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Other (Sea level rise and consequences)

Beach Carrying Capacity Under Sea-level Rise

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Long and short-term sea level rise represents, probably, one of the most significant beach threats. Beach erosion is particularly devastating in the case of the confined in length Mediterranean beaches and can be particularly detrimental to the coastal infrastructure and the tourist industry. The purpose of this contribution is to estimate the range of the sea level rise-driven retreat at the well-known touristic destination of Katerini beach at north Greece and also to comment on the changes of the beach carrying capacity. The Katerini beach has a length of about 6.2km and it can be divided into three segments: the north segment is 1.34km long and 103m in max width, it is well organized with a luxurious hotel at its northern tip. The central part is 2.16km long has a max width of ~30m with a lot of touristic infrastructures at a small distance from the beach. A small fishing port that was constructed in the middle 90's was the main reason for a considerable beach erosion that was tried to be managed by groynes that, however, enhanced the problem, especially under the severe action of the prevailing winds. The south segment is 2.7km long and 57m in max width and appears a moderate touristic development due to the neighbouring marshes. The methodological approach included: (i) the estimation of the beach spatial characteristics through the digitization of the Google Earth Pro images; (ii) the assessment of the coastal retreat through the application of an ensemble of 3 analytical and 2 numerical 1-D morphodynamic models. The retreat/inundation predictions of the model ensemble was compared with the width of the beach; (iii) monitoring of the beach users along a 3060 sq. m highly touristic sub-area in order to observe the number of visitors 3 times per day, using a standing camera. A total of 90 videos were collected and analysed during the peak touristic period (10/7 to 15/8 of 2012). A relatively low value of carrying capacity (9 sq. m/user) was used in the estimations. The analysis showed that the sea level rise will have considerable impacts. In the worst scenario of 1.0m rise the northern beach segment will lose 32 to 50% of its width, at the central part the effects will be devastating (54.7% to complete inundation), whereas at the southern part the width loss will be between 32% and locally to complete inundation. It is obvious that at the optimum case of a small sea-level rise (22cm) and at the low prediction mean of the ensemble morphodynamic models the beach retreat at the north and south segments will be very small, whilst in the central and most susceptible

part of the beach the retreat will only reach 12%. The potential capacity of the video-recorded part of the beach is 340 users, whereas the mean value of the visitors per day is 333, suggesting that the beach offers an acceptable range of comfort for the users. Regarding the carrying capacity, the Katerini beach can stand for the current users but it will face serious problems in the future due to the anticipated sea level rise and beach width reduction, having as a consequence either the visitors congestion and the decline in the quality of their overall experience or the subsequent touristic and economical denudation together with the environmental degradation of the whole area. According to the aforementioned and taking into account that the area presents a high touristic potential, coastal management plans must be implemented based on a detailed socio-economic and an analytical coastal engineering study in order to restrain beach erosion and properly protect the existing infrastructures and to face the expected consequences of the future sea level rise.