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Cartographic visualization of the effects of climate change: a practical application for the Atlas of Switzerland

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Abstract:

Climate change represents one of the biggest challenges our society is currently facing. According to the IPCC (2023), the global surface temperature in the period 2011–2020 rose by 1.1 °C compared to the period 1850–1900. In the future, the increase could range from 1.5 °C to more than 4 °C, depending on the climate scenario.

Maps can be employed to facilitate effective communication of climate change: the topic has a geographical dimension, and the use of cartography can assist in making the problem more tangible and easier to understand for a broad public (Fish 2020). Data about climate change have an inherent temporal dimension, encompassing measurements from the past and predictions into the future. Interactive digital maps are well-suited for visualising time series of data, allowing the user to select different timestamps. Several atlases illustrate the impact of climate change using maps. For instance, the Climate Atlas of Canada (https://climateatlas.ca/), the web application of the IPCC (https://interactive-atlas.ipcc.ch/) or the National Atlas of Hungary.

We intend to use the Atlas of Switzerland (AoS), a desktop application with interactive 3D maps, for the visualisation of climate change in Switzerland. Maps presenting the changes in the zero degree level (the altitude where the temperature is 0°C) and the evolution of the glacial lakes are created for the AoS, and an additional map with the changes in the phenology is in preparation.

Some of the core strengths of the AoS are utilized: 3D data visualization, particularly for variables related to height, the use of 3D symbols and the possibility to control the temporal dimension. This allows to switch between observation periods in the past and predictions for the future. Furthermore, the AoS enables the combination of the aforementioned maps with other related maps.

The zero degree level is strongly related to the elevation and can be effectively represented with the 3D terrain model in the AoS (Figure 1). This map presents observations from the past and predictions for the future, considering two climate scenarios, thereby enabling the user to select which data to visualise on the map. The impact of climate change mitigation is shown by visualising the two scenarios on the same map: thus it is possible to accentuate areas that could benefit from a decrease in greenhouse gas emissions.

The map of the evolution of glacial lakes in Switzerland (Figure 2) focuses more on the combination of 2D and 3D symbolisation: the shapes of the glacial lakes are shown as 2D polygons, but because they are relatively small, additional spherical 3D symbols, whose volume is related to the area of the lakes, are added with an offset above the lakes. This gives a better overview of the distribution of lakes in the Swiss Alps, even from a distance. This map also combines past observations with predictions for the future.

There are some limitations to both maps: in the zero degree map, only averaged values for a selected period and for the whole country are shown, neglecting regional differences. The values should therefore be considered only as an approximation. The glacial lake map depicts all potential future lakes, even those that are expected to disappear in the future.

Despite all the limitations, we believe that these or similar maps are well suited to informing the general public about the impacts of climate change in Switzerland by clearly showing its effects. Other maps can be created to illustrate the effects of climate change further. One potential map could be one showing the evolution and future predictions of snow cover in Switzerland. In addition, if the storytelling functionalities in the AoS are further developed, by giving the user more possibilities to explore maps, and by adding more multimedia elements, these maps can be particularly well suited to present more facts about climate change.

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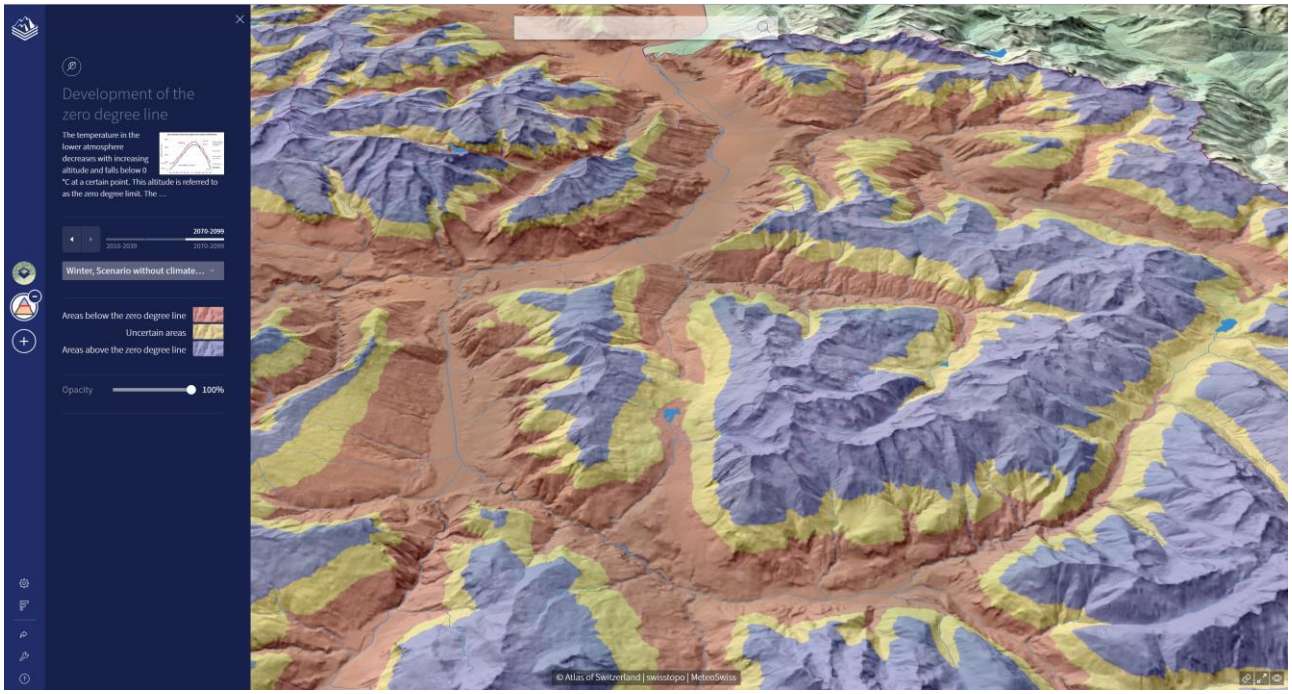

