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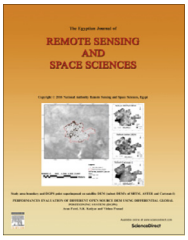

RESEARCH PAPER

Applying post classification change detection technique to monitor an Egyptian coastal zone (Abu Qir Bay)

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Abstract Land cover changes considered as one of the important global phenomena exerting perhaps one of the most significant effects on the environment than any other factor. It is, therefore, vital that accurate data on land cover changes are made available to facilitate the understanding of the link between land cover changes and environmental changes to allow planners to make effective decisions. In this paper, the post classification approach was used to detect and assess land cover changes of one of the important coastal zones in Egypt, Abu Qir Bay zone, based on the comparative analysis of independently produced classification images of the same area at different dates. In addition to satellite images, socioeconomic data were used with the aid of land use model EGSLR to indicate relation between land cover and land use changes. Results indicated that changes in different land covers reflected the changes in occupation status in specific zones. For example, in the south of Idku Lake zone, it was observed that the occupation of settlers changed from being unskilled workers to fishermen based on the expansion of the area of fish farms. Change rates increased dramatically in the period from 2004 to 2013 as remarkable negative changes were found especially in fruits and palm trees (i.e. loss of about 66 km^2 of land having fruits and palm trees) due to industrialization in the coastal area. Also, a rapid urbanization was monitored along the coastline of Abu Qir Bay zone due to the political conditions in Egypt (25th of January Revolution) within this period and which resulted to the temporary absence of monitoring systems to regulate urbanization.

1. Introduction

With the overpopulation change in the Nile Delta, human activities in the region, like the establishment of new industrial projects, usually result in significant and rapid changes in different land covers. These rapid changes could create disastrous physical, biological and socio-economic problems. The reliable knowledge about how the land cover in such areas actually

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respond to environmental changes and human actions are prerequisite to making effective decisions in response to these environmental problems. Lack of such knowledge is a major impediment to the design of sustainable development strategies. Most recent studies have conducted to detect, monitor and assess these environmental changes in a number of regions in Egypt (El-Hattab, 2015a,b; El-Askary et al., 2014; Aymen et al., 2014). However, the traditional monitoring systems for assessing land cover changes, such as sampling methods and geographical surveys, are no longer sufficient (Rokni et al., 2015). Recent techniques of studying such changes depend on identifying differences in the state of objects or phenomena by observing them at different dates (Lu et al., 2004; Abdul Jabbar, 2008; Berberoglu and Akin, 2009; Chen et al., 2012). This detection process frequently employs the following two basic approaches:

(1) The *post classification approach* which is the comparative analysis of independently produced classifications for different dates (Alagu Raja et al., 2013).
(2) The *pixel-to-pixel approach* (Nemmour and Chibani, 2004; Hussain et al., 2013) which is a simultaneous analysis of multispectral images.

This study primarily used the post classification approach for detecting, monitoring and assessing land cover changes of one of the coastal zones in the north of Egypt, Abu Qir Bay zone. The zone is a coastal region that extends between longitudes 30°00′ and 33°30′ to the East and latitudes of 31°10′ and 31°30′ to the North. It is one of the important coastal areas in Egypt due to its location and socio-economic importance. Its coast extends along 47 km between Rosetta promontory and Abu Qir head, deepening landward for more than 27 km along its longest axis. It represents an ideal arc-shape embayment among the Mediterranean bays on the Egyptian northern coast, and is considered as one of the highly dynamic areas on the Nile Delta.

2. Data used

The data used in this study were collected from different sources. It consisted mainly of images from LANDSAT satellite covering the area of study in different dates, topographic maps, socioeconomic data, and field survey measures. Each of these types of data described briefly in the next section.

2.1. Satellite images

Three LANDSAT multispectral satellite images were used (WRS_PATH = 177 Starting Row = 038; Reference Datum = "WGS84", Reference Ellipsoid = "WGS84" Map Projection = "UTM", Projection = UTM, Zone Number = 36). They are acquired in different dates but still at the same month and conditions (for change detection reasons); 30 August 2000, 9 August 2004, and 31 August 2013. The spatial resolution of used images is 30 meters. Fig. 1 represents one of those used satellite images. Those three dates chosen to examine the changes and its rates are after and before 25th January, revolution in Egypt to measure the effect of human activities during these periods as well as the effect of the temporary absence of monitoring systems anticipated during these periods.

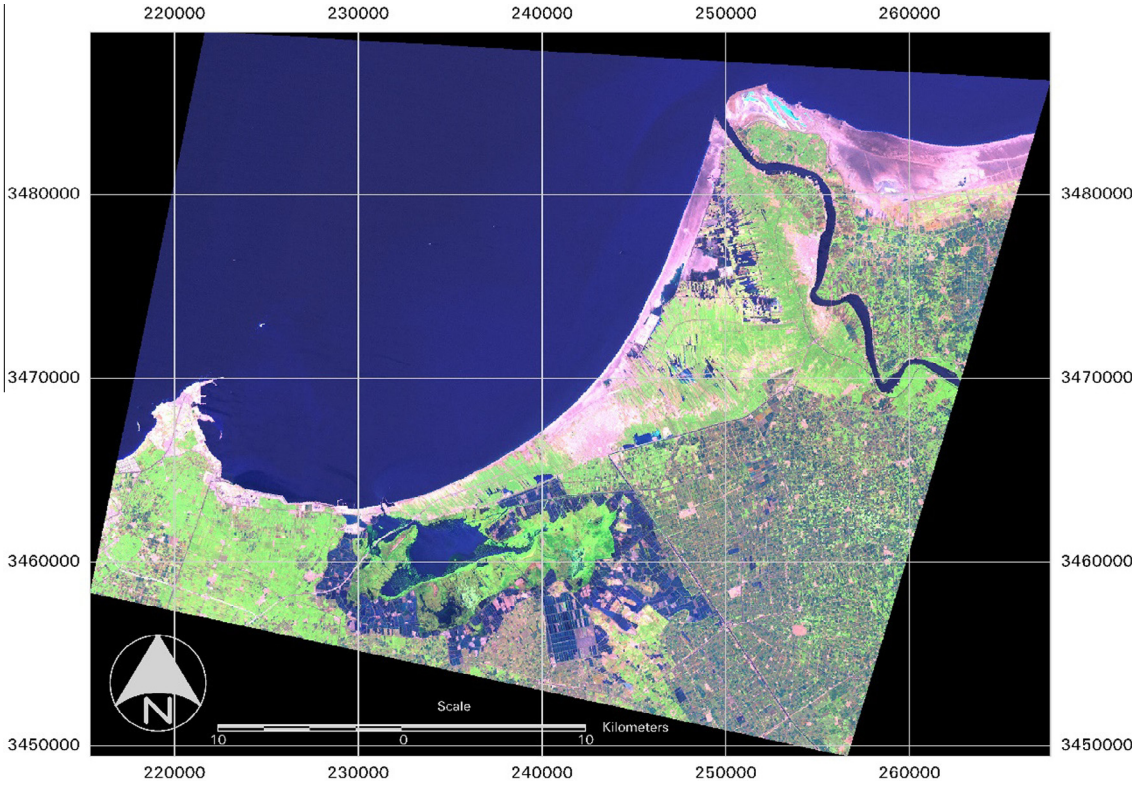

Figure 1 False color composite image of the study area, (year 2004).