Horizontal Hachures

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Outline

Definition

Horizontal hachures vs. custom relief contours

Methodology

Results

Summary

Definition

- From *Cartographic Relief Presentation* (Imhof, 1982)
  - Horizontal hachures are more compactly and evenly arranged than contours
  - In contrast to contours, no exact elevation value is assigned to the individual hachure line
  - The thickness of horizontal hachure lines is not constant, usually following the principle of oblique lighting

Horizontal Hachures

From Imhof (1982), figure 154, page 231

Custom Relief Contours

Comparison with Horizontal Hachures

Horizontal Hachures vs. Custom Relief Contours

Horizontal hachures

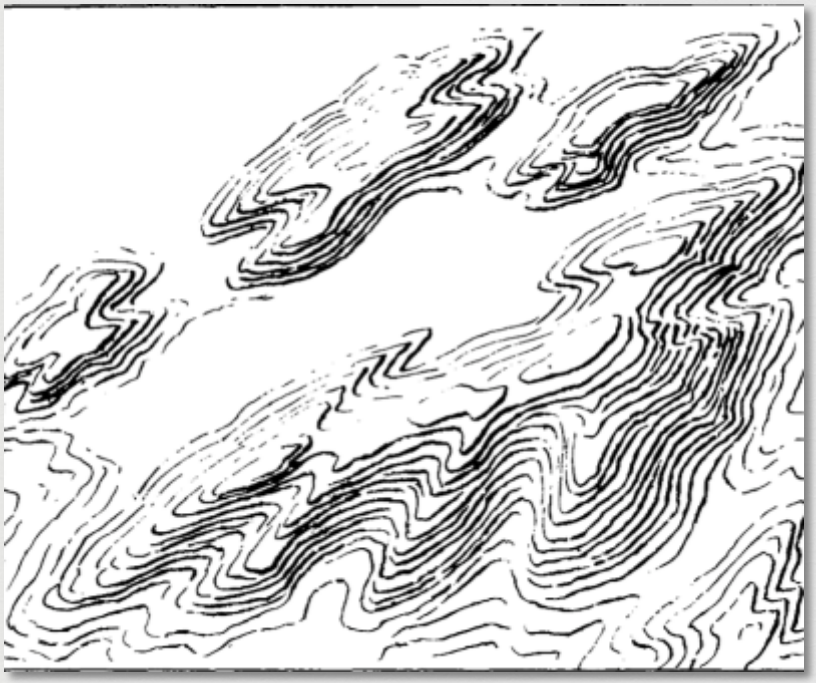
- Compact and evenly arranged
- No exact elevation values assigned
- Thickness varies with oblique lighting effect

Custom relief contours

- Spacing based on contour interval
- Contours drawn at round numbers (e.g. 10, 100 etc.)
- Thickness and/or color vary with oblique lighting effect

Horizontal Hachures vs. Custom Relief Contours

Horizontal hachures

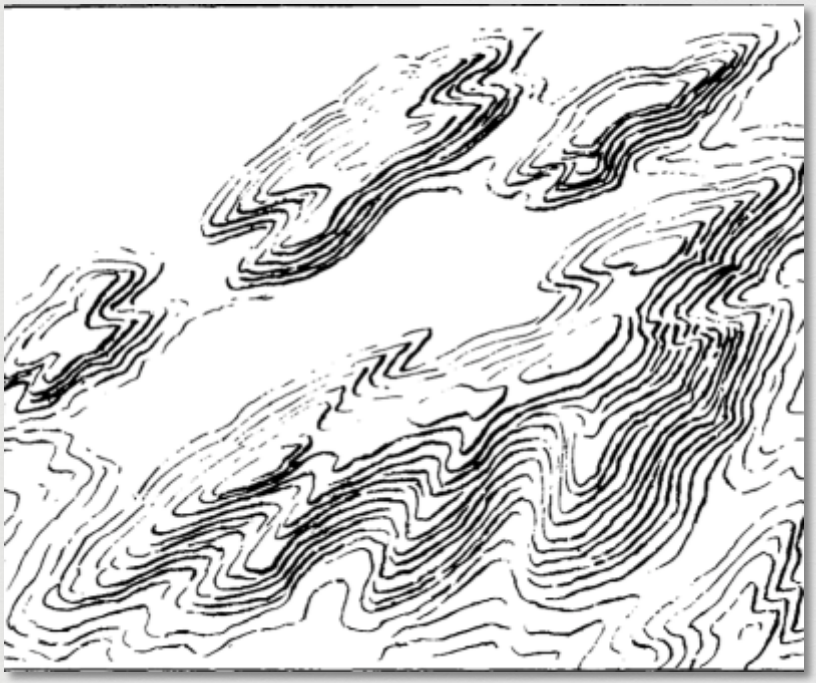


Illuminated contours

Tanaka (1950) The Relief Contour Method of Representing Topography on Maps.

