Japan Geoscience Union Meeting 2015
(May 24th - 28th at Makuhari, Chiba, Japan)

SSS25-09 会場:A04 時間:5 月 25 日 11:15-11:30

S 波ピーク領域と距離別の速度を使って解析した２０１１東北沖地震の多重震源の解析
Multiple Seismic Origins of the 2011 Tohoku Earthquake Analyzed by S-Wave Peak and Regions

沼倉 政幸 [1*]
NUMAKURA, Masayuki[1*]

[1] 元　千葉県　佐倉東高校　教諭
[1]Last position Sakura Higashi High School

1, Introduction

Within the field of research on the 2011 Tohoku earthquakes, analyses of the vicinity of the ocean trench axis have made remarkable progress. In contrast, opinion is divided regarding regions closer to land. One example concerns the question of whether tremors that reached the Kanto region originated from the ocean trench axis. Many studies emphasize land-based seismic origins for these tremors, but the precise locations from which these tremors originated remains to be determined in detail. Considering that this earthquake was a ones-in-several-hundred-years event, it can hardly be said that our understanding of the earthquake as a whole has progressed to a fully satisfactory state.

The S-wave and P-wave data available for this earthquake are mixed together and hence difficult to use. Multiple large-amplitude contributions following S-wave initial shocks, S-wave peaks, were present. These data may be used for analyses, despite their mixed nature, if they can be well separated. Due to the paucity of previous research on this subject, we have tested our methods on other large earthquakes in Japan. Method is indicated to 3-1-2 Results of validation.

2, Method

2-1 We determined epicenters by following the Omori method of drawing three circles on map.

2-2 We use Omori's formula. (However, we use distant-dependent velocities.)

r=k×t k1=(Vp×Vs)/(Vp-Vs)

2-3 We used S-wave peak travel times and velocities. The method is indicated to 3-1-2.

3, Results

3.1 Validation.

3-1-2 2004 Niigata Chuetsu earthquake

Epicenter 37.29N 138.87E Depth 12km Start ; 17:56:00

Ojiya Distance13.9km Traveltime S-wave peak 8.73s

Velocity peak3.19km/s Acceleration0.365 Constant1.16Time arrival 56:08

Tokamachi Distance24.1km Travel time S-wave peak 12.60s

Velocity peak 3.83km/s Acceleration 0.304 Constant1.16 Time arrival 56:12

Kashiwazaki Distance31.0km Travel time S-wave peak 14.90s

Velocity peak4.16km/s Acceleration 0.280 Constant1.16 Time arrival 56:14

Travel time is peak time at many stations. (2)r=1/2×a×tˆ2 (3)r=1/2 √ (ktˆ3)

(4) r=1/2×v×t (5)k=v×a k=4rˆ2/tˆ3 (6)v=2r/t v=dr/dt (7) a=2r/tˆ2 a=dv/dt

It is sufficiently possible to calculate in this equation (2), but coefficient ″ a ″ is not constant. Therefore, I prepare the equation (3). The equations (2) and (3) are function that the distance and time of the hypocenter and observation point. In those equations, the function (5), which is in inverse proportion to ″ v ″ and ″ a ″ , is contained.

3-2 Seismic origins of 2011 Tohoku Earthquake

P-1-2 (Epicenter announced by United States Geological Survey)

Epicenter 37.291N 138.867N Depth 30km Start: 46minites, 24 seconds

Oshika Distance 81.5km Travel time S-wave peak 43.3s

Velocity peak 3.76km/s Acceleration 0.0868 Constant 0.327

Time arrival 47:07

Utatsu Distance 94.1km Travel time S-wave peak 47.6s

Velocity peak 3.95km/s Acceleration 0.0829 Constant 0.327

Time arrival 47:11

Tsukidate Distance 130.9km Travel time S-wave peak 59.3s

Velocity peak 4.41km/s Acceleration 0.0744 Constant 0.327
Time arrival 47:23

P-3, Epicenter 38.045N141.47E Depth30km Start: 47minites, 37 seconds
Oshika Distance 41.8km Travel time peak 20.0s
Velocity peak 4.18km/s Acceleration 0.209 Constant 0.873
Time arrival 47:57
Kamaishi Distance 143.6km Travel time peak 45.4s
Velocity peak 6.33km/s Acceleration 0.139 Constant 0.873
Time arrival 48:22
Hitachi Distance 180.2km Travel time peak 53.0s
Velocity peak 6.80km/s Acceleration 0.128 Constant 0.873
Time arrival 48:30
P5 (May be divided into 5 epicenters in all)
In the first phase, P1-2 and P1-3 gave a strong motion to Miyagi and Iwate. In the third phase, Max acceleration of Tsukidate and Oshika was observed by P3. It is both epicenter third phase and trench axis that gave a strong motion to Kanto.

キーワード: S 波ピーク, ２０１１東北沖地震
Keywords: S-Wave Peak, 2011 Tohoku Warthquake