

Using PKiKP coda to study heterogeneity in the top layer of the inner core beneath North and Central America

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Significant lateral variations of the inner's core properties, such as the large-scale hemispherical pattern and depth variations, have been constrained by a variety of seismological observations. However it is still unclear what or which dynamic processes in the inner core are responsible for these seismological observations. Small scale volumetric heterogeneity has been detected in the top layer of the inner core by PKiKP coda observations. Studies of these small scale heterogeneity can provide critical information, such as the alignment or misalignment of iron crystals, possible partial melt and the grain size of iron crystals, to constrain the dynamic processes of the inner core. However most previous observations sampled the inner core beneath Pacific and Asia regions which is the "eastern" hemisphere. We use seismic stations in the United States, especially the Earthscope Transportable Array (TA) to look at PKiKP and its coda waves. We found 21 events with clear PKiKP and/or its coda observations. The distance for these PKiKP observations ranges from short distance to 95° . In agreement with in previous studies, inner core scattering (ICS), resulting in strong PKiKP coda, is observed at the distances of 35° - 90° . However, the ICS we observe in these 21 western hemisphere events is weaker than previously reported estimations for the Eastern hemisphere. Moreover, the ICS duration is only 30-35 seconds (Figure 1) which is also much shorter. Comparing our observations with numerical simulations, we conclude that this relatively weak ICS with short duration requires small scale heterogeneity concentrated in the top layer ($\sim 100\text{km}$) of the inner core beneath Central America. Our clear observations and previous studies show the hemispherical difference or regional variations of small scale heterogeneity in the inner core.

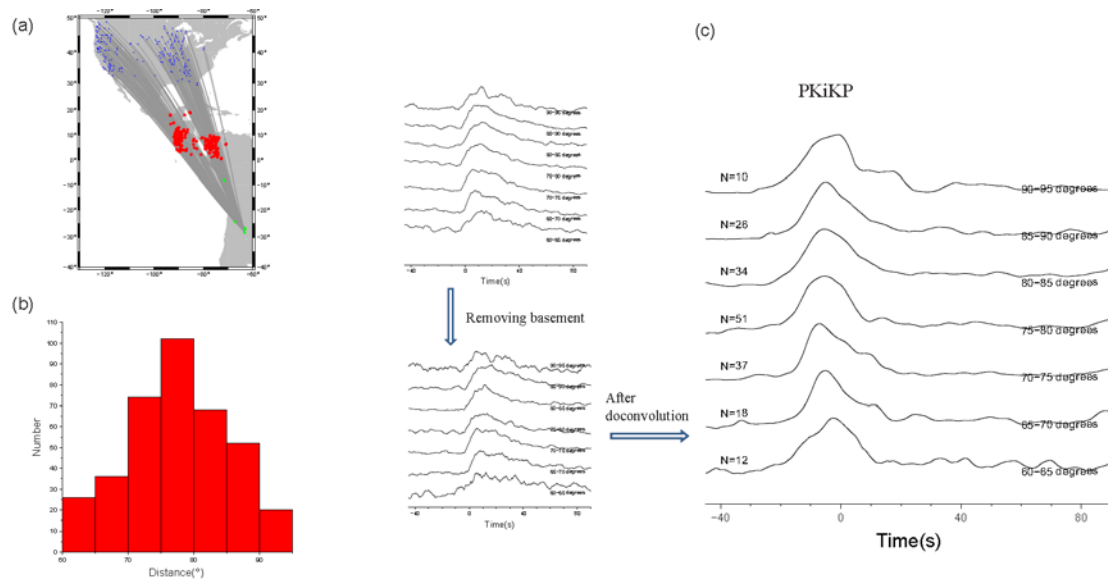


Figure 1. Map and stacking results for all the clear PKiKP observations at large distances. (a) The geometry of stations (blue triangles), bounce points (red circles) and events (green stars). (b) The histogram of records used in Figure 1(a). (c) The stacking results for 5 degree bins.