



Advances in hydrological modelling based on improvement in process and system understanding

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Heterogeneity and complexity of hydrological processes offer substantial challenges to the hydrological modeller. Some hydrologists try to tackle this problem by introducing more and more detail in their models, or by setting-up more and more complicated models starting from basic principles at the smallest possible level. As we know, this reductionist approach leads to ever higher levels of equifinality and predictive uncertainty. On the other hand, simple, lumped and parsimonious models may be too simple to be realistic or representative of the dominant hydrological processes. This requires a new modelling approach that tries to find the middle way between complex distributed and simple lumped modelling approaches. What is probably needed is a stepped approach where a model develops from simple to more complicated in tune with the availability of additional information. There should be a balance between the level of complexity and the number of orthogonal data sources for processes and parameters to be identifiable. The approach is a learning framework where step by step we enhance our understanding of catchment behaviour as additional information becomes available.

Hence for completely ungauged basins, the level of complexity is dictated by the availability of topographic, geologic and remote sensing information. Complexity is not only related with the number of parameters, but also with model structure. For a given number of parameters there may be certain model structures that outperform others. Hence a modelling framework that allows alternative model structures is required. The challenge is to find relatively simple model structures that can represent the spatially distributed nature of rainfall, topography, geology and land use.