The gravity anomaly of western offshore of Noto peninsula and the estimation of basement structure

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Estimation of basement structure is important for understanding seismo-tectonics in coastal areas. The gravity anomaly reflects the density structure of the basement, and its analysis provides information on subsurface fault structures. However, it is not easy to conduct gravity measurements in coastal sea areas, and there are often gaps in gravity data. In order to obtain more detailed information on the continuity of the fault structure from land to sea, it is essential to improve gravity measurement points in coastal seas. Hokuriku Electric Power Company performed seafloor gravity measurements on the western coast of the Noto Peninsula from May to June 2018 (Ishida et al., 2018). Seafloor gravity measurements were taken at approximately 40 km along the coast and about 10 km offshore. The measurement interval is about 700 m in the dense area and about 2 km in other areas, and the number of measurement points is 275. Terrain correction (assumed density: 2300 kg/m^3) was performed on these new measurement data using the digital data M7000 series of seafloor topography. In addition, 283 gravity measurements have been conducted on land since 2013. The seafloor gravity data and the marine gravity anomaly data (AIST, 2013), the existing gravity data (Honda et al., 2012; The Gravity Research Group in Southwest Japan, 2001; Yamamoto et al., 2011), and merged new land-based measurement data to create a gravity anomaly distribution map with continuity from land to sea.
The acoustic survey has been conducted along survey lines in the coastal area west of the Noto Peninsula, and the boundary depth distribution of the marine sedimentary layers has been obtained as a profile of the velocity structure along the survey lines. By combining the depth distributions of these sedimentary layer boundaries, we created a three-dimensional density structure model consisting of four layers. Correcting the gravity anomaly caused by the three-dimensional density structure, we obtained a pseudo gravity anomaly due to the two-layer structure consisting of the sedimentary layer and the basement. From the pseudo gravity anomaly, we performed a gravity inversion analysis for a two-layer structure model of the basement and the sedimentary layer.
The inversion analysis revealed the following characteristics of the basement depth distribution off the west coast of the Noto Peninsula. There is a thick sedimentary layer on the west side of the eastern flexure off Hakui and on the west side of the flexure northwest to the eastern flexure. The southern end of the fault along the eastern flexure off Hakui corresponds to a shallow basement extending west from Mt. Hodatsu. The northern end corresponds to the deep basement south of the Amamisaki fault zone. For the western side of the eastern flexure off Hakui, the basement depth is large on the uplift-side. This suggests that the eastern flexure off Hakui is formed by inversion tectonics associated with the change from an extension to a compression field related to the Japan Sea opening.

Keywords: gravity anomaly, basement structure, acoustic survey

