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Editorial

Airborne surveys and monitoring of the Earth – application to the mitigation of natural and anthropogenic hazards

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This special issue of *Exploration Geophysics* is based on papers presented at a session of the Japan Geoscience Union Meeting 2012, with the same title as this issue, which was held on 23 May 2012 at Makuhari Messe International Convention Complex in Chiba, Japan. The Society of Exploration Geophysicists of Japan (SEGJ) participated in the meeting as a member society.

The session typically deals with studies on the theory, instrumentation, processing, modelling or inversion, and applications of airborne surveys, which are useful in furthering understanding of the Earth's global and/or detailed structures and their variations. Unexpectedly, on 11 March 2011, the Tohoku earthquake occurred off the Pacific coast, which caused the collapse of infrastructure, land subsidence, and liquefaction of the ground. Successive tsunamis struck coastal areas, causing significant loss of life and damage to property. Furthermore, the earthquake and tsunamis damaged the Fukushima Daiichi nuclear power plant, resulting in a severe nuclear accident. On this occasion, the usefulness of airborne surveys was highlighted by their capacity to map, monitor, and forecast natural and anthropogenic hazards safely and efficiently from the air.

Therefore, an international session focusing on these topics, involving three invited international speakers, was held a year after the earthquake, at which 14 papers were presented. Most of the presented papers were submitted to this special issue and seven were accepted in time for its publication through the review process.

The first two papers are dedicated to the subject of airborne gamma-ray spectrometry. Sanada et al. (2014) developed a radiation-monitoring system using an unmanned helicopter to monitor the radiation levels in areas where the soil had been polluted by the ^{137}Cs emitted from the Fukushima Daiichi nuclear power plant. The measured dose rate in dry riverbeds close to the plant was higher than in their surroundings. Repeated surveys revealed a temporal change of the rate downstream, suggesting a migration of ^{137}Cs-contaminated sediments via flooding. Ahl et al. (2014) proposed a method of precipitation correction for airborne gamma-ray spectrometry, based on repeated flights over a monitoring profile. Consideration of weather conditions is essential for large surveys and the monitoring of ^{137}Cs contamination after a nuclear accident, and the authors demonstrated that the method is more efficacious for practical use compared with traditional levelling.

The following three papers are dedicated to aeromagnetic surveying and its application over volcanic areas in Japan, primarily in terms of the mitigation of volcanic hazards. Nakatsuka and Okuma (2014) introduced a 3D imaging method with source volume minimisation and confirmed its usefulness when applied to synthetic magnetic anomalies. Subsequently, they applied the method to the actual magnetic anomalies of the Otoge cauldron in central Japan and obtained reasonable estimations of the subsurface distribution of the former magma reservoir, as inferred from geological studies.

Okuma et al. (2014) applied the same 3D imaging method to magnetic anomalies observed during a helicopter-borne magnetic survey over Usu Volcano in Hokkaido, Japan, just after its eruption in 2000. The results revealed the detailed geologic signatures related to past volcanic activities, but lacked information regarding the magma intruded during the more recent eruptions of 1977–1978 and 2000. They suggested that the intruded magma (in particular, that of the most recent eruption) had not cooled sufficiently and had not become strongly magnetised at the time of the survey.

Hashimoto et al. (2014) conducted an aeromagnetic survey over Tarumae Volcano in Hokkaido, Japan, with an unmanned autonomous helicopter. They proposed that the observed magnetic anomalies could be approximated in the first order by synthetic anomalies from the terrain effect with a uniform magnetisation. Based on simulations, they suggested that this system is able to detect temporal changes caused by a remagnetising source.

The final two papers are related to grounded electrical-source airborne transient electromagnetic (GREATEM) surveys over areas of active crustal movement (volcanic and faulted areas) in Japan. Ito et al. (2014) conducted GREATEM surveys to improve understanding of the subsurface structure of Aso Volcano in Kyushu, Japan. The survey was successful both in clarifying the resistivity structure to a depth of ~800 m, even in rugged terrain, and in mapping a NW extension of a low-resistivity zone from the active Naka-Dake crater, indicating the potential for future volcanic activity in the area.

Abd Allah et al. (2014) presented the results of a GREATEM survey over the Nojima Fault on Awaji Island, south-east Japan, which is known as a source fault of the 1995 Hyogo-ken Nanbu earthquake ($M_w = 7.2$). Three-dimensional forward modelling using a finite-difference staggered-grid method was performed, which indicated that their system is able to map subsurface resistivity structures to a depth of 500 m, in both onshore and offshore areas. Obvious resistivity lows were mapped along the coastline at some depth and were interpreted as seawater invasion, providing useful information for the management of water resources.

I would like to thank all the authors who presented their papers at the session and/or submitted manuscripts to this special issue. I would also like to express my sincere gratitude to the co-conveners of the session, Professors Toru Mogi (Hokkaido University) and Jiro Segawa (Tokyo University of Marine Science and Technology), for their help in organising a successful session. Finally, I wish to acknowledge the encouragement and assistance of Mr Koya Suto, ASEG President, and Dr Mark Lackie, Managing Editor of *Exploration Geophysics*, with regard to the publication of this special issue.

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