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IKG
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Automatic Adjustment of Image Sharpness in Relief Shading

Motivation

Relief shading is a technique to depict topography on maps in a way that it is intuitively understood by the user. While relief shading was traditionally performed manually, nowadays digital elevation models (DEM) are used as basis for analytical (i.e., automatic) relief shading methods. This Master thesis aims at the creation of a new method to perform automatic contrast adjustment in analytical relief shading. This is one of the core tasks of the Swiss-style relief shading and relies on applying the aerial perspective effect.
In this research a novel method was developed and implemented in Geographic Information System (GIS) environment (ArcGIS), since currently there is no standardized method to employ atmospheric corrections in GIS.

Methods

As a first step in developing a novel method, two existing approaches from Brassel (1974) and Jenny (2001) for calculating the aerial perspective effect were implemented as ArcGIS models processing the whole area analyzed. The following improvements were made:

1) emphasizing sharpness of ridges
2) placing the haze effect in the lower elevations.

The novel approach is designed to constrain the aerial perspective effect to an area of watersheds generated with the ArcHydro module and allowing the enhancement of ridges and major landforms according to the Swiss-style manual relief shading.

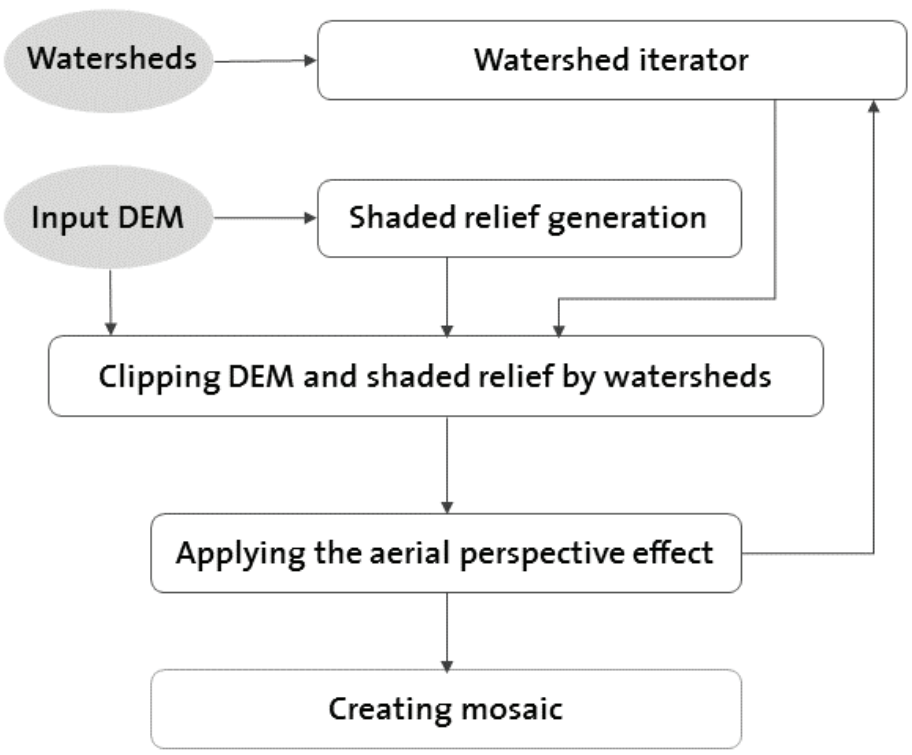

Figure 1: A workflow for generating the aerial perspective effect restricted to watersheds

References:
Brassel, K. (1974). A model for automatic hill-shading. The American Cartographer, 1(1):15-27.
Jenny, B. (2001). An interactive approach to analytical relief shading. Cartographica, 38(1):67-75.

Results

The results demonstrate that both global and local approaches properly simulate the aerial perspective effect.

