



Empirical approach to hydrological modelling: a historical perspective in the case of the GR models

Charles Perrin, Vazken Andréassian, Maria-Helena Ramos, Guillaume Thirel, Pierre Nicolle, and Olivier Delaigue

Irstea, Hydrosystem and Bioprocesses Research Unit (HBAN), Antony Cedex, France (charles.perrin@irstea.fr)

Modelling the hydrological response of a catchment to climate variables has been the subject of much research over the past decades, and the issue of environmental change adds much difficulty to this task. In spite of various advances, there is not a single approach today which would appear as best in all cases. Instead, many intercomparisons showed that different modelling approaches can have various advantages and drawbacks in different contexts.

The empirical approach is one of these modelling approaches. The main idea is to test a large number of hypotheses and options to build model structures, and to keep only those which prove useful to improve the predictive power of models. It results in models, which seem a good compromise between data requirements, complexity, modelling efficiency and ease of use, for various applications. This is the approach followed by the Catchment Hydrology research group at Irstea (Antony, France), which has been developing the family of storage-type hydrological 'GR' models since the 1980's, using large samples of data. The main objective of these developments was to robustly model flows at gauged and ungauged catchments and enhance model applications for decision-making on risk anticipation and resource management.

The objective of this presentation is to discuss the strengths and weaknesses of the development approach of these models and their applicability for various uses and contexts. This will be based on a review of 350 papers which applied the GR models over the past three decades. The evolution of these models as well as their range of applications will be analyzed, and issues of parsimony, time and space scales, and perspectives for further developments will be discussed.