Environmental changes, remote sensing, and infrastructure development: The case of Egypt's East Port Said harbour

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Abstract:
Using Landsat TM data, this article examines the environmental impact of the East Port Said harbour project on the surrounding landscape. The optimum three-band combination and the most appropriate multispectral bands were selected to enhance the images and monitor land cover changes for the periods of 1984–1991 and 1991–2003. The results indicate that wetland areas declined from 103 km$^2$ in 1984 to 30 km$^2$ in 2003. In addition, the surface area of El-Malha Lake has shrunk from 27 km$^2$ to 18 km$^2$ over the same period. In contrast, the area covered by salt crust has increased from 11 km$^2$ in 1984 to 19 km$^2$ in 2003. Urban land use and designed cultivated lands were also significant in 2003, covering 49 km$^2$ and 71 km$^2$, respectively. The rate of shoreline change between 1984 and 2003, the period when the East Port Said harbour was constructed, was calculated. Vector data indicate that the rate of shoreline loss was _13 m/year from 1984 to 1991 and _15 m/year from 1991 to 2003. Despite the fact that construction of the East Port Said harbour caused significant changes in the study area, there are several factors controlling coastline and land cover changes including industrial development and fish cultivation farms.
Water resources assessment at El-Arish area, Using remote sensing and GIS, North Sinai, Egypt

Abstract:

This research aims at to analyse the pattern and rate of shoreline changes at the El-Arish area during the period 1984-2002, which represents the time at which the El-Arish harbour has affected along the coastline. Detecting salinity distribution of the ground water is the second objective of this study. The enhanced Landsat Thematic Mapper images utilised in this study were geometrically corrected. GIS techniques were used to produce vector maps for El-Arish coastline positions and estimate shoreline displacement during the last two decades. The measured shoreline changes derived from remote sensing data indicate accretion along the western coast of El-Arish harbour with +\(420\) m/yr, at a rate of +\(89\) m/yr. However, neighbour shore is suffering from erosion with -\(90\) m/yr (-\(1\) m/yr). Downdrift erosion occurred along the eastern coast of El-Arish harbour with -\(410\) m/yr, at a rate of -\(7\) m/yr. Physical and chemical properties of the El-Arish groundwater are analysed in 19 groundwater samples collected from pumping wells discharged from the Quaternary aquifer during July 2002. Assessment maps constructed by the integrated GIS techniques indicate that, eroded beach was observed at the area subjected high salinity ground water. Two main factors controlling salt water intrusion at El-Arish area are recognized, including the concentration of pumping wells which enhanced upward leakage of saline water from deeper formation and coastal erosion created by natural and human factors. This research indicates significant positive relationship between the groundwater salinity problem and coastal erosion at El-Arish area.
Validity of the equilibrium beach profiles: Nile Delta Coastal Zone, Egypt

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Abstract:

Beach profile equilibrium is the principal concept assumed by most numerical modelling. The response of beach profile configuration to natural and anthropogenic changes could be predicted to help in selecting the most appropriate engineering design required to mitigate coastal erosion and accretion alongshore. Thus, in order to apply coastal engineering projects, the predicted profile of equilibrium should be close enough to the measured profile. Therefore, before application of numerical modelling techniques, equilibrium expressions have to be validated at the study site. This research aims to assess the validity of the equilibrium profile concept on the Nile Delta coast based on beach profiles surveyed in 1991 from the main promontories; Abu-Quir Bay, the Rosetta promontory and the El-Burullus promontory. The results indicate that the equilibrium beach profile is consistent with the measured profiles at the study sites beyond 4 m distance offshore at −4 m depth. In contrast, the equilibrium status is not valid along the beach face at −1 m depth. Accreted beaches at Abu-Quir bay and Burullus promontory are characterized by wide berms and gentle beach face whereas eroded stretches at Rosetta promontory have a narrow berm and steep beach faces. The measured profiles are also compared with the exponential beach profile concept. An exponential hypothesis is not valid along the Nile Delta coast. Profiles measured at Abu-Quir, Rosetta and El-Burullus depart significantly from the exponential equation. Despite the fact that equilibrium expression can describe beach profiles along the Nile Delta, one equilibrium profile equation is not sufficient to assess all beach profiles. This can be explained as the morphology of beach profiles is subjected to some factors including; sediment characteristics, wave parameters and closure depth, which vary alongshore. Analysis of the validity of the equilibrium beach profile is recommended to get accurate results in modelling simulations and design the most appropriate engineering projects required for shore protection.