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NX-2G : autonomous BBOBS-NX for a highly mobile broadband seismic observation at the seafloor

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We had developed the broadband ocean bottom seismometer (BBOBS) and its new generation system (BBOBS-NX), and, with them, several practical observations have been performed to create and establish a new category of the ocean floor broadband seismology, since 1999. Now, our BBOBS and BBOBS-NX data is proved to be at acceptable level for broadband seismic analyses. Especially, the BBOBS-NX is able to obtain the low noise horizontal data comparable to the land station in periods longer than 10 s, which is adequate for modern analyses of the mantle structure. Moreover, the BBOBS(T)-NX is under practical evaluation for the mobile tilt observation at the seafloor, which will enable dense geodetic monitoring.
The BBOBS-NX system must be a powerful tool, although, the current system has intrinsic limitation in opportunity of observations due to the necessary use of the submersible vehicle for the deployment and recovery. If we can use this system with almost any kind of vessels, like as the BBOBS (self pop-up system), it should lead us a true breakthrough of seafloor observations in geodynamics. Hereafter, we call the new autonomous BBOBS-NX as NX-2G in short. There are two main problems to be cleared to realize the NX-2G system. The first one is a tilt of the sensor unit on landing, which is larger than the acceptable limit of the sensor ($\pm 8^\circ$) in 47 % after our 15 free-fall deployments of the BBOBS-NX. As we had no evidence at which moment the tilt occurred, so it was observed during the BBOBS-NX deployment in the last year by attaching a video camera and an acceleration logger those were originally developed for this purpose. The only one result shows that the tilt on landing seemed determined by the final posture of the BBOBS-NX system just before the penetration into the sediment. The second problem is a required force to extract the sensor unit from the sticky clay sediment, which was about 80 kgf in maximum with the current BBOBS-NX system from in-situ measurements. This value is not so large to realize the self pop-up recovery system, but we need to pay attention to design the whole autonomous system for the reliable recovery. The function of the NX-2G is based on 3 stage operations like as the current BBOBS-NX system. The core mechanism to perform these operations has been developed for the ultra-deep OBS system in 2012, already. It was also examined that we can place any object close to the sensor unit as far as they were mechanically decoupled, in the sense of the seismic band noise induced by the bottom current.