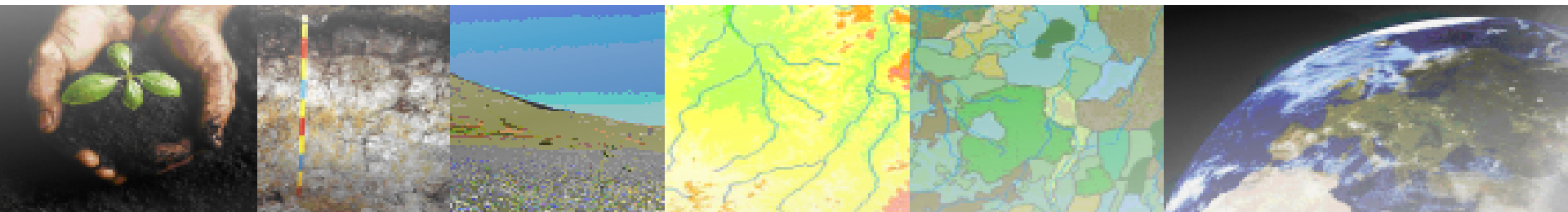


A new System of Terrain Classification

Rüdiger Köthe
scilands GmbH, Göttingen (Germany)



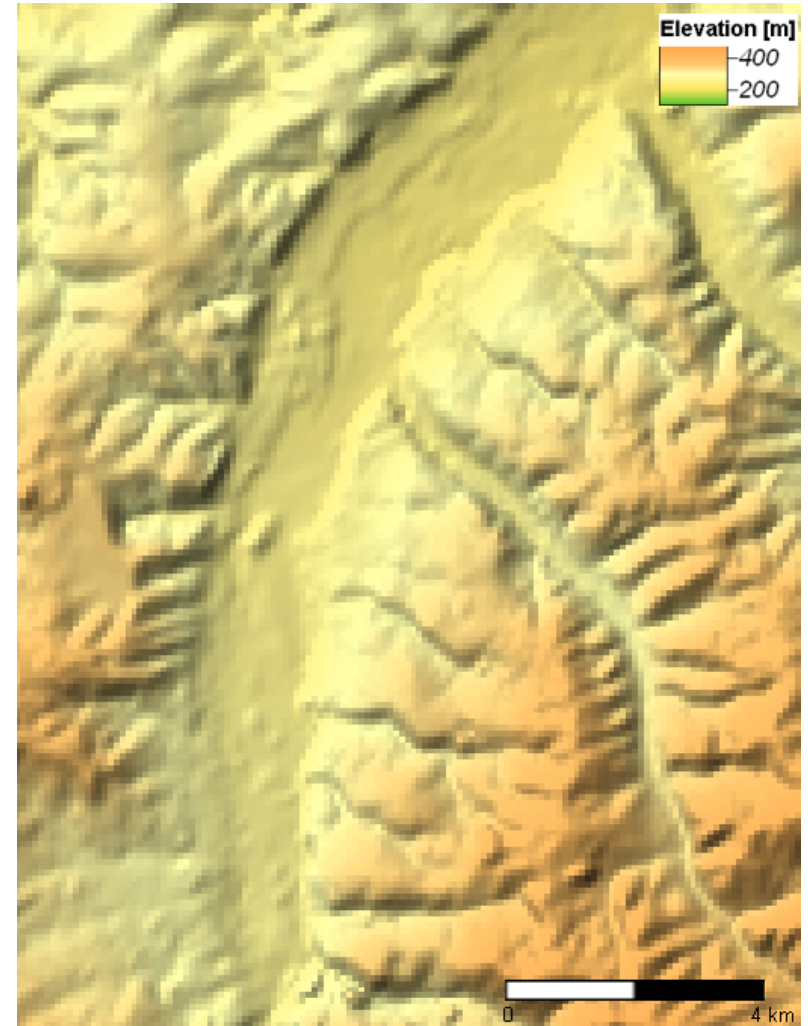
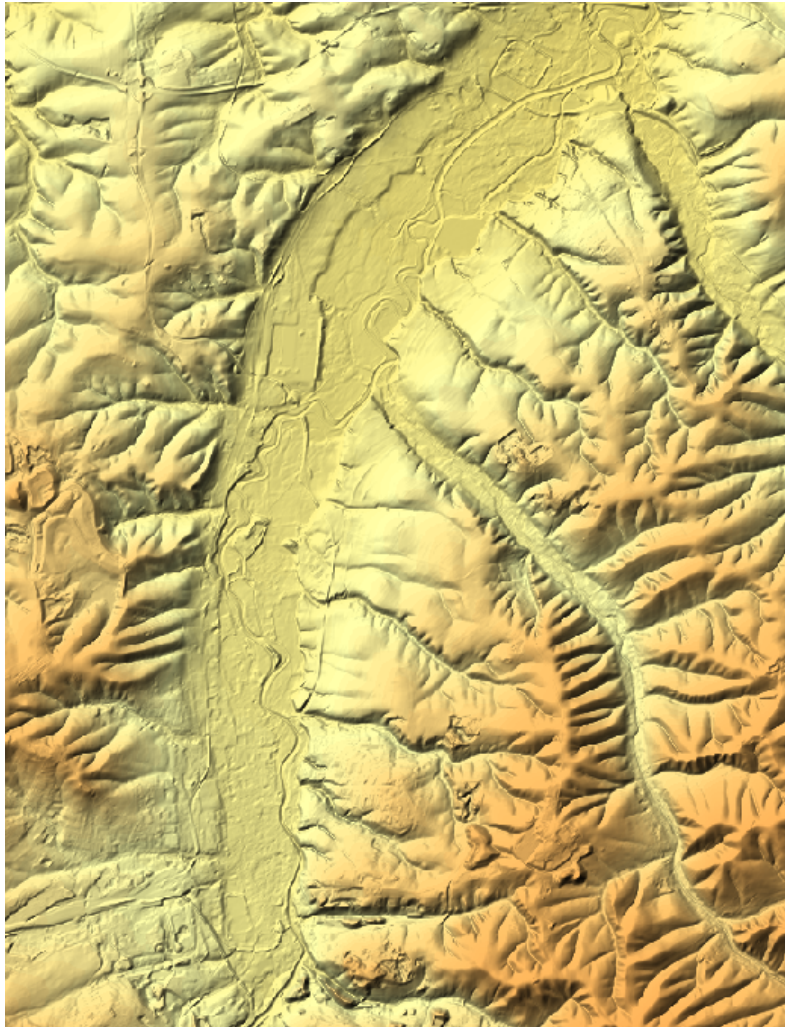
Objectives

- Terrain analysis and terrain classification for mapping in geoscience
- in particular for **soil mapping**
- Terrain classification should outline units with similar conditions for soil genesis or similar soil properties
- Terrain analysis and classification should help to
 - enhance existing soil maps (in countries with good data availability)
 - create soil maps (in countries with poor data availability)
- Terrain analysis and classification should be based only on digital terrain models (DTM)
- Terrain analysis and classification should be independent from landscape type and spatial resolution of DTM

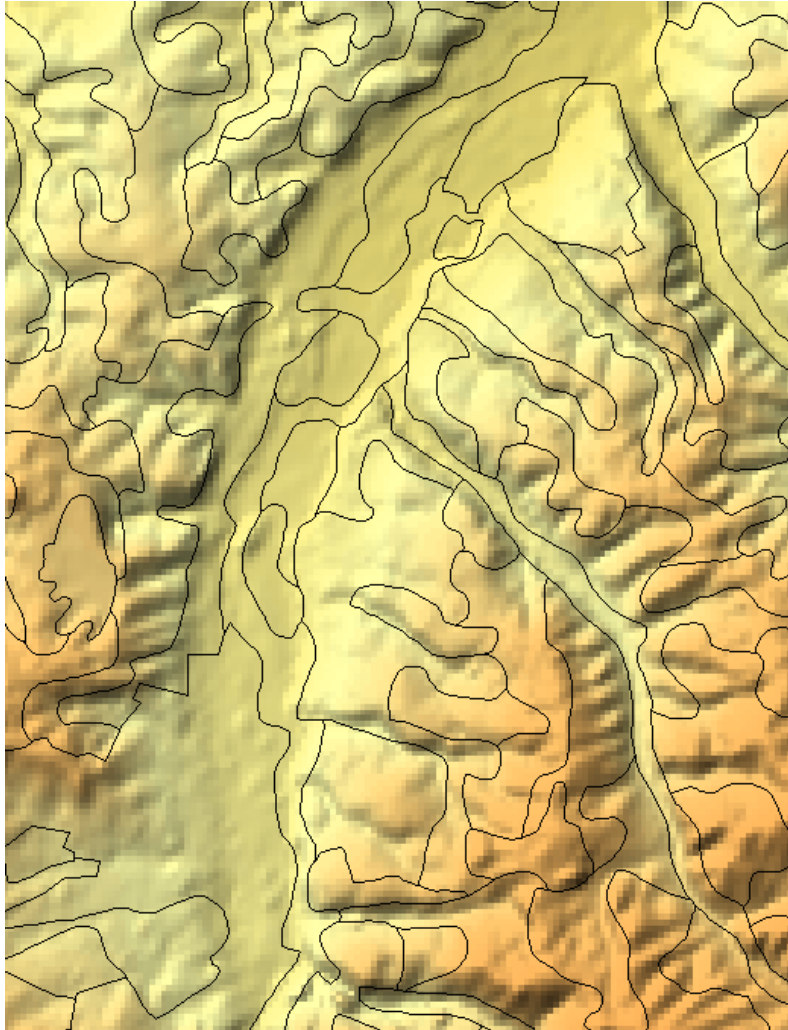
Content

- Relief and soil - some thoughts and comparisons
 - different terrain classification systems
 - terrain classification and soil maps
- Methods of terrain analysis and classification
 - enhanced geomorphometric terrain parameters
 - self adjusting thresholds for classification
- System of terrain units for terrain classification
 - one system for all types of landscapes
 - Geomorphographic Maps
- Results of terrain classification
 - Geomorphographic Maps for eSOTER test sites

