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Climate Change Impact on Various Land Cover Types Water Balance in South Western Hungary

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Water balance of Zala county (South Western Hungary) was analyzed using remote-sensing based evapotranspiration (ET) 1-km spatial resolution maps for Hungary by Szilagyi and Kovacs over the 1999-2008 period [Szilagyi J., Kovacs A., 2011: A calibration-free evapotranspiration mapping technique for spatially-distributed regional-scale hydrologic modeling. J. Hydrol. Hydromech., 59, 2011, 2, 118–130.].

Mean (1999-2008 period) annual evapotranspiration and runoff (as the difference of precipitation and evapotranspiration: R = P - ET) were analyzed in the context of land cover types (artificial surfaces, agricultural areas, forest and semi natural areas, wetlands, water bodies). The average ET of Zala county was 581 mm/year, it was more than 89 percent of the mean annual precipitation (650 mm/year). The highest mean annual ET values (1999-2008) determined for water bodies and wetlands. Forest and semi natural areas had higher mean annual value than agricultural areas, the lowest rate belonged to artificial surfaces. The maximum ET value was very high in case of water bodies (845 mm) as well as forest and semi natural areas (828 mm). Runoff was the largest on artificial surfaces (89 mm/year), and it was especially low for wetlands.

Spatially-distributed calibration parameter of Budyko-model (alfa) was calculated by using temperature, precipitation and ET values. Another parameter, beta (which gives the relationship between pan-evapotranspiration and actual evapotranspiration) was calculated for those pixels, where the ET value was higher than the precipitation value, because the Budyko-type model for such type of pixels is not valid. The two parameter maps (alfa and beta) aggregate all of the factors affecting ET, dominantly the surface cover. They can be used for evaluating future ET and runoff in spatially-distributed mode.

ET and runoff predictions have been done for three periods (2011-2040, 2041-2070, 2071-2100) using the parameter maps (alfa and beta) and future data of climate models (mean annual temperature and precipitation). According to the predictions, about 3 Celsius mean annual temperature rising and 25 mm precipitation decreasing can be expected to the end of the 21st century. Thus the mean annual ET is increasing (from 577 mm/year to 604 mm/year) and the runoff is significantly decreasing (from 78 mm/year to 27 mm/year, from 12 to 4 percent of the precipitation) to the end of the 21st century.

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