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Construction of a dense GNSS array in the San-in shear zone

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Introduction

An analysis of the GEONET (GNSS Earth Observation NETwork system) data operated by the Geospatial Information Authority of Japan (Nishimura, 2014) revealed that there is a distinct zone in which ongoing deformation is localized from an eastern part of Shimane Prefecture to Tottori Prefecture in the San-in area (hereafter the San-in shear zone). We constructed 13 new GNSS stations in order to clarify a detailed spatial pattern of deformation and a mechanism of strain localization in the San-in shear zone. Here, we report an overview of crustal deformation in the San-in shear zone and the new GNSS stations.

Characteristics and seismicity in the San-in shear zone

We recognize the following characteristics in a velocity distribution of the GEONET station in the San-in region and its vicinity. First, a northern limit of the observed northwestward velocity due to subduction of the Philippine Sea plate locates in and around the southern coastal area of the Chugoku district facing the Seto Inland Sea. Second, an inland region in the Chugoku district does not significantly move relative to a northern part of Hyogo Prefecture though the northern coast of Tottori Prefecture and an eastern part of Shimane Prefecture moves eastward with a velocity of 4 mm/yr. We call this deformed zone ”the San-in shear zone”. The San-in shear zone is more than 200 km long along the coast of the Japan Sea and accommodates right-lateral shear motion. Its width is variable, that is, less than 20 km in a eastern part of Tottori Prefecture and 50˜70 km in a western part of Tottori Prefecture and a eastern part of Shimane Prefecture.

There is a distinct band of high microseismicity along the coast of the Japan Sea in the San-in region, as suggested by previous studies. The San-in shear zone corresponds to the seismic band. It is interesting that several north-northwest (NNW) and south-southeast (SSE) alignments oblique to a general east-west alignment of seismicity and the shear zone. The NNW-SSE alignments may be explained by left-lateral Riedel shear R2 in a right-lateral shear zone.

Construction of new GNSS stations and a collection and analysis system for GNSS data

The 25-km average spacing of the GEONET stations is not enough to clarify a detailed pattern of deformation in and around the San-in shear zone. We, therefore, constructed 13 new stations along three lines across the San-in shear zone. We started to observe at 3 sites in Kurayoshi City and the other sites in August and December, 2014, respectively. GNSS data with 1-sec sampling in compact RINEX format are transferred every day. Daily coordinates are estimated with the PPP-AR (Precise Point Positioning with Ambiguity Resolution) strategy using GIPSY 6.2 software. The coordinates and vector maps can be browsed at http://www1.rcep.dpri.kyoto-u.ac.jp/˜nishimura/monitoring.html. Repeatability of daily coordinates for the new stations is comparable to that for the surrounding GEONET ones, which demonstrates data quality of the new stations. We expect that the detailed deformation will be clarified in a few years.

Acknowledgements

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Keywords: strain concentration zone, GNSS, Crustal deformation, San-in district, inland earthquake