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

OISHI, Yukio[1*]

[1]Atelier Science

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.

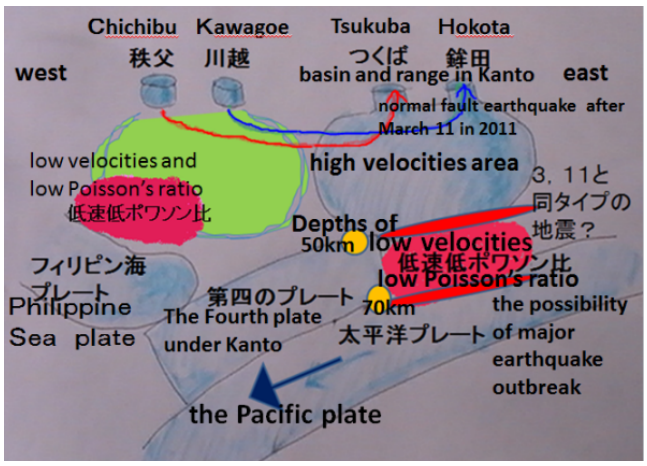
Speaking of the low velocities and low Poisson's ratio area , the similar area exists in the asperity of M9 in 2011 off the Pacific Coast of Tohoku Earthquake; the upper part of the Pacific plate and also exists in Unzen in Nagasaki prefecture from the ground to the depths of about 30km.

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.



Japan Geoscience Union Meeting 2014
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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

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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

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

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[1]NIED

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

Japan Geoscience Union Meeting 2014
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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)

IIDAKA, Takashi[1*] ; IGARASHI, Toshihiro[1] ; KATO, Aitaro[1] ; IWASAKI, Takaya[1] ; JOINT SEISMIC OBSERVATIONS, At the area of nobi earthquake[1]

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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

Japan Geoscience Union Meeting 2014
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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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[1]Japan Coast Guard

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.

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Spectral and spatial characteristics of the refined CRUST1.0 gravity field

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We investigate the density structure of the oceanic and continental crust using the global crustal model CRUST1.0, which has been refined by incorporating additional global datasets of the topography/bathymetry (ETOPO1), the polar ice sheets (DTM2006.0 ice-thickness data) and the global geoid model (GOCO-03S). The analysis reveals that the average crustal density is 2830 kg/m^3, while it decreases to 2490 kg/m^3 when including the seawater. The average density of the oceanic crust (without the seawater) is 2860 kg/m^3, and the average continental crustal density (including the continental shelves) is 2790 kg/m^3. We further compile the gravity field quantities generated by the Earth crustal structures. The correlation analysis of results shows that the gravity field corrected for major known anomalous crustal density structures has a maximum (absolute) correlation with the Moho geometry. The Moho signature in these gravity data is seen mainly at the long-to-medium wavelengths. At higher frequencies, the Moho signature is weakening due to a noise in gravity data, which is mainly attributed to crustal model uncertainties. The Moho determination thus requires a combination of gravity and seismic data. In global studies, gravimetric methods can help improving seismic results, because (i) large parts of the world are not yet sufficiently covered by seismic surveys, and (i) global gravity models have a relatively high accuracy and resolution. In regional and local studies, the gravimetric Moho determination requires either a detailed crustal density model, or seismic data (for a combined gravity and seismic data inversion). We also demonstrate that the Earth long-wavelength gravity spectrum comprises not only the gravitational signal of deep mantle heterogeneities (including the core-mantle boundary zone), but also shallow crustal structures. Consequently, the application of spectral filtering in the gravimetric Moho determination will remove not only the gravitational signal of (unknown) mantle heterogeneities, but also the Moho signature at the long-wavelength gravity spectrum.

Keywords: correlation, crust, density, gravity, Moho

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SSS26-P02 Room:Poster Time:April 30 18:15-19:30

Correction of Gravity Measurements Utilizing GSI Maps and its Application in the Southern part of Uemachi Fault Zone

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1. Summary

In Earth science research with some field work, acquisitions of geolocation of the measurement point are essential. Particularly, it is a major burden that the latitude, longitude and altitude of the measurement points are obtained for the various corrections in gravity measurements. These pieces of information can be obtained by geodetic surveying or GNSS surveying in the field. Occasionally, topographic maps of large scale are substituted for these surveying.

