International Cartographic Association
Association Cartographique Internationale

#mappingmtushba – data collection and automated map generation

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Keywords: High Mountain cartography, map production, OpenStreetMap

Abstract:

While working on a new Alpine Club map around Mt. Ushba in Georgia in the Great Caucasus (Gröbe et al. 2021; Gröbe et al. 2022), a lot of experience was gained how to organize and conducting fieldwork with OpenStreetMap. The usage of OpenStreetMap as a data backbone offers access to a large volume of already available data, profits from an open and extensible data model, and a large set of tools for data editing and processing combined with the power of VGI. The gained know-how can be divided into two parts: collecting data efficiently and creating a map. Mapping campaigns took place in 2021 and 2022, both years, with around 10 participants. Challenges during this work and its preparation were finding unmapped, incompletely mapped, or ceased topographic features, getting information about missing toponyms, and a time- and cost-efficient, and at the same time secure organization of the on-site mapping.

Data collection

In preparation, it was necessary to identify missing or uncertain information. The catalog of objects which should be mapped was derived from existing Alpine Club maps and the feature tags of OpenStreetMap (Masino 2020). The collection of potential ways was a more time-consuming task. By collecting and comparing openly available GPS tracks, hiking guides, and old maps, a number of trails currently missing in OpenStreetMap could be identified. The comprehensive information collection summarized the knowledge of all the sources and became central for planning the office work on the data and organizing the extensive on-site mapping.

Based on the collected information, the routes were planned in advance and assigned to the mapping teams during the fieldwork. In preparation for the mapping, the teams were instructed about the individual routes in the evening before: They informed themselves about the specific task, the current vector data, and the aerial images covering the route. On tour, new data was collected, which could not be obtained from aerial images such as small paths, hiking routes, guideposts, and POIs. Overall, two strategies worked well, starting with known ways and proceeding to the less known ones. In connection to aerial images with partly visible paths, exploring downwards works better than upwards. Asking locals for ways can help sometimes, but the provided information still has to be cross-checked.

The collection of geographical names worked similar to the collection of missing paths. After reviewing and selecting various sources, an updated set of names has been compiled. Old maps play an important role because they sometimes contain names that are missing or ambiguously spatially related in more recent documents. In combination with background literature on the region, uncertainties in the assignment of geographical features can frequently be solved. Asking locals helped in finding the ideal spelling. Nevertheless, geographic names and their relation to spatial features remain hard to verify because one deals with conventions rather than absolute truth. The result is, however, a much more consistent toponym base both in the OpenStreetMap database and in the derived produced map.

Automated map generation

Another part of the project aimed to create an automated workflow for the map production, implemented using the most recent OpenStreetMap data stack using osm2pgsql and PostgreSQL/PostGIS with QGIS as a renderer. The results are displayed as a WMS and a slippy map with daily updates so that all participants in the campaign can immediately see the progress and the latest processing status. For an example, see the slippy map preview in Figure 1. It allows the viewing of all essential data up-to-date, quickly, and in an appropriate cartographic symbolization. The offered function allows solving the common task of reviewing the progress, planning routes, and measuring distances in a web browser.

Abstracts of the International Cartographic Association, 6, 80, 2023.
31st International Cartographic Conference (ICC 2023), 13–18 August 2023, Cape Town, South Africa.
https://doi.org/10.5194/ica-abs-6-80-2023

There are different stages of map production: The first task is downloading the OpenStreetMap data and clipping it to the region of interest. An import into the database is the following, making the data ready for use within a GIS. Prior to any cartographic generalization, the data has to be reprojected into an appropriate UTM projection and to be harmonized. Thus, we arrive, e.g., at valid elevation values and standardized attributes. The following generalization is entirely based on SQL queries within the database and comprises various generalization operators: refinement, aggregation, simplification, and typification are applied with individually customized constraints/parameters for each feature class. Finally, the rendering of the data is carried out with QGIS. The project stores the symbolization and labeling of the data independently. The project is also in use as a configuration for WMS using the QGIS server.