Figure 1. 3D Map showing the zero degree level in Switzerland considering the scenario without climate protection for the period 2070-2099.

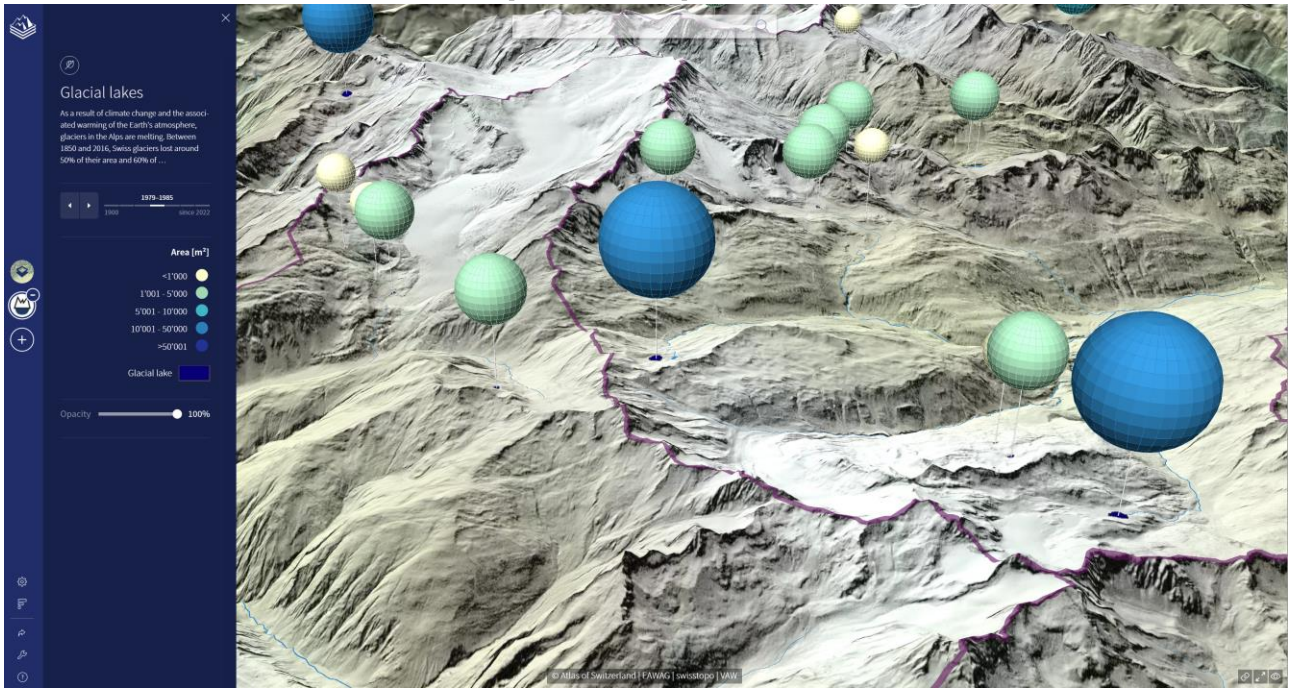

Figure 2. 3D Map showing the glacial lakes in Switzerland. The size of the spheres is related to the area of the lakes.

References

Carolyn S. Fish, 2020. Cartographic content analysis of compelling climate change communication, In: *Cartography and Geographic Information Science*, 47:6, 492–507, DOI: 10.1080/15230406.2020.1774421

IPCC, 2023: Summary for Policymakers. In: *Climate Change 2023: Synthesis Report*. Contribution of Working Groups I, II and III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, H. Lee and J. Romero (eds.)]. IPCC, Geneva, Switzerland, 1–34, DOI: 10.59327/IPCC/AR6-9789291691647.001

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