On the other hand, the acquisition of geographic information, that has been digitized, into a numerical value has become possible on WWW in recent years. Web browsing service map of GSI, Geospatial Information Authority of Japan, which had been put to the test, was translated to the formal opening to the public on October 30, 2013. The new browsing service is ”GSI Maps” (GSI, 2013a). According to the Agreement of GSI Tile Use, it is to be able to take advantage of this service in the academic research (GSI, 2013b). Therefore, it is created that JavaScript applications give information on the measuring position by using GSI Tiles (GSI, 2013c). If combined with some mobile digital devices, information of geolocation is readily available even in the field.

When gravity measurements have been conducted, until now, the authors have been made the most use of the large-scale topographic map as the base map in the southern part of Uemachi Fault Zone. These results were mixed up to base on Tokyo Datum and Japanese Geodetic Sytem 2000. Therefore, they are integrated with the latter in this time.

2. Target area

Survey’s line of the target has integrated the results by Ryoki (2011), Ryoki and Nishitani (2013) and recent measurements. The length of the survey line is about 9,7 Km. The line lies from Yunagi-cho Izumiotsu to Ibukino Izumi and intersects the some faults included in Uemachi Fault Zone.

3. Acquisition of geographic information

Latitude, longitude and altitude of the measuring points were used numerical information provided by GSI. These elements obtained by constructing an HTML application. A JavaScript code has been created to revise some samples of GSI Tile. In general, for the purpose of protecting the system, the string is not transferred directly to the clipboard from a Web browser. However, there is a function to be transferred through JavaScript in the specific browser. On the other hand, in some browsers which not support such a function, the ZeroClipBoard library is possible to use to transfer the information (zeroclipboard.org, 2014). Numerical information, transferred to the clipboard, is edited in a spreadsheet application or in an editor software. In this study, an application which is used at indoor after measurement in situ is coded for a batch process. If operated in tablet devices instead to a field note book, numerical information is easily got in the measurement point. Numerical site information is used for various corrections and illustrated the gravity measurement point on the map.

4. Result

Formerly, in order to obtain numerical information related to the measurement point, latitude, longitude and altitude had been read using a digitizer from topographic map. But, if using the application proposed in this paper, time required for these operations could be significantly reduced. In particular, as it becomes a constant accuracy of the reading errors of the elevations which determined by GSI Maps, homogeneity of the data could be secured.

5. Challenges for the future

It is obvious that the application, which is proposed in this paper, ensures the homogeneity of data and improves the measurement efficiency in a variety of field research that includes geosciences. Development of the system for the operation of the tablet terminal is able to challenge, and it is an aim that an application of the terrain correction have been considered in the future.

Keywords: gravity structure, digital geographic information, JavaScript, Uemachi Fault, field research, efficiency of measurement

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SSS26-P03 Room:Poster Time:April 30 18:15-19:30

The crustal structures of the subduction of the Philippine Sea Plate in the northern Nansei-Shoto trench

OIKAWA, Mitsuhiro[1*] ; NISHIZAWA, Azusa[1] ; KANEDA, Kentaro[1] ; FUJIOKA, Yukari[1] ; HORIUCHI, Daishi[1]

[1]Japan Coast Guard

Seismic characters of convergent plate boundaries are reflected in the heterogeneity in the structural evolution, the interior regime as well as external architecture (Kopp, 2013). At the north end of the Nansei-Shoto trench the Amami plateau, which is known as a remnant arc, is subducting, and this causes a landward concave of the subduction axis. The Nansei-Shoto trench was recognized that its seismicity is rather low, but in the past few years, new scientific researches indicated the possibility of a mega earthquake is not so much low. There are needs to grasp the Philippine Sea plate's topography and crustal structure around the sea area of the Amami plateau because they might be constraint conditions how the mega earthquake could happen.

Japan Coast Guard conducted two integrated seismic experiments that combine a wide-angle refraction survey and a multi-channel reflection survey. The first line (line ECr10) was conducted in 2009 and the second line (line ECr11) was carried out in 2012. ECr10 started from the west end of the Amami plateau to the north sea area to the Amami-O-Shima island. ECr11 started from the Kikai basin to the just south of the Yaku Shima Island. A depression on the Nansei-Shoto arc between two seismic lines is well known as a major tectonic boundary of the Nansei-Shoto arc.

