# Antipodal seismic observation and sensitivity kernel for liquid region on the top of the Earth’ s Inner Core

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The Earth's inner core is thought to have been formed by the precipitation of iron from the fluid outer core. It is considered that a part of the inner core surface where iron in the fluid outer core is precipitated may be melted and formed a mushy region, but its position is not well understood seismologically. We recently analyzed seismic waveforms observed at the antipodal station of the seismic source and showed that there are clearly observed precursors to reflections beneath the inner core boundary from deeper in the inner core (Butler and Tsuboi, 2021). It has been found that this precursory wave can be successfully modeled as a reflection under the liquid / solid interface at a depth of 100 km below the inner core boundary. In this study, we use these precursor waves of the lower reflection at the inner core boundary observed at the antipodal station (> 179˚). The sensitivity kernel for the shear wave velocity structure on the inner core surface was calculated by the adjoint method corresponding to these precursor waves, using theoretical seismic waveforms. The location of the fluid region was identified using the obtained sensitivity kernel. Our results show two regions of the inner core surface where the shear wave velocity is close to zero and is considered fluid. These results may provide seismological evidence and new insights to the origin of the earth's magnetic field.

 