Geophysical Research Abstracts, Vol. 7, 09534, 2005
SRef-ID: 1607-7962/gra/EGU05-A-09534

On hydrological transition between summer and winter: a study of meso-scale catchments in Luxembourg.

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In this study we analysed the hydrological behaviour of meso-scale catchments in the transition period from summer to winter. Ten catchments, all situated in the Grand Duchy of Luxembourg and characterised by the same pluvio-evaporal hydrological regime, with daily discharge data for a period of eight years were used. Catchment sizes vary from 7 km^2 to 350 km^2. For each catchment we calculated the duration of the transition period and we related it to the total amount of precipitation and to the variation in water storage. Main catchment lithologies are marls, a combination of marls and sandstone or a combination of marls, sandstone and schist.

To calculate the duration of the transition period the end of summer and the start of winter were defined as follows: the end of summer is the date of the lowest point in a catchment's daily water balance; the start of winter is the date when a more or less constant runoff coefficient C is reached. Pfister et al. (2002) proved that catchments display a strong seasonal variation with respect to their runoff coefficient, which reaches a constant value during winter. The water balance was calculated with a simple conceptual model using discharge, precipitation and actual transpiration as input parameters.

By comparing ending dates of summer it turned out that in successive years all catchments reach this date about the same time, while difference only occurs between years. The start of winter turned out to be more differentiated in successive years. In some years all catchments reach the start of winter at approximately the same date; the time between the first and the last catchment reaching the date is about 3 days. In other years the time between the first and last catchment to reach the start of winter is about

40 days and appears to be catchment specific (i.e. the same catchments reach the start of winter first and the same catchments reach the start of winter last). However the amount of precipitation needed to reach the start of winter is catchment specific and fairly constant throughout the years. The increase in storage of the catchments during the transition period also appears to have a catchment specific value, constant throughout successive years.

The outcome of this study demonstrates that during the transition period catchments show the same dynamical behaviour concerning precipitation needed to reach the winter period. This implies a strong dependence on temporal rainfall patterns. For storage a similar dynamical behaviour has been found. Combing this with the fact that the catchments have different lithologies, it implies that the soil is more important than lithology in the behaviour of catchments during the transition period.

References

Pfister L., J. Humbert, J.-F. Iffly & Hoffmann L., 2002, Use of regionalized stormflow coefficients with a view to hydroclimatological hazard mapping, Hydrological Sciences Journal 47, 479-491.