ÉCOLE DOCTORALE SCIENCES DE LA TERRE

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TITRE du SUJET: Study of the inner core boundary topography

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The inner core boundary (ICB) is a major boundary in the earth's internal structure, which corresponds to the solid-liquid phase change in iron at the pressures of the core. Its detailed properties, such as its shape, the density jump across it, as well as its topography are important constraints for understanding the dynamics of the core, and, ultimately, the generation and sustained character of the earth's magnetic field.
In particular, height and wavelength of its topography can help determine the viscosity of the earth's inner core, as well as possible coupling between the inner core and the flow in the outer core. Also, the region right above the ICB, the so-called "F layer" has been shown to have distinct properties from the rest of the outer core.
Several years ago, using earthquake doublet observations, we determined the likely presence of topography with a horizontal wavelength of ~10-15km, and a height of less than 0.5 km, in a particular particular region of the inner core. For this study, we used the comparison of amplitudes of the refracted PKP(DF) phase and the ICB reflected PKiKP phase in a favorable distance range. Topography was inferred from anomalies in the amplitude ratio of these two phases. Other authors have documented the presence of topography in other locations of the ICB.

The goal of this thesis project is to extend our methodology based on PKP/PKiKP amplitude ratios to the global scale, in order to better constrain the ICB topography and its possible lateral variations. The methodology may be also extended to a wider distance range in some regions by applying array processing approach recently developed in our group that allows better phase separation through the introduction of scale-dependent slowness filters. Other phases sampling the inner core may also be explored during this thesis.