

Detailed surface rupture map of the 2016 Kumamoto earthquake sequence

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The 2016 Kumamoto earthquake sequence that culminated in the Mw 7.0 event on April 16 produced a 31-km-long major surface ruptures having dextral and normal slip components mainly along the Futagawa fault zone, central Kyushu, Japan. Also, many minor surface ruptures appeared in the range up to 20 km on the hanging wall side, and up to 15 km extensions of the major rupture zone. We have carried out field investigation of the surficial rupture and deformation caused by the earthquake sequence with reference to aerial photographs, InSAR images, and DEM-derived post-earthquake topographical maps. The geometry and distribution of surface ruptures that have a wide range of slip amount from 1cm to 3 m are compiled on the Digital Topographical Map 25000 published by GSI.

The N60E striking major ruptures mainly constitute a 1.5-2.5 km-wide fault zone and subdivided into three sections. The 12-km-long central section mostly has 2-2.5 m of dextral strike-slip, 1-3 m of northwest-side-down vertical, and 1.5-2.5 m of heave components. The northeastern half of this section is characterized by slip-partitioning into subparallel strike-slip and normal-slip ruptures. The 7-km-long northeastern section is composed of a left-stepping en echelon array of discontinuous fault trace and terminates on the southwest side of the central volcanos of Aso caldera. The 12-km-long southwestern section is a complicated branch fault zone. This section branches into two sub-zones, each along both side wall of the preexisting Kiyama-Kashima graben. A 6-km-long fault, where dextral-slip component dominates, divides toward the south-south-west from near the end of south-side branch sub-zone.

Minor normal-fault ruptures where slip is smaller than about 10-20 cm distribute along the extensions and the hanging wall (northwest) side of the major rupture zone. On the west of the northern branch sub-zone of the southwest section, a horsetail splay occurred in an 8-km-long and 6-km-wide area. The south-south-west branch fault of the southern branch sub-zone is truncated by a conjugate rupture. In a range of 8 to 15 km northeast side of the end of major rupture zone, on the northeast side of the central volcano, northeast trending small rupture zone appeared. On the hanging wall side of the central and northeast sections of the major rupture zone, a large number of small ruptures appeared on a 10-km-wide zone showing the conjugate arrangement to the major zone. These ruptures are generally striking west-north-west and some show sinistral slip component.

Information from modern survey technology enables us to investigate the details of surface ruptures which play an essential role to understand the earthquake rupture propagation and termination.