# Numerical simulation of the observed strain field in the south Ryukyu region

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Using a finite-element model, present-day deformation between Taiwan and south Ryukyu area has been reproduced. Distribution of velocity fields and strain rate has been compared with the actual velocity field and strain rate, which was revealed by the GPS measurements in the Ryukyu arc. The stress fields have also been compared with the data estimated from the focal mechanism solutions.

The 3D-shell elements are employed for the modeling of the Philippine Sea plate (PHS) and Eurasian Plate (EU). Both plates are coupled weakly at the Ryukyu Trench. Thickness of the PHS is 60 km. Thickness of the EU varies from 20 km (in the Taiwan and Ryukyu arc) to 40 km (in the northwest of the area). Thickness of the EU in the Okinawa Trough is set to 2 km. Young's modulus and Poisson's ratio is 60GPa and 0.25, respectively. The PHS is imposed at southeastern edge at the displacement of 8 m, and pulled down at northwestern edge of the subducted PHS at the displacement of 8 m. These correspond to the displacement of the PHS for 100 years.

The results explain the observed deformation of the Ryukyu arc. The model produces the southward motion of the Ryukyu arc (2cm/yr) and the extension of the Okinawa Trough. The calculated velocity is about half of the observed one (4-6cm/yr) in the south Ryukyu arc (Nakamura, 2004). The model also produces the arc-parallel extension stress in the Ryukyu arc (10 nano-strain/yr), which is similar to the observed value (10-30 nano-strain/yr) (Nakamura, 2004). The model describes the stress fields in the subducted PHS slab; the arc-parallel compression stress and slab-dipping extensional stress. This is consistent with the observed stress field from focal mechanism solution.

The model suggests that the regional deformations would have originated in the deformation of PHS. The PHS is bending beneath the southwest Ryukyu arc and subsides by about 2 m (2cm/yr). The PHS is bent by the compression stress from collision of Taiwan. As a result, the Ryukyu Trench and the subducted PHS slab would be retreated southward. Retreat of the PHS slab and Ryukyu Trench would induce the southward motion of Ryukyu arc and extension of the Okinawa Trough. The southward motion of the Ryukyu arc is the largest near the Taiwan because of maximum subsidence of PHS near the Taiwan. Difference of the motion would cause the arc-parallel extension in the Ryukyu arc.

Thus, collision in Taiwan affects to the development of the Okinawa Trough. The collision in Taiwan has been accelerated since two million years ago. The uplift rate of Taiwan has been accelerated after two million years ago (Lan et al., 1990). Extension of the Okinawa Trough started two million years ago, and the extension velocity increased about 100,000 years ago (Sibuet et al, 1998). This suggests that deformation of slab by the collision would be a driving force to the backarc extension.