Japan Geoscience Union Meeting 2015
(May 24th - 28th at Makuhari, Chiba, Japan)

SCG64-P15 会場:コンベンションホール 時間:5 月 27 日 18:15-19:30

ナガスクジラ鳴音から推定される海底表層の物理特性
Physical property of sea bottom surface estimated from fin whale vocalization

岩瀬 良一 [1*]
IWASE, Ryoichi[1*]

[1](独) 海洋研究開発機構 / CREST, JST
[1]JAMSTEC / CREST, JST

At the cabled observatory off Kushiro-Tokachi in Hokkaido, fin whale vocalizations, which have the frequency range of 15-20 Hz and the duration of about 1 second, were sometimes observed not only with hydrophones but also with ocean bottom seismometers (OBSs) mainly in winter seasons. By using the waveform data of both hydrophone and OBS at OBS1 at the observatory observed from 13:44 to 14:59 JST on December 10th in 2004, the location of the fin whale was estimated. The localization was done based on the incident orientation which was estimated from the horizontal particle motion observed with the OBS and the horizontal range between the OBS and the whale estimated from the time difference of multi-path arrival (TDOMA) in sound pressure data of a hydrophone which includes the reflection at both seafloor and sea surface. During the above observation period, 62 vocalizations were used, whose direct and multi-path arrivals were both identified. The waveforms were band-pass filtered between 10 and 25 Hz and the incident orientation of the particle motion was estimated by applying principal component analysis and by obtaining eigen vector of first main component. As a result it was found that the whale was moving south-south-east near the east of OBS1.

In the previous study carried out in the northeast Atlantic (Harris et al., 2013), the incident angle which was estimated from the apparent emergent angle in the sediments observed with the OBS was used instead of the TDOMA for the localization of the whale. However, the apparent emergent angle is affected by the density and P-wave (pressure wave) velocity of both sediments and water, and is also affected by SV-wave (share wave) velocity of the sediments, which are mostly unknown. This time, the author compared the apparent emergent angle in the sediments observed with the OBS with the incident angle estimated from the TDOMA in order to examine the consistency of those estimations. As a result, good correlation between the apparent emergent angle and the incident angle was confirmed, and the critical incident angle of pressure wave in seawater was estimated to be 60 degrees. Accordingly, the P-wave velocity in sediments was estimated to be about 1.7 km/s according to Snell’s law, assuming that sound velocity in water was 1.5 km/s and SV-wave velocity in sediments was very slow.
Keywords: fin whale vocalization, incident angle, apparent emergent angle, critical angle, seismometer, hydrophone