High quiality 4-D active monittoring of an ocean bottom strucuture by inovative active seismic systems

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We have been developing new method and technology to monitor the geophysical and/or geochemical changes in time and space of an ocean bottom structure including some reservoirs such as methane hydrate, oil-gas and seabed resources by using an autonomous underwater vehicle (AUV) as an innovative observation platform.
The ocean system is a total system which consists of a physical, chemical, biological and earth's processes. Tokyo University of Marine Science and Technology is encouraging to develop the effective ocean survey technology and to educate students in order to contribute to an environmental assessment during an ocean development. A real time high-quality monitoring of the various environmental perturbations accompanying to underwater developments is very difficult but we know that the measurements of high-density high-quality accurate data in both 3-D space and 1-D time will be very effective and useful particularly by means of the resource such as AUV and ships. We assumed our survey target area including a reservoir is a relatively narrow squared area with several 100s meters to a few kilometers in length and about 2000 m in deoth. The steps in the study are: (1) to develop an active seismic monitoring system with active sources and receiver arrays by using AUV effectively combining with both a mobile observation system towing in water and a self-controlled observation system installed at the sea floor, and (2) to do test of both observation systems in water simultaneously in a target area. Then it is (3) to evaluate the data quality and quantity for detecting the geophysical changes of underground structure to establish the basic active monitoring method and technology in an oceanic area. Recently we have three major objectives of our study as follows: (A) to understand the seismological feature quantitatively from the wave field simulation with a reservoir of ocean bottom resources such as methane hydrate and submarine hydrothermal deposits as a target (*e.g.*, Tsuruga *et al.*, 2010; Tachibana and Tsuruga, 2015; Mogi and Tsuruga, in this meeting) and (B) to investigate a ACROSS field test to detect the changes of wave fields by an air-injection on a land area (*e.g.*, , Kasahara *et al.*, 2012; Tsuruga *et al.*, 2012) as well as (C) to develop observation system (*e.g.*,, Tsuruga *et al.*, 2013). In this report we show the preliminary results of the developments of portable seismic source system which is towed in water. We show that our active seismic source system and receiver array system have small IC tips of atomic clock and GPS system as an accurate clock in water. We could thus solve a big problem of clock precision in water.
In future after the observation system will be complete, we will do some field tests in oceanic area at the above mentioned step-(2) and finally we will progress to a new observation integrated strategy to monitor any other time-variant items of geochemical and biological observation as well as the geophysical ocean bottom structure.

Keywords: ocean bottom , 4D monitoring of understructure, development of ocean bottom resources, AUV

