How many models should be used for multi-model ensembles in catchment hydrology?

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Ensemble modelling, whereby predictions from several models are pooled to improve the accuracy of model predictions, has often been successfully applied in atmospheric sciences. One of the key aims of the ensemble approach is to reduce uncertainty in the simulation results. Most studies analysing the accuracy of multi-model ensemble forecasts in weather prediction report that they tend to outperform individual models. Ensemble modelling has, however, received little attention in hydrology, where most modelling studies use only one model. This paper presents results of a multi-model-comparison study (LUCHEM project). The results of ten different catchment models applied to the same data set of the meso-scale German Dill catchment (693 km^2) are used to compose simple multi-model ensembles (e.g. mean value, median value). The quality measures of single models compared to the simple model ensembles confirm the findings from studies in the atmospheric sciences: Multi-model-ensembles outperform single model applications with respect to most quality measures. But one of the main questions arising from the LUCHEM project is: How many models are required to contribute to a multi-model ensemble to ensure considerably more reliable simulation results compared to single model applications? Based on the simulation results of the LUCHEM project it is analysed in which extent the answer to this question depends on the selected quality measure (e.g. Nash-Sutcliffe efficiency, coefficient of determination, root mean squared deviation, bias).