

# Determining Practically Temporal Coastline Changing in Trabzon

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**Key words:** Coastline, Temporal Changes, Remote Sensing, Geographic Information Systems, Trabzon

## SUMMARY

Coastal areas have been attractive center for people since ancient times. In terms of tourism activities, coasts provide significant contribution to national economy. This contribution is proportional to how well these areas are manage. Turkey is surrounded by sea on three sides so the concepts of coasts have become more important for the country. For this reason, coast laws are based on old dates. Coasts have been made public domain and have been taken under protection. In order to find coast areas, coastline and coast edge line must be determined. According to the Law no 3621/3830, coastline is defined as sea, natural and artificial lake and rivers, except in the case of flood and it refers to the line of points touching the water to land In addition, Coast edge line is defined as natural boundaries of sea, natural and artificial lakes, and rivers. The area between the coastline and coast edge line is called coast. Coastline changes natural ways such as, melting glaciers, tides global warming and meteorological events or artificial factors which made by human such as, improper construction, fill in the sea and sand extraction from the sea. All these factors emerge from with time. Coastline detection and identification of temporal changes in coastal protection and management is important in order to maintain an appropriate manner. In this study, Trabzon province coastline is found as practically with Google Earth satellite images from 2002 to 2012. Costline is digitized form different temporal satellite images and changing is investigate with ArcGIS software.

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## 1. INTRODUCTION

The world population steadily increase in the past up to the present time immemorial as a result of the attractions that the coastal areas remain under intense urbanization and population pressure. With a wealth of natural resources that attracts the attention of coastal areas, therefore, they are always exposed to the overuse by human. Especially in recent years Turkey coast of internal and external tourism demand depending on the under intense pressure. For example land fillings for acquire new area to enter the second residential and resort sites, transportation problems to resolve the motorways and a lot of applications are making in coasts today, so we can see to what extent pressure.(Akyol vd.,1997).

One of the important features of the coastal areas, in this region large part of conditions can change with time. In order to determine this changes, we have to monitoring this area from time to time. To management and monitoring coastal area, first step is to determine coastline. Nowadays Satellite image and photogrammetric images are usually used for determine coastline.

## 2. REMOTE SENSING

Remote sensing refers to the activities of recording/observing/perceiving (sensing) objects or events at far away (remote) places. [URL 1].Remote Sensing is the science and art of obtaining information about an object, area, or phenomenon through the analysis of data acquired by a device that is not in contact with the object, area, or phenomenon under investigation." (Lillesand and Kiefer). All disciplines of science dealing with the earth uses Remote sensing technology. Investigation of geological studies landforms, natural disasters, structural geology, and in particular the study of natural resources, etc. In addition hydrogeology, botany, agriculture and meteorology effectively use remote sensing.[URL 2]

## 3. GEOGRAPHICAL INFORMATION SYSTEM

A geographic information system (GIS) integrates hardware, software, and data for capturing, managing, analyzing, and displaying all forms of geographically referenced information. GIS allows us to view, understand, question, interpret, and visualize data in many ways that reveal relationships, patterns, and trends in the form of maps, globes, reports, and charts.[URL3] GIS also stands for Geographic Information Science, an emerging interdisciplinary field that combines elements of geography, cartography, and computer science. Thought of in this way, GIS is a way of thinking about the world that puts spatial relationships at the center. GIS technology was originally developed to model the natural world—landmasses and bodies of water, elevation, temperature, soil composition, and suitable habitats.[URL4]

## 4. STUDIES

In this study three change detection method applied. First, different time satellite images 2002 and 2012 download from Google Earth software. Next images registration with 1/1000 resolution base map and using image differencing algorithm with ArcGis software change detection application was made. Secondly, same images digitizing coastline 2002 and 2012 with ArcGis software and determined change detection. Third application was made only using the Google Earth program, again coastline digitized online images and changes were observed.

## 5. CHANGE DETECTION

### 5.1 Study Area

First selected pilot region and three application applied same images so download images 2002 and 2012 from Google Earth software and this image resolution is 4800\*2718 pixel. Kurtuluş and Kemer kaya neighbored which are situated center of Trabzon selected pilot region in this study.



