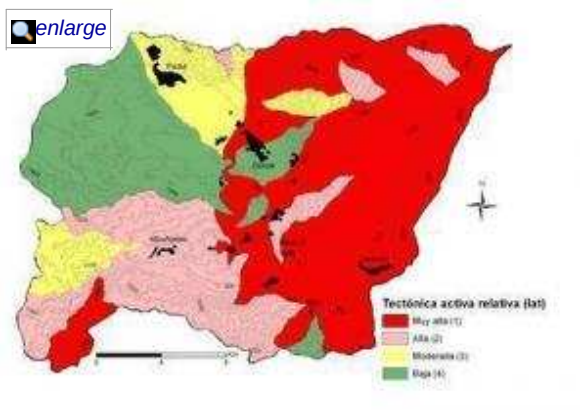
Science News

New Geomorphological Index Created For Studying Active Tectonics Of Mountains

ScienceDaily (Jun. 3, 2008) — To build a hospital, nuclear power station or a large dam you need to know the possible earthquake risks of the terrain. Now, researchers from the Universities of Granada and Jaen, alongside scientists from the University of California, have developed, based on relief data from the southern edge of the Sierra Nevada, a geomorphological index that analyses land form in relation to active tectonics, applicable to any mountain chain on the planet.



Map of relative tectonic activity in Sierra Nevada. (Credit: SINC/University of Granada)

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Active tectonics comprise the most up-to-date deformation processes that affect the Earth's crust, resulting in earthquakes or recent deformations in the planet's faults and folds. This phenomena is analysed in geology research carried out before commencing engineering works.

Depending on the type of project (nuclear power stations or power stations, radioactive storage, natural gas or CO_2, large dams and tunnels, hydroelectricity projects...) and the type of earthquake (single or multiple), the time period for evaluating active tectonics varies between 10,000 and 100,000 years for studies prior to beginning construction work.

The study, which is now published in the magazine Geomorphology and is the result of the doctoral thesis of Rachid El Hamdouni, Professor of the Department of Civil Engineering at the University of Granada, defines a new geomorphological index called Relative Active Tectonics Index, which identifies four classes of active tectonics (from low to very high) and uses six geomorphological indicators.

"The main use of this new index is that it establishes a close relationship between this, the land forms, and direct evidence of active faults", El Hamdouni explained to SINC.

According to José Chacón Montero, Director of the Department of Civil Engineering at the University of Granada and co-author of this research, in Sierra Nevada "areas with 'high' and 'very high' tectonic activity are areas with precipices, hanging valleys, deformed or hanging alluvial fans or deep and narrow gorges excavated near mountain fronts".

A seismic map for southern Spain

The indices are calculated with the help of Geographical Information Systems and teledetection programs in large areas which identify geomorphological anomalies possibly related to active tectonics. "This is really useful in southern Spain where studies on active tectonics are not very widely distributed", Chacón pointed out to SINC.

The study has focused on the Padul-Dúrcal fault and a series of associated fault structures on the edge of the Sierra Nevada, where over the last 30 years seismic activity has been recorded by the Observatory of the Andalusian Institute of Geophysics and Prevention of Seismic Disasters. Chacón explained that the map obtained with the new index depends exclusively on the land forms and divides the area studied into four parts, "of which two thirds of the total area is classed as having high or very high tectonic activity".

The Sierra Nevada is an Alpine mountain chain "with variable active tectonic gradients caused by the collision of Africa with Europe which has given rise to anticlines aligned from east to west, as well as the transverse extension with variable vertical gradients around 0.5 mm/year in normal faults", Chacón specified.

Journal reference:

1. R. El Hamdouni, C. Irigaray, T. Fernández, J. Chacón, E.A. Keller. **Assessment of relative active tectonics, southwest border of the Sierra Nevada (southern**

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