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Spatial and temporal changes in urban fabric exposure to Sea Level Rise, from 1995 to 2018, in mainland Portugal

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All populations are, at some level, directly or indirectly affected by climate change. Sea level rise (SLR) changes can have strong effects in population exposure conditions in coastal areas, being one of the most critical environmental threats in 21st century.

Portugal, like most coastal countries, have high concentrations of settlements, population and activities near the coast, situation that has been intensified from the second half of the 20th century and during the 21st century. Despite of mitigation and adaptation measures based on SLR scenarios, Portugal already faces the expansion of SLR hazard zones, with a rising rate of 2.1 ± 0.1 mm/year between 1977 and 2000 [1], and an increasing exposure and vulnerability to coastal flooding. Moreover, the IPCC/NASA SSP5 scenario for 2100 estimates values between 0.74m e 0.81m for the Portuguese coastline [1]. In addition, an increasing frequency of extreme sea level events is expected, namely associated to the SSP5-8.5 [2]. Despite 30 years of regulatory land use planning that incorporates hazard preventive measures and restrictions, Portuguese coastal communities have long before occupied SLR hazard zones in an ongoing process. In this context, knowledge of processes and impacts in the past is fundamental to assess future conditions and consequences, based on SLR scenarios.

The main goal of this work is the diagnosis of land use land cover (LULC) changes focused on built-environments spatiotemporal dynamics (1995 to 2018) in a SLR context. The results will support exposure assessment for 2040, 2070 and 2100 scenarios for the Portuguese mainland coastal zone at a sub-municipality level.

This work uses a validated SLR hazard baseline [1] as reference to measure the recent and actual exposure of the potentially elements at risk. For LULC one used the official cartography (1995 to 2018), produced by the General Directorate for Territorial Development in Portugal.

To assess the amount and patterns of LULC changes, memoryless stochastic methods are used, extracting two categories of data: i) the persistence, gain, loss, total change, absolute value of net change, and swapping tendency, as well several ratios; ii) measurement of systematic and random LULC changes by using the off-diagonal entries of the transition matrix for the significant inter-class transitions detection.

References

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