Afterslip distribution and viscoelastic relaxation following the 2007 Bengkulu earthquake series from GPS

Ashar Muda LUBIS[1*], Akinori Hashima[1], Toshinori Sato[1]

[1]Earth Sciences, Chiba University

We have estimated afterslip distribution of the 2007 Bengkulu earthquake series, occured in Sumatra Subduction zone, using ABIC inversion method from 15 month GPS post seismic deformation. In this inversion we separated post seismic GPS data into 5 groups which is each group consist of 3 months interval data. To obtain the correct afterslip distribution, we try to remove the deformation due to viscoelastic responses. In each interval, we considered not only viscoelastic responses to coseismic slip but also viscoelastic responses to afterslip in the preceding intervals. We computed postseismic deformation using structure model of Maxwellian viscoelastic asthenosphere with viscosity 5×10^{18} Pa.s underlying elastic lithosphere.

We obtained significant horizontal viscoelastic deformation at BSAT and PRKB sites close to the calculated coseismic rupture area with the trenchward motion direction. The majority of viscoelatsic uplift pattern is obtained in area of Sumatra Island, which is opposite direction with observed vertical postseismic GPS data. We obtained that the afterslip has maximum slip of 0.42 m during 15 months investigation and the moment release due to cumulative afterslip distribution is 0.86×10^{21} Nm (Mw 7.8), which is about 22 % smaller than the moment release due to afterlip considering elastic media only. The main area of afterslip distribution is located at about 100 km northeast of the epicenter of the first earthquake, where this area was not slipping during the main shock. The majority of afterslip area is extended to downdip of the coseismic rupture area, and it seems to be correlated with the aftershocks distribution. In this paper, we show that viscoelastic behavior in asthenosphere is very important and essential to be considered in order to obtain the true afterslip distribution.

Keywords: Sumatra, Subduction zone, GPS, ABIC inversion, Afterslip, Viscoelasticity