THE EFFECT OF POSTSEISMIC RELAXATION INDUCED BY LARGE EARTHQUAKES AROUND NORTHEASTERN ASIA

Ohzono, M.[1], Takahashi, H.[1], Shestakov, N.V.[2,3], Meng, G.[4], Gerasimenko, M.D.[2,3]

1. Institute of Seismology and Volcanology, Hokkaido University, Japan
2. Far East Federal University, Russia
3. Institute of Applied Mathematics, Far Eastern Branch, Russian Academy of Science, Russia
4. Institute of Earthquake Forecasting, China Earthquake Admission, China

We estimate the effect of long-term postseismic deformation induced by large earthquakes around northeastern Asia. After large earthquakes, postseismic deformation occurs around the focal region. Although there are several causes of them, the viscoelastic relaxation especially affects for long period in the wide area. In fact, IGS stations in the northeast Asia have recorded postseismic deformation after the 2011 Tohoku earthquake (M9.0), and it is thought that this deformation will continue for a while. In the same manner, many historical large earthquakes have been occurred along Japan Islands such as the 2011 Tohoku earthquake. Therefore, those signals should be evaluated whether the disturbances affect for stable tectonic movement and long-term earthquake cycle around northeast Asia, or not.

For the calculation of the viscoelastic relaxation, subsurface rheological structure modeling is necessary because it controls the pattern of the postseismic displacement field and its duration. In this study, we assumed a simple two-layered spherical earth model, which consists of upper elastic and lower Maxwell viscoelastic layers. Based on the information of the seismic velocity structure and postseismic deformation signal of the 2011 Tohoku earthquake observed at the IGS sites in northeast Asia, we estimate appropriate rheological structure (65 km of elastic thickness and 1.5×10^{19} Pa s of viscosity of the viscoelastic layer).

Along the Japanese Island, 15 of historical large earthquakes ($M \geq 8.0$) have been recorded since 869 A.D. In order to check the effect of their postseismic deformation signals, we calculate surface displacement field for ~1300 years with the estimated rheological structure. As a result, most of earthquakes may contaminate the stable displacement field around the coastal side of the Asian continent with the movement velocity of several mm/year after each event. The displacement signal from each postseismic deformation depends on the magnitude of earthquake, focal distance, fault mechanism, duration, and so on. Thus, their time series of total displacement shows complex pattern at each area.

From this study, we conclude that we should not ignore the effect of the postseismic deformation in extensive region of northeast Asia. It means that the effect of large earthquake cycle occurring around Japan Islands, such as interplate coupling, tectonic loading and coseismic effect should be considered as same as these postseismic deformation.

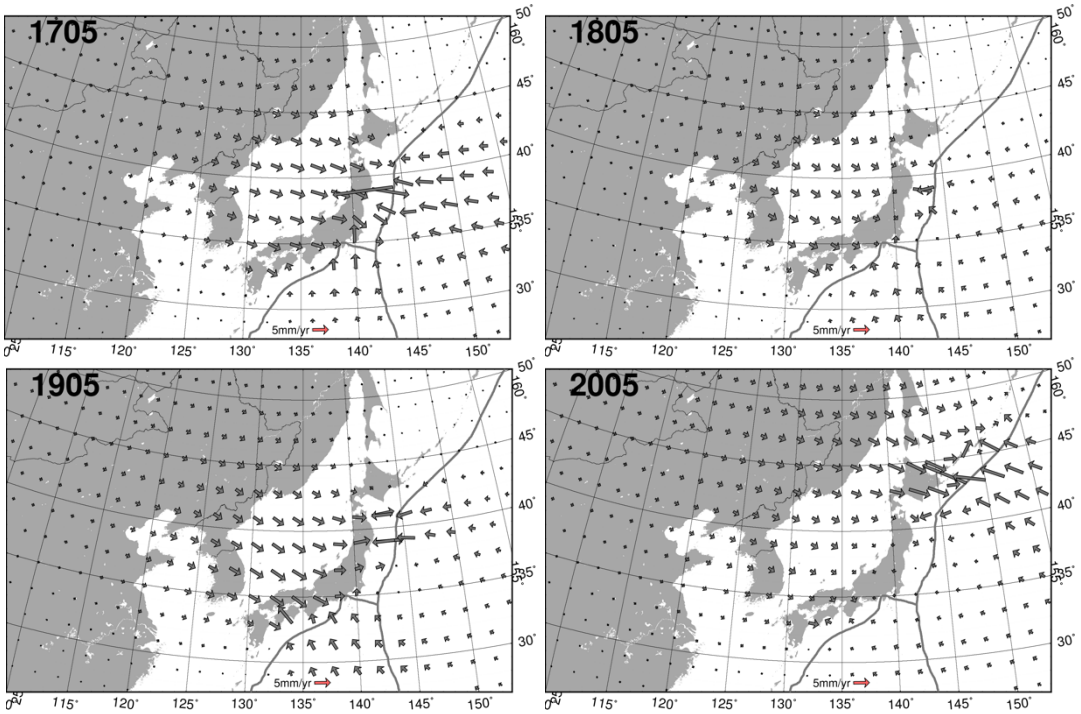

Figure: Snapshot of the simulated postseismic velocity field. Upper left number shows year, respectively.