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Assessment of TOPographic Kinematic APproximation and Integration model TOPKAPI-eX applicability for flood events simulation in two small sub-catchments in Saxony

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Numerical simulations of rainfall-runoff processes are valuable tools for understanding hydrological processes and for assessing the impact of certain decisions on the hydrological cycle of the study areas. The advancements in the computer technology and data acquisition have assisted their rapid development and wide use. The current research aims at evaluating the applicability of the physically-based, fully distributed model TOPographic Kinematic APproximation and Integration TOPKAPI-eX for the simulation of flood events in two sub-catchments in Saxony State, Germany. This model has not been applied for German watersheds with high spatial resolution data. The results indicate that the model is calibrated well for the Wernersbach sub-catchment (Nash Sutcliffe Efficiency coefficient-0.89), whereas for the Wesenitz sub-catchment it was only satisfactory (NSE-0.7). As the model uses two soil layers, the addition of the second soil layer has improved the model performance in comparison to the simulations with only one soil layer in the case of the Wernersbach sub-catchment (NSE increase from 0.83 to 0.89). During the validation process, the model performance has shown variable results for both catchments. The best performance was achieved for the Wernersbach sub-catchment for the year with the highest flow (NSE-0.95) in the last decade. The lowest performance coefficients for Wernersbach and Wesenitz sub-catchments were 0.64 and 0.64, respectively. The reasons for low model performance were discussed to be: low data quality and data insufficiency, methods used during the simulations are interpolations, manual calibration, ETP estimation, etc., and the assumptions made during the calibration.