The southern end of ECr10 is the west edge of the large Amami plateau. Uyeda(2005) said that there is a local bouguer low anomaly and this means the crust of the Amami plateau should be thicker than the normal oceanic crust. The past seismic survey (Nishizawa et. al., 2009, 2014) reveals that the thickness of the center Amami plateau is approximately 16km, which is obviously thicker than the normal oceanic. The southern end of ECr11 is located on the Kikai basin. The Kikai basin's bouguer anomaly is rather high, this means the possibility that the crust of the Kikai basin should be an oceanic crust. The seismic survey supports the high anomaly because of its thin crust. However the composition of the crust shows the horizontal heterogeneity of its crust and an identification of the middle crust (6.0 - 6.5 km/s layer) exists (Nishizawa et. al. 2009). These characters do not support that the basin is a typical oceanic crust.

We made a comparison of the structure on the Philippine plate between ECr10 and ECr11, by using the seismic surveys results and the precise bathymetric data collected by Japan Coast Guard. Regarding topography, we found many normal faults parallel to the trench direction. Especially there are more faults on the margin of the Amami plateau than of the Kikai Basin. As for crustal structures, the crust of the Amami plateau has a middle crust. The existence of middle crust is along with the past results but not only of the Amami plateau but also of Kikai basin. This means that the subducting margin of the Kikai basin might not be a typical oceanic crust.

Keywords: MCS, crustal structure, subduction, OBS

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SSS26-P04 Room:Poster Time:April 30 18:15-19:30

Seismic structure beneath Kyushu island, Japan, inferred from S-wavevector receiver functions.

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The underground structure of Kyushu region is characterized by active subduction of the Philippine Sea plate (PHS) beneath the Eurasian plate and several active volcanos, for example, Aso, Kirishima, and Sakurajima volcanos along with the volcanic front, and Unzen volcano located Beppu-Shimabara graben. And also there are very thick sediments at several plains in Kyushu. Therefore the seismic structure beneath Kyushu Island is seemed to be very complicated and it is very important to understand the detailed structure, especially around Moho and the top of PHS. There are many previous researches on seismic structure beneath Kyushu Island. Travel time tomography method is very useful tool for imaging the subsurface structures. In the previous works, a lot of characteristic structures are identified by the tomography for example, low velocity structure beneath volcanic front.

Receiver function analysis is also very useful tool to image the seismic velocity structures. We apply it to image seismic structure on Kyushu area. In this study, we use teleseismic records from Hi-net and F-net seismic stations in Kyushu, which are supplies by the National Research Institute for Earth Science and Disaster Prevention.

If those seismic stations are located at the top or in the sedimentary layer, the records include strong effect of reverberation within the sedimentary layer, which makes the image of the structure unclear. To overcome this problem, we exploit the modified S-wavevector receiver functions (SWV-RFs). The SWV-RFs are derived by deconvoluting the upgoing S-wave component with the upgoing P-wave component of the records. For suppressing the sedimentary layer effect, we apply SWV-RFs for borehole records and move virtually the seismic sensor to the top of the basement layer, and calculate the SWV-RFs at that location [Takenaka and Murakoshi, 2010]. This method needs the structure model from the surface to the sensor location. We employ the Integrated Velocity Structure Model by the Headquarters for Earthquake Research Promotion. We take several cross sections in Kyushu Island to map the calculated SWV-RFs. We then interpret the continental Moho and low velocity regions in the mapped SWV-RFs. It can be seen that characteristic low velocity regions in mantle wedge, some of which may be related to magma. We also model some SWV-RF sections by the 2.5-D finite-difference method to confirm our imaging results.

