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Runoff-rainfall (sic!) modelling: Comparing two different approaches

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Rainfall is an important input variable for many applications. However, the estimation of areal rainfall is afflicted with significant uncertainties, since it exhibits a large spatio-temporal variability, especially in Alpine areas. Additionally the density of the monitoring network is frequently low and measurements are subject to major errors. The most reliable hydrological information that is available refers to runoff. Kirchner (2009) presented a method to infer catchment rainfall from streamflow fluctuations. The approach is however limited to catchments, where discharge is determined by the volume of water in storage and which can be characterized as simple first-order nonlinear dynamical systems. The model has recently been applied to several catchments in France and Luxembourg (Adamovic et. al., 2014; Krier et al., 2012). In Herrnegger et al. (2014) a different technique to calculate mean areal rainfall on the basis of an inverse conceptual rainfall-runoff model and runoff observations was presented. Thereby a conceptual model is embedded in an iteration algorithm, in which for every time step a rainfall value is determined, which results in a simulated runoff value that corresponds to the observation. The two modelling approaches differ substantially, not only concerning the model concepts, but especially in the number of model parameters. The Kirchner (2009) model (when deriving the storage-discharge relationship directly from runoff data) only has a single parameter. In contrast, the Herrnegger et al. (2014) model uses 10 parameters that have to be calibrated initially, but will offer more degrees of freedom and flexibility in describing more complex catchment responses. In this contribution, we present the application and comparison of both models in the Krems catchment (38.4 km^2) located at the foothills of the Northern Austrian Alps. Apart from comparing the performance of the runoff simulations, the focus of this paper lies in evaluating the inverse rainfall estimates from the two models. Here, time series from a station observation in the proximity of the catchment and the independent INCA rainfall analysis of Austrian Central Institute for Meteorology and Geodynamics (ZAMG, Haiden et al., 2011) are used.

References:

Adamovic, M., Braud, I., Branger, F., and Kirchner, J. W. (2014). Does the simple dynamical systems approach provide useful information about catchment hydrological functioning in a Mediterranean context? Application to the Ardèche catchment (France), Hydrol. Earth Syst. Sci. Discuss., 11, 10725-10786.

Haiden, T., Kann, A., Wittman, C., Pistotnik, G., Bica, B., and Gruber, C. (2011). The Integrated Nowcasting through Comprehensive Analysis (INCA) system and its validation over the Eastern Alpine region. Wea. Forecasting 26, 166-183, doi: 10.1175/2010WAF2222451.1.

Herrnegger, M., Nachtnebel, H.P., and Schulz, K. (2014). From runoff to rainfall: inverse rainfall–runoff modelling in a high temporal resolution, Hydrol. Earth Syst. Sci. Discuss., 11, 13259-13309.

Kirchner, J. W. (2009). Catchments as simple dynamical systems: catchment characterization, rainfall–runoff modeling, and doing hydrology backward. Water Resour .Res., 45, W02429.

Krier, R., Matgen, P., Goergen, K., Pfister, L., Hoffmann, L., Kirchner, J. W., Uhlenbrook, S., and Savenije, H.H.G. (2012). Inferring catchment precipitation by doing hydrology backward: A test in 24 small and mesoscale catchments in Luxembourg, Water Resour. Res., 48, W10525.