors were always committed to fulfilling the users' needs and to implementing a high-quality graphic design of the map content. Besides conventional printed atlases, such as the Swiss World Atlas, the official Swiss school atlas, the institute has now dealt for the last 15 years with the conception and development of interactive atlases. Multimedia Atlas Information Systems (MAIS) are systematic, targeted collections of spatially related knowledge in electronic form, allowing a user-oriented communication for information and decision-making purposes. As in a conventional atlas, a MAIS mainly consists of a harmonized collection of maps with different topics, scales, and/or from different regions (after *Hurni, 2008*).

The Swiss national atlas, the Atlas of Switzerland, was first established in the 1960s at the Institute of Cartography of ETH Zurich by the former institute heads, E. Imhof and E. Spiess, and was edited over 35 years. Within this period, two editions containing 13 deliveries with a total of 146 map tables with 596 single maps were completed. This printed version presented a wide variety of topics on Switzerland on large-size maps. Since 1995, the Atlas of Switzerland was developed as a digital edition. The atlas has been re-published as interactive Multimedia Atlas in 2000. That version consisted of a 2D-part, presenting statistical data covering Switzerland, based on administrative boundaries down to the community level. Furthermore, a 3D-part allowed to visualise Digital Elevation Model data with a resolution of 25 m nation-wide. Over 13'000 copies of the Version 1 on CD-ROM have been sold, making it a best-seller for Multimedia products in Switzerland. From its first publishing, this multimedia atlas information system set high-quality standards in terms of both its graphic quality and interactive functions. It has also been presented at the Mountain Cartography Workshops at Rudolfshütte and Nuria with special emphasis on mountain related themes.

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2. ATLAS OF SWITZERLAND 2: EXTENDING THE THEMATIC DIMENSIONS

The Atlas of Switzerland 2, which was published in 2004 and has been sold over 7300 times since then, has become a well-established national cartographic product. The second edition of the interactive Atlas of Switzerland plays a prominent role in diffusing national spatial data and knowledge. The atlas is based on concepts implementing adaptive maps and interactive tools in a multimedia environment. The concept also integrates 2-D and 3-D maps as well as a highly developed graphic user interface. The basic idea of the Atlas of Switzerland is best communicated by the metaphor of the atlas as a “storybook”. Users should feel just as comfortable as with a book. Whether for laypeople or experts, the atlas should provide a framework for users to immerse themselves in maps, data and history. While “travelling” through the data, the map is always the starting point for investigative rambles and acts as an anchor. But the interactive map provides even more: in the classical sense, it represents the perfectly designed product, always showing cartographically the results of the user queries in an easily accessible form. With its sophisticated maps and easy-to-use tools, the Atlas of Switzerland not only satisfies the user’s curiosity, but also meets their demands. The Atlas of Switzerland is also a common tool at secondary schools and universities where it is frequently used to teach geography, cartography and even architecture. Private individuals use the Atlas of Switzerland as a source of information, to plan their recreational activities and for illustrations. More technical applications of the Atlas of Switzerland can be found in communication, transportation and water management. With its 2-D maps and 3-D views, the Atlas of Switzerland is also used for illustrations in numerous magazines and newspapers. Even 3-D visualisations are used in posters for political advertising. The Atlas of Switzerland unites many visualisation and analysis functions in an advanced form. The conceptual framework and modular technical design allow for sophisticated interactive map authoring and for future development of its functions. The main novelties of the Atlas of Switzerland 2 are (after *Sieber and Huber, 2007*):

- CD-ROM and DVD edition (Win/Mac), with accompanying booklet
- Licence free runtime edition with plug&play capability
- More than 1000 map topics. Update of the 250 statistical topics, adding another 100 statistical topics, and 650 topics from the field of “Nature and Environment”
- 2D section. New map types (raster and symbol maps, etc.), advanced analytical tools (comparison), amplified base map and geographic information
- 3D section. Smart navigation tools (“climber”, etc.), multiple layer overlay, advanced visualisation modules (analytic, cartographic, photorealistic)
- Multimedia elements. 600 text panels, hundreds of pictures, sound and video
- Visualisation attribute export to store the map setting
- Image export and printing.

