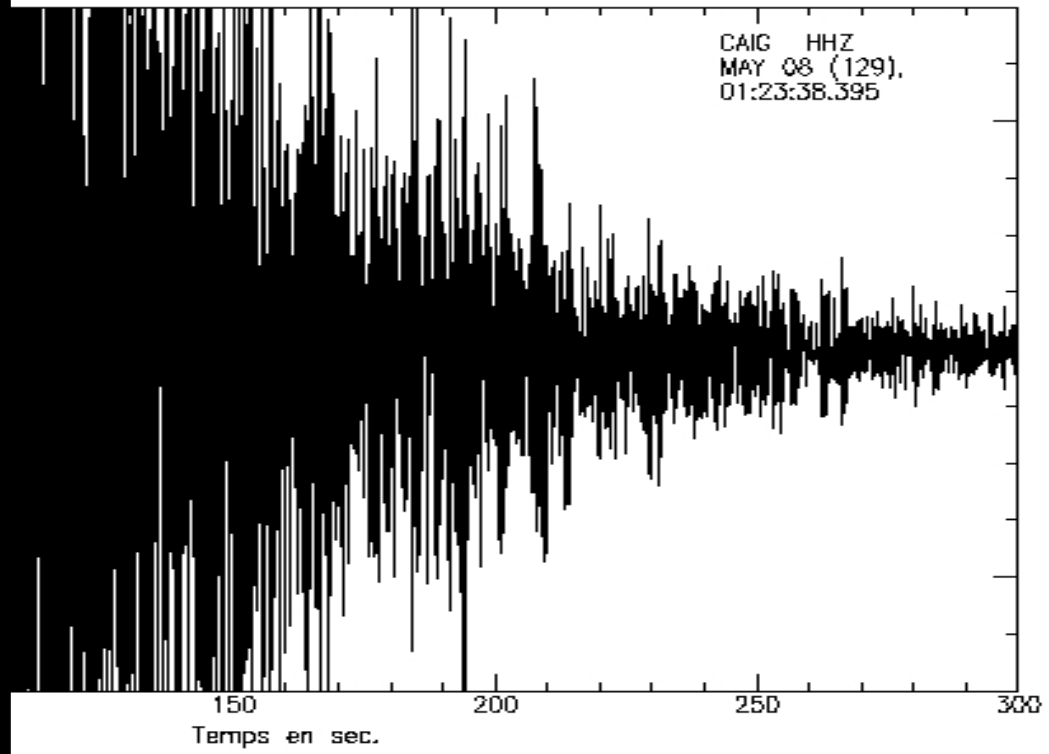
LGIT Grenoble

Equipe Ondes et Structure



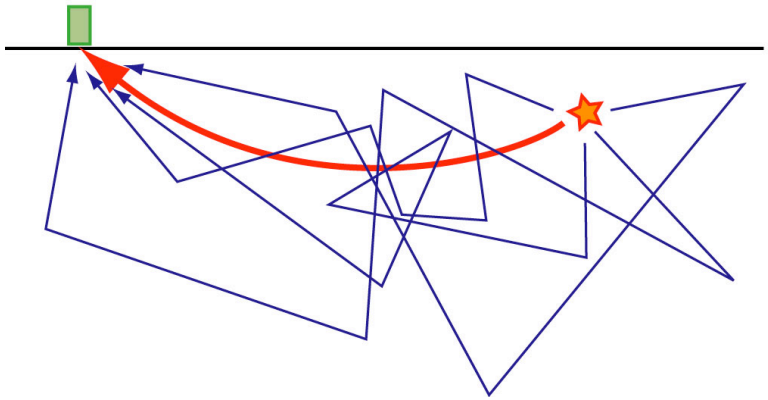
Imagerie passive: perspectives de nouvelles techniques sismologiques

