Japan Geoscience Union Meeting 2011
(May 22-27 2011 at Makuhari, Chiba, Japan)

STT054-P01 Room:Convention Hall Time:May 24 14:00-16:30

Magnetic constraints on the shallow subsurface structure of the Fukui Plain

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The Geological Survey of Japan (GSJ) conducted a helicopter-borne high-resolution aeromagnetic survey over the Fukui Plain, central Japan, to better understand concealed faults associated with the 1948 Fukui Earthquake (June 28, 1948, Mj =7.1) that caused tremendous damage to this area. The survey was flown with a Cesium vapor magnetometer and a differential GPS along east-west and N10W flight lines at an altitude of 150m above terrain and spaced 300m and 3,000 m apart, respectively. The observed magnetic data have been processed and total magnetic intensity anomalies were compiled on a smoothed observed surface. The reduction to the pole anomalies were also calculated from the total magnetic intensity anomalies on the surface. Next, 3-D magnetic imaging has been applied to the magnetic anomalies to better understand the subsurface structure of the area. The characteristics of the results of the imaging are summarized as follows:

(1) Magnetization highs of 2.0 A/m lie south of the Awara Hot Spring in the western part of the plain, implying the existence of a past volcanic center and/or intrusions associated with the hot spring.

(2) A broad high-magnetization area which includes the local highs south of the Awara Hot Spring occupies the western part of the plain, suggesting buried volcanic rocks trapped inside the Neogene basin inferred from seismic and gravity surveys.

(3) The broad high-magnetization area is bounded by the Fukui Earthquake Fault to the east. Whereas, magnetization lows are dominant in the eastern part of the plain.

(4) Negative magnetizations are dominant along the coastline of the Sea of Japan north of the Kaetsu Plateau, suggesting the existence of reversely magnetized volcanic rocks which may outcrop along the coastline.

(5) On the basis of these results, it is suggested that the 1948 Fukui Earthquake occurred along the boundary of the old basement structure.

Keywords: aeromagnetic survey, high-resolution aeromagnetic survey, magnetic anomaly, magnetic structure, Fukui Plain, Fukui earthquake faults

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Three dimensional resistivity modeling for the GREATEM survey data

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ABSTRACT

The Ground Electrical source Airborne Transit Electro Magnetic (GREATEM) system uses a grounded electrical dipole source of nearly 2 to 3 km length as a transmitter and a three-component magnetometer in the towed bird as a detector. With a grounded source, a large-moment source can be applied and a long transmitter-receiver distance used, yielding a greater depth of investigation but limiting the survey area. Other advantages include a smaller effect of flight altitude and the possibility of higher-altitude measurements.

A series of data processing are used to obtain the transient response curves in the end from GREATEM field survey data, these steps include (1) movement correction: which made by subtracting predicted magnetic field variations, as derived by the response function based on the movement measured by the gyro, from the observed magnetic field variations, to yield moving-noise-free data. (2) Coordinate transformation: to transfer magnetic field components from bird-based coordinates to geographical coordinates that based on directional sensor data. (3) Removing local noise: magnetic field data obtained from the ground magnetometer were used to remove natural and artificial noise. (4) Data stacking: as GREATEM data is affected by the horizontal resistivity structure change, to over come this issue a stacking of data is need. (5) Signal portion extraction: search for 0-level, the partial signal (transient) was extracted.

We are going to make a 3D resistivity model for GREATEM data based on 1D resistivity structures inverted from GREATEM field survey data as initial model. The 3D EM forward modeling scheme based on finite difference (FD) staggered grid method (Fomenko and Mogi, 2002) used to calculate the response of 3D resistivity model at each corresponding survey line. Convolution is carried out in frequency domain to add the frequency characteristic response of field survey instrument to forward model synthetic data of EM transit response in order to compare it with field survey data transit response obtained after data processing.

