Oral | Symbol S (Solid Earth Sciences) | S-CG Complex & General

[S-CG67_2AM2]Ocean Floor Geoscience

Convener:*Kyoko Okino(Ocean Research Institute, University of Tokyo), Keiichi Tadokoro(Research Center for Seismology, Volcanology and Earthquake and Volcano Research Center, Nagoya University), Osamu Ishizuka(Institute of Geoscience, Geological Survey of Japan/AIST), Tomohiro Toki(Faculty of Science, University of the Ryukyus), Narumi Takahashi(Earthquake and Tsunami Research Project for Disaster Prevention, Japan Agency for Marine-Earth Science and Technology), Chair:Tomohiro Toki(Faculty of Science, University of the Ryukyus), Kyoko Okino(Ocean Research Institute, University of Tokyo)

Fri. May 2, 2014 11:00 AM - 12:45 PM 418 (4F)

Ocean Floor Geoscience session covers a broad range of research on seafloor such as mid-ocean ridge process, subduction dynamics, arc magmatism, hot spot and LIPs, crustal movement and structure etc. Every field of researches and every approaches are welcomed. The session aims to encourage discussion among scientists from different study fields and to integrate our understanding of ocean floor.

12:00 PM - 12:15 PM

[SCG67-P07_PG]Evaluation of resolution and estimation error of vessel-based seafloor displacement observation using AUV bathymetry

3-min talk in an oral session

*Toshiya FUJIWARA[1], Yuka MASAKI[1], Fujio YAMAMOTO[1] (1.JAMSTEC)

Keywords:Multi-narrow beam bathymetry, seafloor displacement, Iheya-North knoll, AUV Urashima, R/V Yokosuka

Bathymetry is basic information for any kind of seafloor observation, and therefore vessel-based multi-narrow beam bathymetric surveys are conducted quite often. In recent years, previous bathymetric data exist in most scientifically-important areas. A repeated bathymetric survey reveals seafloor displacement related to geodynamics [e.g. Fujiwara et al., Science 2011]. However, the spatial resolution and estimation error of the seafloor displacement observation from the vessel-based bathymetric survey are not exactly known. Because the observation compares a pair of limited-resolution bathymetric data. Water depth (distance from the vessel's echo sounder to the seafloor) degrades the spatial resolution and precision of depth measurement from the vessel-based survey. While on the other hand, a near-seafloor Autonomous Underwater Vehicle (AUV)-based survey enables us to obtain high-resolution bathymetric data. In this paper, we evaluated the spatial resolution and estimation error of the seafloor displacement observation from vessel-based bathymetric survey. In this evaluation, bathymetric data from vessel-based and AUV-based surveys in the Iheya-North knoll of the Okinawa Trough were used.AUV Urashima bathymetric survey was conducted in YK07-07 cruise aboard the R/V Yokosuka in May 2007 [Yamamoto et al., 21st Mtg, Japan Society for Marine Surveys and Technology 2009]. The applied multi-narrow beam echo sounder was a SEABAT 7125. R/V Yokosuka bathymetric survey was performed using a SeaBeam 2112 echo sounder in YK06-09 cruise from 18 to 24 July 2006 [Masaki et al., JAMSTEC R&D 2011]. The vessel passed over the survey area six times with each constant speeds and obtained bathymetric data. One survey track was treated as one's independent survey in this evaluation. The beam angle (angle formed by the vertical line and a narrow sounding beam) was within 40^{o} in the survey area.AUV bathymetry shows hills (the shallowest depth ～870 m) in the western side and basins (the deepest ～1070 m) in the eastern side. The average/median depth is 1010 m. Hydrothermal chimney

mounds ～30 m in diameter and ～10-20 m in height were found on the hillside in the high-resolution bathymetry. Vessel-based bathymetry is spatially-smoothed as a function of the footprint (area of the narrow sounding beam projected onto the seafloor) size. The footprint size of the Yokosuka survey at a depth of 1000 m is ～35×35 m-43×55 m (～5% of water depth). In the vessel bathymetry, geographical features smaller than the footprint size, such as the hydrothermal chimney mounds, cannot be recognized. And seafloor morphology is slightly different from each other track surveys due to distribution of sounding points and measuring error. Standard deviations of depth differences between the AUV- and the vessel-based data were 2.67-3.08 m. The AUV bathymetry are assumed to be the "true" bathymetry, and therefore the precision of the vessel-based depth measurement (standard deviation of measuring error) is considered to be ～0.2-0.3 % of water depth.Simulated vessel-based bathymetric data "before and after" the seafloor displacement were made using AUV-based bathymetric data. The displacement was verified by comparing these simulated data using the analysis conditions that neither depth accuracy variation within the area nor locational errors of beam sounding points are allowed. We used the method of Fujiwara et al. [2011] to estimate horizontal displacement. As a result, we found that estimation error of the seafloor horizontal displacement depends on the precision of the depth measurement and is ～0.2-0.3 % of water depth. As for the seafloor vertical displacement, the smallest displacement that can be detected occurs when the horizontal extent of the deformation is larger than several times the size of the footprint, and in the situation that the amplitude of the depth difference is greater than the preci