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Water temperature fluctuation patterns in surface waters of the Tatra Mts., PolandMiroslaw Żelazny^a, Agnieszka Rajwa-Kuligiewicz^{a,*}, Anna Bojarczuk^a, Łukasz Pęksa^b^a *Institute of Geography and Spatial Management, Faculty of Geography and Geology, Jagiellonian University, Gronostajowa 7, 30-387**Krakow, Poland*^b *Tatra National Park, Kuźnice 1, 34-500 Zakopane, Poland*^{*} *Corresponding author. E-mail address: agnieszka.rajwa@uj.edu.pl***Abstract**

In this study, we aim to characterise natural variability of water temperature in surface waters of the Tatra Mts. and determine the dominant factors controlling its spatial diversity and seasonal patterns. For this purpose, a total of 33 time series of water temperature representing lakes, vaucuse springs and streams were analysed using the continuous wavelet transform (CWT). The periodicity analysis were conducted with the Morlet wavelet on hourly sampled data covering a period of 5 years. The principal components analysis (PCA) has been applied to describe the relationships among variables and extract potential sources of water temperature variability. The results showed an extremely high heterogeneity in temporal patterns of water temperature fluctuations among streams when compared to lakes and vaucuse springs. Wavelet analysis of water temperature time series revealed the presence of seven different configurations of periodical patterns. The lowest variability was observed among vaucuse springs that are supplied by groundwaters. Temporal fluctuations of water temperature in lakes contained four different types of oscillations. Streams were among the most diversified in terms of water temperature patterns exhibiting low, medium and high frequency behaviour. The PCA analysis confirmed the dependence of water temperature on weather conditions, catchment characteristics and flow rate explaining 88.97% of the total variability in the data. The results obtained from this study emphasize the importance of

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