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## Comparing catchment scale subsurface celerities estimated from recession analysis and infiltration experiments.

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Catchment scale hydrological models all have some representation of the dynamics of subsurface flow and hence direct or indirect estimates of the celerities (velocities) involved. Parameters representing these celerities (for example recession coefficients of linear reservoirs) are often calibrated against runoff instead of being estimated directly from measured data. Such a procedure, when applied for hydrological models with (too) many parameters to be calibrated, may lead to unrealistic estimates of subsurface celerity due to equifinality issues. Our aim with this study is to obtain an estimate of the distributions of subsurface celerities corresponding to the distribution of saturation levels through recession analysis. Using the recession characteristic  $\Lambda = \log(Q(t)/Q(t+\Delta t))$  and looking for sequences of recession in a moving average filtered time series of runoff, we find, for many catchments, no clear structure in the relationship between  $Q(t)$  and  $\Lambda$ . In order to better understand the recession process we let the runoff be represented by four (parallel) unit hydrographs (UH) of different temporal scales. The UHs thus represent different subsurface celerities through their different temporal scales and different levels of saturation. Only when there was a systematic build up of saturation from below, i.e. the slowest UH had to be filled to (a chosen max) capacity before the next UH received water, a clear structure between  $Q(t)$  and  $\Lambda$  emerged, where for each value of  $Q(t)$  the maximum  $\Lambda$  represented the true recession to be used for estimating the celerity. At the tiny Muren catchment (7500 m<sup>2</sup>) in southern Norway we performed an infiltration test and estimated the saturated hydraulic conductivity to be 0.00045 m/s. The mean celerity estimated from recession analysis for the same catchment was found to be 0.00034 m/s, and when the distribution of celerities from the recession analysis was used in the Distance Distribution Dynamics (DDD) rainfall runoff model a Kling Gupta efficiency criterion of  $KGE = 0.86$  was obtained for runoff simulations at 15 minutes temporal resolution.