PKKP scattering in the lower mantle resolved by small aperture arrays

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Why scattering?

- Sensitive to small-scale heterogeneities of velocity and density
- CMB topography (roughness)
- PKP; PcP; $P_{\text{diff}}$; PKKP

[Hedlin and Shearer, 2000]
Phonon-scattering synthetics
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• Distances < 70 deg

• Magnitudes $m_b$ > 6.0

YKA: 697 events

GBA: 633 events

UNIVERSITY OF LEEDS
01-MAY-1990_16:12 ⇒ YKA

Lat: 58.82°
Lon: -156.86°
H: 211 km
$M_b$: 6.3
$\Delta$: 20.58°
$\Theta$: 278.82°

**Energy Maximum**

$u_{\text{max}} = 3.7$ s/°

$\Theta_{\text{max}} = 146°$
17-JUN-1996_11:22 ⇒ GBA

Lat: -7.14°
Lon: 122.59°
H: 587 km
$M_b$: 7.9
$\Delta$: 49.35°
$\Theta$: 111.95°

**Energy Maxima**

$u_{\text{max}} = 2.7 \text{ s/}^\circ \text{ and } 2.4 \text{ s/}^\circ$

$\Theta_{\text{max}} = 218^\circ \text{ and } 28^\circ$
YKA: 65 scattering events
GBA: 28 scattering events
Homogeneous heterogeneities

Heterogeneities At Edges

CMB Topography

South Africa

CMB
Summary/Outlook

- PK•KP originates from scattering at or above PKPK PKP CMB bounce point
- PK•KP can be observed undisturbed in a large distance range
- No cross-over phases
- Only sensitive to CMB topography and D” heterogeneity
- Small-aperture arrays are able to detect PK•KP
- Strong scattering beneath:
  - African anomaly
  - Central America
  - Patagonia (previously undetected)
- Synthetic modeling to constrain scattering parameters
END
PK•KP scattering facts:

- High frequency arrivals ⇒ Best observed between 0.9 and 2.1 Hz
- Characteristic slowness pattern ⇒ outer core slowness peaks
- Large observation distance ⇒ 0° to ~70°
Dataset

• Distances < 70 deg

• Magnitudes $m_b$ > 6.0

• Depth $h$ > 100 km

YKA: 697 events (from 1990 to 2005)

GBA: 633 events (from 1985 to 1996)