

HYDROLOGICAL REGIMES OF SMALL CATCHMENTS IN THE HIGH TATRA MOUNTAINS BEFORE AND AFTER THE LARGE WIND-INDUCED DEFORESTATION

H. Hlavata¹, L. Holko², Z. Kostka², J. Novak¹

¹*Slovak Hydrometeorological Institute, Kosice, Slovakia*
Helena.Hlavata@shmu.sk

²*Slovak Academy of Sciences, Institute of Hydrology, Liptovsky Mikulas, Slovakia*

Influence of landcover change (mainly deforestation, but also afforestation) on the hydrological cycle has been the subject of research since the beginning of the 20th century. Actually, the origin of experimental hydrological research in small catchments has been initiated by the interest in changes of hydrological regime due to the landcover changes (Engler, 1900). Since then many studies have been conducted worldwide. There are even numerous studies summarizing their results, e.g. Bosch and Hewlett (1982), McCulloch and Robinson (1993), Andreassian (2004), Kostka and Holko (2006). Despite the existence of conflicting perceptions of landcover impacts on the hydrological cycle (stated for example by Calder, 2004; Forsyth, 2005; Jewitt, 2005), it can be generally concluded that the large-scale deforestation results in temporary increase of some runoff characteristics.

Strong falling wind with maximum velocity of about 230 km·h⁻¹ that occurred on 19 November 2004 caused the large-scale deforestation (about 120-140 km²) on the territory of the High Tatra Mountains, Slovakia. The area represents the highest part of the Carpathian Mountains. Although the smaller wind calamities in the area are common (Konček *et al.*, 1973) such a big wind-induced deforestation has not yet been recorded (Koren, 2005). The event allowed the researchers to study the impacts of deforestation on hydrological cycle at a scale which could not have been achieved by controlled experiments. In this poster we shall present the results of the analysis of the long-term runoff data (1963-2007) from several catchments (30-315 km²) in the area. The decrease of forested area in the studied catchments due to the wind calamity varied between 3 and 35%. We have analysed annual, seasonal and maximum runoff, runoff characteristics O_{10} - O_{90} , hydrological balance, the precipitation-runoff ratio in the warm part of the year (June-September) and selected characteristics of the rainfall-runoff events. The analysis showed that the frequency of flood events did not increase after the deforestation. In several catchments the minimum runoff and spring runoff increased. Despite some indications of the influence of deforestation on runoff, the variability of studied runoff characteristics did not exceed the values observed in the past, i.e. before the wind calamity.

References

- Andreassian V., 2004: *Waters and forests: from historical controversy to scientific debate*. Journal of Hydrology, 291: 1-27.
- Bosch, J. M., Hewlett J. D., 1982: *A review of catchment experiments to determine the effect of vegetation changes on water yield and evapotranspiration*. Journal of Hydrology, 55: 3-23.

- Calder I. R., 2004: *Forests and water-closing the gap between public and science perceptions*. Water Science&Technology, 49(7): 39-53.
- Engler A., 1919: *Untersuchungen über den Einfluss des Waldes auf den Stand der Gewässer*. Mitt. Schweiz. Anst. Forst. Versuchswes., 12: 636 pp.
- Forsyth T., 2005: *Land use Impacts on Water Resources-Science, Social and Political Factors*. In: M.G. Andreson, J.J. McDonnell (eds): *Encyclopedia of Hydrological Sciences, Chapter 187*. John Wiley & Sons, Ltd.: 2910-2923.
- Jewitt G., 2005: *Water and Forests*. In: M.G. Andreson, J.J. McDonnell (eds): *Encyclopedia of Hydrological Sciences, Chapter 186*. John Wiley & Sons, Ltd.: 2895-2909.
- Konček M. et al., 1973: *Climate of the Tatra Mountains* (in Slovak). *Zbornik prac o Tatranskom narodnom parku*, 15: 239-324.
- Koren M., 2005: *Wind calamity on 19 November 2004 - new perspectives and consequences* (in Slovak). *Tatry*, 44: 6-28.
- Kostka Z., Holko L., 2006: *Role of forest in hydrological cycle-forest and runoff*. *Meteorologicky cas.*, 9: 143-148.
- McCulloch J.S.G., Robinson M., 1993: *History of forest hydrology*. *Journal of Hydrology*, 150: 189-216.