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Mastering Cartography with QGIS: Unlocking Its Full Potential

Andreas Neumann [a,b,*]

[a] QGIS.ORG – andreas@qgis.org, [b] Institute of Cartography and Geoinformation, ETH Zurich – andreas.neumann@ethz.ch

* Corresponding author

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Abstract:

QGIS is a popular open-source geographic information system that is constantly improving its cartographic capabilities. It not only allows to symbolize and label maps, but also to create sophisticated layouts and simple reports. During its more than 20 years of development, more renderers, additional symbology and labelling options have been added, and existing ones have been polished. The powerful expression system, combined with data-defined property overrides, adds to the flexibility. Most recently, support for the CMYK color model allows specifying CMYK colors for symbols and labels and preparing maps for professional printing.

The presentation will cover some advanced mapping techniques from both thematic and topographic cartography and demonstrate how they can be achieved in QGIS. This includes some lesser known or even hidden features that can help cartographers unlock their full potential. Examples start with complex strokes and fills (e.g. line offsets, advanced strokes, marker lines), then move on to symbol levels and the separation of layer drawing order from alternative layer order and nesting in groups. When it comes to automatic label placement - using and extending the PAL library (Ertz et al, 2009) - QGIS offers a wealth of fine-tuning options and different placement algorithms that respect cartographic label placement rules. Combined with the selective masking for labels and symbols, both can be masked against darker symbol levels of other layers, e.g. contour lines or other layers that are part of the map situation (traffic network, buildings, etc.).

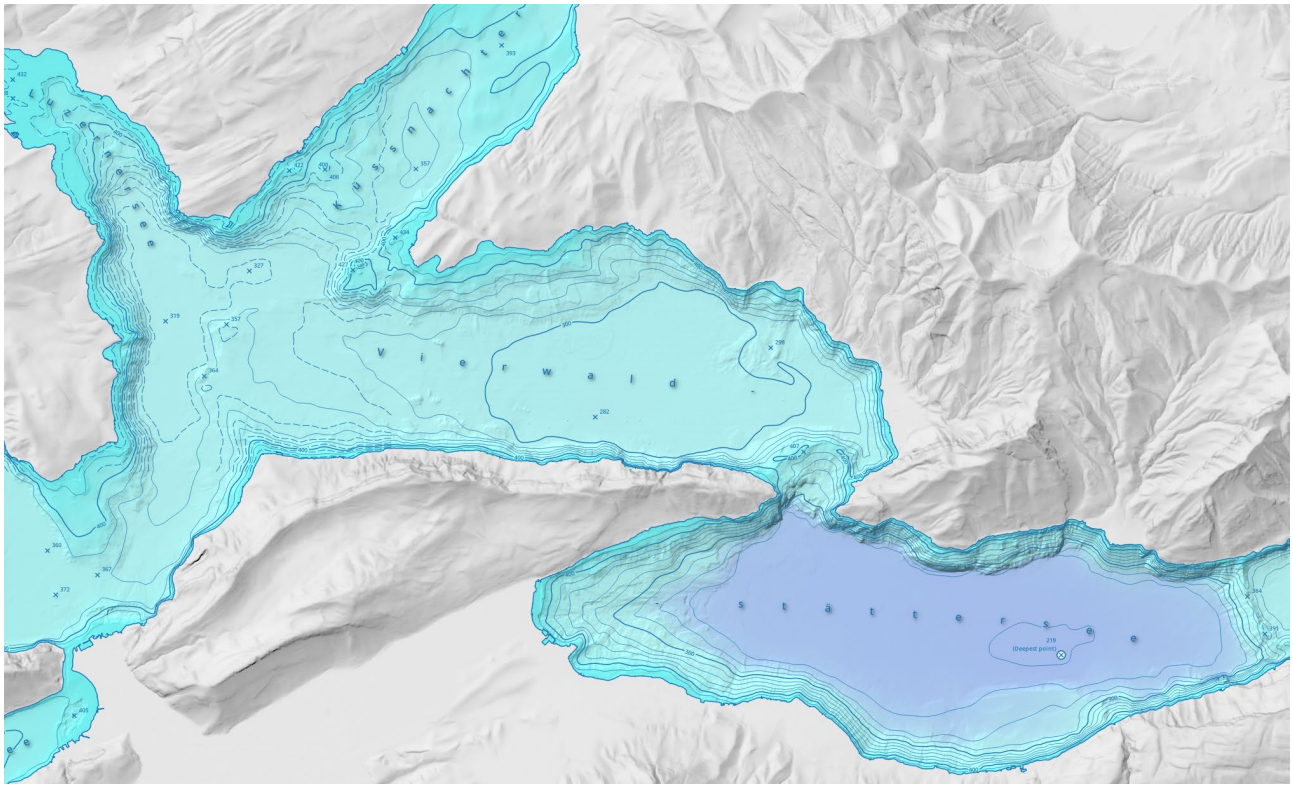

Figure 1. A bathymetric map of Lake Lucerne using blend modes and analytical hillshading combined with Eduard hillshading. Automatic label placement and selective masking are used for point symbols and labels. Dashed lines (contour lines with minor intervals) are automatically adjusted so that they always start and end with full dashes and never show gaps at sharp corners.

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For improved thematic maps, stacked charts have recently been added to QGIS. They allow cartographers to show two or more charts for a single feature next to each other and combine them with advanced labelling. Pie charts can now be constrained to partial circles (half, third, quarter or smaller circles). That way, one could show 4 different pie charts in each quadrangle around a point feature representing temporal changes.

