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# Reducing calibration parameters to increase insight in catchment organization and similarity

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Ideally, hydrological models should be built from equations parameterised from observed catchment characteristics and data. This state of affairs may never be reached, but a governing principle in hydrological modelling should be to keep the number of calibration parameters to a minimum. A reduced number of parameters to be calibrated, while maintaining the accuracy and detail required by modern hydrological models, will reduce parameter and model structure uncertainty and improve model diagnostics. The dynamics of runoff for small catchments are derived from the distribution of distances from points in the catchments to the nearest stream in a catchment. This distribution is unique for each catchment and can be determined from a geographical information system (GIS). The distribution of distances, will, when a celerity of (subsurface) flow is introduced, provide a distribution of travel times, or a unit hydrograph (UH). For spatially varying levels of saturation deficit we have different celerities and, hence, different UHs. Runoff is derived from the super-positioning of the different UHs. This study shows how celerities can be estimated if we assume that recession events represent the superpositioned UH for different levels of saturation deficit. The performance of the DDD (Distance Distribution Dynamics) model is compared to that of the Swedish HBV model and is found to perform equally well for eight Norwegian catchments although the number of parameters to be calibrated in the module concerning soil moisture and runoff dynamics is reduced from 7 in the HBV model to 1 in the DDD model. It is also shown that the DDD model has a more realistic representation of the subsurface hydrology. The transparency of the DDD model makes model diagnostics more easy and experience with DDD shows that differences in model performance may be related to differences in catchment characteristics. More specifically, it appears that the hydrological dynamics of bogs have to be taken especially into account when modelling Norwegian catchments.