Fault Source Model of the 2008 Wenchuan earthquake, China, inferred from PALSAR data

M. Furuya[1$], T. Kobayashi[2], Y. Takada[1, #], and M. Murakami[2]

1. Department of Natural History Sciences, Hokkaido University, Sapporo, JAPAN.

2. Institute of Seismology and Volcanology, Hokkaido University, Sapporo, JAPAN.

#. Now at JAMSTEC/IFREE, Kanagawa, JAPAN

$. To whom correspondence should be addressed. Email: furuya@mail.sci.hokudai.ac.jp

We use crustal deformation data sets derived from satellite-based synthetic aperture radar (SAR) to develop a fault source model of the 2008 M7.9 Wenchuan earthquake, China, which occurred at the Longmen Shan Fault Zone. The data sets include interferometric SAR (InSAR), range offset, and azimuth offset data acquired at seven ascending paths. The range and azimuth offset data are particularly important, exhibiting a single major rupture to the northeast (NE) and multiple ruptures to the southwest (SW). Our preferred model consists of six segments; four follow the previously mapped traces of the Beichuan fault (BF) and its NE extension, one corresponds to the Pengguan fault (PF) to the SW, and the other is included to represent a conjugate fault to the SW. Fixing the location and geometry of those segments, we solve for the variable slip distribution with the patch sizes increasing toward the deeper depth, using a non-negative least-squares method with a smoothing constraint on the slip distribution. The geodetically estimated moment is 1.05×10^{21} N m (Mw=7.9), which is close to the seismological estimate, and suggests that there are insignificant postseismic signals in the data. Maximum slip patches of ~10 m in magnitude consisting of both thrust and right-lateral slip components are identified at the shallowest patches to the NE along the BF. The multiple fault segments to the SW show that the thrust slip component initially dominates, and the strike slip becomes significant toward the NE. Examining the sensitivity of the predicted azimuth offset data to the assumed dip angle, we found that the dip angle changed significantly from 35-45 degrees at the SW fault segment for the PF to 80-90 degrees at the NE extension of the BF.