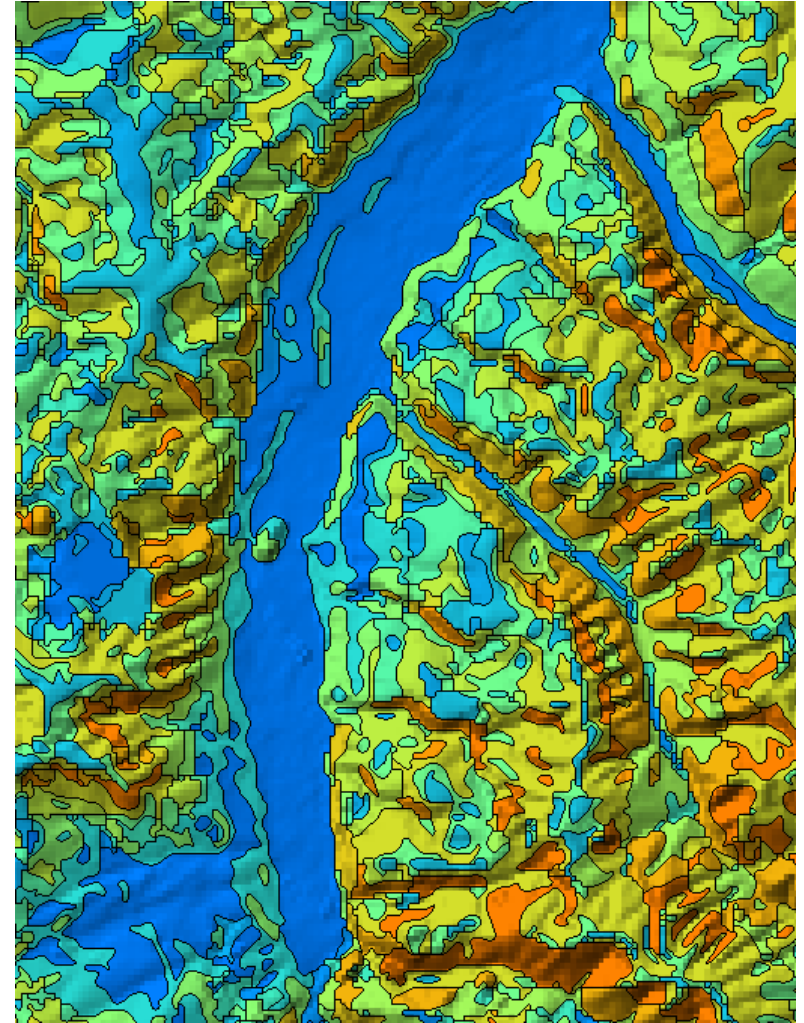
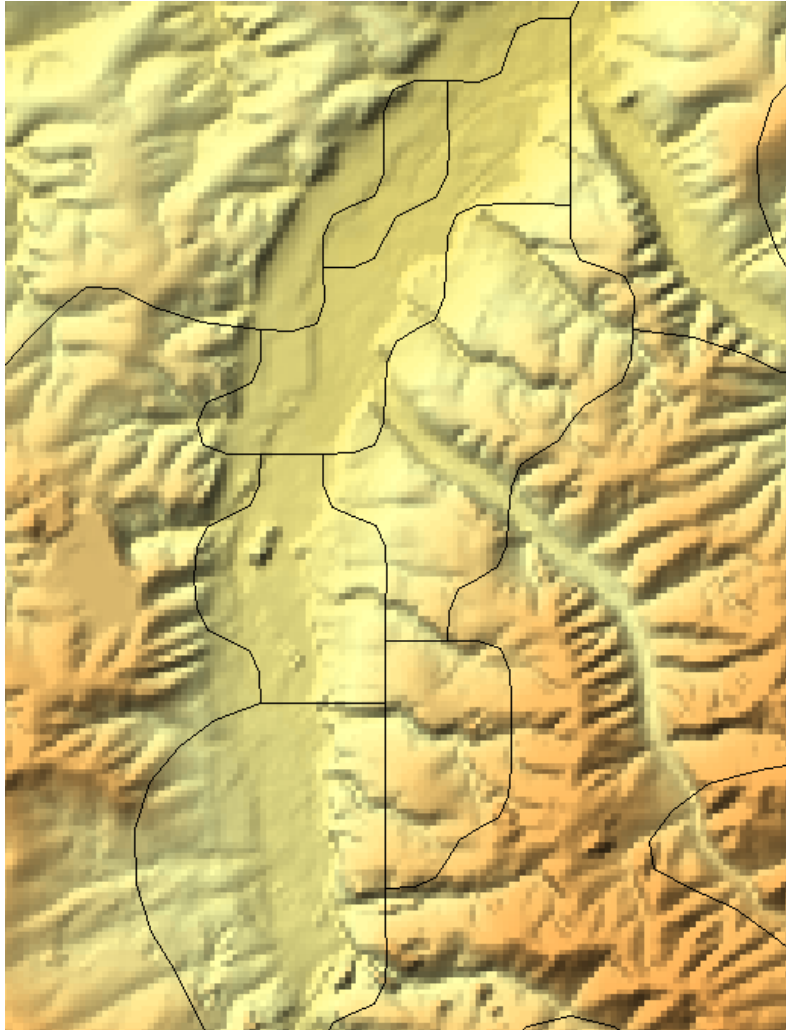
Comparisons - high quality DTM 20m with SRTM (90m)



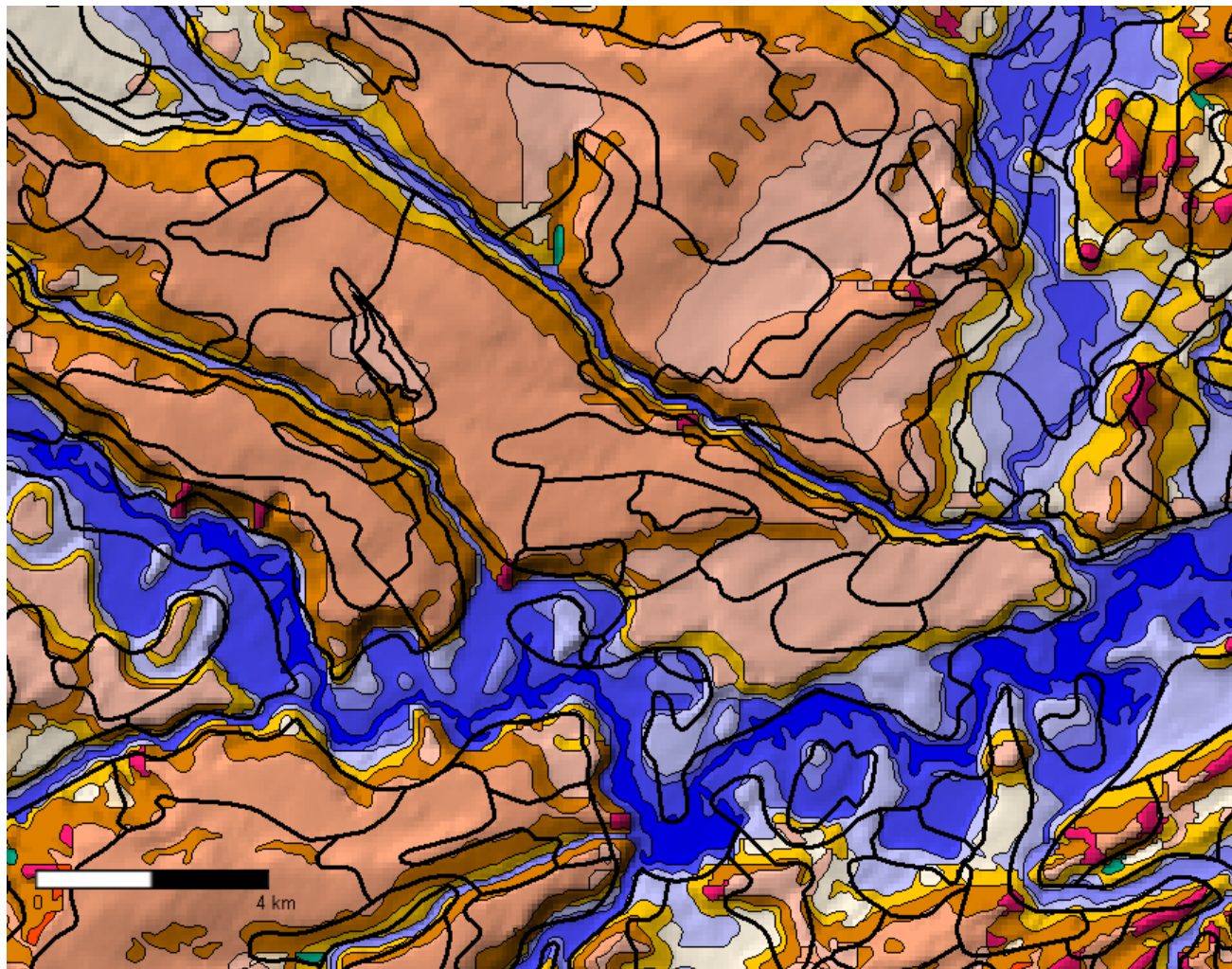
Comparisons - Soil Map 1:250.000 with Geomorphographic Map