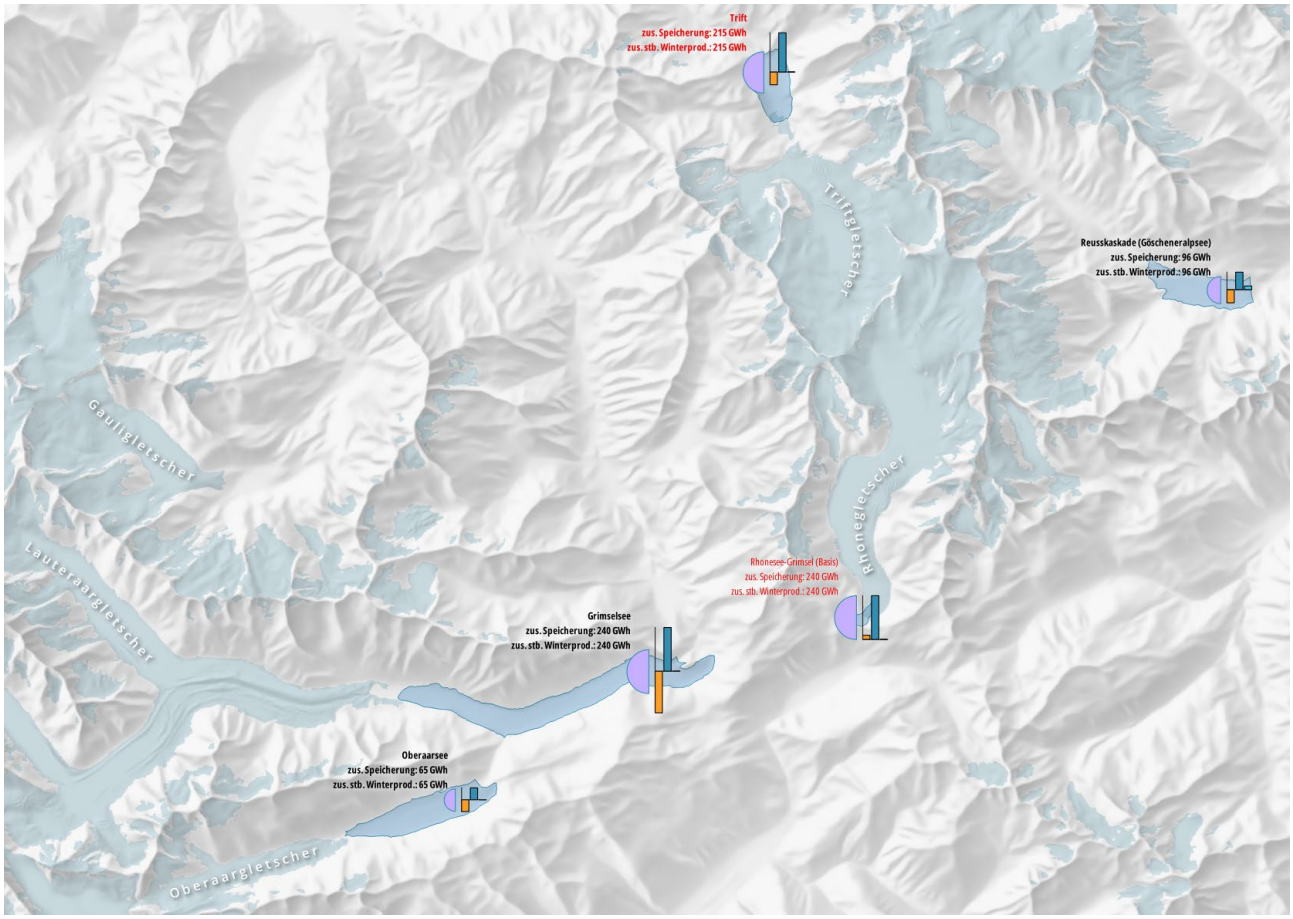

Figure 2. Stacked charts showing planned improvements to Swiss hydropower plants. The purple semi-circle chart on the left represents additional energy storage, while the bar charts show changes in electricity production for summer, controlled winter, and additional winter runoff. Red labels indicate new power plant projects, and black labels indicate changes to existing power plants.

When QGIS symbology and labelling options fall short, geometry generators, the expression system, and data-defined overrides provide powerful solutions. Data-defined overrides and expressions allow precise control over symbology and labelling through rules and formulas. Geometry generators modify geometries for symbology without altering the original data, dynamically updating with any changes to the source geometry.

Due to its open-source nature, the development of new features in QGIS is user or developer driven. There are no product managers who decide what features will be included in the next release. Associations, such as the worldwide QGIS.ORG organization or local QGIS user groups can help coordinate efforts and funding. All new cartographic features have been added because a QGIS user not only specified the feature, but also either developed it or paid for it by hiring a professional QGIS developer. Maintenance and bug-fixes are funded either through support contracts with QGIS support companies or through QGIS.ORG sustaining memberships. This ensures consistent quality through code reviews, automated unit tests, automated code scans and regular bug fix sprints. The QGIS project collaborates with upstream projects: libraries such as GDAL/OGR, proj, GEOS and Qt, as well as other compatible GIS, such as GRASS and SAGA. Whenever it makes sense, a new feature, such as a new algorithm, will be added to an upstream library. This policy allows other GIS or tools to benefit QGIS improvements and vice versa.

References

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