

Numerical Simulation on Subduction of the Pacific Plate into Northeast China and the Seismogenic Mechanism of Earthquake

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The Pacific Plate is subducted into Northeast China up to 660km deep, leading to a series of deep earthquakes in Hunchun zones of Jilin province, which was noticed by seismologists in the past. As the only deep-earthquake belt in China, its occurrence-time, locations and magnitudes are closely associated with Japan trench earthquakes and shallow earthquakes in Northeast China. Until now, seismologists attached great importance to this phenomenon and researched it in various aspects. On the one hand, research results confirmed the above phenomenon. On the other hand, masses of important results were obtained including the structure of the Pacific subducting plate, lithosphere structure in Northeast China, the earthquake focal mechanism and the seismic dynamic mechanism about the deep and shallow earthquakes. But until now, there is seldom systematic research about the relationship among the Pacific plate, deep and shallow earthquakes using numerical simulation method. Therefore, this paper will study their relationships and furtherly explore the tectonic stress field and dynamics environment in Northeast China.

Based on the geology data and the seismic velocity structure in Northeast China, we built the 2D vertical model along the 45 degree latitude ranging from 104 to 144 degree longitude with 0-660km deep to simulate the Pacific plate subducting to Northeast China using finite element numerical simulation method. According to motion rate of the Pacific plate to the Eurasian plate, the boundary conditions are given. The model with the typical tectonic belts, such as Tanlu fault, can explain the earthquake mechanism and study the stress fields and displacement fields. Besides the relationship between fault belts and shallow earthquakes is discussed. Through numerical simulation and comprehensive analysis, some conclusions are obtained as follows:

(1) The Pacific plate subduction into Northeastern China is the main dynamic resource causing a series of deep-focal and shallow-focal earthquakes. The stress field shows that there are two main areas of stress concentration under the subduction of the Pacific plate. It can help us to explain the relationship about the seismogenic mechanism between deep and shallow earthquakes.

(2) The displacement field and deformation field are given. The results show the displacement field and deformation field are controlled by the Pacific plate subduction rates. Exist of low velocity medium in the middle crust layer is in favor of the occurrence of the shallow earthquakes.

Keywords: numerical simulation, subduction of the Pacific plate, deep and shallow earthquakes, Northeast China