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Examining the impact of Empirical Mode Decomposition in ANN hindcasting of daily stream flow series

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In this study, we explore the effects of preprocessing the data through a fully data-driven signal decomposition technique, called Empirical Mode Decomposition (EMD), to perform ensemble modeling of daily stream flow series via artificial neural networks (ANNs). The EMD is used to decompose the original signal into a number of intrinsic components, which are then trained individually by ANNs and combined to rebuild the discharge series. The ANN training is carried out with different sets of initial random weights that are drawn from a uniform distribution to assess the effect of the parameter uncertainty on the modeling results. A large number of performance indices and two formal tests are applied to the model predictions in order to provide a comprehensive assessment of the model performance. The results show that, in a typical ANN modeling procedure, the advantages of the signal preprocessing depend on the characteristics of the signal intrinsic modes highlighted by EMD analysis. When the signal is characterized by highly energetic high frequency components, the error propagation influences the results so that the ensemble algorithm introduces an improvement only in terms of some performance measures, and the uncertainty related to the random generation of the ANN initial weights may be significant. Therefore, the nature of the signal, the effect of the random initialisation of the weights on ANN model performance and the measures which are used for model assessment (and which extend beyond ANNs to other model types) need to be more carefully taken into account in the modeling procedures.

References

Napolitano G, Serinaldi F, See L. (2011) Impact of EMD decomposition and random initialisation of weights in ANN hindcasting of daily stream flow series: an empirical examination. Journal of Hydrology, 406(3-4), 199-214.