Terrain classifications: SOTER 1:1.000.000 and Iwahashi & Pike



Geomorphographic Map and Soil Map 1:250.000



Mountainous Summit Flat

Divergent Slope, Ridge, Small Bump
Convergent Slope, Small Valley

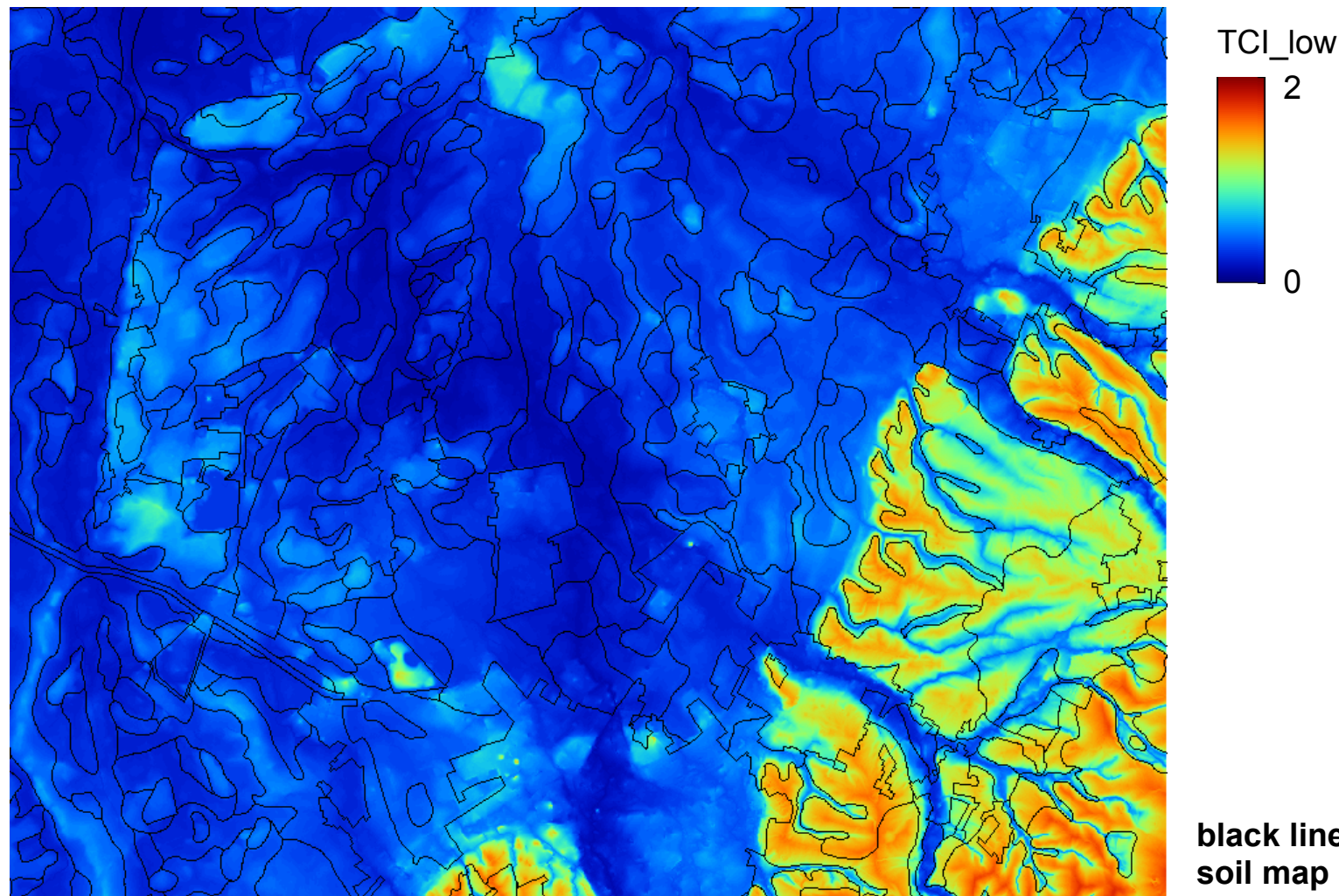
Upper Slope
Mid Slope, Gentle Slope
Lower Slope, Gentle Slope

Upper Terrace 2, Summit Flat 2
Upper Terrace 1, Summit Flat 1
Flat, Lower Terrace 2
Flat, Lower Terrace 1

Bottom Flat 4
Bottom Flat 3
Bottom Flat 2
Bottom Flat 1
Bottom Flat 0

**black lines = outlines of
soil map 1:250.000**

Enhanced Terrain parameter TCI_low and Soil Map 1:50.000

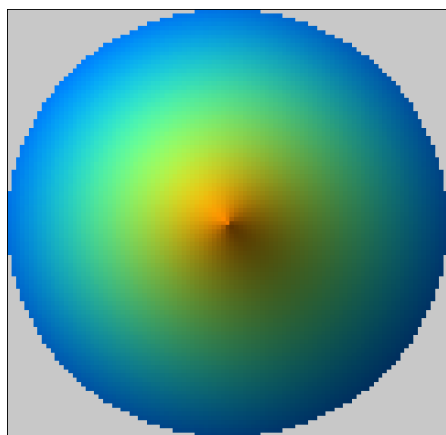


black lines = outlines of
soil map 1:50.000

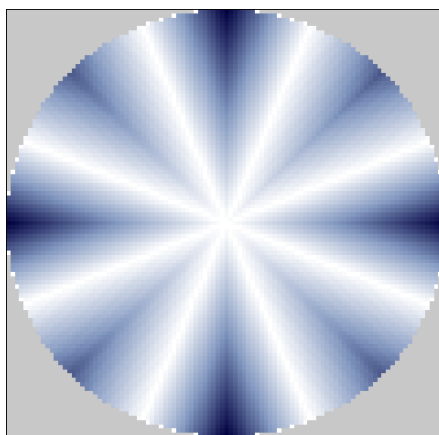
Methods of terrain analysis and classification

Enhanced morphometric terrain parameters

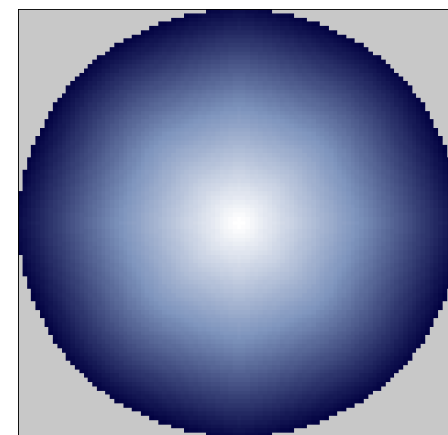
- Example flow accumulation, calculated for a cone



hillshade of a cone



flow accumulation using
a single flow algorithm

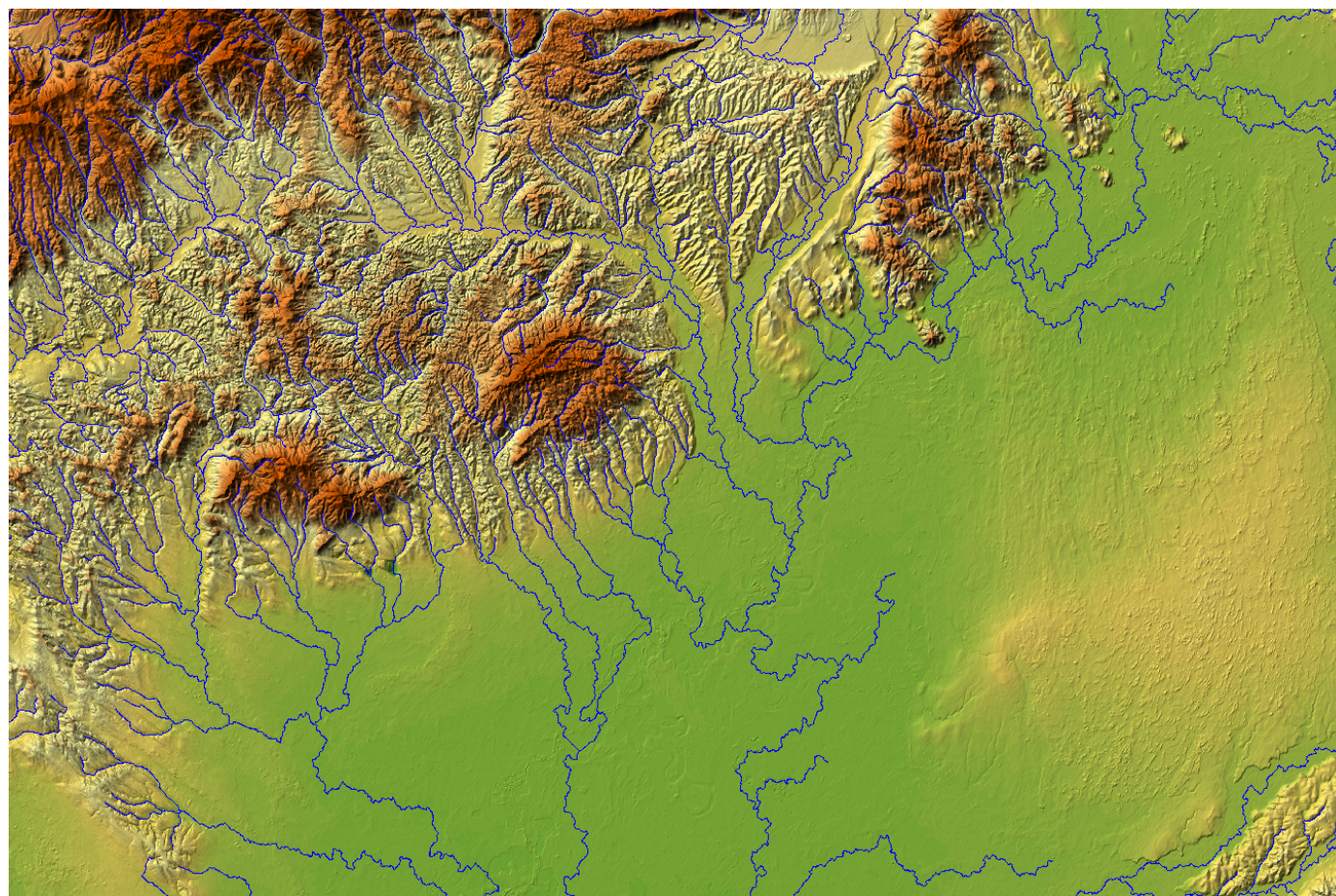


flow accumulation using
a multiple flow algorithm

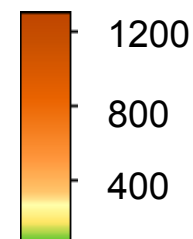

 small catchment area big catchment area

Enhanced morphometric terrain parameters

Channel Lines, pilot test site "Hungary"



