Present state of marginal mountain permafrost in South Eastern Europe

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Permafrost exists in the highest mountains of SE Europe (South Carpathians, Rila, Pirin) in small isolated patches, where local topography and landforms provide conditions for winter ground cooling and for shading and ground thermal isolation during summer.

We present a summary of the present state of mountain permafrost in the study area by analyzing the results of ERT (electrical resistivity tomography) and GPR (ground penetrating radar) profiles together with thermal measurements of ground surface and air performed at the sites of documented permafrost occurrence. The results are put in context with recent climate evolution by a decade of thermal measurements in the South Carpathians and three years in the Rila and Pirin Mountains.

Despite differences in air temperature and snow cover timing and thickness the permafrost extent remains constant at the study sites. The active layer is thick (between 5-10 m), whereas the permanently frozen layers vary in thickness even for the same study site, and are relatively thin compared to sites located in the Alps or the Andes, indicating that the existing permafrost is in imbalance with the current climate. Snow cover is probably the most important factor in seasonal evolution, controlling both the winter cooling and the summer thermal decoupling of ground and air temperature. Recent evolution shows a tendency of shifting the snow cover period with later deposit and later thaw which favors permafrost conditions. We also observe a significant difference between Southern Carpathians and Rila and Pirin mountains, with snow patches lasting until late summer, August or September, in the later.

However snow cover present strong local variations in terms of thickness and isolating proprieties which makes it the least study and least understood factor in mountain permafrost dynamics in SE Europe.