Keywords: receiver function, crustal structure, top of plate, Kyushu region

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Seismic reflection survey at the Kego fault, Kyushu, Japan

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Kego fault is one of the active faults in Japan, which located Kyushu Island, Japan. The fault is composed of two major segments; the earthquake fault of the 2005 West-off Fukuoka prefecture earthquake and southeastern part running through central Fukuoka City. We performed reflection survey at the southeastern part of the fault in order to explore detailed structure of the fault. The experiment was carried out on the two profile. One was located at central part of Fukuoka city with length of 1 km for obtaining reflection section shallower than depth of 1 km. Another was for imaging heterogeneous structure in the seismogenic zone beneath the fault, which was deployed 35 km length across southeast end of the fault. After applying seismic reflection processing, we obtain reflection sections for two profiles. The gap of horizontal reflector was found around the depth of 0.6 km in the shallow seismic section at central Fukuoka, corresponding to the Kego fault. The hanging wall of the fault is western side of the fault as geological study suggested. The deep section at the southeastern part of the fault reveals that strong reflective layers exist in the seismogenic zone at the west of the fault. In addition, we found many reflectors at the lower crust beneath the whole area of the profile.

Keywords: Kego fault, seismic reflection survey

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P-wave heterogeneous structure around the Kego fault inferred from reflection analysis for seismic network data

KAMIZONO, Megumi[1*] ; MATSUMOTO, Satoshi[2] ; MIYAZAKI, Masahiro[1] ; NAKAMOTO, Manami[2] ; SHIMIZU, Hiroshi[2] ; ABE, Susumu[3]

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The Kego fault is one of the active fault in Japan, running through the western margin of the Fukuoka plain. On March 20, 2005 the west off Fukuoka earthquake (M7.0) occurred at northwestern extension of the Kego fault. In order to evaluate the effect on the fault by the earthquake, crustal structure is basic information to model the fault condition. This study estimated the subsurface structure around the Kego fault from artificial source used in the reflection survey.

In the survey, vibrator tracks are used as seismic sources at 8 shot points. Sweep time of the source is 24 seconds and sweep frequency range is from 6 Hz to 30 Hz. We recorded the signal from the vibrators at seismic stations deployed by Kyushu University and NIED. Seismic reflection analysis was applied to the data for detecting reflectors beneath the CMP line located between the reflection profile and the station. As simplicity, we processed observed data on the assumption that basement is homogeneous.

We obtained seismic deapth sections at CMP lines for the seismic stations. Numerous refletors in the lower crust are found in the sections; therefore the lower crust is heterogeneous. The reflective zone in the lower crust is from the depth 20 to 32 km in the section, suggesting that the lower limit of the zone corresponds to the Moho discontinuity. Since the section imaged heterogeneous structure across the Kego fault, we compared characteristics of reflectivity between footwall and hanging walls of the fault. The structure of the superficial part is different depending on the place. At the some point CMP lines, there are reflector in the western side, however in the eastern side of the fault it is not so. This difference in reflectivity depends on the cross point between the CMP line and the fault. This suggests that there isn't clear difference in east and west of the fault at other point. Consequently, there might be variation of the structure along the strike of the Kego fault.

Keywords: Kego Fault, Seismic Reflection Profiling

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SSS26-P07 Room:Poster Time:April 30 18:15-19:30

The seismic velocity structure in the Northern Kinki District using the dense seismic observation

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Micro-seismicity in the Northern Kinki District is active. However we don not know the cause and the relation between these seismic activities and crustal structure or active faults around there clearly. In the Northern Kinki District, we are carrying out a dense array seismic observation using 83 temporal stations since 2008. The average station interval at the center of the Tamba plateau is about 5km, so we expect to know the seismic structure beneath this region with higher resolutions than that derived from the permanent stations.

In this study, we estimate high-resolution seismic velocity structure using data from these dense observations. Based on the results of 3D seismic velocity tomography, we discuss about relations between the seismic activities and other geophysical and geological features of this area.

Keywords: Tamba Plateau, Tomography, micro-earthquake, crustal fluid, dense observation, Manten Project

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Seismic attenuation beneath Tateyama volcano

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Tateyama volcano (Midagahara volcano) locates in southeast Toyama prefecture. Subsurface structures beneath active volcanoes have frequently been investigated using seismic attenuation (e.g., Oikawa et al., 1994: Sudo et al., 1996), and it was reported that there are strong attenuation regions beneath some active volcanoes. The volcanic activity of Tateyama volcano is quite low, and subsurface structure beneath the volcano has not been investigated in detail. Since Hi-net was developed by NIED, the attenuation structure of whole area of Japan has been estimated (e.g., Jin and Aki, 2005; Carcole and Sato, 2009). However, local structure beneath inactive volcanoes is still in question. In this study, we investigated the seismic attenuation beneath Tateyama volcano using seismograms obtained by Hi-net.