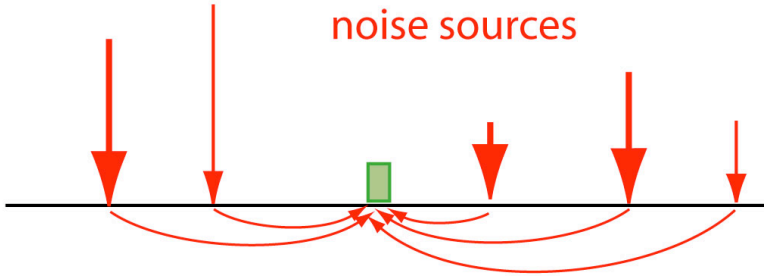
UNIVERSITE JOSEPH FOURIER
SCIENCES TECHNOLOGIE MEDECINE
GRENOBLE 1

CNRS CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE

Seismic coda and ambient seismic noise - random seismic wavefields

Coda - result of multiple scattering on random inhomogeneities





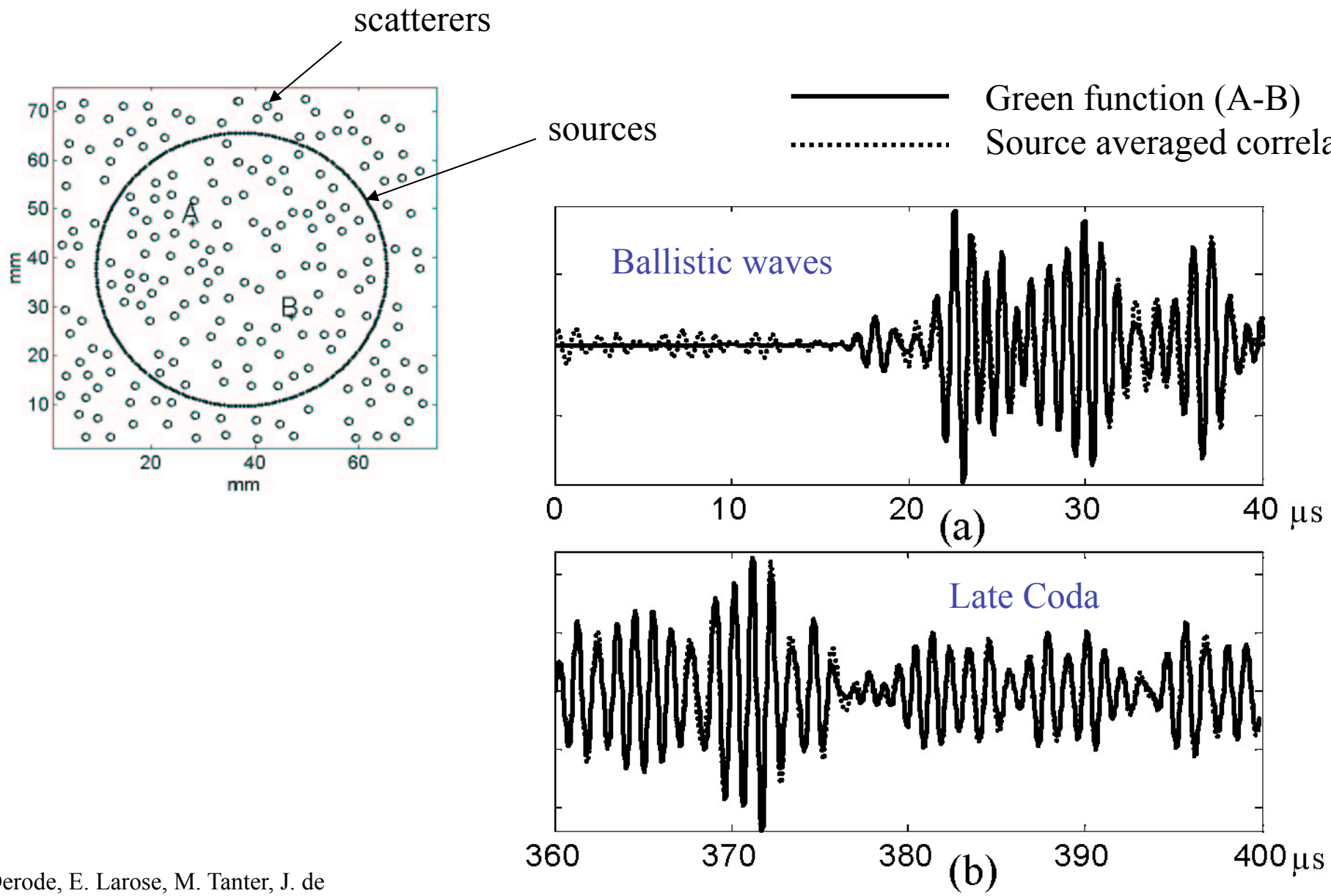
Noise - seismic waves emitted by random ambient sources

