

APPLICATIONS OF DATA SCIENCE IN COASTAL ENGINEERING

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Data science deals with huge amount of multidimensional information giving a more compact and manageable representation of the most important properties contained in the data. It started to be used in meteorology more than one decade ago but not in oceanography or coastal engineering. The first application of data mining was developed with the purpose of the multidimensional characterization of metocean conditions using wave hindcasts [1]. Three clustering techniques were basically analysed: k-means algorithm (KMA), self-organizing maps (SOM) and maximum dissimilarity algorithm (MDA) to assist in the interpretation and understanding of wave data. Afterwards, these techniques were combined with powerful multidimensional interpolation methods to develop new accurate hybrid methodologies (metamodels) to downscale marine dynamics [2]. The knowledge acquired about data mining and the need to project changes in wave climate using atmospheric outputs from several Global Circulation Models under different climate scenarios resulted in the development of statistical downscaling approaches [3]. Based on these statistical frameworks, climate emulators to evaluate coastal impacts were proposed [4].

Several examples of these developments that have been applied to solve different problems in coastal engineering will be described as reconstruction of historical data of marine dynamics, characterization of marine climate patterns, wave climate predictions at different time scales (seasonal, climate change), probabilistic assessment of coastal flooding and erosion under climate change.

References:

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