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Data Mining of Hydrological Model Performances

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Multi-objective criteria have long been used to infer hydrological simulations and fit the natural world. On the other hand, modelling frameworks are also becoming more and more popular as identification of the processes occurring in a catchment is still a very uncertain matter.

In theory, multi-objective criteria and multi-model frameworks should be used in combination so that the 'representation' of the catchment is fitted to the observations, not only the simulated results. In practise those approaches are highly computationally demanding. The modeller is often obliged to find a compromise reducing either the number of objective functions or model structures taken into consideration. This compromise is becoming obsolete using parallel computing.

In the present study we investigate the extend to which model selection algorithms and regionalisation techniques can be improved by such facilities and highlight the challenges that still need to be addressed. The model simulations are obtained using an ensemble of conceptual lumped models (FUSE by Clark et al. 2008), but techniques and suggestions are of general use and applicable to any modelling frameworks.

In particular we developed a novel model selection algorithm tuned to drastically reduce the subjectivity in the analysis. The procedure was automated and coupled with redundancy reduction techniques such as PCA and Cluster Analysis. Results show that the actual model 'representation' has the shape of a set of complementing model structures. It is also possible to capture intra-annum dynamics of the response as the algorithm recognises subtle variations in the selected model structures in different seasons. Similar variations can be found analysing different catchments. This suggests the same methodology would be suitable for analysing spatial patterns in the distribution of suitable model structures and maybe long term dynamics in relation with expedited climate modifications.

Although the mentioned methodology has proven to be successful with regards to the case study, some limitations are worth noting. If this is going to be applied to the more general case of 'models of everywhere', for instance, there could be dominant processes not described in the FUSE framework. Further studies could therefore extend the current framework to include routines able to simulate missing processes.