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Scales, uncertainty and strategy in catchment modelling

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Hydrological modelling is carried out at spatial scales ranging from pore scale to global scale. Catchment properties exhibit spatial variability. For almost all properties this heterogeneity is very large and dominates the behaviour of the catchment. Scaling is basically a question of how to handle heterogeneity at different spatial scales. Different model types do this fundamentally different. Lumped conceptual models build heterogeneity into the process equations, while distributed physically-based models instead try to describe this by differences among model grids. The strengths and weaknesses of these two approaches are discussed and illustrated through examples. Scales also affect the uncertainty. By use of small examples it is illustrated how uncertainty in data and model predictions depend on the support scales. Finally modelling strategy is discussed based on the HarmoniQuA good modelling practise protocol with particular focus on selection of appropriate model code corresponding to the modelling purpose and on documentation of model predictive capabilities and uncertainties.