Geophysical Research Abstracts
Vol. 20, EGU2018-16054, 2018
EGU General Assembly 2018

Stratification of multi-decadal beach dynamics using machine learning

Victor Rodriguez Galiano, Emilia Guisado-Pintado, Antonio Prieto Campos, and José Ojeda Zujar

Physical Geography & AGR, University of Seville. Seville, Spain (vrgaliano@us.es ; eguisado@us.es ; pcampos@us.es ; zujar@us.es)

Undoubtedly, coasts around the world are exposed to pressures with both natural and anthropogenic origins resulting in diverse consequences including erosion, socio-economic costs and health and safety issues for coastal communities. Particularly, the Andalusian coast (South Spain) has been subjected to a profound transformation that started in the 70s driven by the abandonment of agriculture, a strong regulation of river basins and the development of coastal urbanisation and infrastructures (ports, promenades, breakwaters). Additionally, the intensity and the type of response to these changes are unequal, depending on the characteristics of the coastal landforms (exposure, existence of dunes, estuaries and deltas) along the Andalusian coast.

The objective of the present work is twofold: to calculate beach erosion for the past 55 years and to create an unbiased stratification of beaches according to their erosional/depositional dynamics. For this purpose, erosion and deposition rates of exposed beaches in Andalusia (640 km) was calculated using a robust proxy (the upper limit of the beach active profile) and detailed orthophotographies (1:2500) for the periods 1956-1977, 1977-2001, 2001-2011. The consistency of the method allowed comparison of the results among periods in a highly diverse and complex coast, with both Mediterranean and Atlantic façades. A hybrid classification method, unsupervised and supervised, was applied to model the beach dynamics for the three periods of interest. The K-means technique allowed establishing separate beach groups that have responded similarly in terms of shoreline mobility and erosion/deposition patterns. CART (classification and regression tree) classification models were built based on the k-means results to identify the erosional and depositional rate threshold values and the period which characterise every cluster or stratum.

Two different hybrid models were obtained. A first one discriminated between beaches with a wide range of mobility which correspond to Atlantic spits and barrier-islands and to a lesser extent to Mediterranean deltas; whilst a consecutive model was built to achieve a more detailed stratification of beaches corresponding to those that showed a moderate response in terms of erosion and deposition rates. The classification techniques, therefore, permit the stratification and characterisation of a complex continuous multivariate transects of decadal beach behaviour into homogeneous groups for easier interpretation. Implications and performance of using these techniques to classify multidecadal coastal dynamics in terms of erosion/accretion patterns is presented and discussed. This research, thus, shows an alternative for the modelling of beaches and paves the way for further scientific investigation of coasts based on machine learning methods.