Corrélation spatiale et fonction de Green

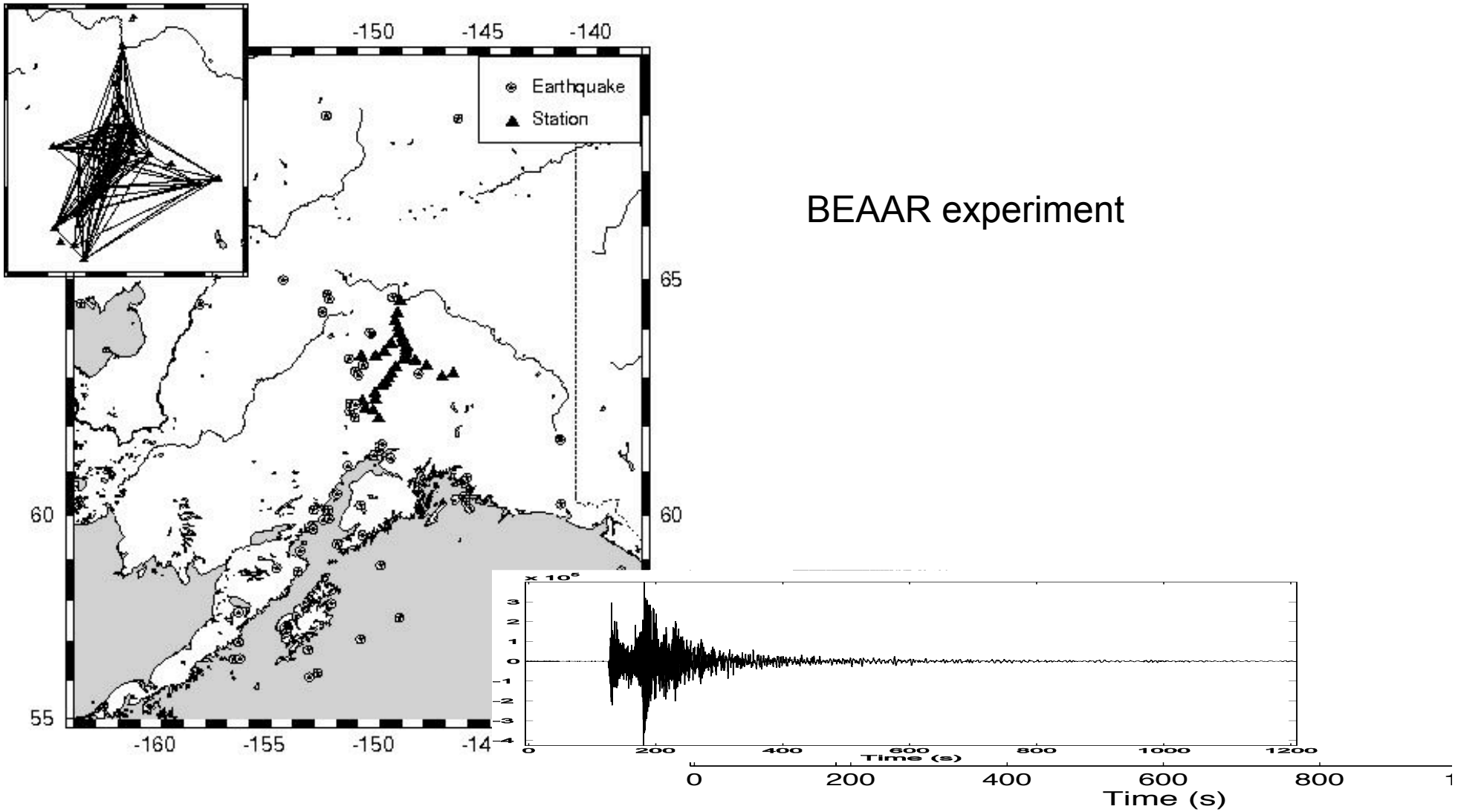
(champ diffus ou moyenne sur une distribution de sources)

$$\left\langle u_i(\mathbf{y},\omega)u_j^*(\mathbf{x},\omega)\right\rangle = -4\mu E_S \,\mathrm{Im}\left[G_{ij}(\mathbf{x},\mathbf{y},\omega)\right]$$

Numerical simulation in an open medium:

