Modeling Local and Regional Wave Propagation

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Seismograms reflect the combined effects of the source, recording instrument, ambient noise, and the propagation path. Especially for recording at distances smaller then 10° the signal is affected mainly by the crustal structure, as waves propagate in the crust and/or along Moho. Therefore appearance of regional seismograms varies strongly, which complicates record interpretation and phase identification severely.

However, for earthquakes with small magnitudes, close distance records are the only ones available with a sufficient signal at all. Due to sparse seismic station coverage and the use of only the most distinct phases, typically Pg and Sg, localization can not always be ensured. Yet, retrieving accurate earthquake location, including depth information and the relation with faults is important for understanding tectonic processes and for estimating seismic hazard. Prior works by e.g. Ma (2010) show the benefit of using additional regional phases for localization, in particular depth. At local and regional distances the challenge lies in robustly detecting and identifying these phases correctly, which are usually superimposed by the coda of the P- and S-phase and sometimes even arrive simultaneously.

In this work we want to shed light on the different influences on seismograms at local distances < 200 km. Starting with a simple crust-mantle model we calculate seismic recordings for sources at varying distances and depths. In addition we look at the changes induced by source mechanisms at diverse azimuths surrounding the source. Particularly the change in amplitude, time and frequency induced by the varying parameters is investigated. According to the phases identified in the diverse synthetic record sections, an overview of propagation characteristics is given. Our goal is to understand the usable information content of regional phases. Based on this information the theoretical performance of methods for identification of additional regional phases can be estimated.