# Streamflow Forecast Using Two Distinct Approaches: an Artificial Neural Network Model and a Physically Based Model. A Case Study in Southern Portugal.

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**Abstract**

The Maranhão reservoir (˜180 hm3) is mainly used for energy production and irrigation of 15360 ha in the Sorraia Valley, in southern Portugal. The necessity to save water in the Autumn/Winter rainfall season to be used for irrigation of Spring/Summer crops creates a sensible management situation regarding the control of floods and their impact on downstream areas in years with extreme precipitation events. Streamflow forecast is then essential to improve the reservoir's management regarding water storage. This study addresses the estimation of the daily streamflow in the watershed draining to the Maranhão reservoir (2311 km3) following two different approaches. Firstly, the physically based hydrological model, MOHID-Land, was calibrated/validated for estimating daily streamflow in the study area following physically processes and using a finite volume approach, which require considerable amount of input data. Secondly, a data-driven model composed of an artificial neural network (ANN) was used with the same purpose. This ANN model was selected from a previous work where different models (multi-layer perceptron, convolutional neural network, and long short-term memory model) were tested with different scenarios for the combination of input variables. Both models were optimized considering the observed streamflow in the Ponte Vila Formosa station, which drains 30% of the Maranhão watershed, being after applied to the entire domain. The results for the Maranhão watershed were then validated considering a mass balance considering the reservoir's outflow, level, and water consumed values. The ANN model had a better performance predicting streamflow than the physically based model, and with less calibration effort. However, the physically based model can give much more information about the entire system. Lastly, it is expected that a physically based model can correctly estimate the streamflow for extreme events not considered in the calibration and validation datasets, but for the ANN models this question should be carefully addressed since data-driven models are event-based.

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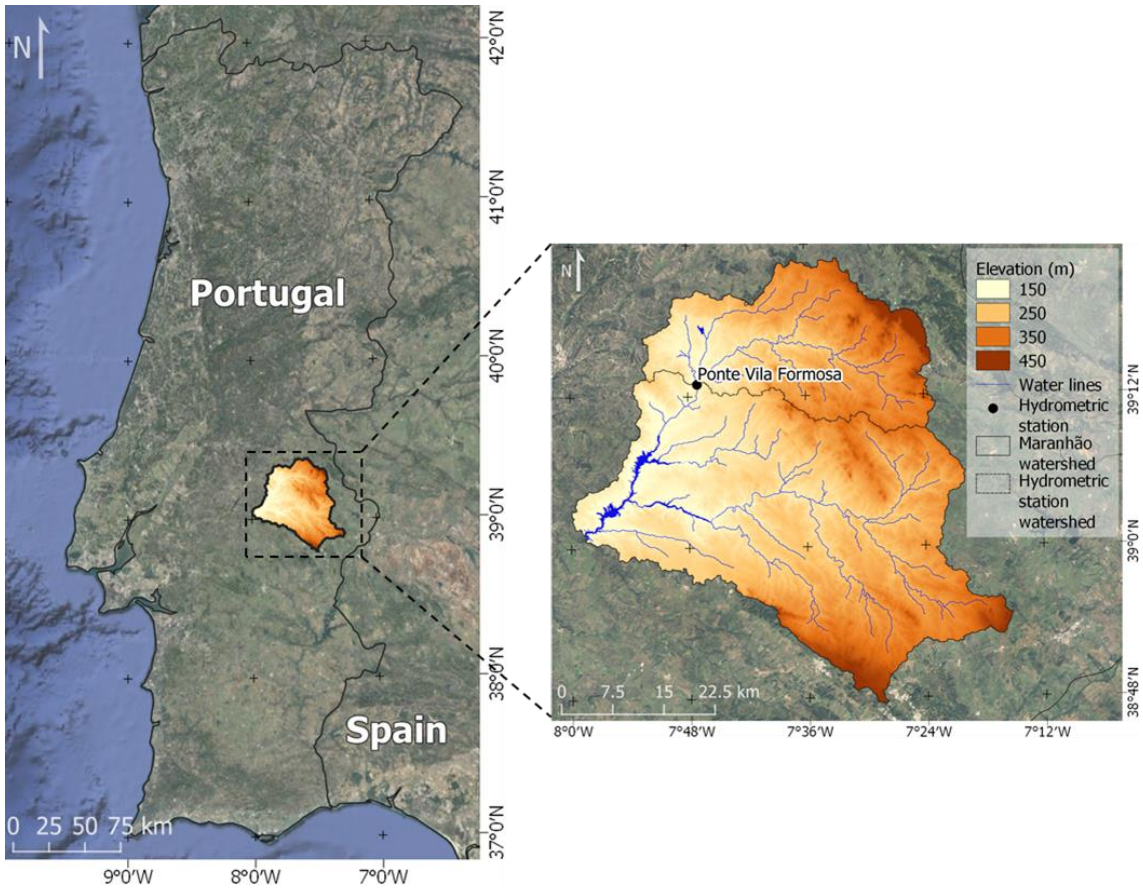
N
Portugal
Spain
0 25 50 75 km
9°0′W
8°0′W
7°0′W
42°0′N
41°0′N
40°0′N
39°0′N
38°0′N
37°0′N
Ponte Vila Formosa
Elevation (m)
150
250
350
450
Water lines
Hydrometric station
Maranhão watershed
Hydrometric station watershed
0 7.5 15 22.5 km
8°0′W
7°48′W
7°36′W
7°24′W
7°12′W
39°12′N
39°0′N
38°48′N