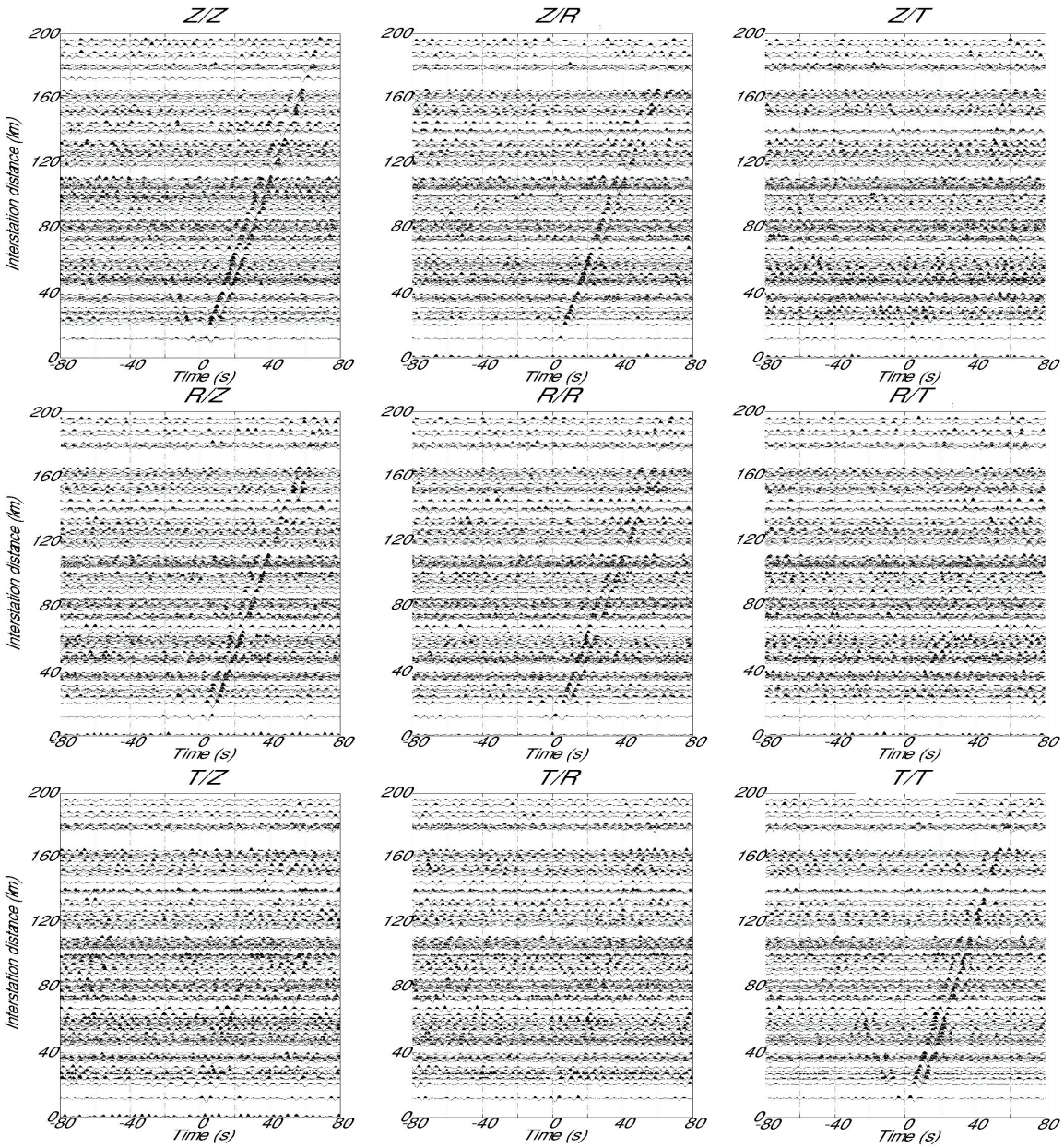


A. Derode, E. Larose, M. Tanter, J. de Rosny, A. Tourin, M. Campillo and M. Fink (2003), Journal of the Acoustical Society of America 113, 2973-2976.



BEAAR experiment

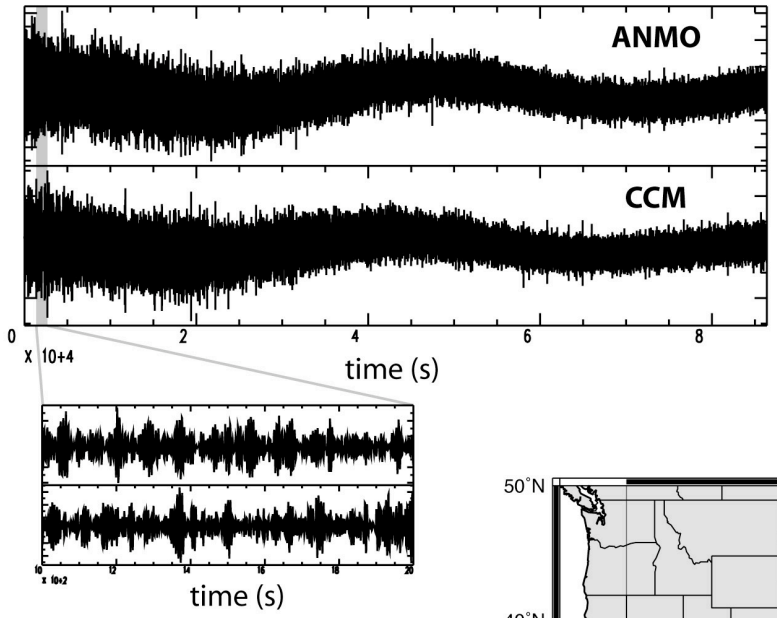
Sections constructed from cross-correlations of coda from regional earthquakes (Paul et al., 2005)



