The detailed spatial distribution of stress field in and around the Izu-collision zone

Yohei Yukutake[1]; Toshikazu Tanada[2]; Tetsuya Takeda[3]

[1] HSRI, Kanagawa Pref.; [2] HSRI,Kanagawa Pref.; [3] NIED

Around the western Kanto region, the Izu-Bonin arc has collided into the Honshu crust. The Philippine Sea (PHS) plate intricately subducts into the Honshu crust around Sagami and Suruga trough. Large historical earthquakes have often occurred. To estimate the detailed spatial distribution of stress field in and around the Izu-collision zone is importance for understanding the tectonics and stress accumulation process of large earthquake in this region. We estimated the spatial distribution of stress field by applying the stress inversion to the focal mechanisms.

We determined the focal mechanisms using absolute P and SH amplitudes and P-wave polarity. According to the method in Ide et al. (2003), we determined the spectral levels by fitting the Omega2-model (Boatwright, 1987). We used the hypocenter location determined by using the differential arrival times from the cross-correlation analysis and catalog data (Yukutake et al., 2008). We determined the focal mechanisms for the events which have the P-wave polarity data greater than or equal to 10 and are magnitude more than or equal to 1.5. We could precisely determine the focal mechanisms of 760 events.

We estimated the spatial distribution of stress field, using the multiple inversion method (Yamaji, 2000; Otsubo and Yamaji, 2006). We identified the different stress solutions from the inversion results, using the k-means clustering algorithm (Otsubo et al., 2006). We divided the whole study area into 5 regions. We could find 10 different stress solutions in and around the Izu-collision zone. We verified the stress solution acting on each focal mechanism, by comparing the maximum shear stress direction calculated from each stress solution and the observed slip direction on the nodal plane of focal mechanisms. We estimated the spatial changes of stress field from the focal mechanisms of which observed slip directions are consistent with only one stress solution.

In the northern margin of Izu-collision zone, it is found that the plunge of S1 axis rotates close to the vertical direction. In the western part of Izu-collision zone, the reverse stress state having the S1 axis oriented to N150E direction predominately operates at shallow depth area, while the strike-slip stress states having the S1 axis oriented to NS direction operates at deep depth area. The complicated geometry of PHS plate around the Izu-collision zone might contribute to these spatial changes of stress field.