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Monitoring of Earthquakes Activities along the Syrian Rift System (Left-Lateral) By using Remote Sensing and GIS Database

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Earthquake mitigation can be achieved with a better knowledge of a region's infra- and substructures. High resolution Remote Sensing data can play a significant role to implement Geological mapping and it is essential to learn about the tectonic setting of a region. It is an effective method to identify active faults from different sources of remote sensing and compare the capability of some satellite sensors in active faults survey.

In this paper it was discussed a few digital image processing approaches to be used for enhancement and feature extraction related to faults.

Those methods include band ratio, filtering and texture statistics . The experimental results show that multi-spectral images have great potentials in large scale active faults investigation. It has also got satisfied results when deal with invisible faults.

Active Faults have distinct features in satellite images. Usually, there are obvious straight lines, circular structures and other distinct patterns along the faults locations. Remotely sensed images Landsat MSS, TM or ETM+, SPOT XS/PAN are often used in active faults mapping.

Moderate and high resolution satellite images are the best choice, because in low resolution images, the faults features may not be visible in most cases.

The area under study is located Northwest of Syria that is part of one of the very

active deformation belt on the Earth today. This area and the western part of Syria are located along the great rift system (Left-Lateral or African- Syrian Rift System). Those areas are tectonically active and caused a lot of seismically events. The AL-Ghab Graben complex is situated within this wide area of Cenozoic deformation. The system formed, initially, as a result of the break up of the Arabian plate from the African plate .

This action indicates that these sites are active and in a continual movement.

In addition to that, the statistic analysis of Thematic Mapper data and the features from a digital elevation model (DEM) produced from SAR interferometry show the existence of spectral structures at the same sites. The Arabian plate is moving in a NNW direction, whereas the African plate is moving to the North. The left-lateral motion along the Dead Sea Fault accommodates the difference in movement rate between both plates.

The analysis of TM Space Imagery and digital image processing of spectral data show that the lineaments along AL-Ghab Graben may be considered as linear Conjunctions accompanied with complex fracturing system. This complex is affected by distance stresses accompanied with intensive forces.

The analysis of TM Space Imagery and digital image processing of spectral data show that there is an intensity in colour contrast of IR, Grey, Blue, and Magenta Spectral zones at several lineaments north of Al-Ghab fault, northwest of Syria, which may be considered as linear Conjunctions accompanied with complex fracturing system. This complex is affected by distance stresses accompanied with intensive forces. This action indicates that these sites are active and in a continual movement. In addition to that, the statistic analysis of Thematic Mapper (TM) data and the features from a digital elevation model (DEM) produced from SAR interferometers show the existence of spectral structures at the same sites. This could represent high values of surface gaseous lionization (O+OH+N) associated with intensity of spectral reflectance in Blue visible range at other lineaments which accompanied with spectral reflectance in the IR range interposed by Radar interpenetrates according to the apparent indicators on SAR image . This indicates to the seismic activity that synchronized with the data of Radar imaging.

1 TM and SAR – DTM data also show a gradual colour tone and interruptions of linear-ellipse shapes which reflecting the presence of discontinuity contours along the fault zone extension. This features refer to abundance of surface morphological features indicate to Fresh Faults. Recent faulting is expressed as freshly exposed soil within the colluvial apron visible by its light tone colour. These indicators had been proved by field checks. Furthermore, the statistic digital analysis of the spectral data shows that there are distributions of spectral plumes. These plumes are decreasing in intensity and colour contrast from the centre of the site to the direction of its edges. This proves that there are an active tectonics reflecting the behaviour of the movement and earth stresses at these fracturing zones. Results from statistic analysis of DTM (Digital Terrain Model) Image, demonstrate that the restraining bend of Al-Ghab fault involves active strike slip faulting. The Al-Ghab fault zone appears capable of generating large earthquakes and it should be an essential element in any regional earthquake hazard assessment. The spectral circular structures might be caused by the increase of gaseous lionization and the high concentration of radon gas leak.

The results are consistent with the observed surface faults that show a greater amount of relative motion on the eastern basin-bounding strike-slip fault. Observations from

AL- Ghab are echoed in theoretical models that show cross-basin oblique-slip faults accommodating initial basin opening, but most subsidence on the basin bounding faults. A northward shifting depocenter, and the subsequent development of a second depocenter in AL- Ghab Basin, are due to increasing fresh faults overlap with time and step-over of the lateral motion from the eastern to the western faults. The system formed, initially, as a result of the break up of the Arabian plate from the African plate since the mid-Cenozoic . The tectonic evolution of Syria has been profoundly affected by movement on nearby Arabian plate boundaries, which almost completely surround the country. This deformation is evidenced in large-scale geologic structures within Syria, which include the Palmyrides folds. The northern continuation of the Dead Sea Fault into Lebanon and Syria is comprised primarily of the Serghaya (SF) and the Yammouneh (YF) faults that trace parallel and close lines in between the Lebanon and Anti-Lebanon mountain chains . The SF is a branch of the main Dead Sea fault in south-western part of Syria, while the YF merges with the AL- Ghab fault (GF) near the Bouqeah plain in western Syria. The south-north trending GF in turn extends parallel to the Syrian coast, and merges with the major East Anatolian Fault (EAF) in southern Turkey . This complex system in Lebanon and Syria has been the location of numerous large historical earthquakes.