Horizontal Hachures vs. Custom Relief Contours

Horizontal hachures

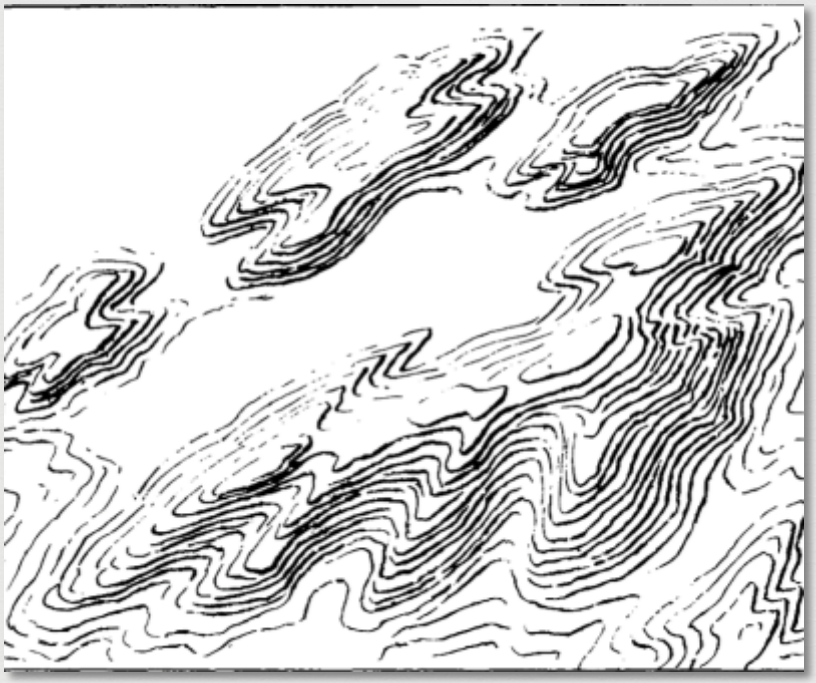


Illuminated contours

Pauliny map - Courtesy ETH Zürich
(historic slide collection)

Horizontal Hachures vs. Custom Relief Contours

Horizontal hachures

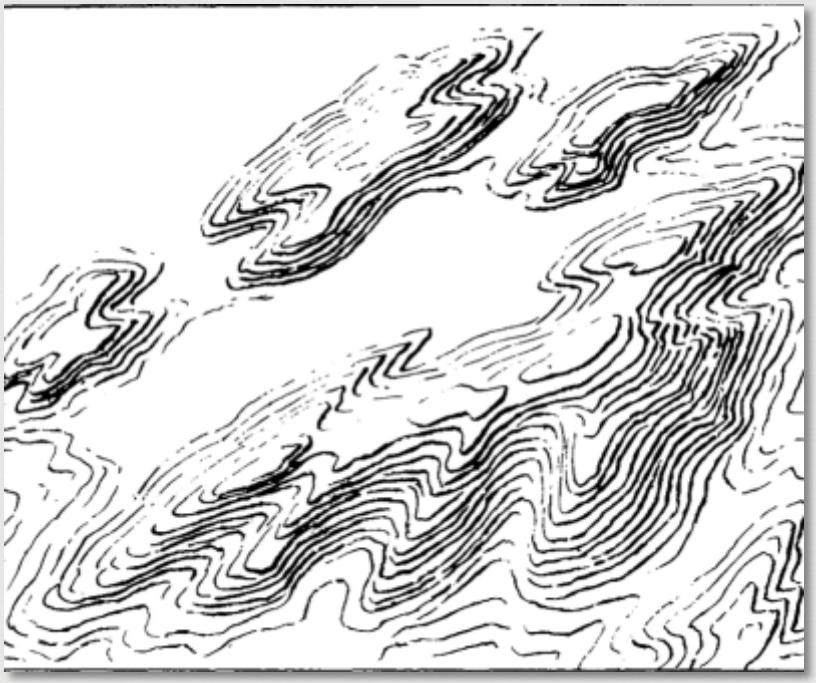


Illuminated contours southwest illumination

Pauliny (1892), Karte von Schneeberg, Raxalpe, und Semmering.

Horizontal Hachures vs. Custom Relief Contours

Horizontal hachures

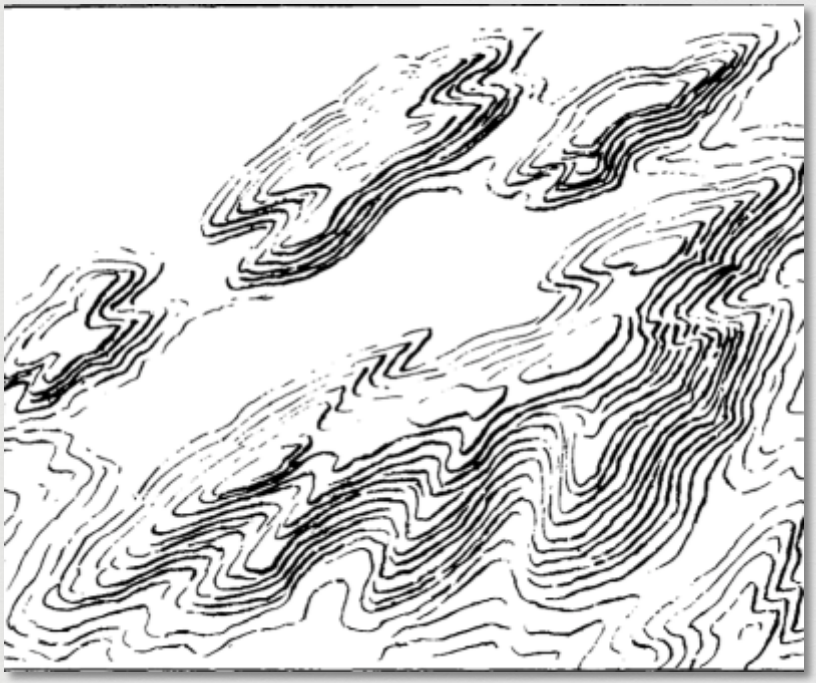


Shadow contours

Yoeli (1983) Shadowed Contours with Computer and Plotter.

