Geophysical Research Abstracts
Vol. 20, EGU2018-18207-1, 2018
EGU General Assembly 2018

Spatial distribution of the horizontal stress in the fold-and-thrust belt of south-central Taiwan from earthquake focal mechanisms

Cristina Biete (1), Björn Lund (2), Dennis Brown (1), Joaquina Alvarez-Marron (1), Yih-Min Wu (3), Hao Kuo-Chen (4), Chun-Wei Ho (4,5)

(1) Institute of Earth Sciences Jaume Almera, ICTJA, CSIC, Barcelona, Spain (cbiete@ictja.csic.es), (2) Department of Earth Sciences, Uppsala University, Uppsala, Sweden, (3) Department of Earth Science, National Taiwan University, Taipei, Taiwan, (4) Department of Earth Science, National Central University, Zhongli District, Taoyuan City, Taiwan, (5) Central Weather Bureau, Taipei, Taiwan

The dominant structure of western Taiwan comprises two fault systems: one that consists of the thrusts of the fold-and-thrust belt (FTB) (NNE striking), which are being cut at a high angle by a second system that is inherited from the continental margin (ENE striking). To investigate the complexities that the interaction of these two fault systems introduce into the deformation style and kinematics of the south-central Taiwan FTB we integrate the surface geology with the inversion of more than 2400 earthquake focal mechanisms to calculate the reduced stress tensor, the horizontal stress directions and the most probable failure planes. Earthquakes in the study area occur throughout the crust, but they are predominantly located below the basal thrust of the FTB between 5 and 20 km depth. For the fewer events above the basal thrust, we investigate the relationship between the earthquake driving stress field and the surface strain rate field measured by GPS data. The focal mechanism data set has been manually discretized depending on their distribution in tectono-stratigraphic units, structures and mechanisms. In depth, we take into account the location of the basement, then: from 0-7km depth is above the basement, 7-15km lies within the basement, and 15–45km represents the deeper crust. Using these criteria, we identified 42 clusters with more than the minimum 20 events needed to obtain a reliable stress tensor, these were used to calculate the maximum horizontal stress azimuth (SH). The SH azimuths smoothly turn along the study area from NW in the east to SW in the west, with the exception of the Chi-chi earthquake area, where the SH azimuth is N-S. While SH does not present significant depth variations and is coherent with the surface strain directions, depth changes are found in the stress regime and principal failure planes through the study area. Above the basement, which has predominantly strike-slip stress states, both fault systems are represented but NE-striking ones (those similar to the margin) are located below surface geology along-strike changes. The upper basement presents a clear ENE-striking band of strike-slip stress in the center of the FTB with principal failure planes ENE-striking, as the ones representing the margin structure also found in the foreland basin basement. Moreover, this band location is just below a surface interaction between the two fault systems, where an ENE-striking fault cuts the deformation front surface expression. South of this band, the basement presents revers tensors and N-S principal failure planes as in the FTB. Finally, the deep basement slice presents clusters with revers behavior and N-S principal failure planes as are that characteristic from the mountain belt. This study shows that the tectonic stress just above and in the upper basement has a clear influence from the continental margin structures and, considering the casual relationship between tectonic stress and failure planes striking distribution and the surface geology along-strike changes it suggests that the structures and configuration of the margin may be also affecting the deformation style and kinematics of the south-central Taiwan FTB.

This research is supported by the project PROTAI-2 (CGL2013-43877-P).