



The 18 December 2001 (Mw 6.8) earthquake offshore eastern Taiwan: Rupture at the landward flank of a subducted ridge

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The southern Ryukyus represents an area where different tectonic stress regimes result in high seismicity and increased seismic hazard for nearby areas such as Taiwan. On 18 December 2001 at 04:03 (GMT) a strong earthquake (Mw 6.8) occurred in the forearc area of the southern Ryukyu subduction zone. Even though the event did not cause significant damage or casualties, it was felt throughout eastern Taiwan, at the capital Taipei and in the southern Ryukyu islands. Revised moment tensor solutions published by GCMT and BATS groups show a normal faulting mechanism with some strike-slip component and also point to a shallow focal depth (~ 12 km). We use arrival times picked at both Taiwanese and Japanese stations along with a 3D geo-realistic a priori velocity model in order to obtain accurate absolute locations for the mainshock and 153 of its aftershocks. Locations are derived by using the Maximum Intersection (MAXI) algorithm which has been used in many previous seismicity studies in the southern Ryukyus. These improved locations indicate that the mainshock was caused by the failure of a NE-SW oriented fault that extends from the edge of the Nanao forearc sedimentary basin to the Ryukyu arc basement. Far-field P and SH waveforms of the mainshock recorded at stations surrounding the source and at distances 30-100 degrees, were inverted for the purpose of investigating its rupture process. A non-negative least-squares inversion technique utilizing multiple time windows was used to derive the spatio-temporal slip distribution. The preferred slip distribution model shows that there is one large area of high slip (~ 0.9 m) at 5-15 km depth that essentially represents the crystalline rocks of the Ryukyu arc basement. Another smaller area with lower slip (~ 0.4 m) extends at 10-15 km depth beneath the Nanao basin. Most aftershocks are located in areas of low slip (< 0.4 m) filling the regions of slip deficit. It is likely that the 18 December 2001 earthquake was caused by a stress field interaction generated by the oblique subduction of the Gagua ridge and the gravitational forces acting at its landward flank.