Horizontal Hachures vs. Custom Relief Contours

Horizontal hachures

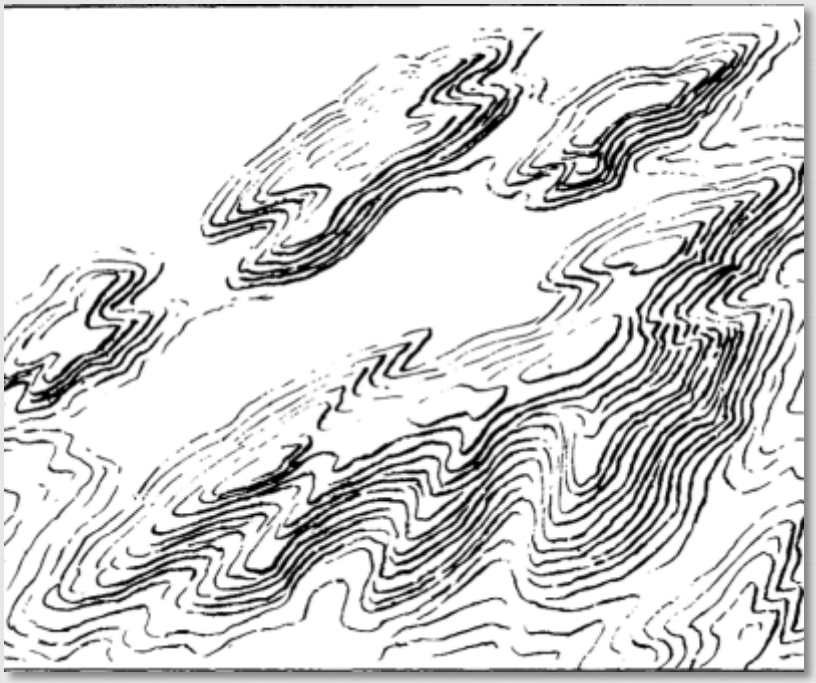


Shadow contours

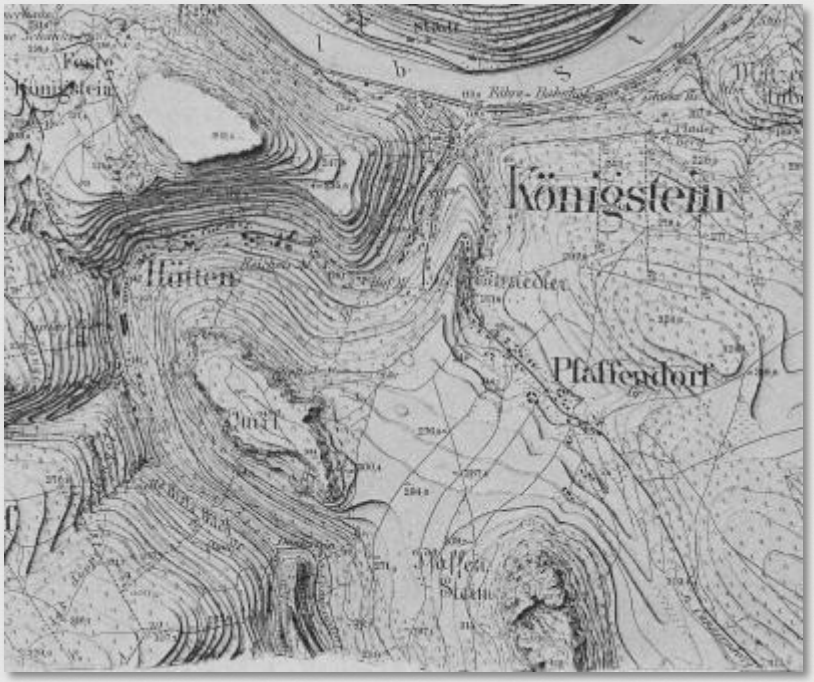
Landkarte des Kantons Thurgau (188?)

