

## ***Interactive comment on “Assessment of island beach erosion due to sea level rise: The case of the Aegean Archipelago (Eastern Mediterranean)” by Isavela N. Monioudi et al.***

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We would like to thank Referee #2 for the constructive comments. Please find below our response to his comments.

Comment 1: The width of the beach has been extracted from Google Earth images and 4 operators obtained consistent results on 400 beaches, and considers irrelevant the influence of the tide (0,15 m) on its position. But it does not take into account the fact that the baric tides can have a much greater value and add up to the astronomical one.

Answer: Beach width estimation is mainly affected from the shoreline position, which

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is a dynamic coastal feature, showing continuous changes over time and space; being strongly connected with the beach morphodynamic processes. Recent research has shown that even in the case of “protected” beach systems (i.e. fronted by natural submerged reefs which act similar to artificial submerged breakwaters) for which data of high spatio-temporal resolution are available (i.e. 10 month period shoreline position data of hourly frequency), there is strong shoreline variability over time and space which in specific beach sections can reach up to 8 m (Velegrakis et al., 2016). This variability can be even higher in the case of satellite beach imagery of lower frequency (annual in the best case when it comes to Google earth application), for which different hydrodynamic conditions are evident (absence or presence of storminess, different tidal signal). Any method using satellite imagery, land based topographic methods or, even, video-imaging to provide positions of the shoreline has to deal with the fact that these positions may not delineate accurately the ‘mean shoreline’ e.g. the mean annual shoreline; this has been stated in the text (see page 7 lines 33-36). Accurate estimation of mean shoreline positions requires long time series of beach morphology of high temporal resolution, from which estimations of the mean shoreline position can be obtained (e.g. Aubrey, 1979). However, such information is rarely available, particularly at basin/Archipelago scale. Nevertheless, digitization through satellite imagery seems to be the most efficient way in identifying/estimating specific coastal features in order to provide a first assessment of the exposure to sea level rise over larger spatial scales, like the case of the Aegean archipelago beaches. If more accurate information becomes available in the future, this can be incorporated in the database, which is planned to become fully dynamic.

Velegrakis, A.F., Trygonis, V., Chatzipavlis, A.E., Karambas, Th., Vousdoukas, M.I., Ghionis, G., Monioudi I.N., Hasiotis, Th., Andreadis, O., Psarros, F., 2016. Shoreline variability of an urban beach fronted by a beachrock reef from video imagery. *Natural Hazards* DOI: 10.1007/s11069-016-2415-9.

Comment 2: Sediment texture cannot be retrieved from satellite images for pixel size

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at ground.

Answer: The sediment texture (e.g. sand or gravel) was not retrieved from satellite images, it was assessed on the basis of the available photos on the Google Earth application and other available information collated from scientific literature/reports. To address this comment we will modify the text in order to make it clearer to the readership.

Comment 3: No bathymetry data are presented for beaches, which affects the distance from the shore of the depth of closure, value that enters the erosion evaluation resulting in some SLR some models (e.g., Bruun).

Answer: Given the large (Archipelago) scale of the application, the input data of the models for the evaluation of beach retreat, could not be based on in situ measurements. So we used linear profiles of a wide range of beach slopes. The distance from the shore of the depth of closure and the surf zone width, values necessary for the use of the analytical models, were estimated on the basis of the beach slope. The lack of accurate bathymetry data may enter some uncertainties in this point. However the validation of the models showed that the results of the models set with the equivalent linear profile were reasonably close to those of the physical experiments, and that the use of the models in an ensemble mode gave improved projections, with differences between models and experiments ranging from about 3 % to 11 % (see section 4.2.1). The aim of the exercise has not been to replace detailed modeling studies for individual beaches, but to provide ranges of beach erosion and flooding at a large (Archipelago) scale using minimum environmental information.

Comment 4: Well-sorted sand was simulated, but data provided is D50, not sorting.

Answer: One of the input data needed for the models is the median sediment size D50 (not sorting), this is the reason that D50 data are provided and not sorting. We will modify the text in order to make it clearer to the readership.

Comment 5: Beach rock exposure do not degrade beach aesthetics, its presence is considered a positive factor in Coastal Scenery Assessment.

Answer: According to literature beach rock can affect the actual size of a beach and diminish its carrying capacity (Vousdoukas et al, 2009). Moreover, the presence of weathered/deformed beachrock outcrops at the beachface, commonly colonised by assemblages of epilithic and borrowing organisms (Brattström, 1992) that form a 'slippery' mat, can make the access to the sea difficult, or even dangerous, and degrade the aesthetics and amenity value of the beach and, thus, affect its touristic potential (Vousdoukas et al, 2009). Beachrock formation/outcropping may also result in increased biodiversity in the coastal zone, since beachrock outcrops can create habitats suitable for colonisation by hard-substrate species (e.g. corals, molluscs, algae and annelid worms) (Brattström, 1992; Vousdoukas, Velegrakis, & Plomaritis, 2007). However, it is questionable whether the overall effect on the coastal ecology would be beneficial, particularly in view of the biodiversity losses in soft-substrate species (Brown, 1982). Beach aesthetics/scenery may suffer by the presence of beachrocks, as beachrock-infected beaches do not comply with the widely-recognisable beach model (long and wide beaches consisting of light coloured sands). With regard to the tourists' perceptions on this subject, a contingent valuation study among European tourists showed that although the majority of tourists were not previously aware of beachrock phenomenon, half of them paid notice to the hard coastal sedimentary formations. Survey respondents believe that the authorities should undertake precautionary measures and that European Union should increase research funding in order to avoid further beachrock expansion. Actually, almost half of the respondents would be willing to pay an annual tax in the range of 13.2-16.4 € per household in order to contribute to this effort (Kontogianni et al., 2014). We may add some refs in order to address the recommendation, but due to space limitations we do not think that further documentation of this subject would be beneficial to the manuscript.

Brattström, H., 1992. Marine biological investigations in the Bahamas. 22. Littoral

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zonation at three Bahamian beachrock localities. *Sarsia* 77, 81-109.

Brown, B., 1982. Spatial and temporal distribution of a deposit-feeding polychaete on a heterogeneous tidal flat. *Journal of Experimental Marine Biology and Ecology* 65(3), 213-227.

Kontogianni, A., Damigos, D., Tourkolias, C., Vousdoukas, M., Velegrakis, A., Zanou, B., & Skourtos, M., 2014. Eliciting beach users' willingness to pay for protecting European beaches from beachrock processes. *Ocean & Coastal Management* 98, 167-175.

Vousdoukas, M.I., Velegrakis, A.F., & Plomaritis, T.A., 2007. Beachrock occurrence, characteristics, formation mechanisms and impacts. *Earth-Science Reviews* 85, 23-46.

Vousdoukas, M.I., Velegrakis, A.F., Kontogianni, A., Makrykosta, E.N., 2009. Implications of the cementation of beach sediments for the recreational use of the beach. *Tour. Manag.* 30 (4), 544-552.

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