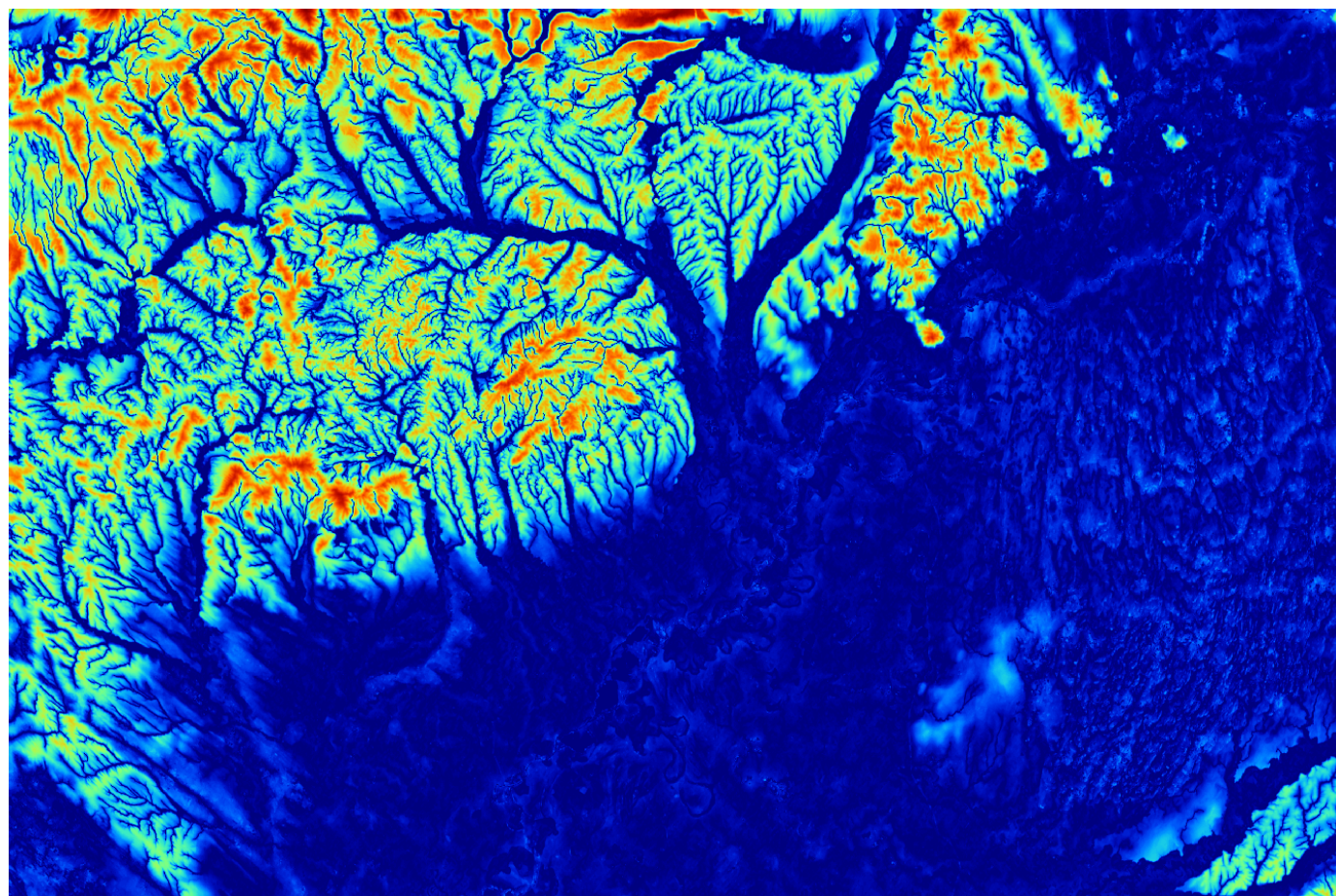
Elevation [m]



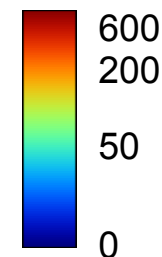
channel line

Enhanced morphometric terrain parameters

Relative elevation above channel lines, pilot test site "Hungary"

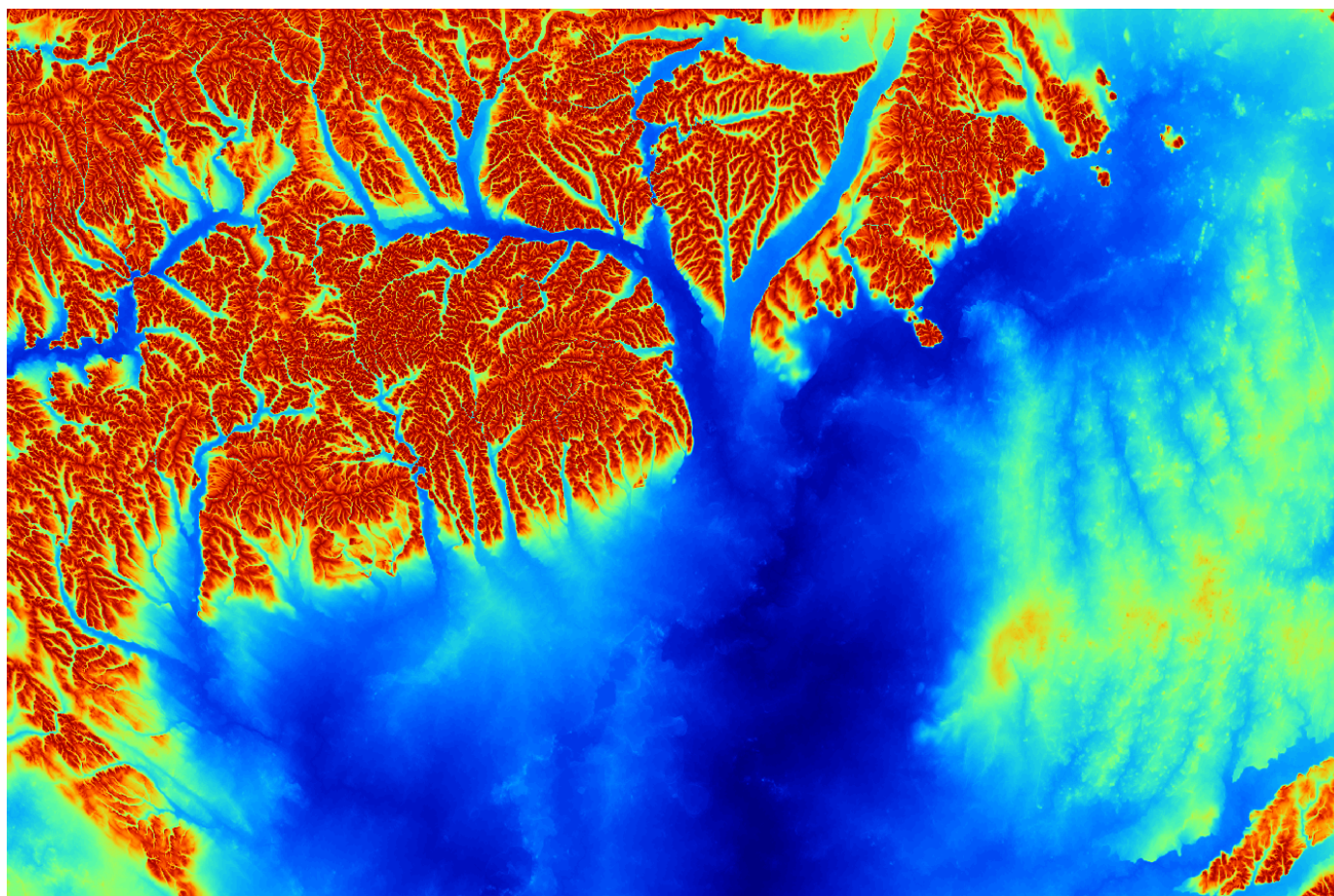


rel. elevation [m]

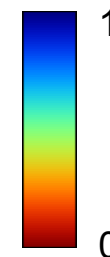


Enhanced morphometric terrain parameters

Wetness Index, pilot test site "Hungary"

