P-08 Hydrologic Model Prediction Uncertainty Recognition and Quantification

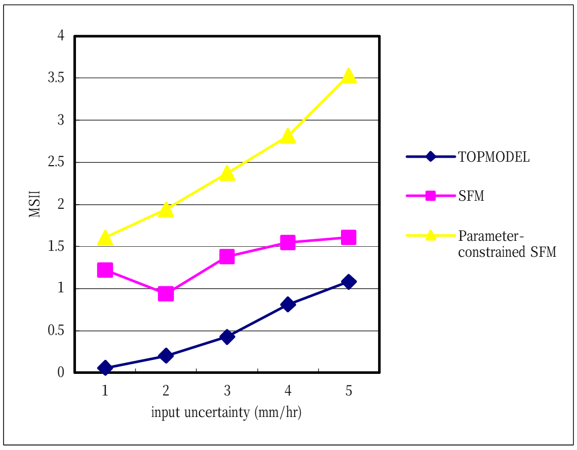
〇Shen CHIANG・Yasuto TACHIKAWA・Kaoru TAKARA

1. Introduction

A hydrologic model is an integration of mathematical descriptions of conceptualized hydrologic processes, which serves for a specific purpose. Consequently, the spatial scale, temporal scale, structure, architecture, and applicability of a model are restricted a lot by the hypothesis of the hydrologic model in most of the cases. As a result, there are numerous hydrologic models developed for various aspects, and the development of new hydrologic models or improvement of previously developed models continues in Japan and elsewhere. Therefore, a methodology to assess the error, uncertainty and adequacy of adopting hydrologic models in specific purpose is needed. The present study provides a methodology for model comparison and selection through model uncertainty recognition and quantification.

2. Methodology

The methodology starts with generating the parameter set space by introducing noise item into input data with specified probability distribution. Here Normal distribution with mean equals to zero and standard deviation from 1.0 to 5.0 (mm/hr) is used to acquire model parameter space and outcomes under different input uncertainty. For each iteration, 10000 model outcomes for each specified input uncertainty were derived from the combination of rainfall series and parameter set generate output series through the model. The system uncertainty and the prediction ability were identified and recognized by corresponding parameter set. Statistical second moment is used as a measure of uncertainty, also an index which originated from Nash coefficient named Model Structure Indicating Index (MSII) is proposed to quantify model structure uncertainty which can be used as a tool for implementing model quantitative comparison (selection). For the demostration of the proposed method, a conceptual hydrologic model named Storage Function Method (SFM) is employed. A poorer structure model which through fixing the value of one parameter of SFM and TOPDMOEL are applied as contradistinctions in performing model comparison. The results show that a larger value of MSII indicating a poorer structure of hydrologic model in a dynamic manner, that is, incorporating the MSII to the input uncertainty.



3. Conclusion

Instead of sampling the parameter space directly like what GLUE did, the study here generates the parameter set space by introducing noise item into input data with specified probability distribution. This reflects the truth that parameter uncertainty came from uncertainty of data to hand and the way the model structure responses it. The results show that within increasing input uncertainty, the distance between entire and inherent uncertainty is also increased. A smaller magnitude of the ratio of inherent uncertainty to entire uncertainty indicates lacking of the ability to simulate the true watershed behavior. MSII is proposed to evaluate the goodness of model structure. The results show that a larger value of MSII indicates a poorer structure of hydrologic model, within increasing input uncertainty the tendency becomes more apparently. The index can be used as a tool for implementing model quantitative comparison.