If the high-quality graphic standards of an Alpine Club map have to be fulfilled, some challenges of the automated map derivation remain unsolved. This makes some manual fine-tuning necessary, such as the placement of labels and adjustments of peak positions or sections of a path. The aim is to keep the dynamic link to the database running, to apply manual adjustments of a feature only once. This can only be achieved by storing such manually modified features independent of OpenStreetMap because they are specific to the map and its unique graphics. Currently, our solution is to hold the adjustments in separate tables and merge them by IDs or by their positions during the update process. Through this split storage, editing has to be more sophisticated than just a standard feature alteration. A record in the separated table needs to be kept and has to be observed to allow the adjustments to stay active over an extended period.

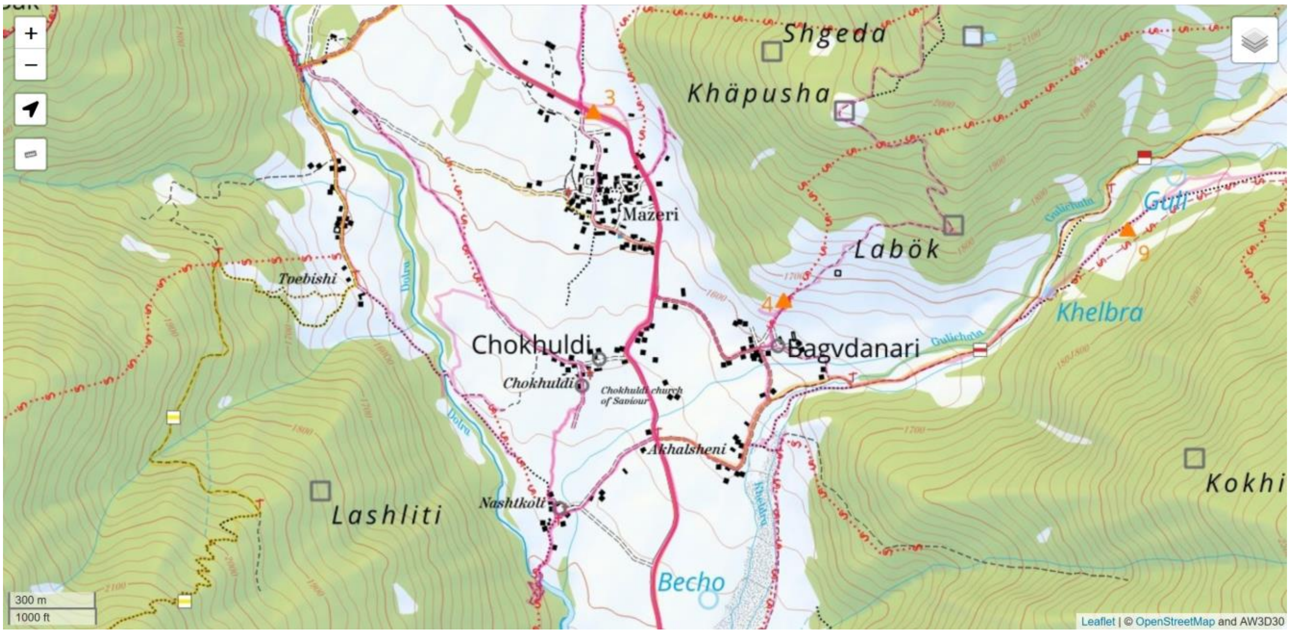

Figure 1. Leaflet-based preview of the map, showing potential paths (dotted back, red "S" on top) and GPS tracks from the fieldwork as an orange and pink overlay.

Acknowledgments

We want to thank the participants of our field campaigns in Svaneti in 2021 and 2022 for their work and contribution to projects and the students who contributed with their thesis to the project's progress.

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https://doi.org/10.5194/ica-abs-6-80-2023 |