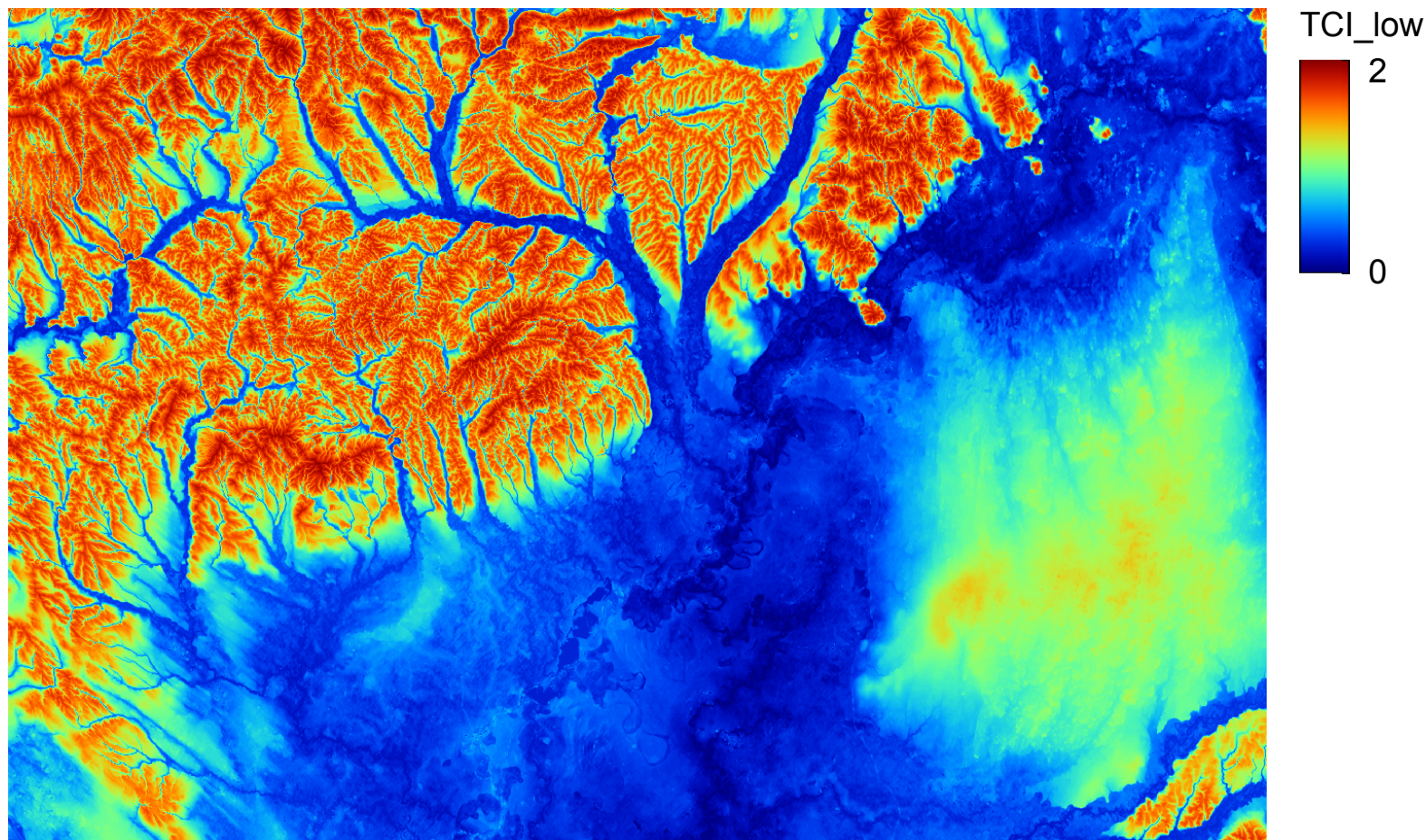


Wetness Index

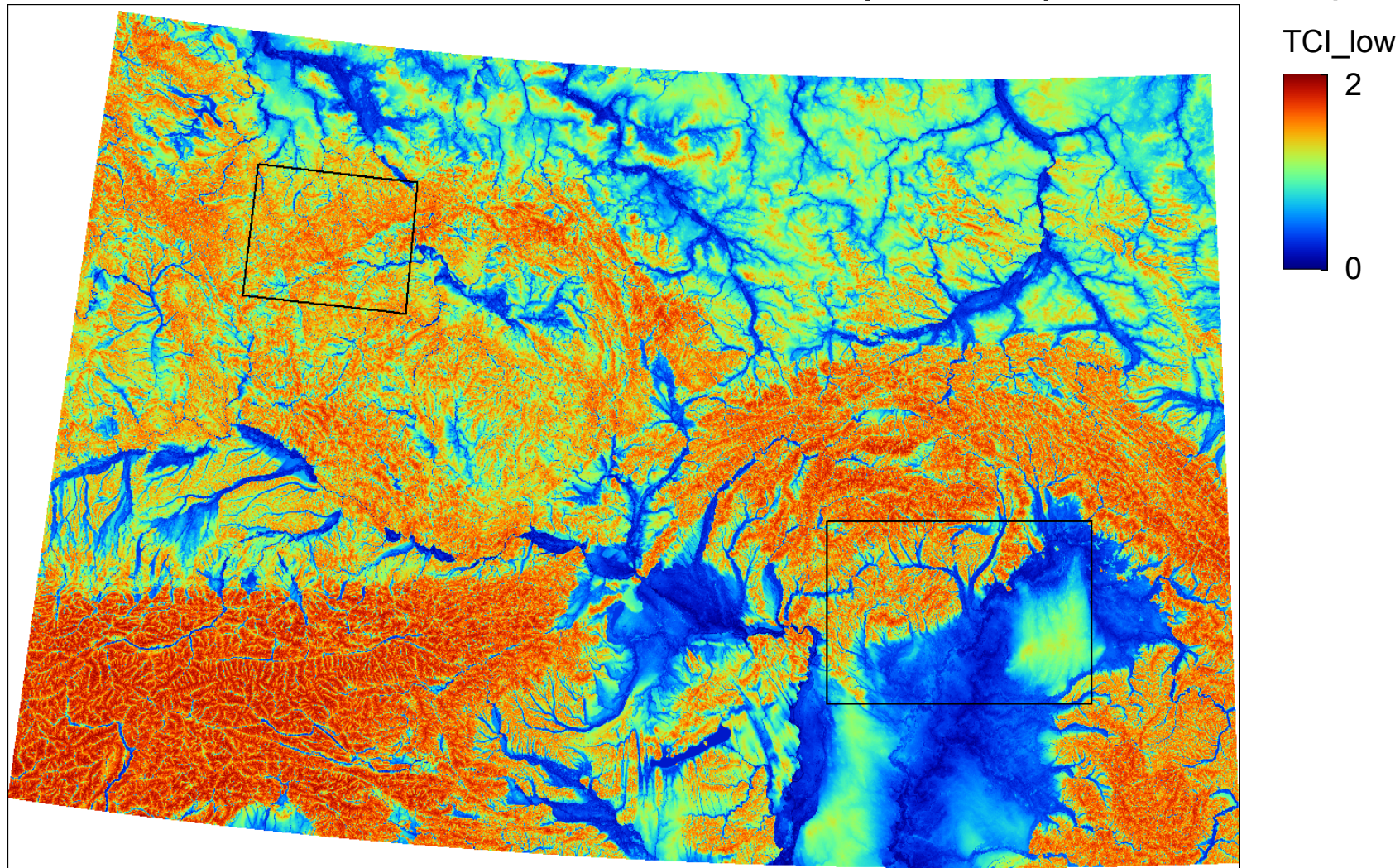


Enhanced morphometric terrain parameters

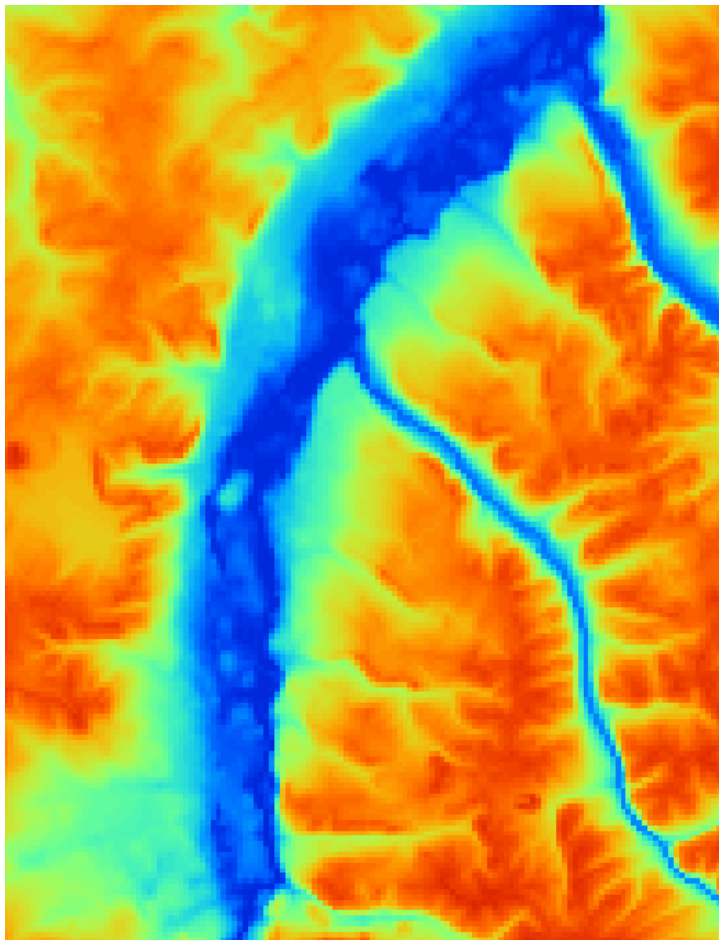
Terrain classification index for lowlands (TCI_low)



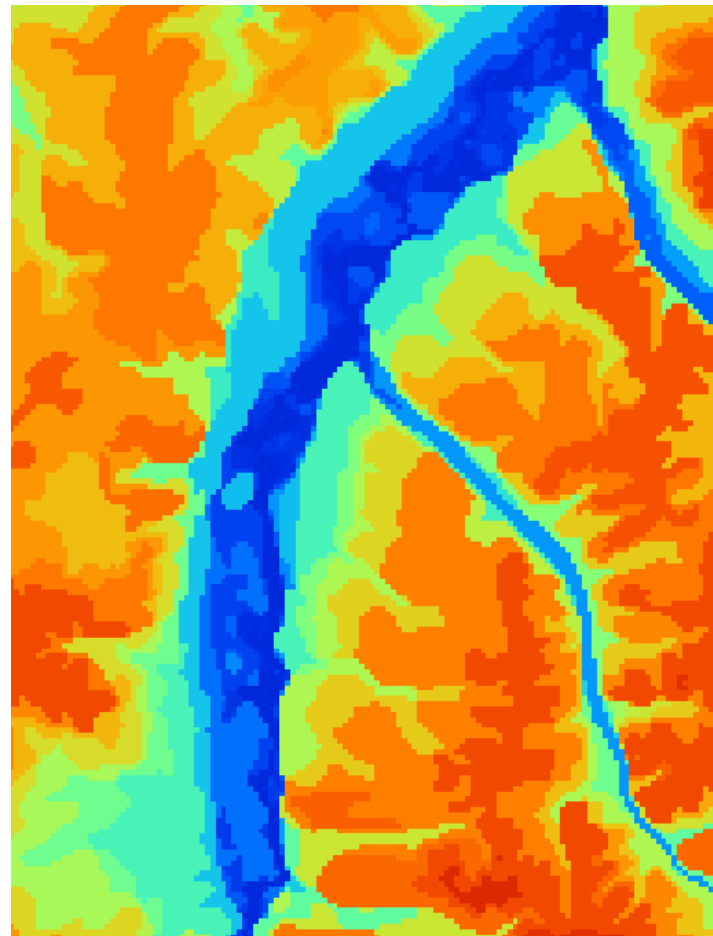
Terrain classification index for lowlands (TCI_low), Central Europe



