Exploiting Seismic Waveforms of Ambient Noise and Earthquakes

Thesis by

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To my parents.

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Abstract

In this thesis, I apply detailed waveform modeling to study noise correlations in different environments, and earthquake waveforms for source parameters and velocity structure.

Green's functions from ambient noise correlations have primarily been used for travel-time measurement. In Part I of this thesis, by detailed waveform modeling of noise correlation functions, I retrieve both surface waves and crustal body waves from noise, and use them in improving earthquake centroid locations and regional crustal structures. I also present examples in which the noise correlations do not yield Green's functions, yet the results are still interesting and useful after case-by-case analyses, including non-uniform distribution of noise sources, spurious velocity changes, and noise correlations on the Amery Ice Shelf.

In Part II of this thesis, I study teleseismic body waves of earthquakes for source parameters or near-source structure. With the dense modern global network and improved methodologies, I obtain high-resolution earthquake locations, focal mechanisms and rupture processes, which provide critical insights to earthquake faulting processes in shallow and deep parts of subduction zones. Waveform modeling of relatively simple subduction zone events also displays new constraints on the structure of subducted slabs.

In summary, behind my approaches to the relatively independent problems, the philosophy is to bring observational insights from seismic waveforms in critical and simple ways.

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