Time variations analysis of the Hormoz strait northern shoreline by using Digital Shoreline Analysis System (DSAS)

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Extended abstract

1- Introduction

Coastal systems are very dynamic, and their movement is relatively fast due to the collision of onshore and marine environment. The majority of the world's population is concentrated along with the coastal areas. Hormuz Strait coasts are affected by morphological variables due to the hydrodynamics of the sea and the dynamics of coastal and onshore environments. Destruction, transport, and displacement of sediments, Settlement of destruction's materials, are the most prominent features of this case study. Coastal areas of Bandar Abbas are occupied by the dense of human constructions and residential people. The northern coast of the Hormoz strait has the highest tidal range in comparison with the shoreline of the Oman Sea and the Persian Gulf. Therefore, the effects of seawater in this area are more obvious than other places, and all of these factors cause coastal changes. In general, the research goal is to study the shoreline changes in a 47 years period and also find the most important factor in shoreline changes in that period, finally to predict the shoreline changes in the future.

2- Methodology

In this study, Landsat satellite images, MSS, TM, ETM +, OLI sensors from 1972 to 2019 were used to monitoring the shoreline changes in the northwest and west of the Hormuz Strait. In the next step, the necessary preprocesses (radiometric and atmospheric corrections) were applied to the images in ENVI 5.3 software. Next, the NDWI index was used to process satellite images and to separate water and land index. After that, to improve the clarity of shoreline changes, the High Pass filter was applied on each image. After applying the filter, the shoreline was extracted in each year. After extracting the shoreline, the shoreline zones turned into Vector in ENVI software and then moved to Arc GIS10.5 software. After transferring to Arc GIS10.5 software, the coast was divided into 4 zones, by using satellite images and field visits and also according to natural and human factors. Furthermore, Digital Shoreline Analysis System (DSAS) was used to analyze the shoreline variations. After calculating shoreline variations through the Digital Shoreline Analysis System, the MAPE and RMSE criteria were used to evaluate the error in the change ratio, accuracy, and positioning of shorelines in 2029 and 2039.

3- Results

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Linear Regression Rate (LRR) is derived from fitting the position of the shoreline to the shoreline time. The slope of the linear regression equation shows the displacement rate in meters per year at a confidence level of 95%. For zone A, which includes the Delta of Hasan Langi and the Shur river, the coastal displacement rate is between 0.05 to 11.04 meters per year. The positive value of the slope in the regression equation indicates the progression of the shoreline to the sea (the sedimentation process). This progress is related to the extension of two important rivers, Hasan Langhi and Shur, and the amount of sediment carried by these rivers. For zone B, the shoreline displacement is between 1.78 to 7.7 meters per year, which the coastal constructions that have expanded over the past 30 to 40 years are one of the most important factors in this case. The study of transects in this zone shows the stability of this zone because most of the shoreline changes are less than 1 meter per year. For zone C, which includes the Kol river delta, the shoreline displacement is between -0.9 to 8.58 meter per year, which the sedimentation was seen in different parts of this zone by calculations and the review of transects. In zone D that covers the area of Mangrove forests and the Mehran river delta, the shoreline displacement from -3.6 to 6.84 meter per year. Due to the values obtained from the validation of LRR and EPR parameters, the EPR parameter has less error in both MAPE and RMSE criteria and is more proper for shoreline prediction.

4- Discussion & Conclusions

During the 47 years, Linear Regression Rate (LRR) in the zones of A, B, C, and D was respectively 12.6, 1.65, 2.63 and 0.8 meters per year. According to the results, shorelines have more progress toward the sea, showing that the sedimentation is more than erosion. The changes were calculated by the transect method during four periods, and then using the statistical analysis, and finally the calculation of MAPE and RMSE. As a result, the EPR parameter was selected as the basis for predicting shorelines. The predicted shorelines for the next 10 to 20 years also show the progress of the shoreline toward the sea and the continuation of this sedimentation process. In addition, it is not possible to ignore the zones that the erosion process occurred, especially in the Hara forests in the Khour Khoran and parts of the Kol River delta and in the west zone of Bandar Abbas. The results of this study give an indication of the vulnerability of various coastal areas and essential needs for planning to protect the shoreline in different zones.

Key Words: DSAS tool, shoreline changes, Strait of Hormuz.