Self adjusting thresholds for classification



TCI_low (original)




Segments of TCI_low



System of terrain units for terrain classification




- one system of terrain units for all types of landscapes

Flats in top position





 *Mountainous Summit Flat*

Slopes and scarps






 *Divergent Slope, Ridge, Small Bump*
 *Convergent Slope, Small Valley*

 *Upper Slope*
 *Mid Slope, Gentle Slope*
 *Lower Slope, Gentle Slope*

Flats and terraces

 *Upper Terrace 2, Summit Flat 2*
 *Upper Terrace 1, Summit Flat 1*
 *Flat, Lower Terrace 2*
 *Flat, Lower Terrace 1*

Flats in low positions

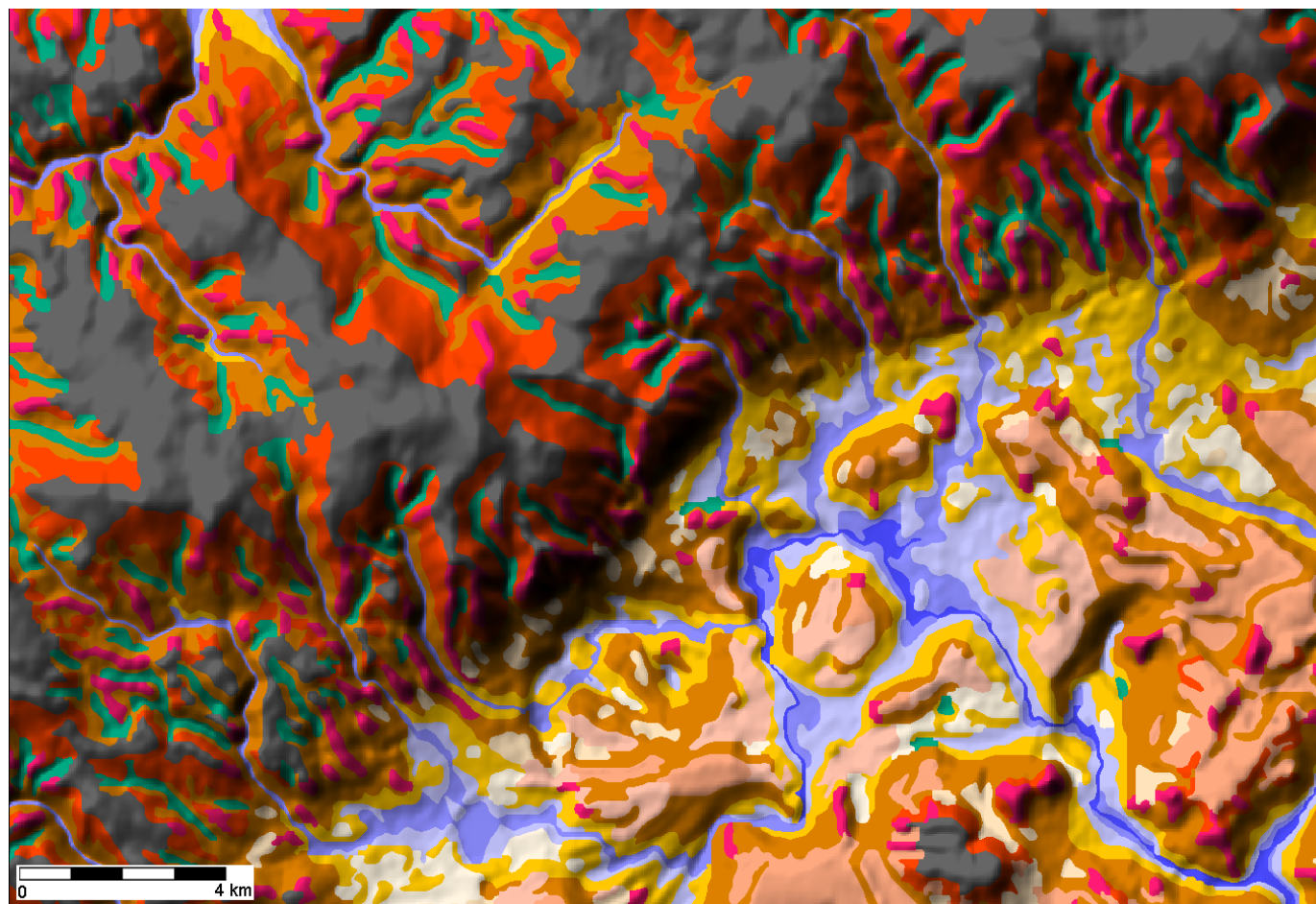
 *Bottom Flat 4*
 *Bottom Flat 3*
 *Bottom Flat 2*
 *Bottom Flat 1*
 *Bottom Flat 0*

Terrain units of Geomorphographic Maps

The delineation of the terrain units is mainly based on the classification of the TCI_{low}, using locally self adjusting thresholds

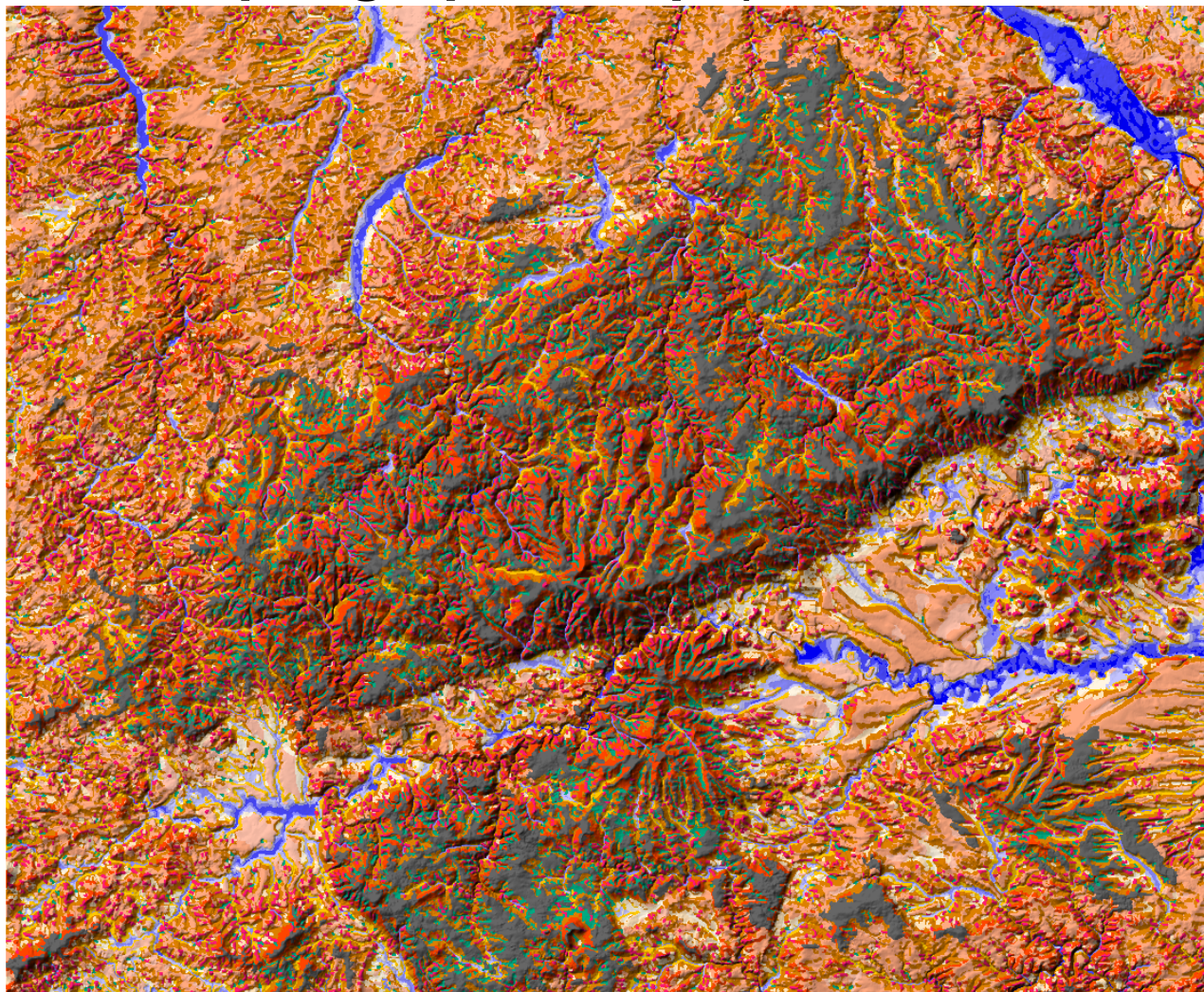
Terrain classification - Geomorphographic Map
