In this study, we used seismograms of five Hi-net stations near Tateyama volcano. The seismograms were selected so that epicentral distances from Tateyama volcano were 70 km˜140 km, the magnitudes of the earthquakes were larger than 2.5, focal depths were less than 30 km, and signal-to-noise ratios were sufficiently high.

At first, we focused on the two stations which locate opposite sides of Tateyama volcano each other, and compared seismograms whose epicenters were located almost along the line of Tateyama volcano and the two stations. For the seismograms which passed beneath the volcano, S-waves were more attenuated than P-wave. In detail, S-wave attenuation was pronounced in 4˜8Hz and 8˜16 Hz bands. This feature was seen in all seismograms from northwestern or southeastern sources. On the other hand, seismograms from northeastern or southwestern sources did not show such a feature. There should be a region that preferentially attenuated S-waves beneath Tateyama volcano, and the distribution is heterogeneous.

Also, it should be noted that S-waves passing beneath Tateyama volcano showed clear peak delay, which suggested that there was a region with high scattering attenuation beneath Tateyama volcano.

Keywords: seismic attenuation, volcano, spectral analysis

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Detailed velocity structure along the Nankai trough, off the Kii Peninsula, obtained from DONET data

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Along the Nankai trough off southwestern Japan, the Philippine Sea (PHS) plate is subducting to the northwest below the Eurasian plate. Historically, mega-thrust earthquakes have occurred repeatedly along the Nankai trough (e.g., Ando, 1975). Future great earthquakes will cause serious and widespread damage in central and western Japan. The Japan Agency for Marine-Earth Science and Technology (JAMSTEC) installed a network of permanent ocean-bottom observation stations off the Kii Peninsula above the source region of the expected great earthquakes. This is known as the Dense Oceanfloor Network System for Earthquakes and Tsunamis (DONET). Previous studies (e.g. Nakano et al., 2014) revealed that the present seismic activity well overlaps the aftershock region of the sequence of 2004 off the Kii Peninsula earthquakes (M_{JMA} = 7.1, 7.4, and 6.5). The focal mechanisms of the earthquakes show that the axis of compressive stress in the PHS plate is oriented N?S, almost perpendicular to the direction of plate convergence, indicating a complex tectonic regime in this region. In this study, we investigate detailed seismic velocity structure in this region.

In this region, P-wave velocity (Vp) structure is well developed based on repeated seismic surveys, but S-wave velocity (Vs) structure is not well known. Therefore, we start from an initial layered velocity structure assuming Vs, and update it to well explain the travel-time of earthquakes, then obtain three-dimensional velocity structure described below.

1. Estimate average layered structure below the study area.

1.1. An initial layered structure of Vp is constructed referring to the result of seismic surveys. The Vp/Vs ratio of each layer is assumed considering oceanic structures. Using this structure, we determine the hypocenter distribution.

1.2. Using the travel-time and initial hypocenters, 3D velocity structure is computed by using the tomoDD program (Zhang and Thurber, 2003).

1.3. The 1D velocity structure is updated by averaging the velocity at each depth.

1.4. Hypocenters are re-calculated based on the updated velocity structure, and the procedures 1.2.-1.4. are repeated until the 1D velocity structure converges.

2. Construction of 3D velocity structure.

2.1. Initial 3D velocity structure representing the subducting plate and oceanic sedimentary layers is constructed based on the study of Nakamura et al. (2011). Vp is from the result in 1.

2.2. The Vp/Vs ratio of each layer is obtained by a grid search method, in which minimizes the residual between observed and calculated travel time.

2.3. Site correction is obtained for the best model.

3. Computation of detailed 3D velocity structure.

3.1 Using the velocity structure and hypocenter distribution obtained in 2. as the input, detailed 3D velocity structure is obtained by using tomoDD program. In the computation of travel time, the site correction obtained in 2.3. is included.

The obtained velocity structure shows that the velocity anomaly along the trough anomaly well corresponds to the earthquake distribution. In the oceanic crust, seismic activity corresponds to a region of low-velocity anomaly, while earthquake distribution corresponds to a high-velocity anomaly in the mantle. The obtained structure may help to understand the detailed structure in this region. However, since the used data is from earthquakes immediately below DONET, the resolution of tomography may not be good. We will investigate the resolution and dependence on the initial velocity structures in the future study.