3. ATLAS OF SWITZERLAND 3: ENHANCEMENT OF FUNCTIONALITY

The research and development period of the third version can be characterized as high-level enhancement of the atlas. Since the atlas GUI needed a comprehensive redesign, an in-house development of all tools and graphical technical interface components was realized. At the same time the GUI components of the 2D map part and of the 3D map part were unified. The atlas has been enhanced with 3D object labelling, a comprehensive query system, and a legend module using the smart legend approach (*Sieber et al., 2005*). Concerning 2D visualization, the data-driven multivariate map approach (*Huber et al.,*

2007) allows for versatile map symbolization. A new 3D modus dealing with statistical surfaces (Sieber *et al.*, 2009a) and augmented panoramic views complete the rich palette of high-end cartographic representations. The third edition Atlas of Switzerland 3 (Fig. 1) appears in autumn 2010 on DVD. In the following, the main features characterising the new edition are presented (after Sieber *et al.*, 2009b): New content, new GUI and advanced functionality.

3.1. New content for the atlas of Switzerland 3

For the new Atlas of Switzerland 3 the thematic domains from Version 2, i.e. Nature & Environment, Society, Economy, State & Politics were updated. Furthermore, data for three new domains, i.e. Energy, Traffic and Communication have been collected, resulting in additional 250 maps. All in all, Version 3 consists of about 1400 thematic issues!

The various data types of the huge amount of data were a main challenge: Statistical data, geometric data from GIS and cartographic sources, DTMs, and satellite images. Raster data have been tiled in various resolutions in order to build up an image pyramid. Vector data often needed cartographic refinement and attributing whereas statistical data had to be harmonised, checked for plausibility consistency and was aggregated to the respective administrative units in order to ensure the high cartographical quality level. A consequence of newly acquired data was also the need for new cartographic visualisations, which can be seen as one of the major innovations in Version 3.

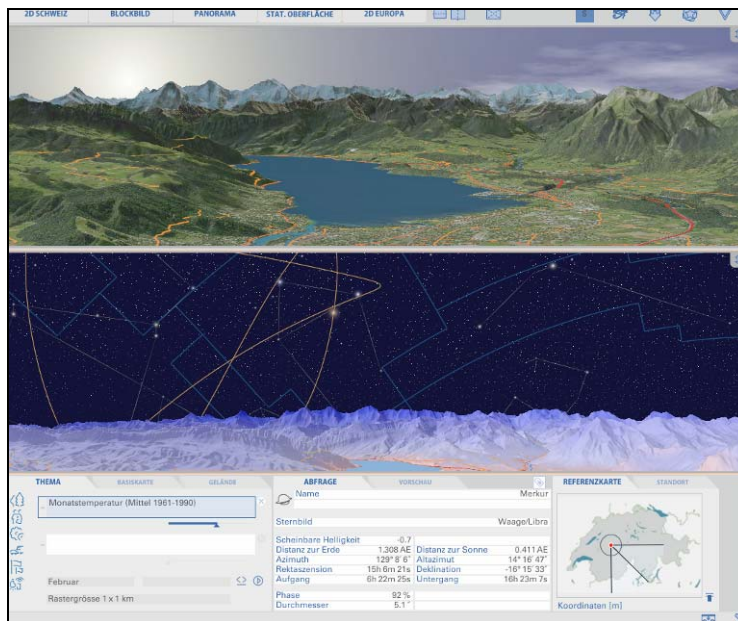


Fig. 1 Atlas of Switzerland 3 – GUI prototype with split screen option

3.2. New graphical user interface (GUI) for the atlas of Switzerland 3

Innovative Graphical User Interfaces (GUI) concepts can help in mastering the huge amount of information to be efficiently accessed and pleasingly presented. Five principles are the base for the GUI design of the Atlas of Switzerland and should therefore fulfil the above needs:

3.2.1 Layered layout

Those GUI elements (panels) representing functions with highest priority (most used, high ease of use) are placed at the top. This principle can be seen in **Fig. 1** with permanently visible and sufficiently sized buttons for map mode (2D, block image, panorama, statistical surface) selection, an eye-catching theme selection tool and the prominent placement of the maps area. Advanced or rarely used options should be made accessible indirectly through menus, pop-ups, or tabs.

3.2.2 Staged display of map information

With only limited space due to screen/windows restrictions and the wealth of map topics and navigation elements, data should be presented in a way that takes the reduced display area into account. There are several ways implemented in the atlas to solve this (**Fig. 2**): Discarding data of lower priority when place is scarce; this definition is done beforehand by editorial choice. The legend follows a tree structure with three main branches “Theme 1”, “Theme 2”, and “Basemap”, each having visual variables as “boughs” (layers). Branches can be individually collapsed, only represented by a title. Thematic legend has a higher priority than basemap legend. Toolbar GUI elements (located at the bottom of window), are laid out as follows: Elements with redundant or related map information representations (like toggling map layers), are combined into tabbed blocks (e.g. the reference and the location panel). Layers in the legend are automatically shown or hidden when toggling off/on the respective layers in the toolbar. Map information of only temporary interest is displayed ephemerally, e.g. the 3D preview panel hides behind the query panel after the changes to the 3D map have been updated in the main view.

