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Effects on rainfall-runoff models from different definitions of the climatological and discharge day

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Rainfall-runoff models are important tools for water resources planning, runoff predictions at ungauged basins and research. Their performance is affected by uncertainties related to the available data used to drive them. Although the effects on rainfall-runoff models caused by the quantity and quality of the data, spatial and temporal variability of their inputs, and temporal resolution of the data have been well investigated, the effects on rainfall-runoff models caused by different definitions of the climatological and discharge day have been overlooked. Do they matter in hydrological modelling? In this study, data from one tropical basin were used to investigate the effects from different starting times of the day on a typical bucket-type hydrological model, the HBV. An optimisation procedure based on a genetic algorithm was used to assess the effects on model performance. Results show that Nash-Sutcliffe efficiencies varied considerably between day definitions with the largest dependence on the climatological-day definition. The main reason for variation is assumed to be related on how storm water was assigned to one or two daily rainfall values depending on the definition of the climatological day, which strongly influenced the relation between daily rainfall and runoff for every model setup. Therefore, hydrological models are unlikely to predict high flows accurately if rainfall intensities are reduced because of the climatological-day definition. Problems caused by the definition of the climatological and discharge day are likely to affect parameter inference, runoff predictions and model performance on rainfall-runoff models at the daily resolution. This could have implications for regionalisation and may lead to misleading information for water resources planning.