Japan Geoscience Union Meeting 2014
(28 April - 02 May 2014 at Pacifico YOKOHAMA, Kanagawa, Japan)

SSS26-01 Room:315 Time:April 30 15:45-16:00

Relationship between half-graben and high-velocities area at depths of 10 km 7

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There are four oval shaped high velocities areas in Kanto Area .Two of them are in the southern part of Ibaraki prefecture. (after Matsubara Makoto 2005)

These two high velocities areas in Ibaraki prefecture gets larger, the deeper you see. At the depths of about 30km, this huge high velocities mass ,whose shape is donut, almost covers the southern part of Ibaraki prefecture and reaches at the depths of about 50km.

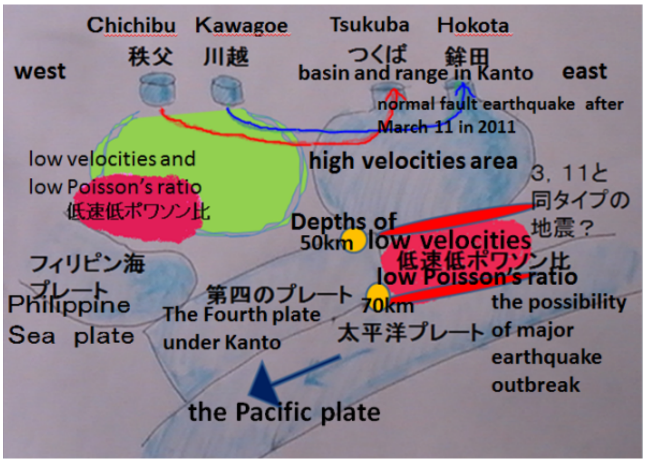
The western half of this huge high velocities area is on The Fourth Plate under Kanto; a part of Philippine Sea Plate(Toda Shinji 2005) at the depths of about 50km.

The eastern half of huge high velocities mass rides on the low velocities and low Poisson's ratio area, that is under beneath Lake Kasumigaura and the Southern of Lake Kasumigaura.(after Matsubara Makoto 2008)

This low velocities and low Poisson's ratio area faces subducting Pacific Plate at the depths of about 70 km.

Speaking of the low velocities and low Poisson's ratio area , the similar area exists in the asperity of M9 in 2011 off the Pacific Coast of Tohoku Earthquake; the upper part of the Pacific plate and also exists in Unzen in Nagasaki prefecture from the ground to the depths of about 30km.
I pointed out the possibility that the flexibility of the existence of the felsic rock or magma developed adherence of asperity of M9. (Ohishi Yukio 2013)

From the above it seems to be necessary to examine the possibility of the major earthquake outbreak underneath Lake Kasumigaura and the Southern Lake Kasumigaura at the depths of about from 50km to 70km.
There is another view that this low velocities area is not low Poisson's area but high Poisson's area (Nakajima Junichi 2008).
I want to wait for solution.



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SSS26-02 Room:315 Time:April 30 16:15-16:30

Three-dimensional S-wave velocity structure beneath the Naruko volcanic area by ambient noise seismic interferometry

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The 2008 Iwate-Miyagi Nairiku earthquake (M7.2) occurred along a fault ranging from the south of Iwate to the north of Miyagi. The focal region of the earthquake is located in the proximity of four volcanoes: Yakeishi-dake, Mt. Kurikoma, Onikobe, and Naruko. To study the positional relationship between the fault and magmatic bodies beneath these volcanoes, several studies have been conducted. Okada et al., (2010) estimated the S-wave velocity structure up to a depth of 40 km from body-wave tomography, and revealed that aftershock regions are distributed escaping the low velocity zones beneath the volcanoes. This study attempts to elucidate the correlation between the shallow structure of the volcanic bodies and aftershock regions in detail, focusing on the Naruko volcano locating in the south of the focal region, by seismic interferometry using cross-correlation analysis from ambient noise. Seismic interferometry is a method based on the fact that a cross-correlation function calculated from particle-motion records at a pair of stations in a wave field is equivalent to a Green's function between the two stations.

In cross-correlation analysis, we used the vertical-component data recorded by an observation network, which is densely installed in the Naruko volcanic region. By spectrum and beamforming analysis, we identified the characteristic of noise dominating in 0.1-10 Hz. The main sources of the noise are due to ocean waves coming from the Pacific Ocean and the Sea of Japan. Targeting the low-frequency range in which surface waves are more dominant than body waves, cross-correlation functions are calculated for each observation day for each pair of stations, and then stacked for 18 months to obtain a Green's function with a high SN ratio. We extract group velocity dispersion curves of Rayleigh waves using the multiple filter technique proposed in Dziewonski et al., (1969). Rayleigh-wave velocity maps from the period of 3 to 10 seconds are then calculated by processing surface-wave tomography based on the method of Barmin et al. (2001). Finally, we estimate the 3-D S-wave velocity structure up to 10 km depth by S-wave velocity inversion.