3.2.3 Map centred view

The map is the central part of the atlas interface and should not be visually disturbed by other parts of the GUI. In the Atlas of Switzerland, as much space as possible is dedicated to the map window by placing permanently visible interaction tools at the screen’s margins. Furthermore, dialogs which are not part of the toolbar (below of map window) can be moved away. GUI elements are designed with low colour saturation allowing accentuation of the colour maps (**Fig. 1**).

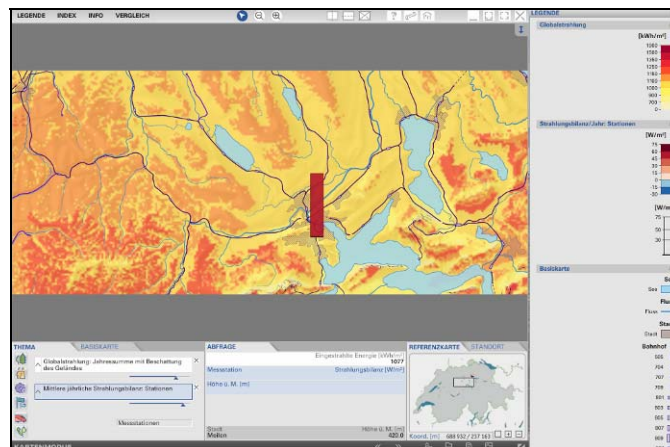


Fig. 2 Atlas of Switzerland 3 – Staged display of map information

3.2.4 Consistent interface for all map modes

In Version 2 of the Atlas of Switzerland, switching between map modes was a relatively copious and time-consuming procedure, also affected by a change of GUI layout and elements. Thus, the user prefers a consistent interface for 2D, panorama, block image and statistical surface modes (**Fig. 3**). GUI elements for common tasks should remain in place with only minor tool content adaptation. Some tools are only meaningful for specific map modes, e.g. profile display in 3D mode. Temporarily unused floating and tabbed panels are hidden or deactivated (such as the preview in 3D after refreshing the screen).

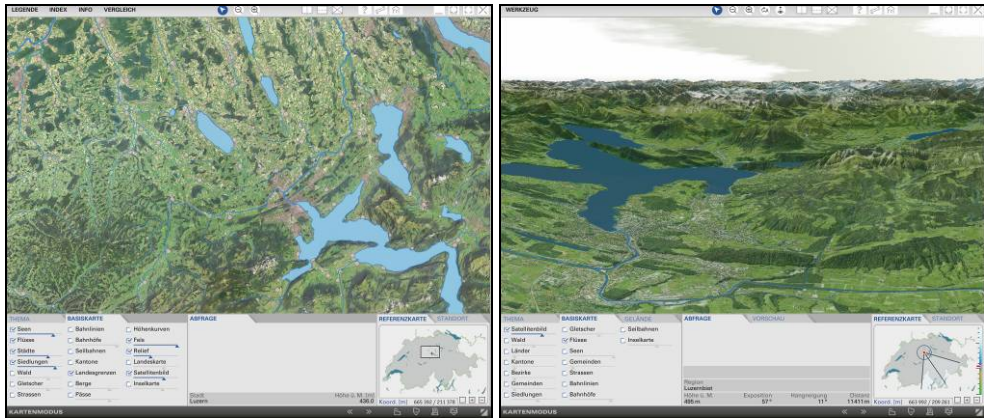


Fig. 3 Atlas of Switzerland 3 – Consistent interface for all map modes

3.2.5 Multiple map mode

Such an interface also significantly simplifies the simultaneous visualization of multiple maps showing the same or different map modes. The GUI allows for up to four maps being displayed in parallel with one of them being the (inter)active map (**Fig. 4**).