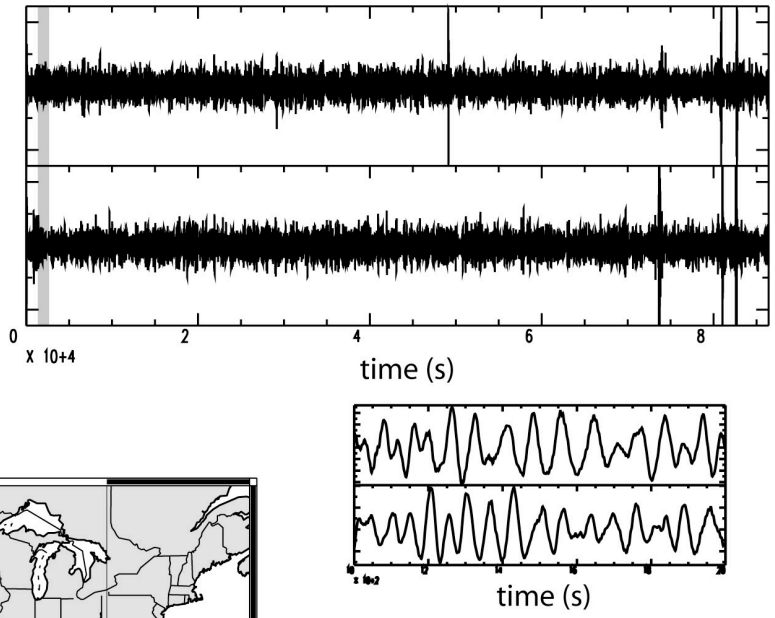
Symetries of the Green tensor

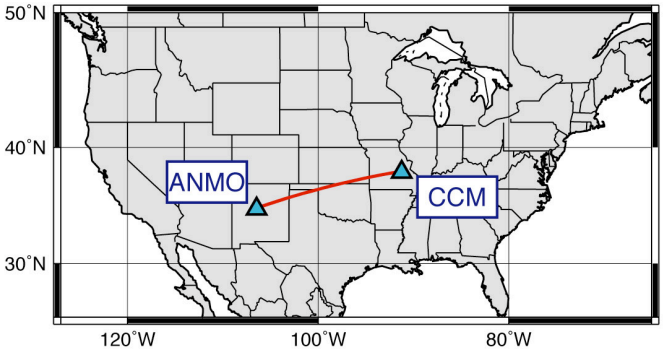
‘observation’ of the acausal field

1. Raw data (January 18, 2002)

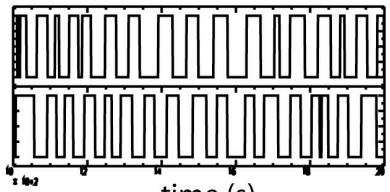


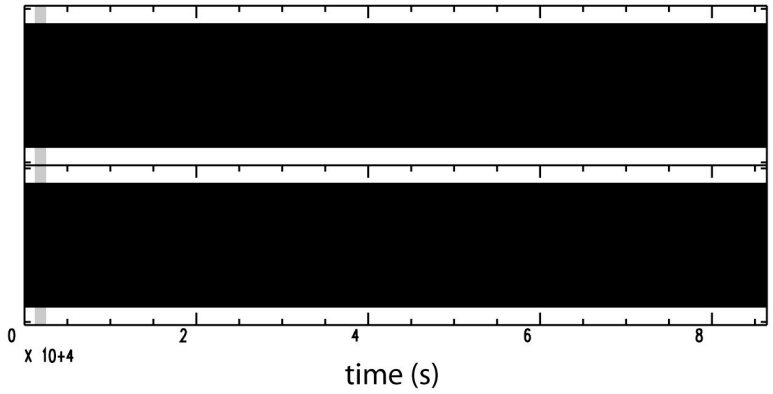
2. Filtered seismograms (0.01-0.025 Hz)





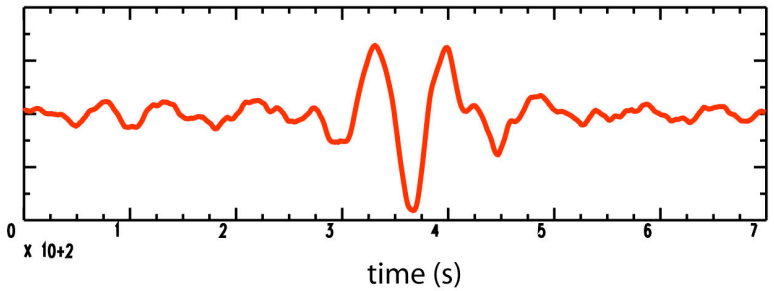
3. One-bit normalization





4. Computing cross-correlation

5. Stacking results for 30 days



Comparison between earthquake records and reconstructed response

event 1 12/31/1997 20:36:47 M = 4.8
event 2 02/10/2001 21:05:05 M = 5.3

signal from earthquake

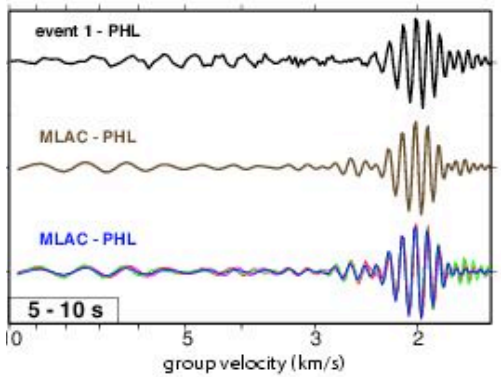
one-year cross-correlation (2002)