The structure shows two significant low velocity anomalies in the northwest of Naruko and in the south of Onikobe Caldera between 3 and 4 km depth. These anomalies are presumably magmatic bodies or geothermal water. Compared with the distribution of aftershocks and the fault, we can see that aftershocks do not occur in the low velocity anomaly beneath the Naruko volcano, and aftershock activity stops immediately at the northeast part of the anomaly.

Keywords: seismic interferometry, cross-correlation analysis, ambient noise, tomography

SSS26-03 Room:315 Time:April 30 16:30-16:45

Three-dimensional velocity structures in the region between Hakone volcano and Tanzawa Mountains, central Japan

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Hakone volcano is located in the northern boundary zone of the Izu-Mariana volcanic arc in central Japan, where the Izu Peninsula on the Philippine-sea plate has been colliding into the Japan island arc. There has been fumarolic activity around the Owakudani area, and many intense swarm activities have occurred in the caldera of Hakone Volcano. Previous studies (e.g. Oki and Hirano, 1970; Yukutake et al., 2011) interpreted that the hydro thermal fluid derived from a deep-seated magma beneath Hakone volcano contributes to the occurrence of swarm earthquake. However, there is no evidence to show existence of the hydro thermal fluid and a deep-seated magma. To understand the mechanism of swarm earthquake occurrence and tectonic process around Izu-collision zone, we tried to estimate three-dimensional velocity structure in and around Hakone volcano, by using tomographic inversion of seismic wave velocity.

We used the data of 52 temporary stations installed in and around the caldera of Hakone volcano. We also used the data obtained by the permanent seismic station installed by Hot Springs Research Institute of Kanagawa prefecture, Earthquake Research Institute, National Research Institute for Earth Science and Disaster Prevention, and Japan Meteorological Agency. The double-difference tomography method (Zhang and Thurber, 2003) was applied to the present analysis.

Under Hakone volcano, low Vp and low Vs anomaly regions were estimated in the depth range from 6 km to 15 km. Within the low velocity zone, Vp/Vs is high (1.9) in the 10-15km depth, while that at the 6 km depth is relatively low (1.6). This result suggests that the deep-seated magma body is located in the high Vp/Vs region, and the low Vp/Vs region reflects the hydro thermal fluid or volatiles from the magma body. High Vp and high Vs regions were estimated under Tanzawa Mountains. The high velocity zone corresponds to a plutonic body of tonalite or hornblende gabbro. A low-velocity wedge was estimated between Tanzawa Mountains and Hakone volcano that corresponds to trough-filled deposits.

Keywords: Three-dimensional velocity structures, Hakone volcano, Tanzawa Mountains

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SSS26-04 Room:315 Time:April 30 16:45-17:00

Continental Moho slanting upwards to the southeast beneath Kii Peninsula and middle layer earthquakes

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We carried out linear array seismic observations in Kii Peninsula from 2004 to 2013 in order to estimate the structure of the Philippine Sea slab and the surrounding area. We performed receiver function analyses for 14 cross-sections including four profile lines in the dipping direction of the slab and two lines in the perpendicular direction so far. We estimated three dimensional shapes of seismic velocity discontinuities such as the continental and oceanic Mohos and the upper surface of the oceanic crust. The results clearly showed that the slab top and the oceanic Moho are dipping northwestwards and that they correspond to the upper surfaces of the low and high velocity layers, respectively. Beneath northern to central Kinki the continental Moho spreads subhorizontally at 35 - 37 km deep, while beneath the Kii Peninsula it shallows southeastwards above the slab, reaching 20 km at the central part and 15 km at the southern shore.

Mizoue et al. (1983) analyzed data from permanent seismic stations which were being developed in the Kii Peninsula at that time, found that the travel time differences between the direct P waves and the Moho reflections or the Moho refractions propagating in the east - west direction became smaller from the northern part to the southern part of the peninsula, and suggested that the continental Moho slanted upwards to the south. They also found out earthquakes in the middle depth which were distinguished from both events in the upper crust and in the Philippine Sea slab, and called them as middle layer events. They pointed out that the middle layer events occurred around the slant continental Moho.

As mentioned above our receiver function analyses successfully estimated the three dimensional configuration of the continental Moho with a high accuracy. The results clearly showed that the middle layer events are located beneath the continental Moho shallowing southeastwards. Usually no earthquake occurs in the depth range equivalent to the lower crust. This is because crustal materials deform plastically at the depth and the strength of plastic flow becomes lower than that of brittle fracture. However, if the continental Moho shallows to the depth, the strength of plastic flow for mantle materials becomes larger than that of brittle fracture. This can be a cause of the middle layer events in the shallow mantle.

