Duality in Geomorphology

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Extended Abstract

Introduction
Some of phenomena have certain relationships which cannot be raised as correlation, but they considered as duality. Concept of duality is regarded when a phenomenon with another phenomenon is dual. Although each of these phenomena are independent in nature, there is a relationship between them. So, we will analyze the behavior of phenomena in relation to other phenomena.

Earth subsidence has been one of the important issues jeopardizing environment and there are many studies, which blame shortage of underground water resources for having uplift and subsidence. However, many argue such conclusion and believe that earth subsidence has been studied in the past without considering the changes in the hill over a long period. In this study, we use SAR interferometry study to investigate earth subsidence in many plains of Iran and explain duality theory in the geomorphology. Concept of duality in geomorphology is mostly rely on the land subsidence and the uplift in the adjacent hills.

Mahyar plain is located 25 kilometers south of city of Isfahan, Iran. The region is covered with calcareous rocks of cretaceous and there are many rocky mountains. Many sediment erosions cover the areas of desert and there are various faults.Yazd- Ardakan region is located in central part of Yazd and it contains many well-known faults. Ardabil plain is located in west northern part of Iran.

Methodology
In order to achieve the aims of research in this paper, the following stages and procedures are to be considered:

- Studying and examining of the documents relevant to the plains in Iran and the amount of their subsidence,
- Selecting, three plain (Mahyar with Yazd Ardakan and Ardabil) in different formation
system for research,
- Analysis of acquired data using SAR Scape software,
- Providing and processing the radar data from the study area and applying the method of radar wave's interference measuring in two certain time frames.

Radar interference measuring can help us explain this issue. This method enables us to assess height changes of the earth in centimeter scale per year. The processing of SAR interferometric data is a complex procedure. Based on the quality of the datasets, the performance of each processing step is crucial. To summarise, the interferometric processing consists of the following steps:

1. image registration,
2. calculation of modulate phase difference,
3. phase unwrapping and geocoding.

Results and Discussion
Data analysis of Envisat Satellite (Alospalsar) in Mahyar plain shows the land subsidence of plain has been synchronized with uplift occurred in the mountains of adjacent plains. The results show that most uplift is in the Kolah Ghazi Mountain and the rate of subsidence is increasing towards the center of plain. The results indicate that the maximum subsidence in Yazd-Ardakan belongs to a Tile producer located 14 kilometers from the road of Yazd-Meibod. In addition, the maximum uplift is North-East to east part of desert of Yazd-Ardakan.

The analysis of radar data into the Ardebil plain on 3 September 2009 and 11 September 2010 shows the highest rate of subsidence in Ardabil airport and the highest uplift in the adjacent hills.

Conclusion
Although the effect of irregular exploitation of water resource can be linked to an increase in land subsidence, the main cause of land subsidence in the plains of Iran is the simultaneousness raising the subsidence in the floor of plains and adjacent mountains. These processes, as a series, act together and coordinate in reverse order. This is called duality in geomorphology. Although each of these phenomena is independent in nature, there is a relationship between them.

Keywords: Duality, Geomorphology, Plain, Subsidence, Uplift, Iran.