

Multicomponent Mapping (Mx) - Florian Pappenberger

PUB-IAHS Workshop
Uncertainty Analysis in
Environmental Modelling
6th - 8th July 2004

a) Introduction:

The Multicomponent Mapping (Mx) method is based on visual graphical evaluation. The hydrograph is subdivided into box areas to which membership values are assigned, according to the distance to the hydrograph. The box size is influenced by the 'effective' error structure. This error structure is determined not only by the measurement error, but can also include commensurable errors.

A quantitative performance measure can be computed. Depending on how close a modelled hydrograph is to the predetermined boxes, a membership value is assigned. The individual values can then be combined by summation or multiplication to an overall performance measure.

Moreover, by comparing the box patterns of different hydrographs, it is possible to group them into functional classes. For this, a cluster analysis with different dissimilarity measures is performed. Each functional class contains hydrographs which behave in a similar way (e.g. steep rising and long falling hydrograph limb). A representative hydrograph can be chosen from each class and enables, for example, the cascading of uncertainty in larger, time consuming modelling systems.

b) Advantages

- Visual and thus intuitive
- Allows clustering of hydrographs to better understand the similarity of model responses
- Forces the user to make informed decisions on the error structure / bands which are explicit for the analysis

c) Disadvantages

- The technique is computer intensive
- Assumption of how to combine point performances
- Clusters may not be consistent for future events

d) Assumptions

see above

e) Most appropriate application areas

Evaluation of hydrographs

Clustering of hydrographs in functional similar groups

f) Reading list

Pappenberger, F., and Beven, K. (in press). "Functional Classification and Evaluation of Hydrographs based on Multicomponent Mapping." International Journal of River Basin Management.

Pappenberger, F., Beven, K. J., Hunter, N., Gouweleeuw, B., Bates, P., de Roo, A., and Thielen, J. (submitted). "Cascading model uncertainty from medium range weather forecasts (10 days) through a rainfall-runoff model to flood inundation predictions within the European Flood Forecasting System (EFFS)." Hydrology and Earth System Science.

g) Software availability

Matlab source code on request later this year + stand alone executable beginning 2005

h) Web links or other information

none given

i) Figures

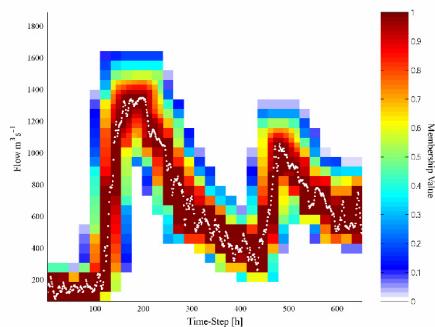


Figure 1: Subdivision of a flow hydrograph into boxes. The weight of each box reflects the modellers scientific understanding in the error structure. It is possible to put extra emphasis on areas by controlling the box density

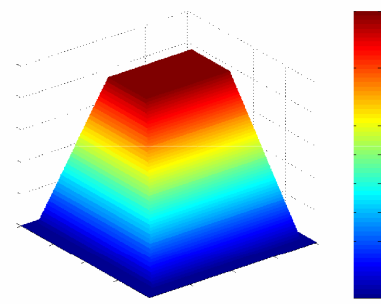


Figure 2: Two dimensional Fuzzy membership function which can be used as computation basis of box values

j) Delegates Comments (please add !!)