Keywords: continental Moho, middle layer earthquakes, Kii Peninsula, receiver function

SSS26-05 Room:315 Time:April 30 17:00-17:15

Seismic anisotropy within the subducting Philippine Sea slab beneath the central Japan

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Subduction of the Philippine Sea slab (PHS) is caused recurrent megathrust earthquakes every 100 to 150 years. Knowledge of slab geometry has been increased by using the recently established dense seismograph networks, but anisotropic feature, which is related to the tectonic stress field and/or rock properties, within the slab is still unclear. To reveal depth-dependent anisotropic feature within the PHS by using teleseismic receiver functions (RFs), we select 100 stations located in the Kii Peninsula and Shikoku, southwest Japan. We choose teleseismic events (M>6.0) from October 2000 to November 2013 for RF analysis, and use seismograms with good S/N. Low-pass filters with fc = 1.0 and 1.5 Hz are applied to estimate RFs. To estimate the orientation of anisotropy symmetry axis at each station, we apply the harmonic expansion method to the RFs (Bianch *et al*., 2010; JGR). When we apply this method to the data, we focus at the Moho depth for the CCD stacking and use the seismic velocity model by Matsubara & Obara (2011; EPS).

In the depth range around the slab Moho, the plunge azimuths in the eastern Kii, central and western Shikoku are corresponds well to the dip direction of the slab Moho estimated from the radial RFs only (Shiomi *et al*., 2008; GJI). At the southern edge of the Kii Peninsula, the plunge azimuths are rotated to clock-wise from the result of Shiomi *et al*. (2008). When N-S directed anisotropic rock exists just above the Moho, this feature can be explained. In the oceanic crust, the plunge azimuths and anisotropic axes correspond well to the dip direction of the slab, and 4-lobed terms are dominant as the Moho deepens to 40 km. This feature is consistent with the NE-SW extension field estimated from the focal mechanisms of earthquakes occurred in the slab. Within the oceanic mantle, plunge azimuths and anisotropic axes are directed to E-W direction. This direction corresponds to the spreading direction of the subducting PHS beneath this area.

Keywords: Philippine Sea slab, Receiver function, Harmonic analysis, Seismic anisotropy

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SSS26-06 Room:315 Time:April 30 17:15-17:30

The receiver function analysis at the area of the Nobi earthquake (II)

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1) Introduction

The mechanism of the inland earthquakes is related to the concentration of the strain and accumulation of the stress. It is very important to know the relationship between the stress/strain and fault plane. The 1891 Nobi earthquake is one of the biggest inland earthquakes in Japan. The joint geophysical observations had been done at the area. Based on the results of the previous survey at the Atotsugawa fault region, we found that the lower crust structure and fluid were very important factors to the cause of the inland earthquake. In the Nobi earthquake area, the seismic tomography studies figured out the existence of a low velocity region beneath the fault. The low velocity region continues to the subducting Philippine Sea slab. It can be interpreted that the low velocity region is made by water, which was dehydrated from the subducting slab. It is expected that there is some close relationship between the inland earthquake and liquid released from the subducting slab. We did receiver function analysis at the faults area of the Nobi earthquake.

2) Data

The seismic network deployed by the Japanese University Group of the Joint Seismic Observations and the seismic stations belong to the Hi-net were used.

The earthquakes with the epicentral distances from 30 to 90 degs were used. The earthquakes occurred from Aug., 2002 to Mar. 10, 2011.

3) Results

It has been suggested that the configuration of the subducting Philippine Sea plate is distorted in the southwestern Japan region. We figured out the image of the subducting Philippine Sea plate using the receiver function analysis.

The cross sections along the longitude of 137.5^o E and 137^o E suggested the negative and positive receiver function boundaries. We can trace the negative and positive boundaries from shallower part to deeper part. The boundaries are interpreted as the upper boundary and oceanic Moho of the subducting Philippine Sea plate. It was found that the Philippine Sea plate is lying in a horizontal beneath Ise bay to Wakasa bay by the previous studies. Our receiver function results also support the result. We can obtain clear image of the crust and upper most mantle of the area using the spatially high dense seismic array deployed by the joint seismic observation.

Keywords: crust, mantle, Receiver function, Nobi earthquake

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SSS26-07 Room:315 Time:April 30 17:30-17:45

P-wave velocity structure in the forearc region of the southwestern Nansei-Shoto (Ryukyu) Trench subduction zone

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We carried out five seismic lines across the southwestern Nansei-Shoto (Ryukyu) forearc region to elucidate variation in crustal structures along the trench. The seismic experiment consists of multichannel reflection seismic (MCS) profiling using 240 ch. and 3000 m long hydrophone streamer and wide-angle seismic refraction profiling using ocean bottom seismographs (OBSs) as receivers. We present the seismic structure related to the Philippine Sea plate subduction in the forearc region of the Nansei-Shoto island arc.

Thick materials with Vp less than 4 km/s characterize the accretionary wedge at the front of the forearc basin in the oblique subduction area to the southwest of 126 E. On the other hand, P-wave velocity structure beneath the high free-air gravity region in the forearc at 126-128 E reveals that materials with a high velocity of around 4.5 km/s ascend to 2-3 km beneath the seafloor. The subducting Okinawa-Luzon fracture zone was able to be clearly imaged not only in MCS profiles but also in the P-wave velocity distribution to the northeast of 126 E. We will discuss the relationship between the variation in the seismic structure and the characteristic of the regional seismicity.

Many OBSs on the forearc region recorded several reflection signals from the subducting Philippine Sea plate. We tried mapping these signals to estimate the position of the subducting plate.