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Potential value of crowd-based stream level observations for discharge simulation

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Simple hydrological models with a low number of model parameters are often able to simulate discharge reasonably well, but these models rely on model calibration, which makes their use in ungauged basins challenging. We recently demonstrated that for humid catchments good model performances can be achieved when only stream level data, instead of stream flow data, are available. For these catchments, the level-based modeling approach can be used to generate simulated discharge time series from the stream level time series. The latter are obviously easier to observe, and in practice several approaches could be used for stream level observations. One of these is a crowd-based approach (e.g., crowdhydrology.org), where citizen scientists engage in stream level observations. However, the challenge of these data are that observations are taken at irregular time intervals and with a limited vertical resolution. The latter is especially the case at sites where no staff gauge is available but relative stream levels are observed based on (not) visible features in the stream, such as rocks. Here, we extend our previous study and pretend that stream level observations are available at limited temporal and vertical resolutions. Using these hypothetical data sets, the model was calibrated and subsequently evaluated on the full observed stream flow record. Preliminary results indicate that stream level data can provide good model simulation results for discharge in humid catchments, even with a reduced temporal resolution of the level observations. On the other hand, with decreasing vertical resolution, level data became less informative. This study also allowed quantification of the value of additional observations and/or increased resolution for reducing the uncertainties in discharge simulations. These results provide a basis for designing crowd-based observation systems for the real world that obtain as informative as possible data for deriving model-based discharge time series for (previously) ungauged basins.