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# Mulstiscale Stochastic Generator of Multivariate Met-Ocean Time Series

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The design of maritime structures requires information on sea state conditions that influence its behavior during its life cycle. In the last decades, there has been a increasing development of sea databases (buoys, reanalysis, satellite) that allow an accurate description of the marine climate and its interaction with a given structure in terms of functionality and stability. However, these databases have a limited timelength, and its appliance entails an associated uncertainty. To avoid this limitation, engineers try to sample synthetically generated time series, statistically consistent, which allow the simulation of longer time periods. The present work proposes a hybrid methodology to deal with this issue. It is based in the combination of clustering algorithms (k-means) and an autoregressive logistic regression model (logit). Since the marine climate is directly related to the atmospheric conditions at a synoptic scale, the proposed methodology takes both systems into account; generating simultaneously circulation patterns (weather types) time series and the sea state time series related. The generation of these time series can be summarized in three steps: (1) By applying the clustering technique k-means the atmospheric conditions are classified into a representative number of synoptical patterns (2) Taking into account different covariates involved (such as seasonality, interannual variability, trends or autoregressive term) the autoregressive logistic model is adjusted (3) Once the model is able to simulate weather types time series the last step is to generate multivariate hourly metocean parameters related to these weather types. This is done by an autoregressive model (ARMA) for each variable, including cross-correlation between them.
To show the goodness of the proposed method the following data has been used: Sea Level Pressure (SLP) databases from NCEP-NCAR and Global Ocean Wave (GOW) reanalysis from IH Cantabria.
The synthetical met-ocean hourly time series obtained are statistically consistent (also in terms of extremes and persistence) and keep the temporal dependence structure of the initial stochastic process. This method constitutes a very useful tool in the designing phase of maritime structures or in other branches of coastal engineering.