Horizontal Hachures vs. Custom Relief Contours

Horizontal hachures



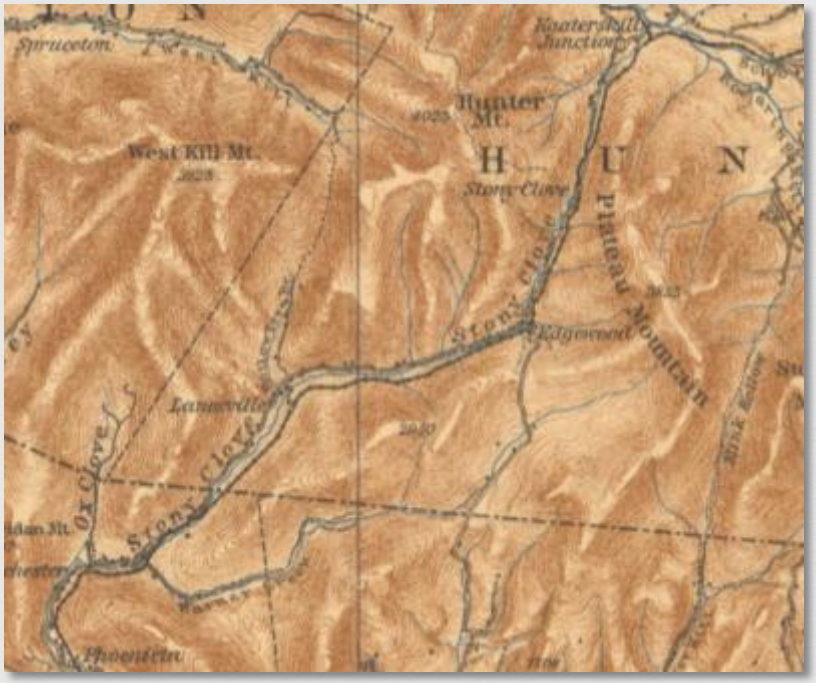
Shadow contours



Köpcke (1885) Ueber Reliefs und Relief-Photogramme

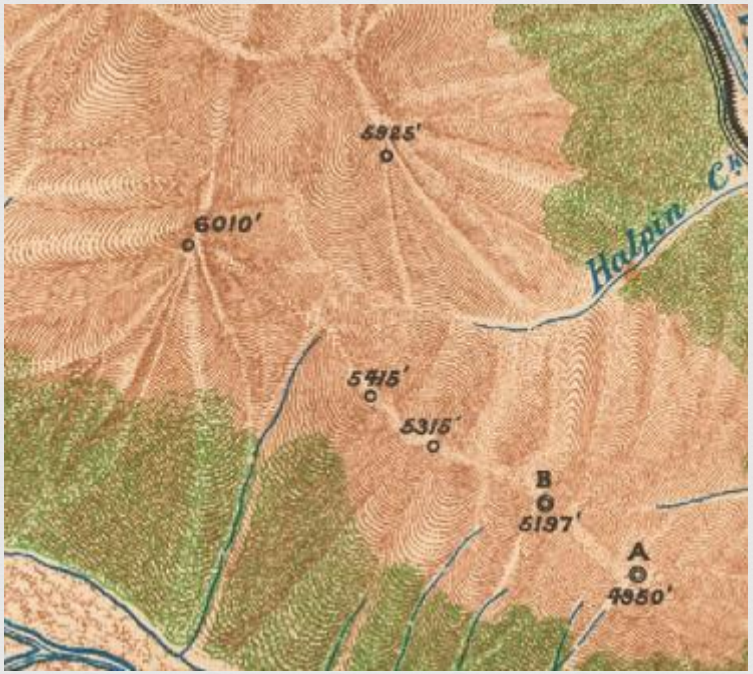
Other Custom Relief Contours

Slope shading effect



Bulletin of the American Geographic Society (1907)

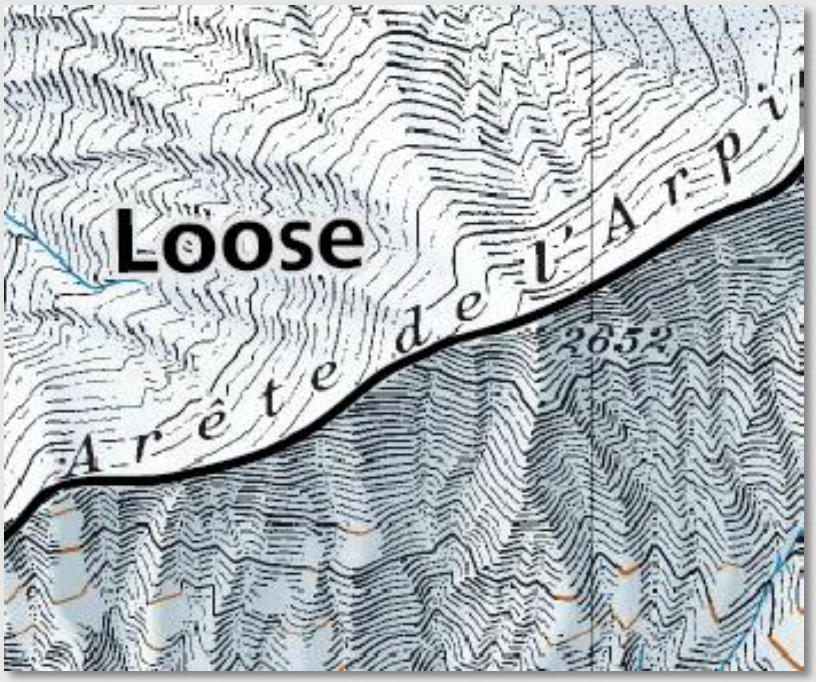
Oblique lighting effect?



New Zealand Mapping Series #58 Arthur's Pass map (1931)

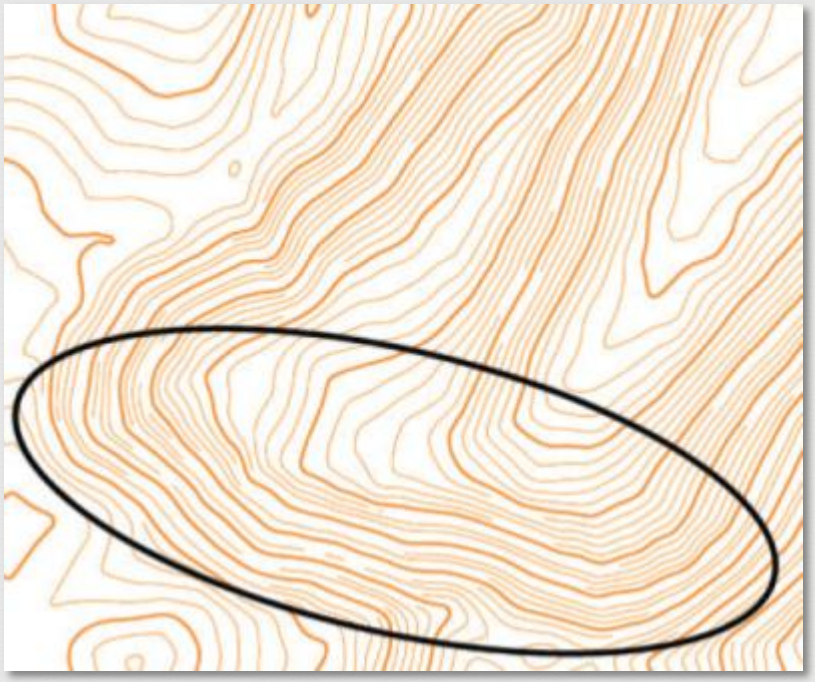
Other Custom Relief Contours

Loose rocks



Swisstopo (in Jenny et al. (2014) Design Principles for Swiss-style Rock Drawing)

Localized contour removal - steep areas



Mackaness and Steven (2006) An Algorithm for Localised Contour Removal over Steep Terrain

Methodology

Methodology - Overview

- Use contours to create shading effect
- Create shading effect by varying number and spacing of contour segments as opposed to varying thickness or color of contours
- Avoid sharp edges to the contour segments that could be associated with using polygonal outlines to define the ends of contour lines

