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Austrian vecMap – Vector Tiles for the Austrian Map Online

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Abstract:

The web application *Austrian Map*[1], in this form online since 2022, provides free access to the current official Austrian map series including maps in the scales 1:500k, 1:250k, and 1:50k as well as an overview map for smaller scales (all scales are combined in a single *amap* layer). Besides current orthophotos, the application also includes several historic layers of the official Austrian map series dating back to the *Franzisco-Josephinische Landesaufnahme*. The *histMap*[2] feature was introduced with the 100th BEV anniversary in December 2023.

The current *amap* layer is served as a pre-rendered raster tile set reusing raster data originally produced for our printed maps. Any change to the geometry or attributes of a feature or the map style itself that affects the map display requires a re-calculation of parts or the entire tile set. By introducing vector tiles, we can simplify the update process, because data (Mapbox vector tiles[3]) and styles[4] are maintained separately. Symbology changes can easily be updated in a style file (JSON) that specifies how the data is visualized in the map application. Other benefits of vector tiles include[5]: smaller file sizes lead to faster services and require less disk space; metadata provided through properties allows to filter, select, highlight, and query features; or allow zoom level and attribute dependent styling with advanced filters and expressions.

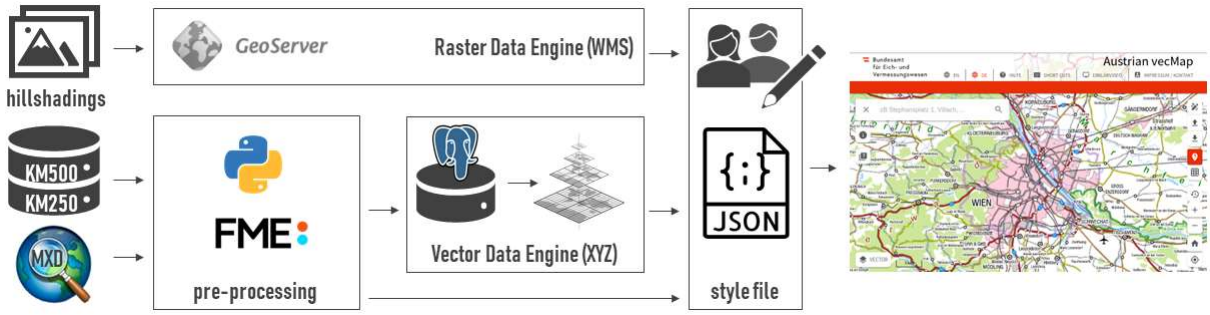

Figure 1. Visual summary of the vecMap production workflow.

In a current prototype, we develop the *Austrian vecMap* for the scales 1:500k, 1:250k and a smaller overview scale as an additional layer for the already existing *Austrian Map*. Therefore, we implemented a semi-automatic workflow process (see Figure 1). Using a combination of Python scripts and FME processes, we extract and pre-process the data from an Esri file-based geodatabase (overview scales and 1:500k) and an Oracle enterprise geodatabase (1:250k) and store them in a PostGIS database. We use Mapbox Tippecanoe[6] to build the vector tile set. While we can extract certain styling and layer structure information automatically from the original ArcMap documents, the style specification file is mainly compiled manually. The React frontend uses the mapping framework OpenLayers[7] together with the ol-mapbox-style[8] library to load the vector tile set and uses the style specification file to render the map on the client-side in the browser.

[1] https://maps.bev.gv.at/
[2] https://www.bev.gv.at/hundertjahrebev/Zeitreise-histMap.html
[3] https://github.com/mapbox/vector-tile-spec
[4] https://docs.mapbox.com/style-spec/
[5] https://www.ordnancesurvey.co.uk/blog/the-benefits-of-vector-tiles
[6] https://github.com/mapbox/tippecanoe
[7] https://openlayers.org/
[8] https://github.com/openlayers/ol-mapbox-style

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By re-using the cartographic models (KM500[9] and KM250[10]), carefully crafted by our cartographers, we are also able to achieve a high cartographic quality in this product. From a cartographic perspective, we aim to replicate the current map image but adapt the styling for each zoom level to gain a visually more seamless transition across the original scales. The *vecMap* layer includes several cartographic features that are based on analog cartographic work. Both, the rock drawing and hill shading were digitized and used throughout our products. Also, the label placement is refined manually in our cartographic models. To meet the high-quality standards for labelling also in the *vecMap*, we had to work around existing styling options for curved labels that span across multiple tiles (i.e., the labelling of larger areas such as mountain ranges or valleys). For example, instead of placing labels along a curved line – which is possible with the Mapbox style specification – we used the line to calculate the placement and rotation letter by letter converting the original ArcMap annotation into a point layer which gave us the best control over label placement and repetition.

When comparing to basemap.at[11], an already available vector tile set for Austria that uses official geodata of Austrian administrations, it is the above-mentioned cartographic and topographic aspects that make the *vecMap* a unique and valuable resource.

While pre-rendered raster tiles allow more control over a map's appearance, we are convinced that the benefits of the now-introduced client-side rendered vector tiles allow us to react more quickly to changes in our cartographic models. For example, in the future, when available nationwide, we will also include the scale 1:50k in the *vecMap* layer or update to the new generation the symbology when used throughout the entire map series (e.g., red instead of black rail tracks). While we currently hand-craft the legend, we also experiment with automatic legend generation.

In summary, with the new vector tiles, the carefully created cartographic and topographic data of the BEV with all the underlying attributes can be provided with high performance via the web and not only integrated into web applications in any capable GIS (e.g., QGIS). The presentation provides an overview of the motivation, the technical aspects, and the current and future state of the Austrian *vecMap* and reflects upon the challenges we have encountered in the work process.

[9] https://www.bev.gv.at/Services/Produkte/Kartographische-Modelle/KM500-V.html
[10] https://www.bev.gv.at/Services/Produkte/Kartographische-Modelle/KM250-V.html
[11] https://basemap.at/

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