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Long-term changes of snow cover regime in connection with observed solid, liquid and mixed precipitation ratio trends in Slovakia

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Snow cover information is very frequently used. For many people it is in the centre of interest during whole winter season. On the other hand snow cover is one of the mostly affected due to ongoing climate change. Recently some increase in winter precipitation has been registered, mainly in the northern Slovakia. This resulted in significant increase of new snow in the high mountain localities at some extreme events (above 1300 m a.s.l.). Such examples are well known not only in Slovakia, but also at many sites in the Alps (the newest events occurred in the 2008/09 winter). On the other side significant decrease of snow cover days was observed in the lowlands. There are about 700 precipitation gauges in Slovakia every year since 1951 and some lower number since 1921. In 1980 the Slovak Hydrometeorological Institute decided to create precipitation database, including all snow data (climatologic database is ready for 1961-2008). Altogether 600 station data are complete in 1981-2008. In spite of shorter 30-year period, it is considered long enough in order to identify principal changes in snow cover during current climate change. This snow cover series is very valuable also for future analysis in some years or decades.

The analysis of snow cover regime changes in the context of observed solid, liquid and mixed precipitation ratio trends within the territory of Slovakia represents the essential goal of the contribution. In addition, the analysis presented here is focused on the changes in annual regime and territorial distribution of snow cover due to warming of climate and change in precipitation. Very important is the dividing line between the influence of rising temperature and increasing winter precipitation. Recent investigation supports the fact that it lies at about 900 m a.s.l. and it tends slowly to increase. Below this boundary decrease of snow is observed and above it some increase. Finally some extreme events with high new and total snow cover depth are listed. Snow cover analysis is highly important also in terms of prevention of dangerous avalanche events occurring in Slovakia every year.

The precipitation state ratio analysis (liquid, solid and mixed) at selected meteorological stations has confirmed the existence of positive trend in the case of annual liquid and mixed precipitation rate and on the contrary the negative trend of annual solid precipitation rate in the south as well as north part of Slovakia, including mountain regions. Analogous or even more expressive trends of proportion of particular precipitation state have been revealed for individual months as well as for period when solid and mixed precipitation predominate (in the cold half-year). Similarly the results of fresh snow cover depth analysis have shown an expected increase at considered meteorological stations in Slovakia in the winter. The fresh snow cover depth maxima ranking and its temporal occurrence support an exceptional status of the values recorded in the last decade of the 20th century and in the first decade of the 21st century, as well. In the case of n-days sum maxima (particularly 3-, 4- and 5-days sum) of fresh snow cover depth as well as the number of days with higher values of fresh snow cover depth, the statistical analysis have preliminarily detected a significant positive trend for the most of territory of Slovakia during winter period.