

Changes in the channel-bed level of the western Carpathian rivers over the last 40 years

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Channel-bed level is constantly changing in time and space, and the process is dependent on both natural and anthropogenic factors. In mountain areas this is one of the more visible morphological processes. The main aim of the research was to analyze the dynamics of the position of river channel beds. Three rivers located within the western part of Polish Carpathians were chosen for the analysis: the Ropa river, the Kamienica Nawojowska river and the Ochotnica river. They are typical rivers for the Beskidy Mountains, medium Flysch mountains. To assess changes in the position of channel bed long-term series of data of minimum water stages in the river were used. The Ropa river is the biggest left tributary of the Wisłoka river (basin a of the upper Vistula River). The total length of the river amounts to 80 km, its gradient equals 58.9‰ and the water basin area amounts to 974 km². The Kamienica Nawojowska river, with a length of 32.2 km is a right tributary of Dunajec river. The average decrease for the entire watercourse is 18.1‰. The catchment area is 238 km². The Ochotnica river is 22.7 km long and it is a left tributary of the Dunajec river. The average slope for the entire watercourse is 36.1‰. The Ochotnica river characterized by deep valleys (catchment area 107.6 km²).

Analysis of trends in minimum annual water stages in the alluvial Ropa river channel throughout the multi-year period of 1995-2014 shows an increasing trend amounting to 0.8 cm/year. In the Kamienica Nawojowska river the tendency of incision was observed starting from the 1960 to 2014. Average annual rate of increase of the minimum stages was between 0.4 to 1.2 cm/year. On the basis of the analysis of the minimum water levels in the years 1972–2011 two periods can be seen with different tendencies to change the position of the Ochotnica channel bottom. The first covers the years 1972–1996, where aggradation (3.9 cm/year) was the predominant process while in the period 1997–2011 incision (3.2 cm/year) was dominated.

Two main factors determine changes in the position of the rivers channel beds: natural (floods, tributaries, type of the channel bed substrate) and anthropogenic (control works in the channel, extraction gravels, reservoir backwater). The deep erosion observed in the Carpathians rivers in the last decade is also associated with changes in land use that have increased due to the economic transformation of the country, and in recent years, the Polish accession to the EU.