Finite element analysis of surface rupture: parametric study with several types of fault shape and tectonic stress directions

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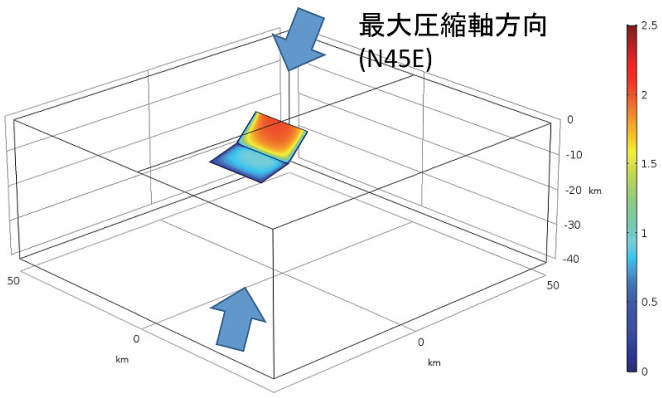
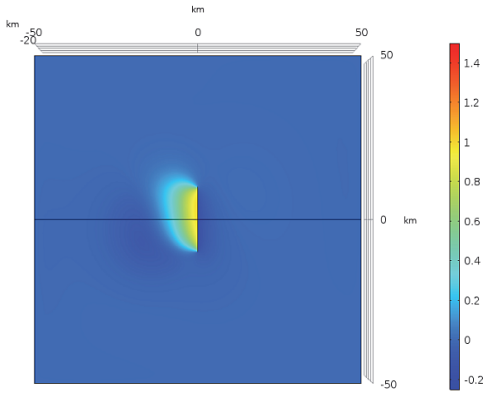
Fault shape and tectonic stress direction play an important role in the prediction of the surface rupture during an earthquake. Since it is often difficult to obtain these information clearly, the parametric study using numerical simulation is still needed to discuss the possibilities of surface rupture as much as possible.
We here implemented a 3-D deformation simulator into the finite element package (COMSOL Multiphysics) and then performed a series of parametric study of surface rupture by changing both the fault shape and the maximum stress direction.
The outcomes from the parametric study are summarized as follows:
(1) The slip is inhibited by the kink-line on the fault plane.
(2) The slip on the flat fault plane in the flat-ramp structure is not sensitive to the ground deformation.
(3) We confirmed that the oblique stress compression for the fault plane derives the anti-symmetric deformation pattern on the ground surface.

Keywords: Finite element method, Fault geometry, Surface rupture, Compressional stress direction



屈曲部を持つ断層面形状と断層面上相対変位
(断層線長20 km, 断層幅合計 20km)

Snapshot of the finite element analysis with N45E compressional stress and kinked fault plane



上下変位量分布 (m)

Distribution of U-D displacement on ground surface corresponding to the state in the snapshot