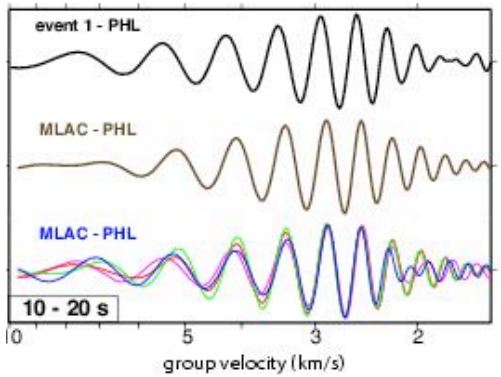
one-month cross-correlation (January, 2002)

one-month cross-correlation (April, 2002)

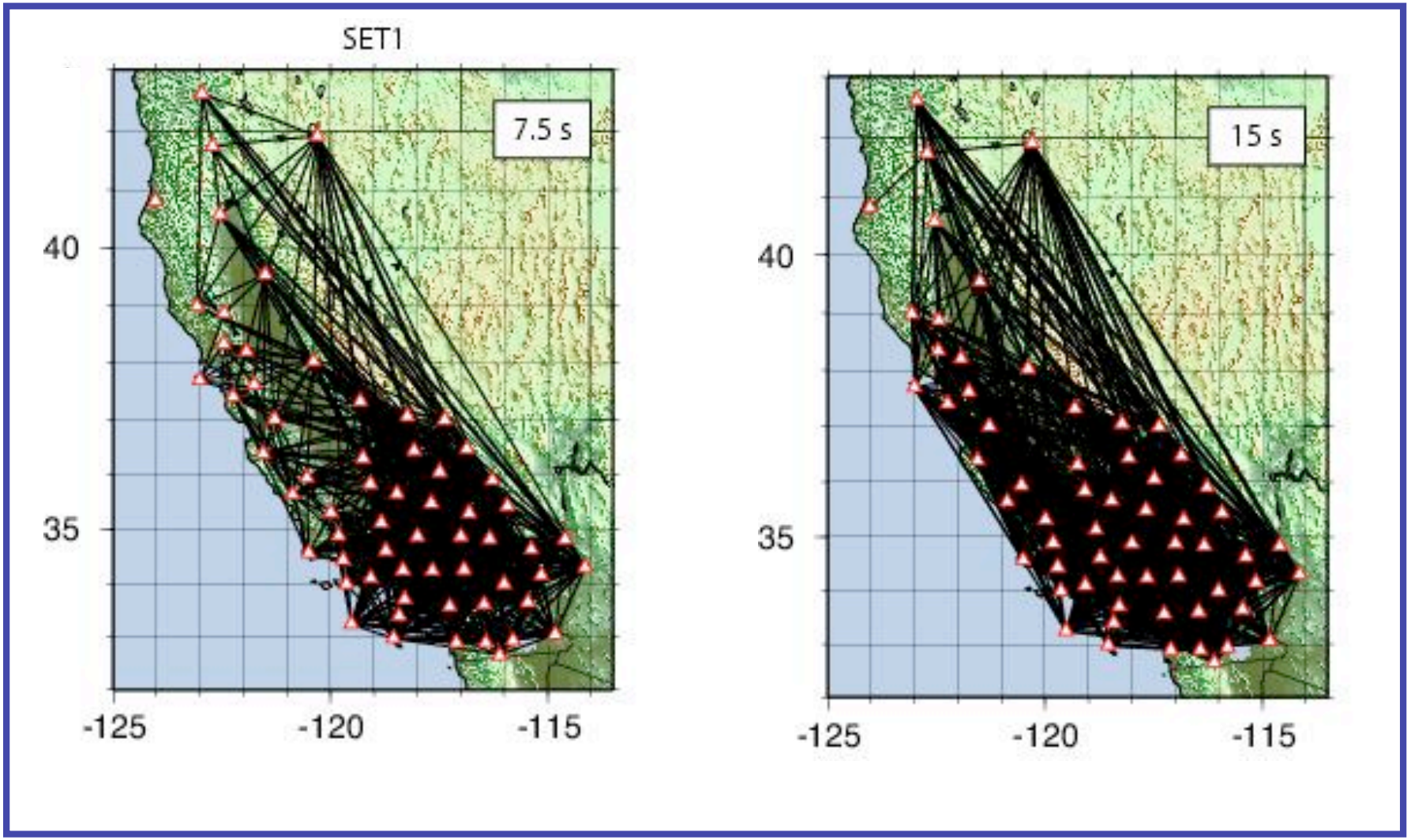
one-month cross-correlation (July, 2002)

one-month cross-correlation (October, 2002)

