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Morphostructural Analysis of the White Sea Southeastern Coast

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The question of how of the vertical motions are reflected in the morphometrical characteristics of the relief is still not resolved in modern geomorphology. In this research, we focus on the morphometric analysis and finding a way to use it in morphostructural approach of vertical motions qualitative assessment.
We have chosen the southeastern coast of the White Sea (Russia) as a study area. Some morphostructural studies were performed on this territory in the past, but all of them were made on rather small scale (1:750 000 – 1:2 000 000), and moreover they lack cohesion with each other, so it could been a good experimental site to test our methods. The territory span is near 50 thousand km2, and it is not sufficiently covered with instrumental measurements of vertical crustal velocities. According to the literature, it is characterized by a differentiated distribution of vertical velocities: from nearly -2 mm/yr up to +4 mm/yr, so we could suppose that it should give us a mosaic, well-interpretative image of morphometric parameters. We chose 1:500 000 scale as basic for our research.
First, we used all available morphostructural and neotectonic maps to link together different representations of tectonic regime. It gave us an opportunity to compile them in a structural block map of study area. Then we made an attempt to apply different morphometrical and morphostructural analysis' methods and calculate a set of characteristics of each block – the height of Pre-Quartenary top layer, relief amplitude and energy (local amplitude), mean isolong value (isolines connecting rivers of one order and similar length), river density, normalized lineament intersection density, and thickness of Quartenary layer.
We integrated the results of our morphometrical data analysis using a simple approach: we selected 12,5-quantile and 87,5-quantile of each parameter to build an hierarchy of blocks according to their vertical velocities. Then these quantiles were combined for each block by each parameter, and final rank of vertical movements was calculated as a difference between the number of "high velocity" and "low velocity" indexes. By doing this, we ranked all the blocks from -4 to 6. Then we plus 5 to all these numbers in order to prevent association between 0 rank and 0 of vertical velocities. The main advantage of this method is its reduced sensitiveness to external factors, resulting from high number of input parameters: accidental fluctuations compensate the influence of each other.
Based on these ranks we finally the synthesized the morphostructural map. Ranks and vertical velocities calculated from radiocarbon (14C) dating demonstrate a certain linear dependence (velocity [mm/yr] = 1,05*rank - 2,6), though we don't have enough data to provide a statistical analysis because of sparse distribution of 14C dating points. More field data and 14C samples are needed to increase representativeness and approve our model.