#### 5.1.1 Change Detection with Image Differencing (first application)

Timely and accurate change detection of Earth's surface features is extremely important for understanding relationships and interactions between human and natural phenomena in order to promote better decision making. (D.Lu, P. Mmausel E. Brondi'zio and E. Moran) Remote sensing data are primary sources extensively used for change detection in recent decades. Change analysis is determination changing which same area using different times satellite images. Basically, object-based and pixel-based approaches are available. Two Google Earth images open ArcGIS software and image analysis menu using and applied pixel based band differencing method. In this technique, images of the same area, obtained from times  $t_1$  and  $t_2$ , are subtracted pixelwise. Mathematically, the difference image is  $I_d(x, y) = I_1(x, y) - I_2(x, y)$ , (2.1) where  $I_1$  and  $I_2$  are the images obtained from  $t_1$  and  $t_2$ ,  $(x, y)$  are the coordinates of the pixels. The resulting image,  $I_d$ , represents the intensity difference of  $I_1$  from  $I_2$ . This technique works only if images are registered. (İlsever, M ; Ünsalan, C.)



2002

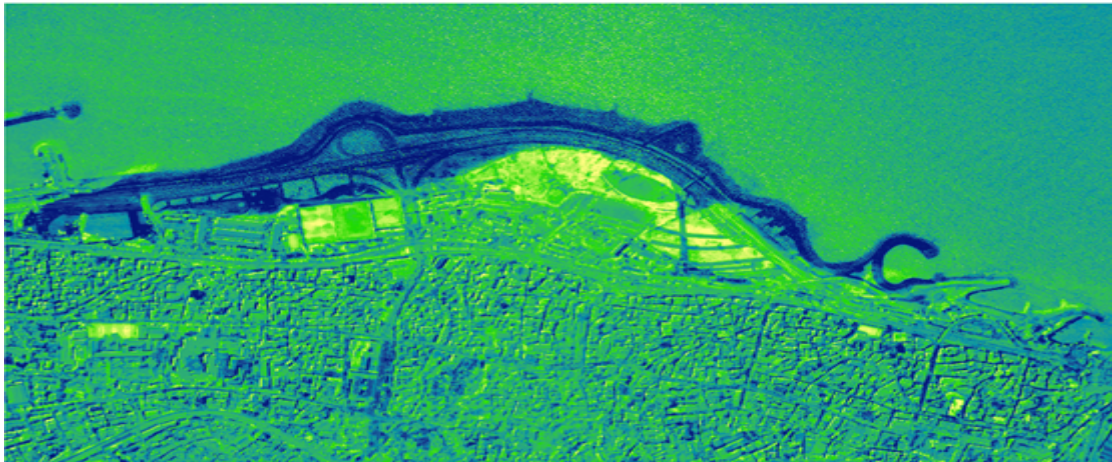
2012



2012 1.Band



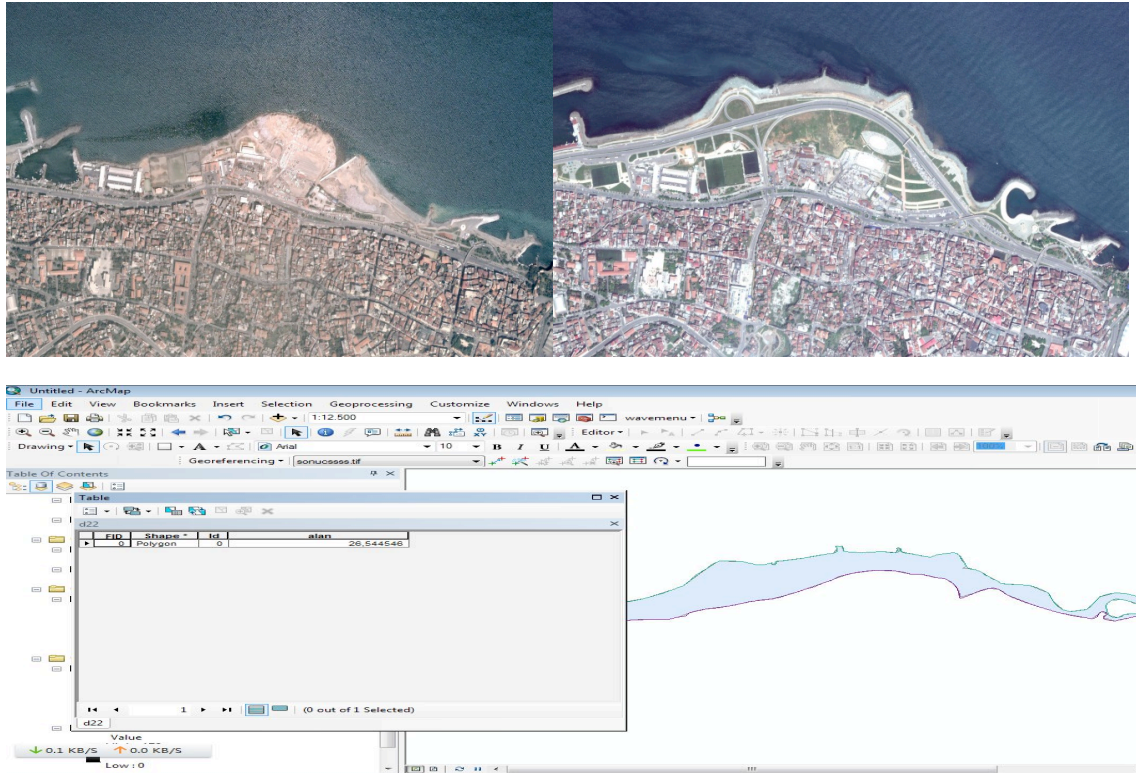
2002 1.Band



Blue areas show fill area on the coast. Change is 26,40 hectares

### 5.1.2 Change Detection with Digitizing Registered Google Earth image (second application)

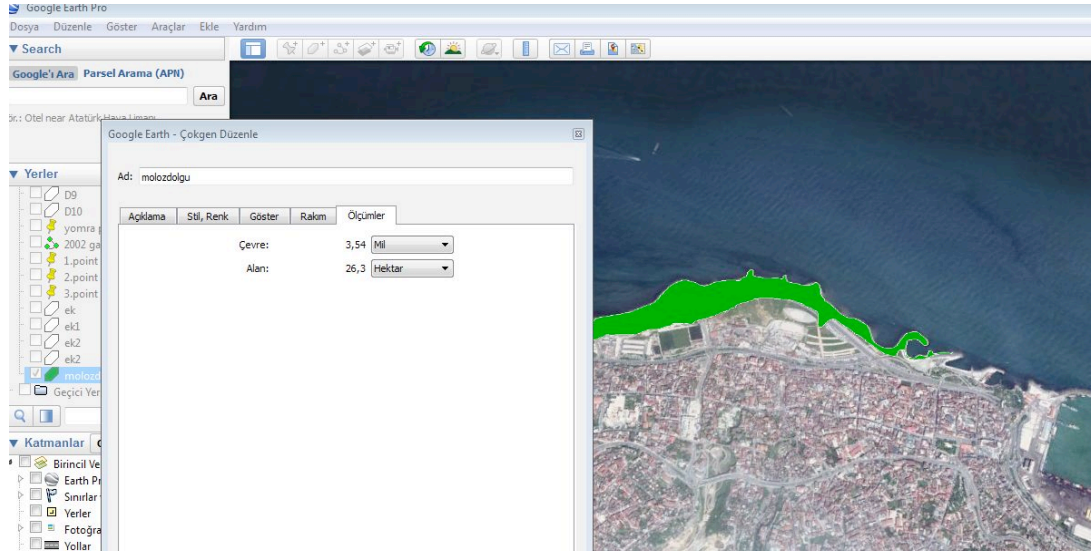
Registered same image coastline 2002 and 2012 digitizing manually ArcGIS software and find change of coastline.



Change is 26,54 hectares

### 5.1.3 Change Detection with Using Only Google Earth Software

Thirdly only using Google Earth software same images digitizing and change area are detected. Google Earth software include different times satellite images. In this conflict of satellite imagery in the study area around 5-10 meters contain errors however, changes in these images can be analyzed digitizing coast lines and changes can be observed. Cost line digitizing two image online Google Earth software and change area are detected.