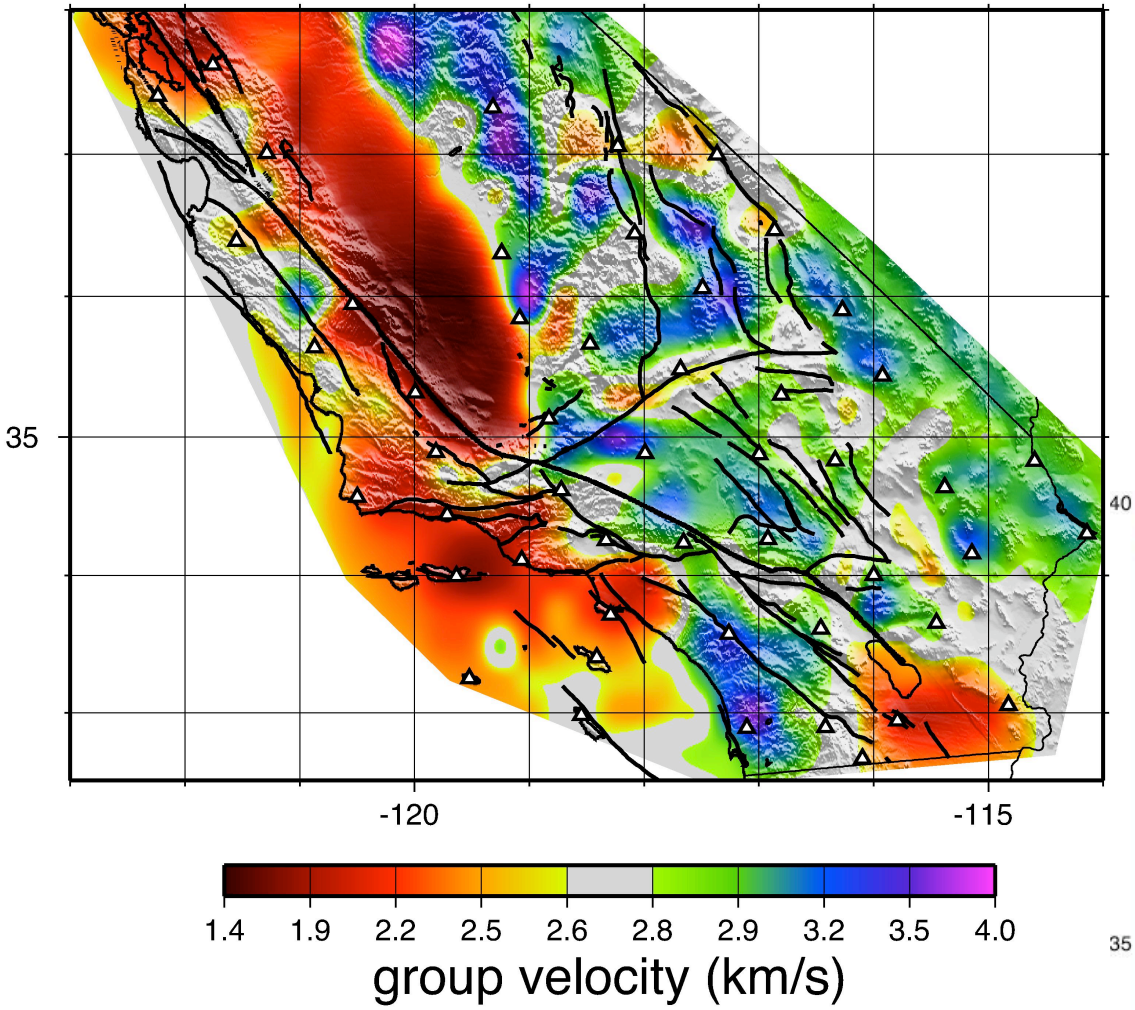


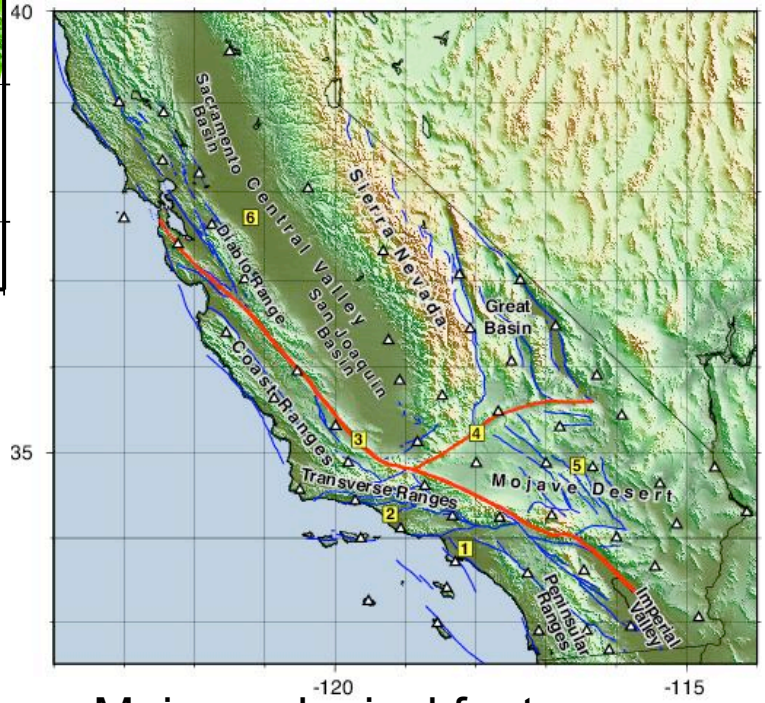


Path coverage with reconstructed GF (~3000 pairs)



