Convergence velocity between Amurian plate and north American plate estimated by GNSS at northern part of Hokkaido, Japan

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In south part of Sakhalin island and northern Hokkaido Island of northern most Japan, which are in E-W compression field, seismic activity on the Japan sea side is higher than that on the sea of Okhotsk. That is because of the convergence between Amurian and North American plates. However, the boundary of two and detailed condition of that’ s motion aren’ t clear. So, as the first step to consider those motion, we estimated the strike, location, convergence velocity of a plate boundary, and the thickness of the lithospheric plate, simultaneously. Deformation field was modeled using the Shimazaki and Zhao (2000)’ s scheme, such as summation of rigid block motion and elastic deformation due to vertically tensile open fault along the collision boundary. Grid search procedure was applied to determine the best fit 4 parameters. Then used observables is the velocity of each station calculated by using GNSS measurement. In northern Hokkaido, we used the data 2008-2011 obtained by the GNSS stations established by Institute of Seismology and Volcanology, Hokkaido University and Geospatial Information Authority of Japan. Station velocities were estimated from GNSS coordinate time series taking into account seasonal variation. The total of 25 stations were applied with Bernese GNSS software in ITRF2008. Velocity data in Sakhalin Island were from Vasilenko and Prytkov (2012). Observed velocity field were well modelled. The best fit parameters were determined; in northern Hokkaido, the convergence velocity is 10.1~12mm/yr, the strike of the collision zone is 6~13degree from north to east, and the thickness of the lithospheric plate is 13~18km and in southern Sakhalin, the convergence velocity is 5.7~6.5mm/yr, the strike of the collision zone is -3~8degree from north to east, and the thickness of the lithospheric plate is 14~19.5km . Variation of estimated parameters were due to different reference stations of most eastern and most western GNSS stations. Pseudo infinity station in limited station distribution might arise above variance in result. The location of the collision boundary estimated in this study consists with active faults, boundaries of seismicity, geological structure, and Bouguer gravity anomaly. The convergence velocity is similar value in the south Sakhalin (Vasilenko and Prytkov, 2012) and block-modeling results (Loveless and Meade, 2010). These facts support estimation validity. It was suggested that elastic deformation due to collision could explain observed data. Strong contrast in seismicity between high western and low eastern sides might indicate physical property difference for earthquake generation due to geological structure. Our result indicates ongoing strain accumulation and increasing earthquake occurrence potential in this region.

Keywords: GNSS measurement, collision zone, crustal deformation

