Geophysical Research Abstracts
Vol. 19, EGU2017-15221, 2017
EGU General Assembly 2017
© Author(s) 2017. CC Attribution 3.0 License.

Late Quaternary slip rate determination by CRN dating on the Haiyuan fault, China, and implication for complex geometry fault systems

Rémi Matrau (1), Yann Klinger (1), Jérôme Van der Woerd (2), Jing Liu-Zeng (3), Zhanfei Li (3), and Xiwei Xu (3)

(1) Institut de Physique du Globe de Paris, (2) Institut de Physique du Globe de Strasbourg, (3) Institute of Geology, China Earthquake Administration

Late Quaternary slip rate determination by CRN dating on the Haiyuan fault, China, and implication for complex geometry fault systems

Matrau Rémi, Klinger Yann, Van der Woerd Jérôme, Liu-Zeng Jing, Li Zhanfei, Xu Xiwei

The Haiyuan fault in Gansu Province, China, is a major left-lateral strike-slip fault forming the northeastern boundary of the Tibetan plateau and accommodating part of the deformation from the India-Asia collision. Geomorphic and geodetic studies of the Haiyuan fault show slip rates ranging from $\sim$ 4 mm/yr to $\sim$ 19 mm/yr from east to west along 500 km of the fault. Such discrepancy could be explained by the complex geometry of the fault system, leading to slip distribution on multiple branches.
Combining displacement measurements of alluvial terraces from high-resolution Pléiades images and 10Be - 26Al cosmogenic radionuclides (CRN) dating, we bracket the late Quaternary slip rate along the Hasi Shan fault segment (37°00' N, 104°25' E). At our calibration site, terrace riser offsets for 5 terraces ranging from $\sim$ 6 m to $\sim$ 227 m and CRN ages ranging from 6.5$\pm$0.6 kyr to 41$\pm$4 kyr – yield geological left-lateral slip rates from 2.0 mm/yr to 4.4 mm/yr. We measured consistent terrace riser offset values along the entire 25 km-long segment, which suggests that some external forcing controls the regional river-terrace emplacement, regardless of each specific catchment. Hence, we extend our slip rate determination to the entire Hasi Shan fault segment to be 4.0$\pm$1.0 mm/yr since the last $\sim$ 40 kyr. This rate is consistent with other long-term rates of 4 mm/yr to 5 mm/yr east and west of Hasi Shan – as well as geodetic rates of 4 mm/yr to 6 mm/yr west of Hasi Shan. However, Holocene terraces and moraines offsets have suggested higher rates of 15 to 20 mm/yr further west. Such disparate rates may be explained by slip distribution on multiple branches. In particular, the Zhongwei fault splay in the central part of the Haiyuan fault, with a slip rate of 4-5 mm/yr could partly explain the faster rates on the western single stranded Haiyuan fault. In addition we constrained 0.55$\pm$0.1 mm/yr of uplift rate along the Hasi Shan, where the fault strike veers southward, indicating slip partitioning.
Our slip rate along the Hasi Shan segment is consistent with most of the long-term and short-term slip rates ($\sim$ 5 mm/yr) measured along the central and eastern parts of the Haiyuan fault. However the discrepancy with other studies to the west highlights the major implication of complex geometries on the slip distribution over large fault systems.