Methodology - Technique

- Begin with digital elevation model (DEM) grid
- Hillshade the DEM
- Convert grid cells of the DEM to points
- Contour the points at a small contour interval
- Buffer points using values smaller than the grid cell size and clip the contours
- Assign hillshade value to the clipped contours
- Iteratively buffer and clip the contour segments to create longer, more continuous horizontal hachures that are more closely spaced in more darkly shaded areas

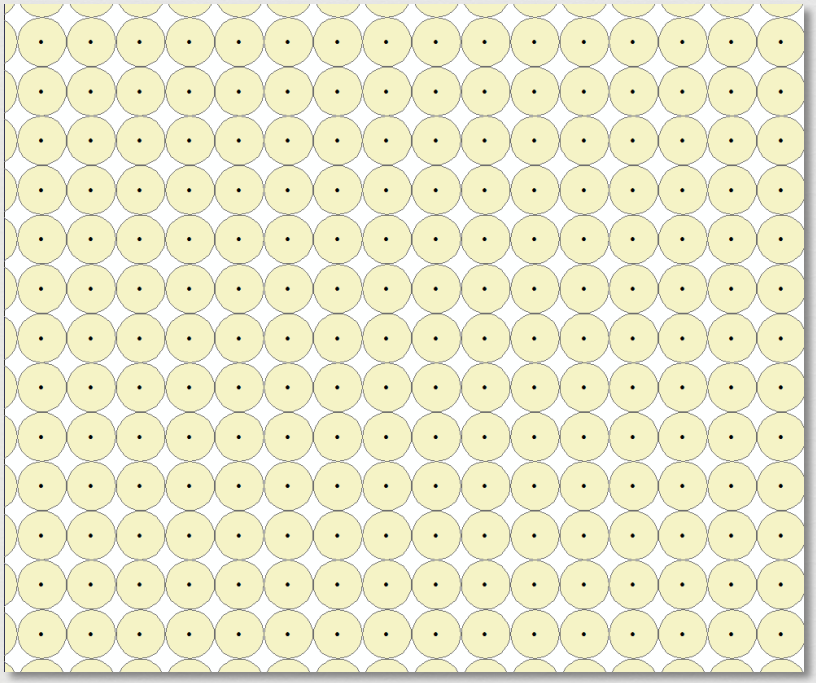
Methodology – Site Example

Methodology

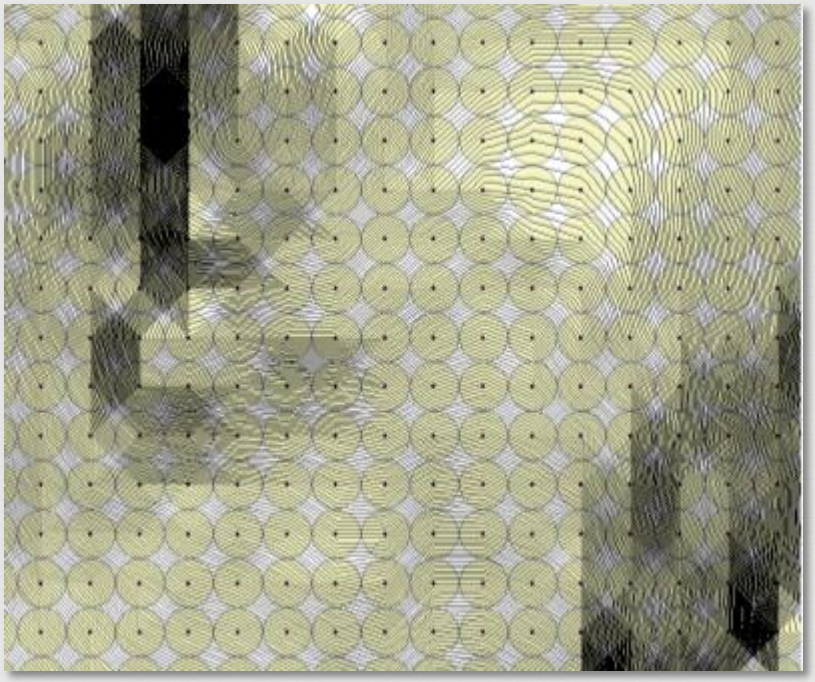
DEM of Mt. Hood, Oregon, USA
26.3 meter grid cells
Grid extent = 92 x 111
Contour interval = 1 meter

