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Selection of climatic parameters affecting wave height prediction using an enhanced Takagi-Sugeno-based fuzzy methodology

Roslan Hashim [a,b,*], Chandrabhushan Roy [a], Shervin Motamedi [a,b], Shahaboddin Shamshirband [c,**], Dalibor Petković [d]

[a] Department of Civil Engineering, Faculty of Engineering, University of Malaya, 50603 Kuala Lumpur, Malaysia
[b] Institute of Ocean and Earth Sciences, University of Malaya, 50603 Kuala Lumpur, Malaysia
[c] Department of Computer System and Information Technology, Faculty of Computer Science and Information Technology, University of Malaya, 50603 Kuala Lumpur, Malaysia
[d] University of Niš, Faculty of Mechanical Engineering, Department for Mechatronics and Control, Aleksandra Medvedeva 14, 18000 Niš, Serbia

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ABSTRACT

This study dealt with finding the sequence of the most influential parameters among the factors that affect the offshore wave height. A dataset comprising of four climatic input parameters: sea surface wind speed (U), wind direction (θ), air temperature (T_a), and sea surface temperature (T_w); as well as one output parameter (significant wave heights, H_s) was generated. The offshore field measurements were derived from three buoy stations, deployed in the western part of the North Atlantic Ocean. The primary goal of this study was to identify the predominant input parameters that influence prediction of H_s at each buoy station. In this view, ANFIS (an enhanced type of Takagi-Sugeno-based fuzzy inference system) was implemented on the dataset for variable selection. This process found a subset of the entire set of the observed parameters, which was suitable for prediction purposes. As a result, the following sequence of parameter have the most to least influence on the predictions of H_s, U, T_a, T_w, and θ. In addition, it was found that combination of three variables, namely U, T_a, and θ, forms the most influential set of input parameters with RMSEs of 0.82, 0.44 and 0.62, respectively for the predicted H_s at three stations. Most of the previous studies only employed U and θ to predict H_s using the soft-computing methods. As the first study of its type, the findings from this study suggest that the accuracy of wave height prediction may improve when T_a and T_w are included as inputs along with U and θ. The present study can serve as a gear towards enhancing the accuracy in prediction of wave height at various offshore locations.

Contents

* Corresponding author at: Department of Civil Engineering, Faculty of Engineering, University of Malaya, 50603 Kuala Lumpur, Malaysia. Tel.: +60 379675271.
** Corresponding author. Tel.: +60 146266763.
E-mail addresses: roslan@um.edu.my (R. Hashim), shamshirband1396@gmail.com (S. Shamshirband).

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