In current work, we have developed 3D stacking of data in each grid, and employed this method practically on the data of GREATEM filed survey at the Kujukuri beach that has been conducted to test the GREATEM survey system and clarify the subsurface structure in coast line area such as the Kujukuri beach which located on the east coast of the Boso peninsula in Chiba Prefecture, Japan.

Keywords: GREATEM 3D resisitivity model, GREATEM survey at cost line

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Application of the airborne electromagnetic survey in landslide survey

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The airborne electromagnetic survey can survey underground three-dimensional resistivity structure from the air in a short time. The analysis method draws resistivity structure from the measurement data on a survey line, and presumes geological structure from resistivity structure. Many airborne electromagnetic survey methods have been developed recently. The frequency domain airborne electromagnetic survey method and the ground sauce type TIMEDOMAIN airborne electromagnetic survey method (GREATEM) are used according to the investigation purpose.

This announcement reports the enforcement example of a frequency domain airborne electromagnetic survey method.

Landslide survey was conducted by Minamishimabara of Nagasaki Prefecture. Northern Nagasaki is a national leading landslide zone. The area which surveyed is a landslide frequent occurrence zone which is equal to northern Nagasaki. Nagasaki Prefecture specifies the survey area as the landslide prevention zone. Survey was conducted for two years, in order to obtain the fundamental data of landslide preventive measures. The adjoining land of the survey area carried out measure construction in the previous year. The established construction place also investigated simultaneously. As a result, it turned out that an airborne electromagnetic survey is effective in the construction plan of landslide preventive measures. Moreover, it can carry out the effect judging of the area which carried out prevention construction of the measure against a landslide.

Keywords: airborne electromagnetic survey, landslide, airobrne geophysics, resistivity

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Coseismic Displacement Measurement of The 2010 El Mayor, Mexico Earthquake Using Satellite Optical Images

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This paper performed to measure the ground deformation of the fault rupture due to the 2010 El Mayor, Mexico earthquake by the sub-pixel correlation technique to pre- and post-event satellite orthorectified images. The Terra/ASTER and ALOS/PRISM images processed by the GEO Grid system were used for this examination. The maximum displacement interpreted from the image analysis was few meters of right-lateral strike slip. The results will be validated in comparison with field survey and other sensors' data.

Keywords: subpixel correlation, crustal displacement, satellite optical sensor, Terra/ASTER, ALOS/PRISM, the 2010 Baja california earthquake

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Observations of temperature distributions in Sakurajima volcano crater using airborne hyperspectral scanner

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Brightness temperature distributions in Sakurajima Volcano were acquired by using airborne hyperspectral scanners (ARTS). They revealed a significant temporal change of geothermal activity in the Sakurajima Volcano crater from Nov. 2008 to Nov. 2010. ARTS images were acquired over the Sakurajima Volcano crater on 8 April 2008, 26 November 2008, and 21 November 2010. ARTS was flown on a clear day at 4,000m ASL (8 April 2008, 26 November 2008) and at 5,000m ASL (21 November 2010). Brightness temperature distributions in the Sakurajima Volcano crater were acquired with a spatial resolution of 3.6 to 4.8m. The geo-corrected image was calculated directly using the data from the GPS/IMU system. We could detect the geothermal activities of Sakurajima crater (Minamidake A-crater and Showa crater) from these data. We calculated the heat flux at the Sakurajima Volcano crater from the Sekioka equation. The estimated heat flux at the Minamidake A-crater was 16.4MW at 1518 (UTC+9) 26 Nov. 2008 and 0.8MW at 1126 (UTC+9) 21 Nov. 2010. The estimated heat flux at the Showa crater was 4.2MW at 1518 (UTC+9) 26 Nov. 2008 and 57.3MW at 1126 (UTC+9) 21 Nov. 2010. These results indicated both the increase of geothermal activity of the Showa crater and the decrease of the geothermal activity of the Minamidake A-crater from Nov. 2008 to Nov. 2010.

Keywords: hyperspectral sensor, airborne, geothermal distribution