

Ocean Bottom Imaging using Multiple Reflected Water Waves Obtained by OBS

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OBS(Ocean Bottom Seismometer) provides wide-angle and multi-component data with great advantages for reflection and refraction seismics to investigate crustal seismic structures. OBS records are also used for tomographic analysis to estimate the velocity structure. In these studies, the sea bottom depth is one of the most important issues. We can use travel times of the direct water wave arrivals to estimate the OBS location, including the depth. However, due to the limited number of OBS, these OBS depth data are very sparse. Therefore we usually utilize other surveys, such as MCS or multi-beam bathymetric surveys, to obtain the ocean bottom profile. We propose the effective method to obtain the bottom profile only with OBS data, in cases where there are no MCS/SCS data

If we consider only direct water wave arrivals, it does not include ocean bottom reflections. On the other hand, the multiple event travels from the shot point to the ocean bottom, and from the ocean bottom to the sea surface and then from the sea surface to OBS. It therefore includes a single reflection from the ocean bottom, and the reflection (illumination) points are offset from the OBS location with fine spacing that is less than $1/3$ of the shot interval.

We adopt a migration technique to the multiple events in order to obtain the depth image of sea bottom. The first step is to mute the first arrival and to extract the multiple events in the OBS hydrophone data whose component contains clearest multiple events. We image the multiples with the assumption that the data were acquired at a virtual receiver position located at the top of the virtual water layer above the sea surface whose thickness is exactly same as the sea depth. We applied this method to OBS data acquired by JCG and JCSS, and generated ocean bottom images that are consistent with MCS/SCS data with comparable quality.