Keywords: Nankai trough, Ocean-bottom seismic observations

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Mechanism of large crustal earthquakes in Kanto and Chubu: Influence of structural heterogeneities

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Large inland crustal earthquakes often cause heavy damage to human society. Therefore it is very important to clarify the generation mechanism of the large crustal earthquakes for disaster reduction. It is considered that fluids dehydrated from the subducting Pacific and Philippine Sea slabs affect the nucleation of large crustal earthquakes under the Japan Islands (Zhao et al., 2010). In this study, we focus on the Kanto and Chubu regions, and investigated the cause of large crustal damaging earthquakes (M>6) (Usami et al., 2013; Utsu, 1999) by comparing the earthquake distribution with tomographic images of the crust and upper mantle.

We used high-quality arrival-time data of local earthquakes which occurred during June 3, 2002 to June 26, 2013 complied by the Japan Meteorological Agency (JMA) Unified Catalogue and those during June 3, 2002 to November 10, 2013 compiled by the Tohoku University Data Base. The local events were carefully selected based on the following criteria. (1) All the events were recorded by more than 20 seismic stations; (2) the uncertainty of hypocentral location is smaller than 4 km; (3) to keep a uniform distribution of hypocenter locations and avoid the event clustering, we divided the study area into small blocks (5 km $\times$ 5 km $\times$ 1 km), and selected only one event in each block that was recorded by the maximal number of seismic stations. As a result, our data set consists of 824,742 P-wave and 627,664 S-wave arrival times from 21,831 events recorded by 877 seismic stations in the study area. We applied the tomographic method of Zhao et al. (1992) to our data set. The grid interval is 0.20 deg. in the lateral direction and 15?30 km in depth, which is the resolution scale of the 3-D velocity model we obtained. The final root-mean-square ravel time residual is 0.287 s for the P-wave data and 0.424 s for the S-wave data.

Our results show significant velocity variations in the crust and upper mantle. The subducting Pacific and Philippine Sea slabs are imaged clearly as high-velocity zones. In contrast, low-velocity anomalies are revealed in the crust and mantle wedge beneath active arc volcanoes, which reflect the source of arc magmatism produced by slab dehydration and corner flow in the mantle wedge. Most of the large crustal earthquakes are located in or around the low-velocity zones in the crust and/or the uppermost mantle. These results suggest that the generation of large crustal earthquakes are affected or controlled by the structural heterogeneities. In particular, fluids play an important role in the nucleation of the large earthquakes.

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Keywords: seismic tomography, crustal fluid

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SSS26-P11 Room:Poster Time:April 30 18:15-19:30

Seismic Reflection Surver around the Mouth of Fuji River

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We conducted seismic reflection survey around the mouth of Fuji River in February 2014. Fujikawa-kako fault zone is identified around this area. Shimokawa et. al. (1996) conducted seismic reflection survey in this area, and identified the Iriyamase fault. Shizuoka Pref. (1996) also identified the Nakayama fault. Our purpose of the survey is that we understand structure around both the Iriyamase and the Nakayama fault in more detail than the previous studies. There are two seismic survey lines. A survey line FJK1 is located from the mouth of Fuji river toward Mukaida river along the coastline, and the length of the line is about 3.5km. A survey line FJK2 is located on the right bank of Fuji river and at about 2km north from the coastline, and cross over the Kambara Jishinyama. The length of FJK2 is a little bit longer than 1km. We used IVI Y2400 as seismic source. Sweep frequency for FJK1 and FJK2 is 10 to 100Hz and 10 to 120Hz, respectively. Sweep length is 12s, and record length is 16s for both lines. We used SG-10 (10Hz of natural frequency) and DSS-12 that is a distributed seismic data acquisition system. Temporal spread length of FJK1 is about 1km. We fixed the spread of FJK2. Geophones are set at intervals of 5 meters for both lines. Some events can be deduced as reflected waves in some samples of shot records for FJK1. However, we are afraid that they are produced by a bank. Soon, we are going to show detailed results.