Geomorphographic Map, Detail of pilot test site Chemnitz



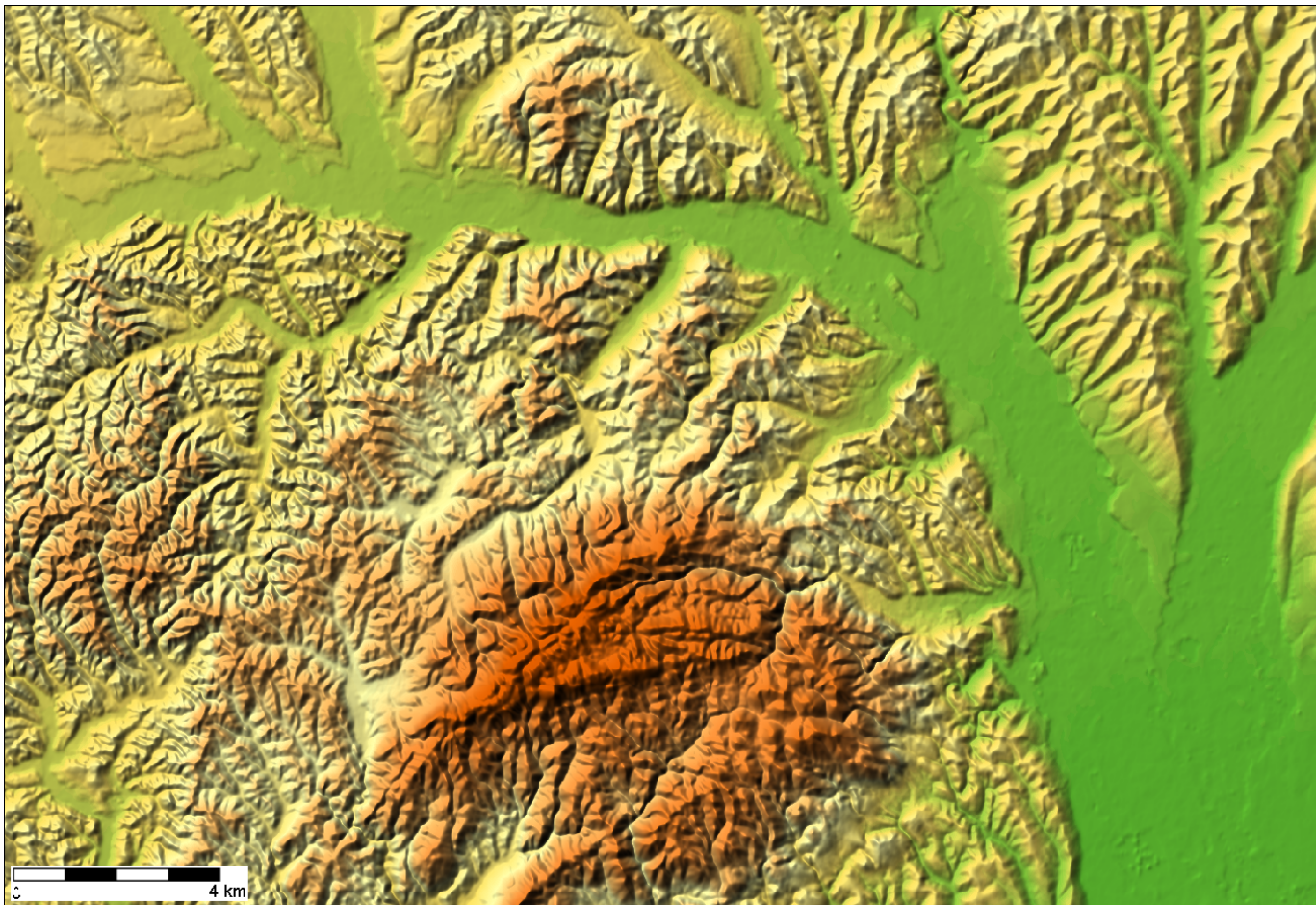
- Mountainous Summit Flat
- Divergent Slope, Ridge, Small Bump
- Convergent Slope, Small Valley
- Upper Slope
- Mid Slope, Gentle Slope
- Lower Slope, Gentle Slope
- Upper Terrace 2, Summit Flat 2
- Upper Terrace 1, Summit Flat 1
- Flat, Lower Terrace 2
- Flat, Lower Terrace 1
- Bottom Flat 4
- Bottom Flat 3
- Bottom Flat 2
- Bottom Flat 1
- Bottom Flat 0

Geomorphographic Map, pilot area "Chemnitz"



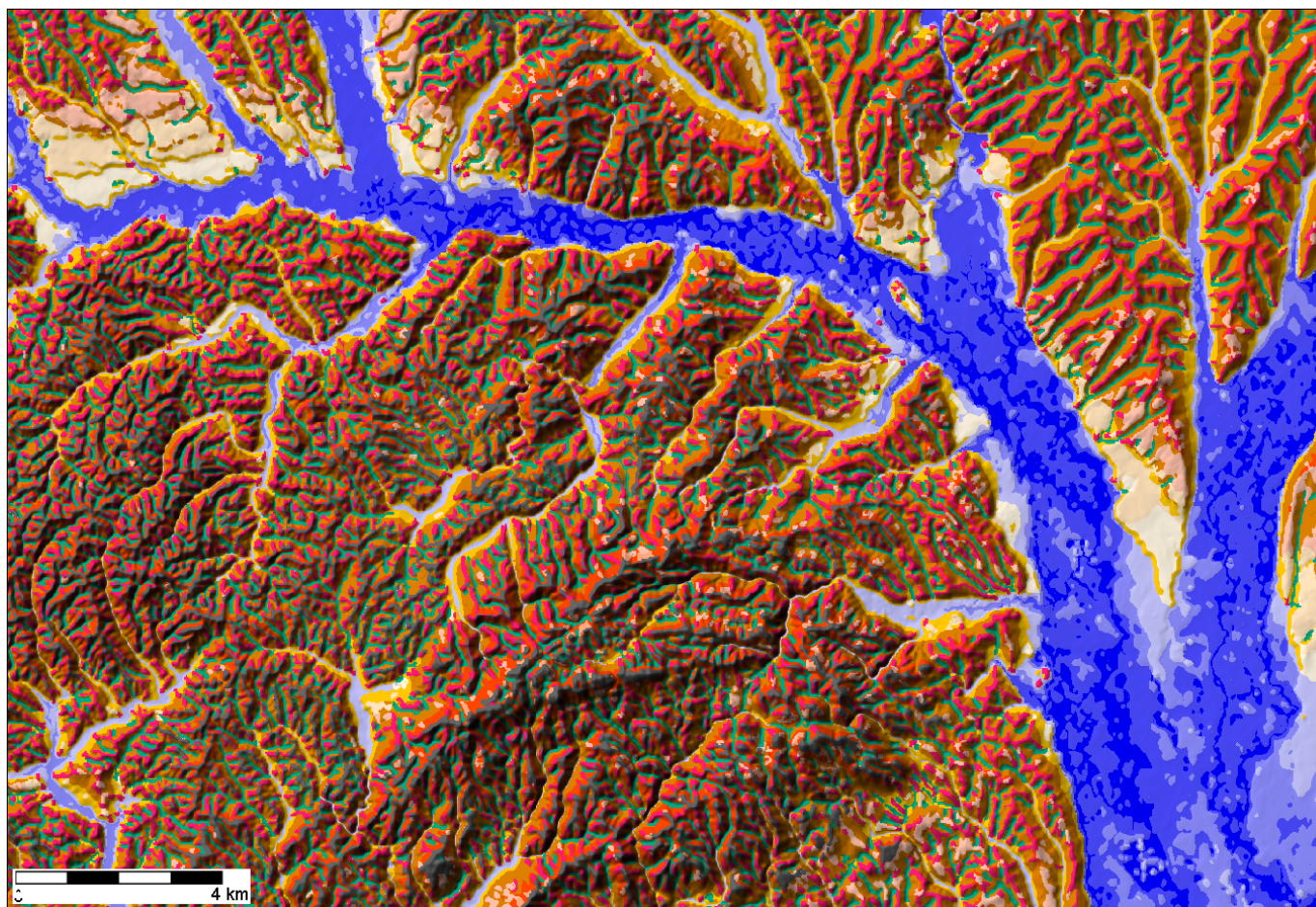
-  Mountainous Summit Flat
-  Divergent Slope, Ridge, Small Bump
-  Convergent Slope, Small Valley
-  Upper Slope
-  Mid Slope, Gentle Slope
-  Lower Slope, Gentle Slope
-  Upper Terrace 2, Summit Flat 2
-  Upper Terrace 1, Summit Flat 1
-  Flat, Lower Terrace 2
-  Flat, Lower Terrace 1
-  Bottom Flat 4
-  Bottom Flat 3
-  Bottom Flat 2
-  Bottom Flat 1
-  Bottom Flat 0

Elevation Map with hillshade, Detail of pilot test site Hungary



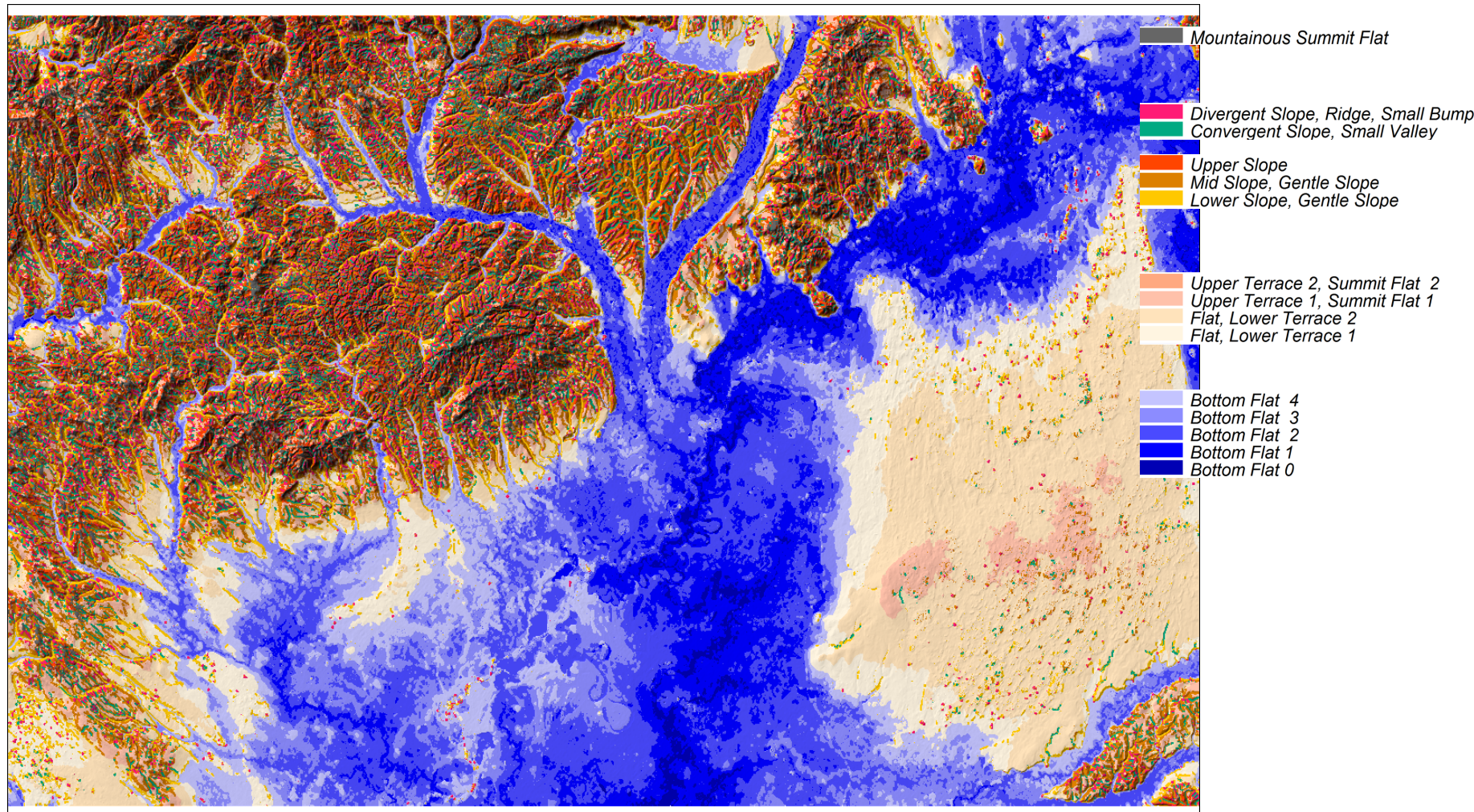
Terrain classification - Geomorphographic Maps

