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50 Years of coastal erosion analysis: A new methodological approach.

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Coasts over the world have been subjected to increased anthropogenic pressures which combined with natural hazards impacts (storm events, rising sea-levels) have led to strong erosion problems with negative impacts on the economy and the safety of coastal communities. The Andalusian coast (South Spain) is a renowned global tourist destination. In the past decades a deep transformation in the economic model led to significant land use changes: strong regulation of rivers, urbanisation and occupation of dunes, among others. As a result irreversible transformations on the coastline, from the aggressive urbanisation undertaken, are now to be faced by local authorities and suffered by locals and visitors. Moreover, the expected impacts derived from the climate change aggravated by anthropic activities emphasises the need for tools that facilitates decision making for a sustainable coastal management.

In this contribution a homogeneous (only a proxy and one photointerpreter) methodology is proposed for the calculation of coastal erosion rates of exposed beaches in Andalusia (640 km) through the use of detailed series (1:2500) of open source orthophotographies for the period (1956-1977-2001-2011). The outstanding combination of the traditional software DSAS (Digital Shoreline Analysis System) with a spatial database (PostgreSQL) which integrates the resulting erosion rates with related coastal thematic information (geomorphology, presence of engineering infrastructures, dunes and ecosystems) enhances the capacity of analysis and exploitation. Further, the homogeneity of the method used allows the comparison of the results among years in a highly diverse coast, with both Mediterranean and Atlantic façades. The novelty development and integration of a PostgreSQL/Postgis database facilitates the exploitation of the results by the user (for instance by relating calculated rates with other thematic information as geomorphology of the coast or the presence of a dune field on that transect). While the proxy, the most recommended in the research literature, defined as the upper limit of the beach active profile (backshore/foredune, cliff or infrastructure limit if exists) guarantees the exclusion of uncertainties linked to either, tides regime (very important in the Atlantic sector) and any seasonal variations of the beach profile.

Spatially, results show a predominance of sectors under erosion (52% -312km – for global period 1956-2011 and 42% -249 km- for most recent period of time 1977-2011), corresponding to mean retreats of 28 m and 20 m for each period respectively. Paradoxically, when incorporating the accumulative rates (positive and negative) for each period, accretional areas appear to be greater than erosional ones, as the methodology simplifies calculations and thus consider coastal erosion as two-dimensional (distances between proxies) whereas it is a three-dimensional process. Greater erosion occurs along the Mediterranean coast as well as progressive reduction of eroded and accreted sectors on behalf of an induced increment of stable sectors driven by the presence of coastal infrastructures (promenades, seawalls, and breakwater) which prevent the shoreline from migrating inland.

The usability of the methodology and its integration on a web-based viewer undoubtedly offers a new opportunity of data exploitation, as combines natural and anthropogenic factors involved in coastal erosion/accretion in a simple but effective way.