Keywords: seismic reflection survey, Fuji River

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Depth variation of the P- and S-wave velocities in the Kanto sedimentary basin inferred from seismic interferometry

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Information on the seismic velocity structure of the Kanto sedimentary basin is necessary for evaluating the strong and long-period ground motions in the Tokyo Metropolitan area for future large-to-great earthquakes. However, there are few studies on the depth variation of both P and S wave velocities of the sediment, except for the vertical seismic profiling (VSP) measurements at a limited number of deep boreholes. In this presentation, we will report the characteristics of the depth variation of both P and S wave velocities of the sediment on the basis of the seismic interferometry for P and S waves of local earthquakes.

Seismic waveforms of 160 local earthquakes recorded by the MeSO-net were analyzed in this study. The autocorrelation of vertical displacement waveform of P wave and SH displacement waveform from a single event were stacked over all events available at each station, respectively, to obtain the P- and S-wave reflection responses of the Kanto sedimentary basin. We successfully found clear P- and S-wave reflections from the bedrock (seismic basement) at 266 observation points. This result indicates that the P-wave seismic interferometry is effective for the exploration of deep sedimentary basin as well as S-wave interferometry. In our dada, two-way travel time between the free surface and the bedrock of P-wave and S-wave (hereafter Tp and Ts, respectively) ranges from 0.5 s to 4.0 s and 2.0 s to 8.0 s, respectively. A graph showing Tp-Ts relation reveals that the trend of its variation is very similar to that reported at Iwatsuki deep boreholes from VSP measurement, even though there is a large scatter of data. Our results indicate that the ratio of P-wave velocity and S-wave velocity of the sediment is approximately 4 at a shallow depth ($<$0.5 km) and decreases down to 2 or less at a deep depth ($>$2.0 km) in the Kanto sedimentary basin.

ACKNOWLEDGMENTS
Data provided by the MeSO-net is gratefully acknowledged. This research was partially supported by the Earthquake Research Institute, University of Tokyo.

Keywords: seismic interferometry, Kanto sedimentary basin, sedimentary structure, seismic velocity structure

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Seismic activity and attenuation structure in fukushima-yamagata prefectural border area

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In Fukushima - Yamagata prefectural border area, seismicity suddenly became active after off the Pacific coast of Tohoku earthquake (here after we call it 2011 Tohoku earthquake). We estimated distribution and focal mechanisms of earthquakes that occurred in the time period before and after the 2011 Tohoku earthquake to clarify causes of the seismicity activation. We used seismograms which are observed at the Hi-net stations operated by National Research Institute for Earth Science and Disaster Prevention. Earthquakes with M ≧ 2.0 in the Hi-net catalogue from July 3 , 2002 to March 10 , 2011 and from April 1 , 2011 to August 31 , 2011 were analyzed in this study. As a result, hypocenters which occurred after the main shock were distributed into five clusters they were located at different region from those where earthquakes occurred before the main shock. It is known that there are active faults near the study area. A fault plane estimated from a northwestern cluster ' s hypocenters shows similar strike and dip of that of an active fault. Further, fault planes estimated from another clusters ' hypocenters seems to have a conjugate relationship with the fault plane of the active faults. In addition, we observed that hypocenters in some certain clusters moved to lateral and vertical direction with approximately constant speed. Most earthquakes have the thrust-type focal mechanisms during the study period. Q value is considered to be a sensitive parameter to temperature and existence of fluid in the crust. We estimated Qp/Qs value by taking velocity amplitude spectral ratio between P and S waves to evaluate the affection of magma or fluid to earthquake occurrence. We used 898 spectra of 152 earthquakes which were observed by 9 stations nearby source region to calculate average Qp/Qs value on the ray path by Takaoka et al. (2013) ' s method. As a result, ray paths from the hypocenters to stations within 20km showed high Qp/Qs values, while paths from the hypocenters to the far stations showed low Qp/Qs values. This result might indicate that high attenuation region exists in a shallow part nearby source region.