Geomorphographic Map, Detail of pilot test site Hungary

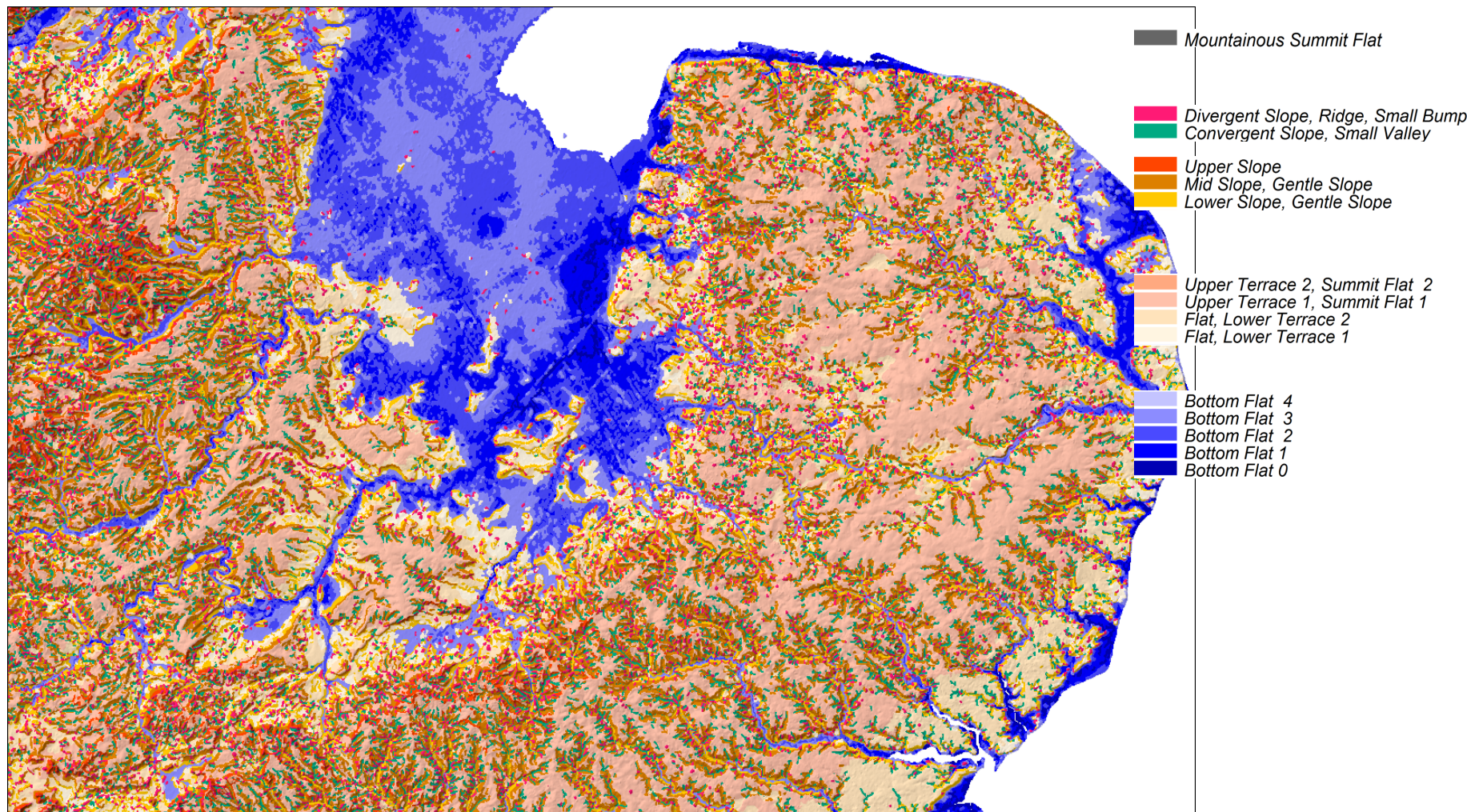


- Mountainous Summit Flat
- Divergent Slope, Ridge, Small Bump
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- Upper Slope
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- Lower Slope, Gentle Slope
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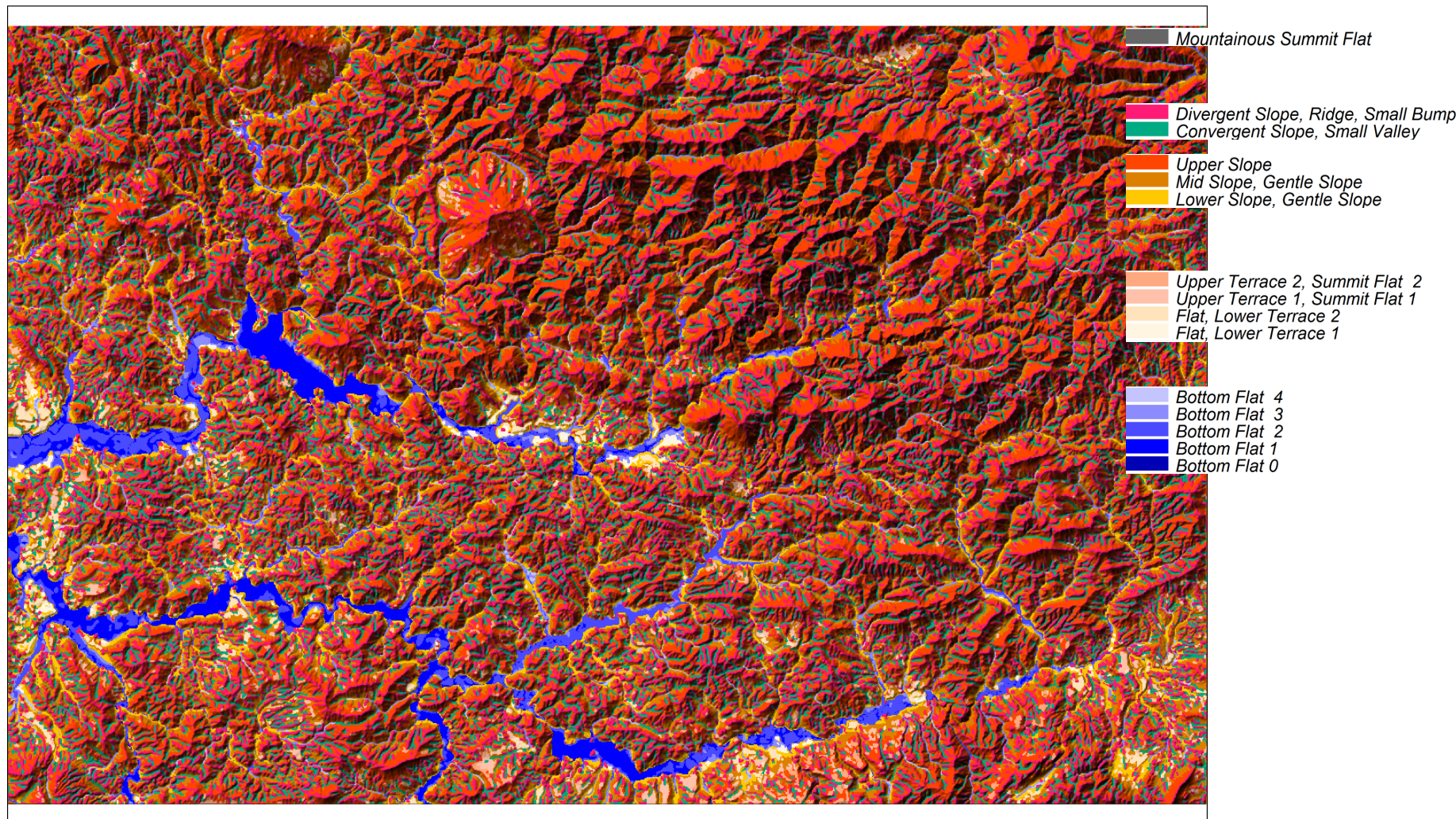
Geomorphographic Map, pilot area "Hungary"



Geomorphographic Map, pilot area "UK"



Geomorphographic Map, pilot area "Fes, Morocco"



Conclusions

- Terrain analysis and classification on the base of DTM can deliver a valuable contribution to create or enhance soil maps.
- SRTM elevation model data exists for 80% of the terrestrial earth's surface.
Particularly in regions with poor data availability terrain analysis on the base of SRTM data can help to create soil maps.
- The concept of Geomorphographic Maps delivers a very detailed terrain classification with relevance for soil mapping.
Geomorphographic Maps are scale-independant and suitable for nearly all types of landscapes.
- Terrain analysis should be done by experts.