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Relationship between great deep earthquakes and strong shallow earthquakes in Northeast Asia

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In Northeast Asia, the Pacific plate subsides beneath the Japan Islands with a convergence rate of about 90 mm/yr and the dip angle is almost constant 35°. Beneath Northeast China the slab has the shallowest dip and the depth of earthquakes changes from 450 km to 650 km. The great deep earthquakes with MR6.8 concentrate from 39°N to 44°N and from 129°E to 131°E. These great deep earthquakes distribute approximately north-south, very similar with the trend of the slab structure.

In the west of 129°E, the region covers North China, Northeast China, Yellow Sea and Korea Peninsular, there are many strong shallow earthquakes with MR5.8. In the region, there are also two famous faults of lithosphere, Tan-Lu fault and Yinshan-Yanshan fault. The Yinshan-Yanshan fault is approximately east-west, which is the geological boundary of North China and Northeast China. The direction of Tan-Lu fault is approximately northeast.

Wavelet is a useful tool for analyzing time-frequency of seismicity. In this paper, we analyzed the time distribution of great deep earthquake from 1900 to 2004 in Northeast Asia with wavelet analysis. Based on the wavelet coefficients, relative active and quiet periods are divided. We also analyze the temporalspatial distribution of strong shallow earthquakes and their relationship with great deep earthquakes. The difference of seismicity in east and west of Tan-Lu fault is analyzed.

The relationship between great deep earthquakes and strong shallow earthquake cannot be understood as an accidental phenomenon. The mechanism of the relationship is analyzed. The mechanism can be explained as the oceanic lithosphere is pushed downward under the continental lithosphere by external forces. The oceanic slab pushes the continental lithosphere does not act as rigid plate, probably due to the mantle convection.

The temporal and spatial distribution of earthquakes give us very important information about dynamic processes in the Earth's crust and upper mantle and the mature of tectonic processes.

Keywords: Seismicity, deep earthquake, shallow earthquake, wavelet analysis, Northeast Asia