Abstract

Evapotranspiration (ET) plays a significant role in the hydrological balance. The terms potential (PET) and reference (RET) evapotranspiration are often used while estimating its rate. The doctoral thesis deals with the estimation of PET, RET and other selected processes.

First, the influence of net longwave radiation (the component of radiation balance) on the rate of PET was examined. It was found that the standard methods result in the significant differences in PET estimation due to the absence of model calibration to local conditions. The original model caused distinction in the PET evaluation for the Liz experimental catchment by up to 100 mm/year. Calibration of the parameters of two commonly used methods for calculating net longwave radiation reduced the error in PET evaluation to less than 20 mm/year.

PET or RET estimation itself can be performed by many direct or indirect methods. Their accuracy is highly discussed. This work focused on selection of suitable methods and their further testing on conditions of 18 stations in the Czech Republic. 37 methods were compared with measured data. It was proven, that the best results in this region were achieved by combination methods (with average RMSE of 1.2 mm/day, 18.6 mm/month, and 33.3 mm/year). Among individual models, the radiation-based Makkink method (1957) and the temperature-based Oudin method (2005) revealed as the best choice.

The rate of ET is also greatly influenced by interception, which is, however, often neglected. Current work analysed 10 years of measured interception data in the Liz catchment and compared them to outcomes of several modelling approaches. The subtraction of the constant value from each rainfall was shown as the most effective method. The impact of the interception rate on ET and other hydrological balance components was investigated with the HBV model. More concretely, the difference up to 6 % was documented for the runoff o ran 11 % difference for the groundwater level. Precipitation intercepted on vegetation reached up to 135 mm in the growing season which is 29.1 % of the total precipitation. This is an amount that cannot be neglected. However, even a simple interception model can be a sufficient for hydrological simulations.

First case study was focused on differences between forested hillslope and a peatland. It was demonstrated that the annual runoff was greater from the peatland with the runoff coefficient 80.3 %. The runoff coefficient of the forested slope was 69.2 %. The reason for such difference was the higher rate of ET of the forested hillslope (the average difference was 170 mm/year). Overall, in the peatland area, the actual ET reached 18-28 % of precipitation in the

examined period 2014-2019. Concurrently, the study pointed out the fact that the peatland contributes to the total runoff mostly in rainfall events, while the water from the forested hillslope predominates in the period of baseflow.

The second case study compared the soil water balance in spruce and beech stands within the period 2001-2022. The study showed a higher amount of soil water is retained under the beech stand in the winter months and, on the contrary, during dry months in the growing season under the spruce stand. In the case of a wet growing season, the smaller amount of soil water persisted under the spruce forest. The balance model of soil moisture revealed interception as the dominant factor affecting the amount of soil water. The interception was by 70 mm/year higher for the spruce stand on average. In case of lack of summer precipitation events, it can be balanced by higher transpiration of beech stands (by 85 mm/year on average).

Keywords: evapotranspiration, potential evapotranspiration, hydrological balance, interception, radiation balance