Methodology

Buffered points



Buffered points with all contours



Methodology

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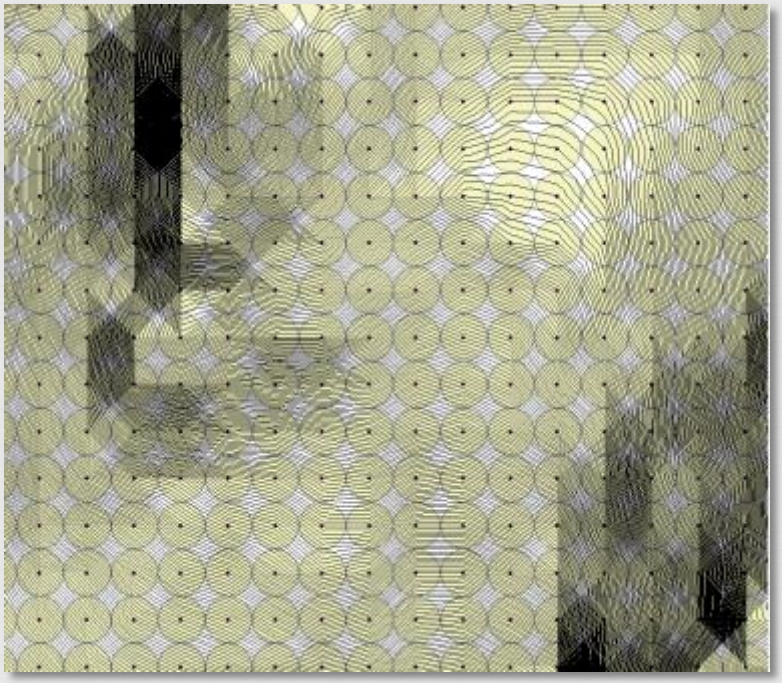
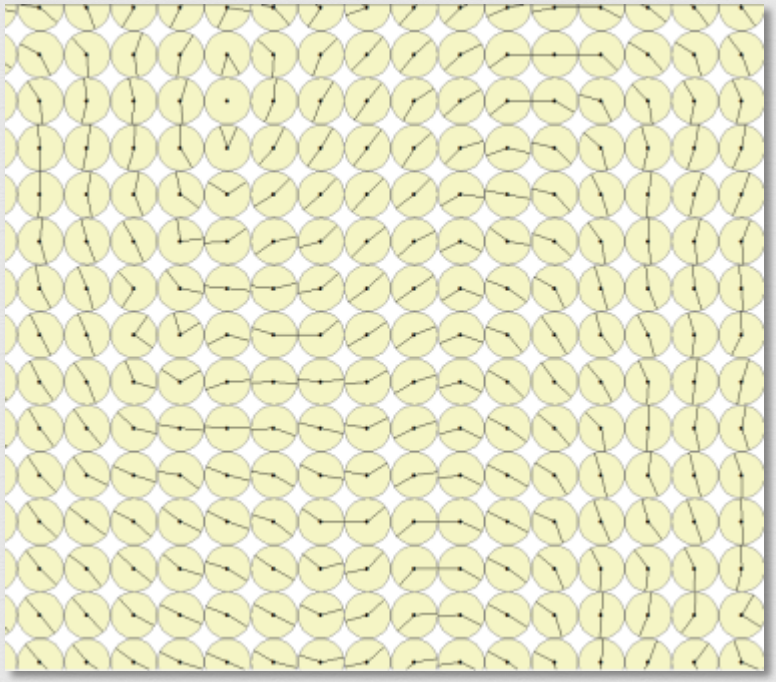
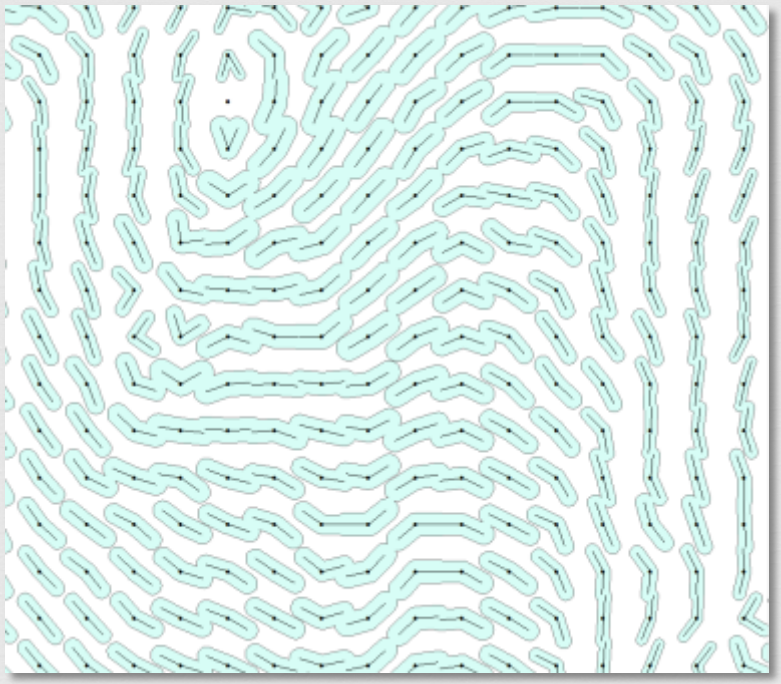


