

Development of GNSS-A in this decade and observation results along the Japan Trench

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Our research group has been studying advanced GNSS-A (Global Navigation Satellite System –Acoustic ranging combination) technique over two decades. The detection sensitivity of GNSS-A observations has been sophisticated especially in this decade by improving the accuracy and frequency of analysis technology and acoustic systems (e.g., Sato et al., 2013, JG; Yokota et al., 2018, MGR; Ishikawa et al., in prep). The current observation frequency is more than 4 times/year, the observation accuracy for each observation is less than 2 cm, and it can detect a steady deformation rate of 1 cm/year or less and an unsteady fluctuation of 5 cm or less. Also, efforts are being made to strengthen the observation network. In this presentation, improvement of the observation capabilities and technological progress are introduced.

GNSS-A observations of the 2011 Tohoku-oki earthquake and its postseismic field revealed the details of the crustal deformation field on the Japan Trench side (Sato et al., 2011, Science; Watanabe et al., 2014, GRL). The long-term observation data in the Nankai Trough region revealed the strain accumulation process and shallow slow slip events during the interseismic period (Yokota et al., 2016, Nature; Watanabe et al., 2018, JGR; Nishimura et al., 2018, Geosphere; Yokota & Ishikawa, 2020, Science Advances). Observation data, especially in the Japan Trench, are the basis of many simulation, theoretical, and drilling observation studies. In these studies, the observation period is still insufficient for the postseismic deformation field after the M9 earthquake. It will be necessary to continue the observation in this area from a longer-term perspective.

What was inadequate in the case of the Tohoku-oki earthquake was the lack of observation network before the event. There was not enough data before and after the earthquake that we want to compare with the data after the earthquake. In the future, it will be necessary to build a thorough observation network in the trenches around Japan and establish technologies and systems that enable permanent operation.

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