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Long-term and short-term morphodynamics in an unprotected sandy beach of the Adriatic Sea

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In the recent years attention has been paid to the beach protection by means of both soft (e.g. nourishments) and hard (e.g. detached breakwaters) defenses. Along the Italian coasts of the Adriatic Sea, sandy beaches are the most common landscapes. In particular, around 70% of the Marche-Region coasts (central Adriatic), is protected by marine defense structures. The longest free-from-obstacle beach in the Region is that of Senigallia, which is North of Ancona.
The double-barred beach of Senigallia, characterized by two main parts, respectively North and South of the small harbor, has been frequently monitored during the last decades, also due to the harbor-entrance modification, occurred in the period 2004-2010. Available bathymetries refer to the years 2006, 2010, 2011, 2012 and 2013. Use of such data leads to a good adaptation of the beach to the Dean-type equilibrium profile, though strong seasonal and annual variability of the wave climate have been observed during the monitored periods. This suggests that the wave forcing does not affect significantly the long-term profile, which seems to only depend on the sediment size. Further, the dynamics of submerged bars, here present as a double-barred array, and their geometric features have been accurately investigated. Such results have been related to the wave climate collected by a buoy located 30 km South of Senigallia during the analyzed temporal windows. Hence, short-medium term changes are analyzed and correlations between bar geometry and wave forcing is also attempted.
An overall interpretation of the complete dynamics, i.e. hydrodynamics (wave-buoy data), sediment characteristics (equilibrium-profile “A” parameter) and morphodynamics (bar characteristics) is here undertaken. From a preliminary analysis, it seems that the submerged beach is, essentially, in equilibrium, though several short-period events occurred in the observed periods. Further, the eroded sediment volumes compensate the deposited ones in the long period. On the other hand, the bars undergo more important changes, especially due to the short-period effects, like sea storms. The recorded buoy data also suggest that the bar evolution is related to the wave-condition type, some events promoting erosion, some promoting accretion/formation of submerged bars.