Geophysical Research Abstracts
Vol. 16, EGU2014-6779, 2014
EGU General Assembly 2014

Geomorphic assessment of the tectonic activity of Qiulitagh fold-belt, Kuqa foreland basin, Xinjiang, China

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The Qiulitagh fold belt is an anticline structure located in the Kuqa fold-and-thrust belt (southern Tian Shan, China), whose active folding is well documented by structural and palaeomagnetic studies (Chen et al., 2007; Hubert-Ferrari et al., 2007; Li et al., 2012; Wang et al., 2011). The topography of Quilitagh fold belt can be divided into two SW-NE parallel ridges: 1) a 90 km long northern ridge, composed of the Northern Qiulitagh anticline and the Yakelike anticline, and 2) a 165km long southern ridge, composed of the Southern Qiulitagh anticline and the Mishikantage anticline. Due to the current absence of vegetation and relative homogeneity of outcropping lithologies (mainly Neogene detrital sandstone and silstone), these anticlines provide exceptional field cases for investigating the dynamic relationships between fold growth mechanisms, the subsurface structures, the geomorphic entities and the drainage network evolution.
We used free topographic and satellite image datasets to carry out a morphometric study of the Quilitagh fold-belt and investigate the kinematics of active folding. Topographic datasets include Digital Elevation Models (DEM) from the NASA SRTM V.4.0 and ASTER programs, whereas satellite images are extracted from Landsat 7 shots and Google Earth. These datasets were incorporated in GIS software where three scales of observation were investigated: 1) a global fold scale, 2) a drainage basin scale and 3) a valley scale. At the drainage basin scale, we selected about 250 items and quantified several geomorphic indices of relative active tectonic growth. These are the basin mean slope, hypsometric integral, basin asymmetry and local relief. We also used published seismic profiles to link the 3D subsurface geometry of the salt-related Qiulitagh fold belt with the geomorphic signal.
Results indicate that the morphometry of Quilitagh drainage basins (hypsometry, drainage basin asymmetry, local relief, valley incision, steepness index) change significantly along-strike, which allows to divide the fold belt into several morphologic structures. These morphologic structures are suspected to be developing under variable uplift rates due to partitioning of deformation. In addition, the observation of very regular landscapes that become more complex along-strike allows investigating relief evolution mechanisms from transient to steady-state. Finally, our morphometric analysis suggests some new insights on the topographic growth of Qiulitagh folds in relation with the growth of sub-surface structures and the accommodation of convergence in Kuqa foreland basin.

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