COASTAL MONITORING USING REMOTE SENSING AND GEOINFORMATION SYSTEMS: ESTIMATION OF EROSION AND ACCRETION RATES ALONG GAZA COASTLINE

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ABSTRACT

The coastal zone is the most important and the most intensively used area compared with the other areas populated by humans. The rapid increase of the population on and around the coastal areas leads to an increase of coastal resources exploitation. Thus, the coastal zone areas are under great pressure from both the human activates and geomorphologic coastal processes, for instance the dynamics of the sediments on the coastal shelf, marine currents, waves, tides, surface circulations, seawater chemistry and the rate of erosion and deposition.

The objective of this study is to use remote sensing and geoinformation systems (GIS) to monitor and analyse the coastline dynamic during the last two decades. The study aims to determine the rate of the coastline change and evaluate the effect of the new seaport nearby.
Study area is the coastal zone of Gaza Strip which is one of the most populated and polluted area in the world. Gaza coastline extends for 40 km from N-S. Gaza coast and beach has been changed and polluted due to many reasons including human activities (like the Gaza port, electricity generator unit, sewage disposal from the domestic's area and seepage sewage on the beach). In addition, Gaza shoreline is also affected and degraded by marine processes, such as wave erosion and deposition, and currents like alongshore current. The study has been started despite of the shortage time of the studies, lack of the in situ data and disability to conduct the field work so far due to political problem.

Medium spatial resolution Landsat and SPOT images were used in this study, as very high spatial resolution satellite images were not available before the year 2002 and because the limited financial budget did not allow to acquire expensive very high resolution optical imagery. This study was performed using three different sets of images: a series of Landsat ETM+ images (30m resolution) for evaluating short-term changes, Landsat TM-5 imagery (56m), SPOT panchromatic imagery (5m) for long-term evaluation. Based on this, the question came up whether it would be possible to get a reasonable result form medium resolution imagery especially for a narrow coastal zone as the Gaza coastal zone.
The pre-processing consisted of wavelet-based pan-sharpening (of the ETM+ imagery) and image-to-image registration with RMS less than 0.015. For automated coastline extraction from satellite imagery a method was developed. This method starts with a Principle Component Analysis (PCA), applies thresholding on the first principle component and uses a median filter (3x3) to enhance the coastline.

The Digital Shoreline Analysis System (DSAS) was used to calculate the rate of change along the Gaza coastal zone. DSAS requires at least two different coastlines, one of them representing the baseline. The systems automatically estimates different statistical parameters such as the End Point Rate (EPR) by dividing the distance of shoreline movement by the time elapsed between the earliest and latest measurements.

The rate of change was calculated between 1999 and 2003 as well as between 1987 and 2008, for each 50 meter along the coastline. The results show negative rates in general, which means that erosion has been the predominant process on the Gaza Coastal zone. The most threatened areas along the coastal zone have been highlighted. Due to natural and manmade factors, such as new sea port and the occlusion of Wadi Gaza (seasonal river), the rate of change was not constant along the coastal zone.