Near-surface shear-wave retrieval from traffic noise and earthquakes

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Road
Railway
Receiver line

500 m
Traffic noise
Cross correlation

Receiver number

Time (s)

$u(r_A)u^*(r_B)$
Cross correlation

Receiver number

Time (s)

0
1
2
3
4
5
Deconvolution

Receiver number

Time (s)

\[ \frac{u(r_A)}{u(r_B)} \]
Deconvolution

Receiver number

Time (s)

0 1 2 3 4 5

50 100 150 200
Cross coherence

\[ u(r_A) u^*(r_B) \]

\[ \frac{1}{|u(r_A)| \| u(r_B) \|} \]
Cross coherence

Receiver number

Time (s)
Cross coherence

Receiver number

Time (s)
- NMO correction
- CMP stack
- Time migration
- Depth conversion
Image from traffic noise
Image from traffic noise
Image from active sources
Image from traffic noise
KiK-net

Longitude
Latitude

128°E  132°E  136°E  140°E  144°E  148°E

32°N  36°N  40°N  44°N  48°N

National Research Institute for Earth Science and Disaster Prevention
KiK-net

Latitude

Longitude

NIGH13

32°N
36°N
40°N
44°N
48°N
128°E
132°E
136°E
140°E
144°E
148°E
Earthquake Records

\[ D = \frac{\text{surface trace}}{\text{borehole trace}} \]

Deconvolve

Time (s)

north-south

east-west

surface

borehole

surface

borehole

0 10 20 30 40 50
Yearly stack
Yearly stack

from logging data

Time (s)
velocity

Mountain sites (older than the Paleogene Period)

geomorphology

http://www.gsi.go.jp/
Shear-wave splitting
Deconvolved wavefield
Deconvolved wavefield
Arrival times

t(North-South)
t(polarization)
Hard rock sites (> 600 m/s)

- Fast shear polarization
- Plate motion from GPS (Segiya et al., 2000)
Conclusion