Contours clipped and those on point selected

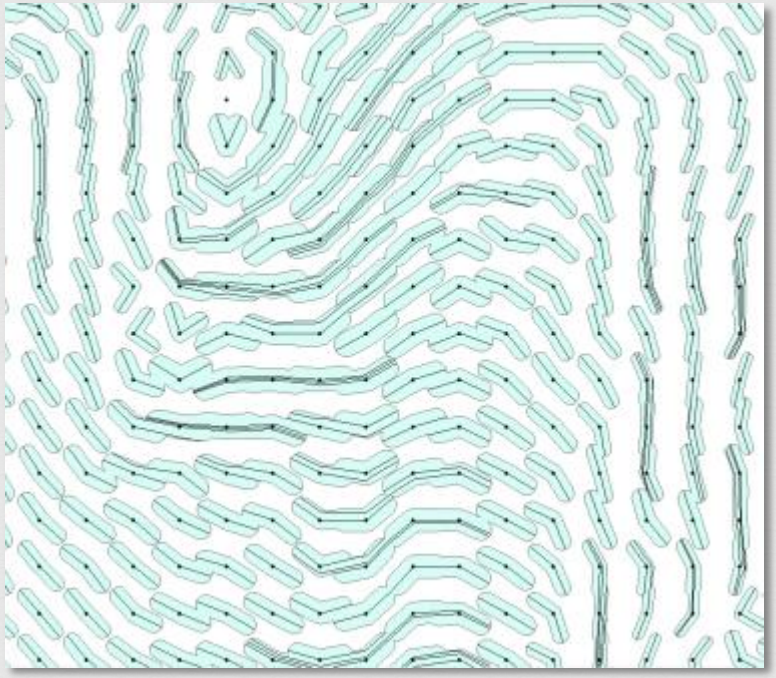


Methodology

Buffered contour segments base on hillshading value



Contours clipped and those on points selected



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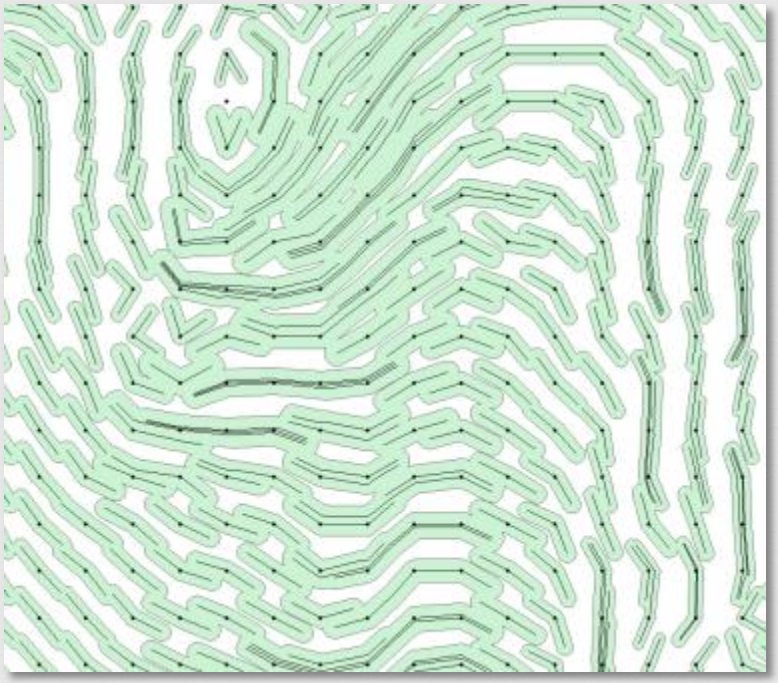
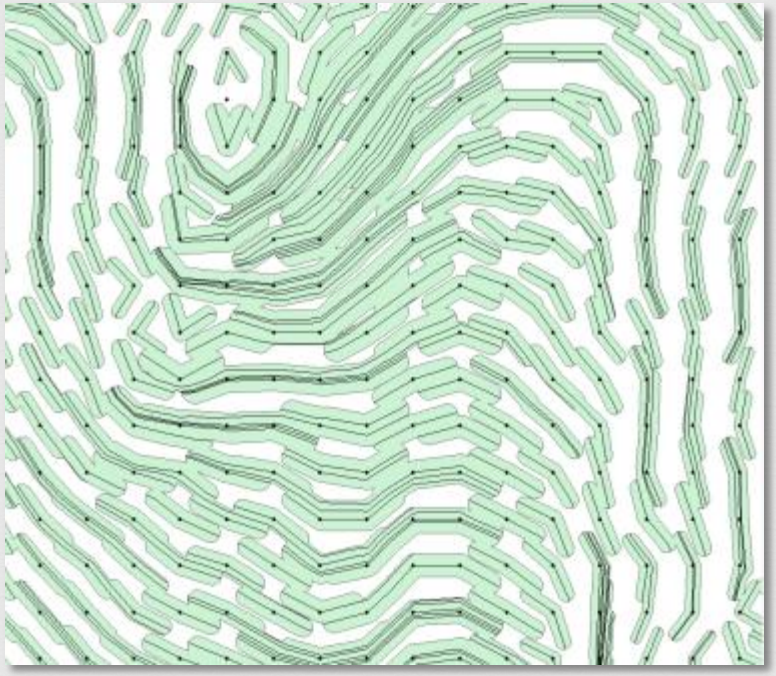