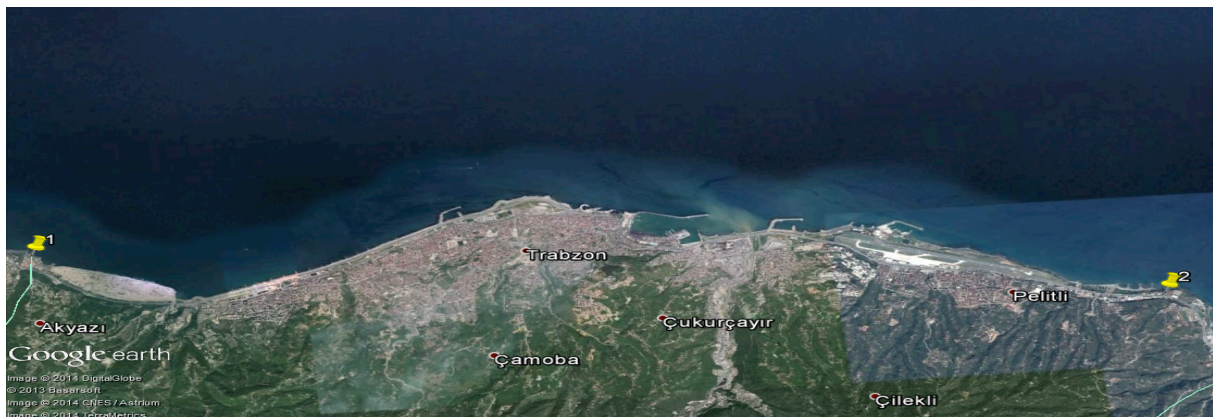


Change is 26,3 hectares

Study	Change
1 Change Detection with Image Differencing	26,40 ha
2 Change Detection with digitizing registered image	26,54 ha
3 Chang Detection with Google Earth	26,3 ha

## 6. TRABZON PROVINCE COASTLINE CHANGE DETECTION

Final Trabzon province digitizing Google Earth and change detection determined.





