Simulation of hypocenter determination by using S-net stations

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To observe earthquakes occurring under seafloor and tsunami, project to construct Seafloor Observation Network for Earthquakes and Tsunamis along the Japan Trench (S-net) is started in 2011. The S-net consists of 150 seismic and tsunami observation stations. These stations are arrayed from off Hokkaido to off Boso at intervals of about 30km in the direction North-South (parallel to the trench axis) and at interval of about 50-60km in the direction East-West (perpendicular to the trench axis). S-net makes it possible to forecast earthquake warning and tsunami warning much earlier than presence. To understand occurrence of earthquake occurring under seafloor, we must research hypocenters distribution, focal mechanism, velocity structure, and stress field under seafloor accurately. Then we need to research relationship between subducting plate and occurrence of earthquake and process of strain accumulation at interplate. To research these in detail, we need to locate hypocenters under seafloor precisely.

To understand accuracy of hypocenters determined by S-net, we simulated of hypocenter determination by using travel times from earthquake occurring under seafloor to stations of S-net. 99 aftershocks at the southern region of 2011 off Pacific Cast of Tohoku Earthquake located by pop-up ocean bottom seismometers (OBSs) (Shinohara et al., 2011) were used. We calculated travel times from these hypocenters to S-net stations and estimated arrival times of every station. Hypocenters were determined by using the arrival times. Then velocity structure used calculation of travel times and determination of hypocenters was modeled by introducing result of seismic survey for installation of S-net. We compared hypocenters located by simulation of this study with those located by OBS data (Shinohara et al., 2011). As the result, difference in the hypocenters was about 1km. We run same simulation by using Hi-net land stations. Then velocity structure used calculation of travel times and relocation of hypocenters was velocity model used determination of hypocenter in Kanto and Tokai area (Ukawa et al., 1984). As the result, several hypocenters by simulation of this study were determined 5km deeper than those by OBS. This indicates that determination of hypocenter using only land seismic stations is not sufficiently precise.