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Crustal structure of the southernmost Ryukyu forearc region from large offset seismic data and gravity modelling

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The southernmost section of the Ryukyu subduction zone, where the Philippine Sea Plate (PSP) subducts beneath the Eurasia Plate (EP), is both tectonically complex and seismically active. Extremely low gravity anomalies have been reported in this section of the Ryukyu forearc region. Several crustal velocity models have been proposed in previous studies and have revealed that the thickness of the forearc crust is about 20 km with crustal velocities between 5.5 km s-1 and 7 km s-1. In the Hoping Basin, the most western end of the Ryukyu forearc region, thick sedimentary layers with seismic velocities between 3 km s-1 and 5.5 km s-1 have been mentioned. In this study, we present a re-processed multichannel seismic reflection profile and its crustal density model along a large-offset (using a 6-km long streamer) seismic profile MGL0906-22N which runs in NNW-SSE direction across the complex area in the forearc region of the southernmost Ryukyu subduction zone. Two sedimentary sequences are observed in the Hoping Basin, the deeper one, called the Suao strata, is tilted western ward. The upper one, called the Hoping strata, is younger than Suao strata and is mostly flat. The interval velocities of the sedimentary layer derived from velocity analyses of the reflection data increase from 1500 m s-1 at the seafloor to 5000 m s-1 near the bottom of the sedimentary layer. The two-dimensional crustal density model along this profile converted from published crustal velocity model reveals that the density values of the sedimentary layer in the Hoping Basin are mostly smaller than 2.54 g cm-3, and the total thickness of the sedimentary layer is about 6 km, which is similar to that observed in the MCS profile. By analyzing the density model, we suggest that seafloor topography and thick sedimentary layer contribute mostly significantly to the very low gravity anomaly over the Hoping Basin. By combining the seismic velocity analyses and gravity modelling, we will be able to construct a reliable crustal structure model which helps to decipher the complex tectonic activities of the region.