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TITLE: The Black Sea coastline erosion: Index-based sensitivity assessment and management-related issues

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ABSTRACT:

The Black Sea basin is a unique and very complex environment in the World Ocean as a result of its evolution, location and history. This is the reason why in the last years there is an increasing scientific interest in deciphering the processes and mechanisms governing this area. Besides the well-known environmental problems of the basin related to pollution, eutrophication, overfishing and loss of biodiversity, erosion (as a result of storminess, sea level rise and human interventions) is affecting many coasts around the Black Sea. This paper deals with an evaluation of the erosion hazards along the Black Sea coasts, (through an in-depth and well-grounded scientific analysis of a comprehensive database of multiple sources), together with the discussion of erosion management issues at basin scale (through literature review and risk perceptions analysis related to planning strategies, protection measures, legislation and administrative implementation). For this endeavour, we have computed a Coastal Sensitivity Index (CSI) at 1-km spatial scale for more than 4000 sectors around the Black Sea, taking into consideration geological?geomorphological and physical characteristics of each sector through the following parameters: type of coast (coastal geomorphology and lithology), coastal slope (from shoreline to 20 m depth), shoreline changes in the last 33 years, wave incidence (the angle between the shoreline and the dominant storm waves), significant wave height during storm conditions and relative sea level rise. The results for each parameter are detailed and statistically presented and are finally aggregated into CSI. Results showed circa 19% (800 km) of the Black Sea coasts are undergoing serious erosion, affecting mostly the coastlines of Romania (37%), Ukraine (29%) and Georgia (26%). The most sensitive sectors to erosion are superposed on the areas with relatively high storm waves and incidence angles: the deltaic coastlines of the main deltas (Danube, Kizilirmak, Yesilirmak, Sakarya, Rioni, Enguri, Kodori, Chorokhi) of the Black Sea, the low-lying areas along the lagoons, limans, coastal barriers and spits from Kalamitsky, Odessa and Karkinitsky Bays (Dniester, Tendrovskaya and Dzharlygachskiy areas), Chornomorske ? Yevpatoriya area (in Crimea), Taman ? Anapa (in Russia) and Karasu ? Karaburun (in Turkey) and the rocky areas Gelendzhik ? Tuapse (in Russia), Sevastopol ? Cape Meganom (in Crimea) and Inebolu ? Eregli (in Turkey). These highly sensitive sectors cover extensive areas along the coastlines of Russia (57%), Georgia (46%), Turkey (44%), Romania (43%) and Ukraine (35%). Implications of coastal erosion management in the Black Sea riverine countries (with different coastal legislation, EU/non-EU regulations and directives etc.) are discussed, emphasizing the main problems and shortcomings. Some guidelines for coastal erosion management in the specific case of the Black Sea are listed at the end of the paper. Despite the complicated regional geo-political context, common framework of coastal erosion management for the entire Black Sea basin is needed at all levels (political, administrative, academics and research) through cross-border cooperation related to legislation, regulations (integrated approaches for Marine Spatial Planning and Coastal Zone Management), research and academic programs, coastal zone monitoring, management/planning (prioritization of protection works and promotion of soft engineering measures) and public participation.

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