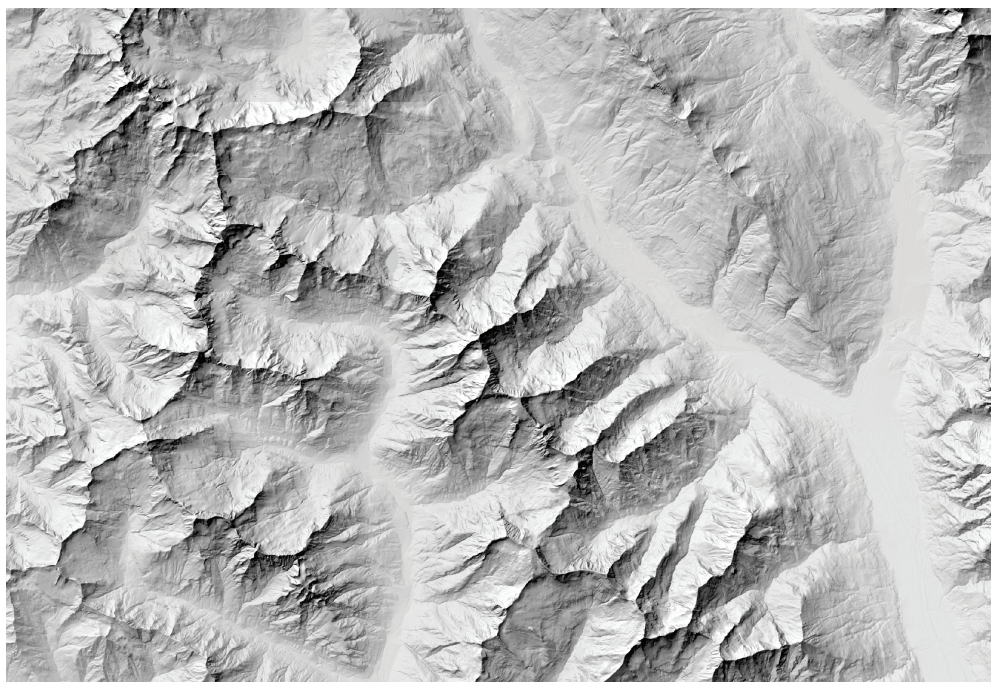

Figure 2: Shaded relief generated using the Hillshade function combined with the aerial perspective effect (Brassel, 1974) calculated within watersheds

Although this is a step closer to a fully-automated method to simulate the aerial perspective effect, it still requires user-definable parameters. Nevertheless, this approach is quantitative, consistent, reliable, and objective.

Outlook

This work is a part of a larger framework developed at the Institute of Cartography and Geoinformation to enhance the overall appearance of analytical shaded relief. It is possible to complement the aerial perspective effect with the light changes also performed within watersheds based on streams orientation. An extra light source originating from the Southwest is used to accentuate the ridges oriented parallel to the standard light direction, which is generally recognized to originate from the Northwest.

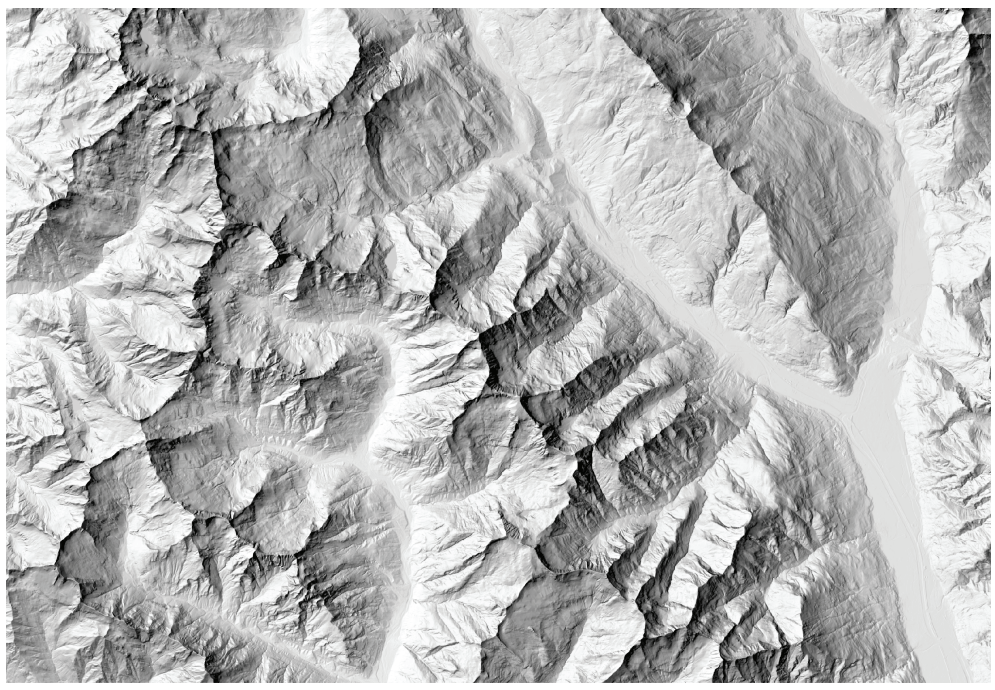

Figure 3: Shaded relief with the aerial perspective effect (Brassel, 1974), calculated within watersheds, and complemented with changes of the light direction

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