

## **Tectonic versus erosional geomorphology of the Sudetes – demystifying polygenetic relief using geomorphometry (popular science version)**

The physical landscape around us is for most people such an obvious component of reality that they only consider it in terms of aesthetic values. It is less realized that landscape and topography have history that often goes millions of years back in time. Earth surface topography is shaped by various processes and hence, provides a most valuable record of events from more or less distant periods of geological past. The value of relief as a carrier of information is amplified by the fact that the most obvious source of information about the past – rocks themselves – may not be present for certain, often crucial periods of time. This is the case of the Cenozoic era history of the Sudetes – one of the Central European mountain ranges. Rock record from this period is scarce whereas this was the period when the contemporary topography was built. If we choose a right approach and use appropriate analytical tools, we are able to read such history and differentiate effects of various events and processes. Likewise, the common public may not be fully aware that surface topography can be accurately and objectively described using numbers which in turn allows us to compare different areas with one another. Increasing availability of data about three-dimensional topographic surface, coupled with increasing computational power of computers, have led to the fast growth of geomorphometry – a scientific approach to Earth topography. Within this promising field of research, features of physical landscapes around us can be expressed quantitatively and in great detail.

The current project follows the rationale presented above. We look at the contemporary topography of the Sudetes as a unique record of long-term landscape evolution, in which various factors have played their role. First, vertical movements of the Earth crust decided about the rise or subsidence of different parts of the Sudetes. Second, the complex geological structure of the area is important in that rocks of different origin and age, occurring adjacent to one another, are not identical in terms of strength and hardness. Third, as time goes by, landforms change and may lose clarity of expression. How to distinguish between contributions of these different factors. Is it possible at all? Following research advances worldwide we claim that it is indeed possible and can be achieved if advanced geomorphometry and statistical tools are applied. Using this approach we will be able to objectively characterize the physical landscape of the Sudetes and by analyzing the topography against rock properties we will be able to show which landscape facets owe their presence to vertical movements of the crust and which reflect variability in rock hardness. Thus, overarching objectives of our project are to read signals inscribed in surface topography, differentiate between effects of erosion, uplift and subsidence, and highlight similarities and differences between various parts of the Sudetes in order to better understand their topography.

In the project we will use digital elevation models as the main source of information. The model will be prepared by us, through joining data obtained from airborne laser scanning of the Earth surface. They are of unprecedented resolution (10 m) and will cover the whole territory of the Sudetes, that is their Polish, Czech and German part. In the next phase, using specialist dedicated software, we compute different parameters describing surface topography and show their distribution on maps. Using statistical approach, we compare various parts of the Sudetes with one another. In particular, we will focus on relief features known as sensitive recorders of vertical movements of Earth crust, mainly longitudinal profiles of streams. After that, we compare objective numerical information about topography derived from terrain models with geology, particularly with distribution of various rock types, to distinguish whether the main traits of contemporary relief are more related to vertical movements than to the presence of rocks of different hardness, or to other factors and reasons. As a final effect, we intend to propose a division of the Sudetes into smaller units, known as morphostructural in Geosciences, and will explain their origin. Thanks to our research, not only the origin of the Sudetes as a mountain terrain will become less mysterious, but we make a significant contribution to the understanding of topography of Central Europe and to advancing tectonic geomorphology in general.

There are several reasons why we decided to run this project. First, we intend to fill a significant gap in our knowledge about the natural history of the Sudetes – the highest mountain range in the Central European belt of mountains and uplands (*Mittelgebirge*). We want to replace vague and too general statements present in literature by more specific explanations of the main features of regional topography, also in respect to individual parts of the Sudetes. Second, the Sudetes represent a type of relief which is rather neglected in contemporary research in tectonic geomorphology. Thus, we have an opportunity to make significant contribution to the scientific discipline and formulate more universal explanatory proposals. Third, we have new elevation data of high resolution, obtained from airborne laser scanning, as well as analytical tools embedded in Geographic Information Systems, which were not available to our predecessors. Thus, their use will considerably add to advancing research in both general as well as regional context.