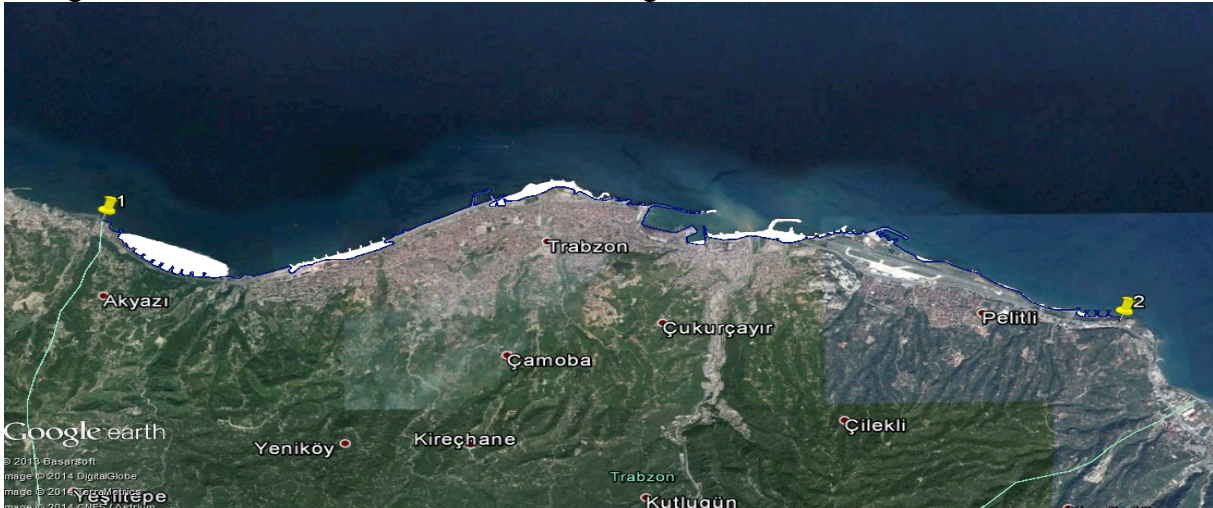
Trabzon Akyazi-Pelitli



Digitizing 2012 image using Google EARTH software

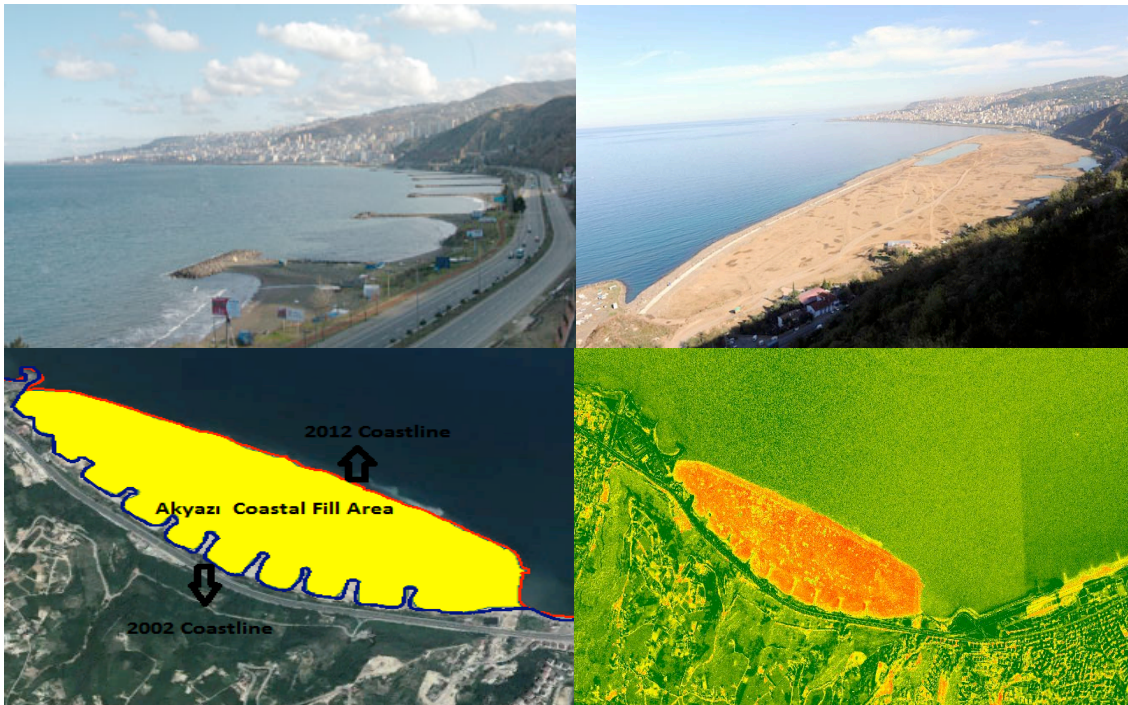


Digitizing 2002 image using Google EARTH software



Final Map

Change is 156,56 hectares



Akyazı Changing Area

## 7. RESULTS AND DISCUSSION

Trabzon province southern part consist of mountains and northern parth consist of Black Sea. Trabzon province population have increase timely therefore, coast is filled in order to gain new area and balance population density. Trabzon coastal area first began to filled in 1967. Fill in the fields generally include highway for transportation facilities and green spaces. In addition sea was filled Akyazı project in order to gain new area. As a result of the filling of the coast, it away from its natural appearance, but new area has been obtained. With today's technology, as depend on the accuracy of the data, can observe change detection in coastline. In terms of better management of coastal areas, observing these change is important. Thus remote sensing, photogrammetry and GIS use for obtain data and query and analysis are performed. With Internet-based Google Earth software, we can observe temporal change.

Pilot region study is made in order to determine Google Earth data accuracy so first two temporal images (2002-2012) are download as 48000\*27800 spatial resolution from Google Earth software and images are registered with 1/1000 base map next two image was paired with together next using ArcGIS software change area is detection with image differencing algorithm. In the second application same registered images digitizing with ArcGIS program and change area are found. In the third application, this area was digitized directly via the Google Earth program and change found. Three application results come close to each other so Trabzon-Pelitli coastal areas were digitized from Google Earth software and change were determined. As a result of the analysis made in Trabzon Akyazı-Pelitli, in a span of 10 years in the coastal area change was 156 hectares. Consequently Google Earth software is effective for change detection. The method is easy for change detection and coast is cheaper all application. We can change detection only Google Earth program.



## REFERENCES

AKYOL N. TÜFEKÇİ.M,SEYHAN.K,DEMİR.O In Turkey, the use of coastal areas and public relations benefits: Trabzon Province coastal use and results.

İlseven,M ;Ünsalan,C Two dimensional Change Detection Methods Remote Sensing Application

Lillesand and Kiefer Remote Sensing and Image Processing

D. Lu , P. Mausel , E. Brondizio & E.Moran Change detection techniques

1)<http://www.crisp.nus.edu.sg/~research/tutorial/intro.htm>

2)[http://www.mta.gov.tr/v2.0/birimler/RSC\\_WEB/index.php?id=ua](http://www.mta.gov.tr/v2.0/birimler/RSC_WEB/index.php?id=ua)

3)[http://www.esri.com/what-is-gis/overview#overview\\_panel](http://www.esri.com/what-is-gis/overview#overview_panel)

4)[http://cml.upenn.edu/what\\_is\\_gis.htm](http://cml.upenn.edu/what_is_gis.htm)

## BIOGRAPHICAL NOTES

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