Contours clipped and those on points selected



Methodology

Buffered contour segments based on hillshading value

Contours clipped and those on points selected

Results

Results

Horizonal hachures

Results

Horizontal hachures

Horizontal hachures with short segments eliminated

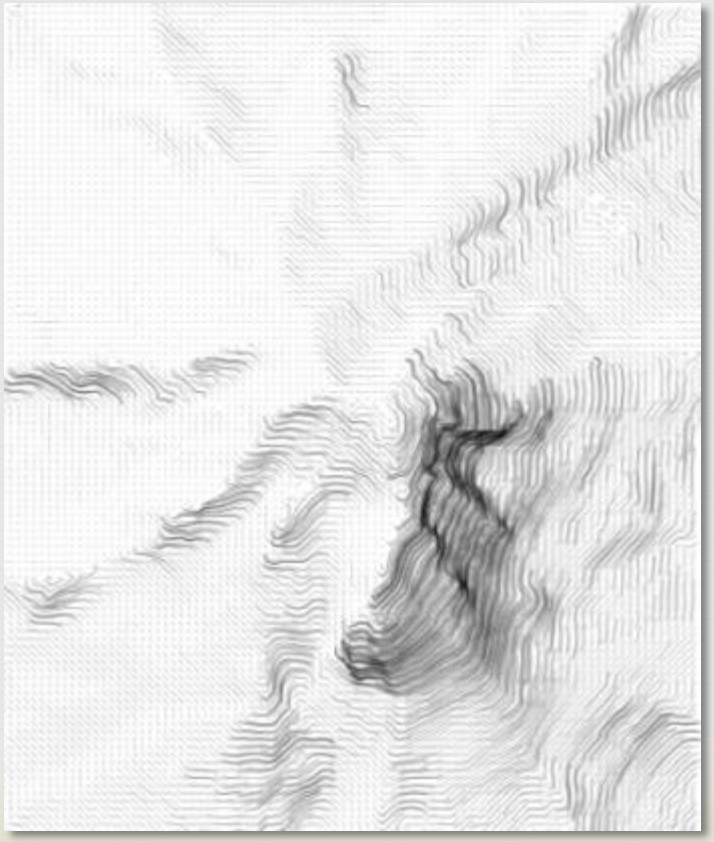
Results

Horizontal hachures

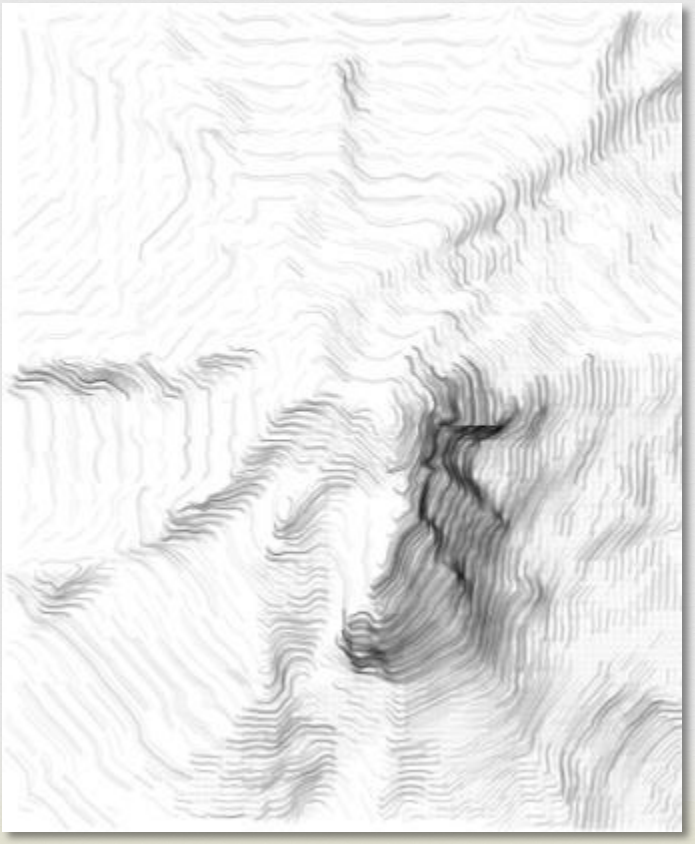
Horizontal hachures
with hypsometric tinting

Results

Horizontal hachures

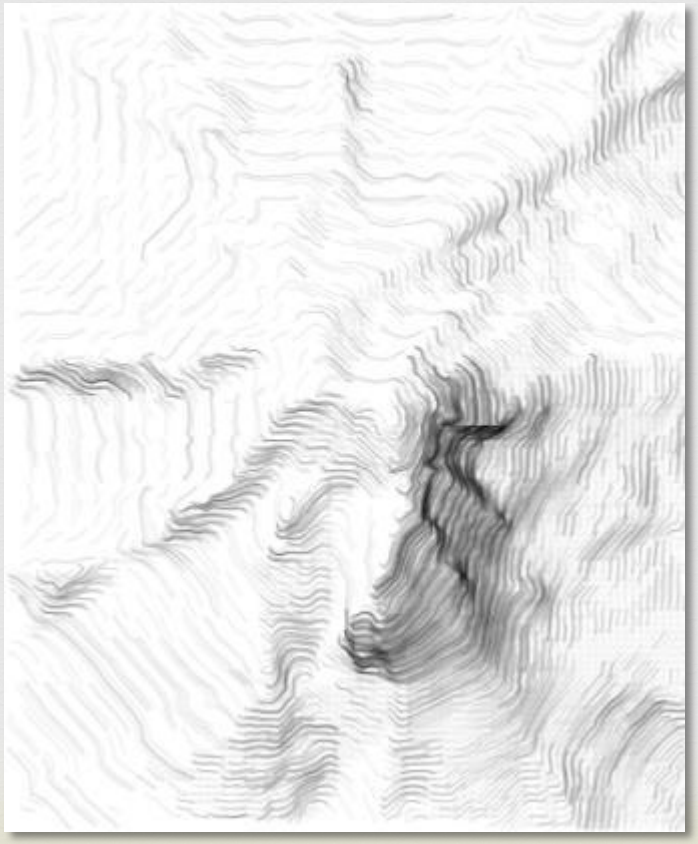


Horizontal hachures with short segments extended

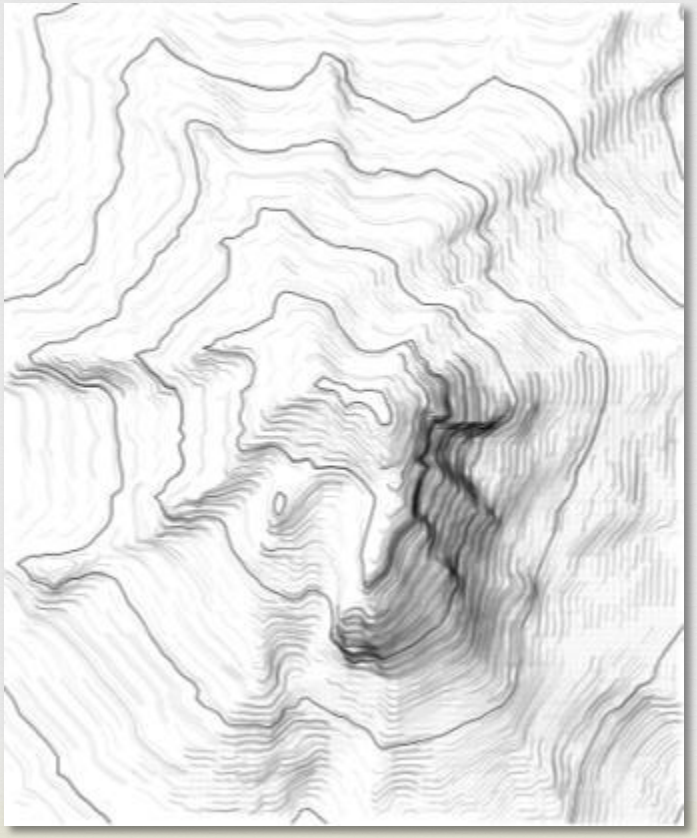


Results

Horizontal hachures



Horizontal hachures with contours



Summary

- Horizontal hachures are one method of modulating contour lines to achieve relief shading
- This method of horizontal hachuring produces fine lines that provide both shading and texture
- The resulting contour segments benefit from traditional contours or hypsometric tinting that highlight the form of the terrain feature

Special Thanks

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