An integration method for multiple sets of seafloor backscatter intensity data

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Acoustic backscattering of the seafloor is thought to provide a useful signal representing the existence of hard materials, such as lava flows with ferromanganese crust along the slope of seamount or knoll [1, 2], and ferromanganese nodules on the seafloor [3]. Previous investigations using vessel-equipped multi-narrow beam echo sounder (MBES) [1–3] identified variations of distributions over an area of tens or hundreds of square kilometres. Therefore, vessel-equipped MBES can provide a more economical exploration for vast areas than that provided by underwater apparatuses such as a deep-towed side scan sonar. However, a disadvantage inhibiting its use is that the different physical and technical parameters, such as sounder characteristics, observation period, and processing, yield different absolute values of backscatter intensity for the same area. As a solution, we propose a generally applicable method for obtaining the widespread distribution of deep-sea solid materials using a combination of several datasets of vessel-equipped MBES.

The Japanese exclusively economic zone (EEZ) around Minamitorishima Island in the western North Pacific is the best candidate area in which to analyse vessel-equipped multibeam backscatter data. This is due to the fact that several research cruises, operated by the Japan Agency for Marine-Earth Science and Technology (JAMSTEC), have obtained multiple sets of backscatter data, combined with bathymetry mapping. These data were obtained with an identical MBES (SeaBeam 3012. multibeam system) for each of the four cruises of *R/V Mirai*(MR14-E02, MR15-E01 Legs 2 and 3, and MR15-02) in 2014 and 2015, and with the other MBES (SeaBeam 2112.004 multibeam system) during a cruise of *R/V Yokosuka* (YK10-05) in 2010.

We identified two important components for successfully integrating several sets of backscatter intensity data collected by vessel-equipped MBES, as follows. (1) The folding points in the trend of the second-order differential values of the histogram of backscatter data correspond to the boundaries between different types of geology, e.g. barren pelagic sediment and dense ferromanganese nodules. (2) These thresholds each indicate that the same geologic boundaries appear at similar intervals in the histogram, even if the absolute values of intensity are different for each dataset. In particular, this latter component ensures linear fitting of the thresholds used to adjust each dataset to the arbitrary standard data. We need the confirmation of the geographical distributions of the identified boundary intensities between the different datasets. In this presentation, we will show an example of data integration for nine datasets to map the backscatter intensity of a region of approximately 155,500 km^2in the Japanese EEZ around Minamitorishima Island.

References: [1] Hirano et al. (2006) *Science***313**, 1426–1428. [1] Hirano et al. (2016) *Mar. Geol.***373**, 39–48. [3] Machida et al. (2016) *Geochem. J.***50**, 539–555.

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