

# CHANGE DETECTION ANALYSIS BY USING IKONOS IMAGERY

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## ABSTRACT:

Earthquake is the most known and harmful disaster for human beings. Especially after 17th August 1999 earthquake in Turkey, it is seen that we have to learn to live with this earthquake disaster. In order to decrease the damage of the earthquakes, precautions has to be taken. In addition to that, at the moment of earthquake and after earthquake, for intervention processes the use of satellite imagery and remote sensing techniques can play a vital role. Discriminations of collapsed buildings, bridges and similar man made features could easily be detect by using satellite imagery. In order to detect collapsed buildings, two images are needed, that are collected on different times. There is two way to detect collapsed buildings by using IKONOS satellite imagery. One of them is visual interpretation. Collapsed buildings can be digitized or detected manually by user. The second way is change detection analysis. For change detection analysis, two images and building layer (vector map) is needed. By using these data set collapsed buildings can be detected

## 1. INTRODUCTION

Remote sensing born with an image, collected from a balloon in 1850 (Aronoff 1991). A camera was first assembled to an aircraft by Wilbur Wright in 1909. After that time, remote sensing data was started to use in several areas. Especially the importance of the remote sensing has again understood in the second world war.

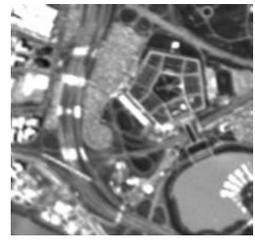
In order to meet the needs to the remote sensing data, the numbers of the satellites are getting increase day by day. The technical specifications such as; spatial resolution, radiometric resolution, temporal resolution, vv. of the satellites are getting improve too. Usage areas of the remote sensing data become wider, together with developing technology.

The spatial resolution of the satellite sensors can be characterized by the ability of defining the object boundaries (Colwell 1983). It is also possible to define the spatial resolution as, the area of a representative pixel on the ground.

IKONOS satellite has a spatial coverage of 1 meter. In other words, objects having 1 meter distance with each other on the ground can be identified. Moreover, if there is a contrast in the media (like tennis court lines or highway lane lines), details can be more distinctive and clearly identified. Different spatial resolutions of different satellites are given in Figure 1.



Landsat 30 Meter



SPOT 10 Meter



KVR-1000 2 Meter



IKONOS 1 Meter

Figure 1. Satellite imageries in different spatial resolutions.

## 2. CHANGE DETECTION ANALYSIS

Using 1 meter spatial resolution IKONOS imagery, in detection of collapsed buildings after the earthquake, is extremely valuable in terms of time and man power.

Detection of collapsed buildings after the earthquake can be easily done by satellite images acquired on different dates. One of the methods to determine this change is, visual interpretation of buildings one by one and the other is change detection analyses method.

### 2.1 Visual Interpretation

First of all, in visual interpretation method, to detect collapsed building, satellite images acquired on different dates are compared and the buildings that have damaged or collapsed are digitized. It could be possible to make digitizing in higher scales as in building bases or for large areas. The detection of collapsed buildings by visual interpretation and the digitized buildings can be seen in Figure 2 and 3.



Figure 2. Digitization in building scale. SULTANDAĞI Earthquake, ÇAY Center and ÇAY Industrial Area 3rd February 2002. Collapsed buildings are detected by visual interpretation.

As seen in Figure2, buildings could easily be digitized by using high resolution imagery. After that digitization process the produced vector layer could be correspond with a new image and collapsed buildings could be detected visually.

An other digitization could be done on larger areas like industrial zones as shown in Figure 3. This process will prevent time consuming for digitization.



BEFORE



AFTER

Figure 3. Digitization of large areas. SULTANDAĞI Earthquake, ÇAY Center and ÇAY Industrial Area 3rd February 2002. Collapsed buildings are detected by visual interpretation.

### 2.2 CHANGE DETECTION ANALYSIS METHOD

Other change detection method is; change detection analysis method. Satellite images acquired on different dates are required for this analysis. To increase the efficiency and success of the method, it is wiser to perform masking. For masking, vector data of the buildings in the study area is needed. By this method, change detection analysis would enclose only the related areas (building boundaries), where the mask is present and the results would yield the change only in these areas. The flow chart showing the steps of the change detection analyses is shown in Figure 4.

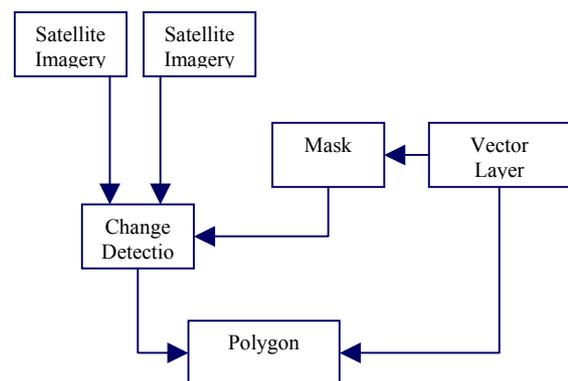
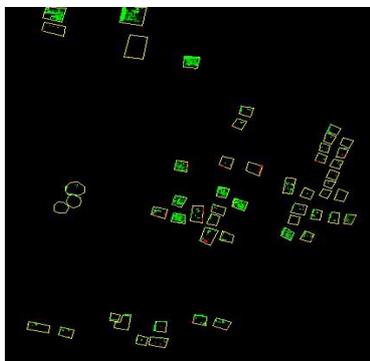


Figure 4. Flow chart of change detection analysis

Figure 5 shows two input data of the change detection analysis as illustrated in Figure 4. These images are collected on different times.



Change Detection Results

Figure 5. Results of change detection analysis and satellite imageries.

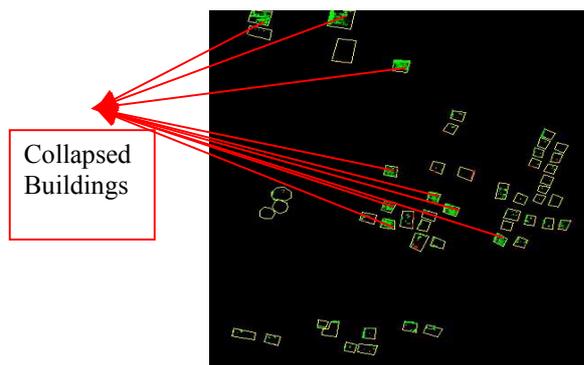


Figure 6. Change detection results are displayed as in red and green colors.

As given in flowchart two satellite images, which are collected on different times, are processed to each other by using the building data as mask. The results could be seen in Figure 6 in red and green colors. Green colors show the DN values that are

increased in this pixel and red colors show the DN values that are decreased in this pixel. After this results it will be healthier to check this results visually. The number of red and green pixels could be increase or decrease depends on to the threshold, which was choosed. This threshold describes the percentage of the DN values of the pixels, which will be taken into consideration in the analysis.

Using IKONOS imagery, it is possible to work on building scale after the disaster. Digitization can be performed on this scale and if there is also available data, including the attributes; it is easier, faster and more reliable to update the data.

### 3. THANKS

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### 4. REFERENCES

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