Keywords: Q value, attenuation, In Fukushima - Yamagata prefectural border area, seismicity, off the Pacific coast of Tohoku earthquake

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SSS26-P14 Room:Poster Time:April 30 18:15-19:30

Crustal and upper mantle structure of East Antarctica, derived from broadband seismic deployments at the International P

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Deployment of broadband seismic stations on the Antarctica continent have been an ambitious project to improve the spatial resolution of seismic data across the Antarctic Plate and surrounding regions. Several international collaborative programs were conducted in Antarctica during the International Polar Year (IPY 2007-2008). The Antarctica's GAmburtsev Province (AGAP; IPY #147), the GAmburtsev Mountain SEISmic experiment (GAMSEIS), a part of AGAP,, and the Polar Earth Observing Network (POLENET; IPY #185) were major contributions in establishing a geophysical network in Antarctica. The AGAP/GAMSEIS project was an internationally coordinated deployment of more than 30 broadband seismographs over the crest of the Gambursev Mountains (Dome-A), Dome-C and Dome-F area. The investigations provide detailed information on crustal thickness and mantle structure; provide key constraints on the origin of the Gamburtsev Mountains; and more broadly on the structure and evolution of the East Antarctic craton and subglacial environment. In addition to the PASSCAL observation system by USA, original coordinated systems were developed by Japan (at Dome-F (GM07) and GM06 stations), as well as by other groups in China and France. Regarding Japanese instrument system, the same sensor and data logger as used by US/PASSCAL were utilized, but the electric power supply system and enclosures were developed independently. Data were recorded in MiniSEED format, a commonly accepted international standard, to ease analysis. Logistical and staff support were provided by the US researchers and staff at AGAP-S camp in the installation of the Japanese stations GM06 and GM07. From GAMSEIS and POLENET data obtained, local and regional seismic signals associated with ice movements, oceanic loading, and local meteorological variations were recorded together with a significant number of teleseismic events. In this presentation, in addition to the Earth's interiors, we will demonstrate some of the remarkable seismic signals detected during IPY that illustrate the capabilities of broadband seismometers to study the sub-glacial environment, particularly at the margins of Antarctica. In future, monitoring stations inland ice plateau of Antarctic, such as Dome-F, firmly attribute a crucial role in the Federation of Digital Seismographic Network (FDSN) in southern high latitude.

Keywords: Antarctica, International Polar Year, crustal structure, broadband seismographs, international project

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Seismo-stratigraphy and structure of the Adventure Plateau (Sicily Channel): an example of old data recovery

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We present here a seismo-stratigraphic and structural study of the Adventure Plateau, the north-westernmost sector of the Sicily Channel. This bank, where water depths do not generally exceed 150 m, is the shallowest part of the whole Sicily Channel, with relief which sometime rises up to less than 50 m. This analysis is based on a large set of multichannel seismic profiles and well information acquired mostly for commercial purposes in the 70s and 80s. Despite the general poor quality and consistency of the data used, it was possible to draw with sufficient detail the various seismo-stratigraphic sequences, calibrated with well information. The sedimentary sequence crossed by wells in the Adventure Plateau comprises deposits ranging from Triassic to Plio-Quaternary. A broad lithological distinction can be made between the sequences ranging from Triassic to Middle Miocene, predominantly carbonate, and the sequences ranging from Tortonian to Quaternary, predominantly siliciclastic. Moreover, we observe in the wells the presence of various hiatuses, particularly at the top of the Miocene and at the Early Jurassic. Three main structural domains have been identified within the Adventure Plateau: (a) a compressional belt in the N-W part of the bank, deformed during Middle-Late Miocene, and corresponding to the SW-trending offshore part of the Maghrebian Chain; (b) the Adventure foredeep of the Maghrebian Chain, located in the central part of the bank, and filled by over 2000 m of siliciclastic Late-Miocene to Quaternary deposits; (c) the Adventure foreland of the Maghrebian Chain, corresponding to the S-W part of the bank, affected from the Early Pliocene by a strong extensional phase associated to the Pantelleria Graben rifting. The eastern boundary of the Adventure Plateau is part of a broadly NS-trending, lithospheric-scale transfer zone which separates the Sicily Channel into two distinct sectors. This study shows the potential and capability of old data in areas where there is scarce geophysical knowledge. They represent an important source of information, especially for the shallow water areas of the Sicily Channel that are still poorly known in terms of geology and stratigraphy.

Keywords: Sicily Channel, Adventure Plateau, seismo-stratigraphy, synthetic seismograms, structural setting