

## Direct determination of water-table depths and EM wave velocities using multiple offset GPR profiling data in peatland

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Bibai bog in Hokkaido is the only high moor peatland left in the Ishikari peatlands (60,000ha). Almost all bogs except Bibai bog have been reclaimed for farmlands, housing lands, etc. in last century. The total area of Bibai bog is now about 50 ha. The remaining bog is suffering from drying and ground subsidence by the drainage of water. To propose an appropriate management for Bibai bog preservation, deep understanding of the temporal and spatial variability of water table elevations at the site is needed.

To estimate water-table depths, we used ground-penetrating radar (GPR), one of the common non-destructive geophysical techniques to explore subsurface environment. GPR uses the reflections of electromagnetic (EM) waves in high frequencies. In many applications, GPR data are collected with the common-offset profiling (CO), in which the separation distance between a transmitter and a receiver is constant. However, it gives only travel time of reflected EM waves from an unknown reflector. To calculate the velocity of the EM wave, the common-midpoint (CMP) method, one of the multi-offset acquisition methods, is also used.

In this study, we collected CO profiling data with different antenna separations along a common survey line in Bibai bog. This approach allows us to directly estimate the EM wave velocity at all measurement locations without performing a common multi-offset acquisition method, such as the CMP method. In this survey, 7 CO data with 7 different antenna separations varying from 60 cm to 120 cm were collected along survey lines in and around the bog. As a result, we could calculate the average EM wave velocity and gain the velocity distribution every 5cm along the survey lines. In addition, we could determine the shallow water-table depths directly by using multiple offset GPR profiling data.