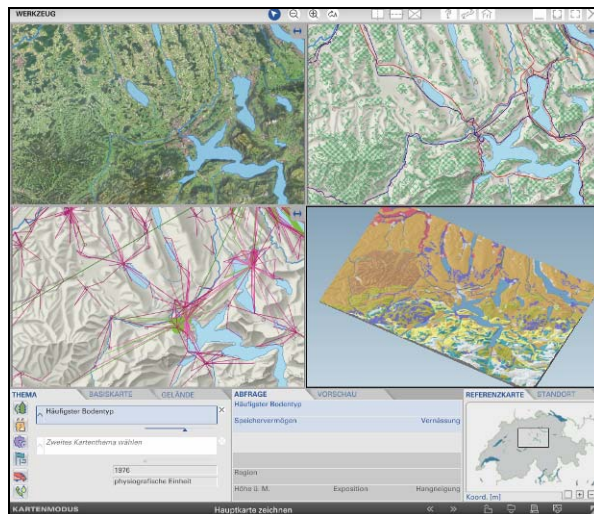


Fig. 4 Atlas of Switzerland 3 – Multiple map mode

4. NEW FUNCTIONS FOR RELIEF DEPICTION: APPLICATIONS FOR MOUNTAIN CARTOGRAPHY

The essence of the Atlas of Switzerland 3 is thematic cartography with high-level interactivity. Due to the new topics Energy, Traffic and Communication, new thematic map types, such as network maps had to be developed. For a detailed description, refer to *Sieber et al. (2009a and b)*.

Concerning possible applications in Mountain Cartography, the well-proven relief representation functions from version 2 have been further developed, namely the 3D map section. Many of the 3D tools like illumination, hypsography and cast shadow have been improved. **Fig. 5** shows a 3D mountain scene including cast shadows. Additionally, arbitrary cloud patterns can be added to the scene.

As a further 3D feature, geographic object labelling (**Fig. 6**) can be activated for panoramic views, block diagrams and statistical surfaces. By clicking on the object or its name, the object name can be easily indicated or omitted. Labelling facilitates spatial orientation and will also meet the demands of publication purposes. A very special feature is the visualisation of the starry sky including star constellations and planets (**Fig. 7**).

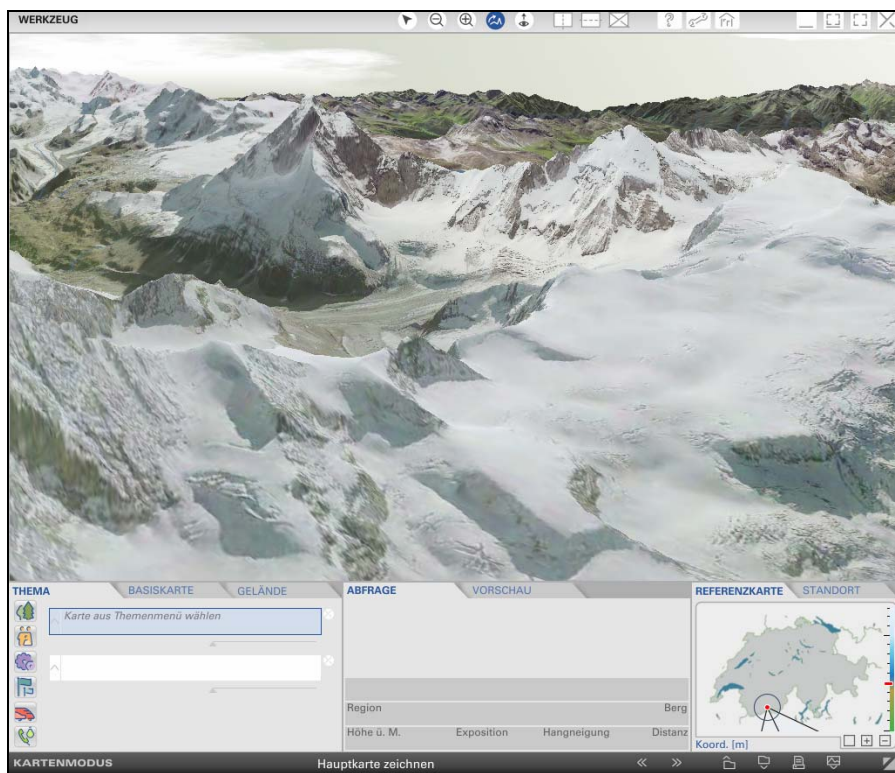


Fig. 5 Atlas of Switzerland 3 – 3D scene visualisation with cast shadows and cloudy sky

to the various functions. In the future, the original data should be stored and administered in a (distributed) database accessible over the internet. The functions should be made available as geospatial services which can be combined with other services and data layers. First concept studies for such an online version of the Atlas of Switzerland have already started and promise a bright future for Multimedia Atlas Information Systems.

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