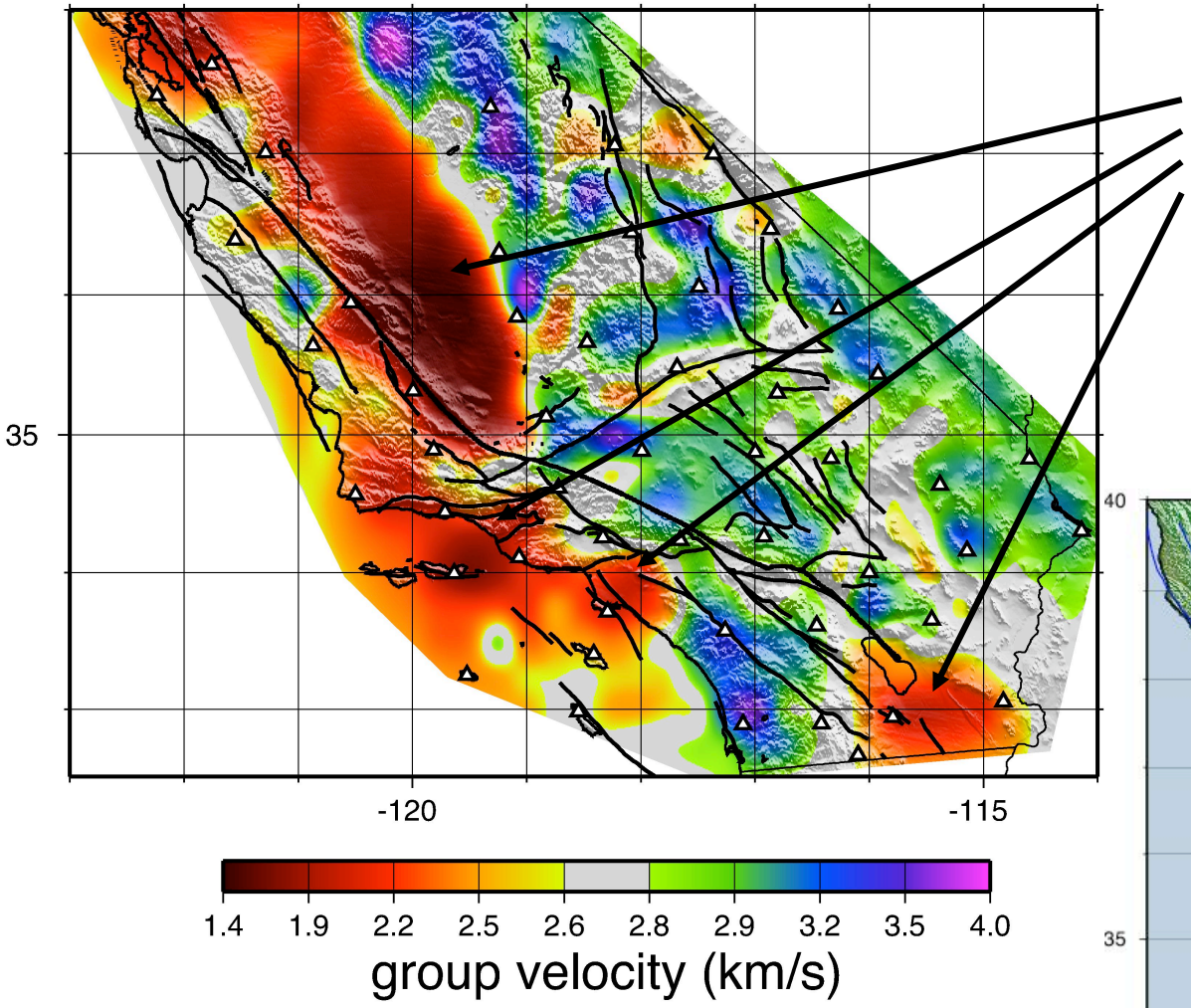
High resolution velocity map obtained from noise (Rayleigh 7.5 s)



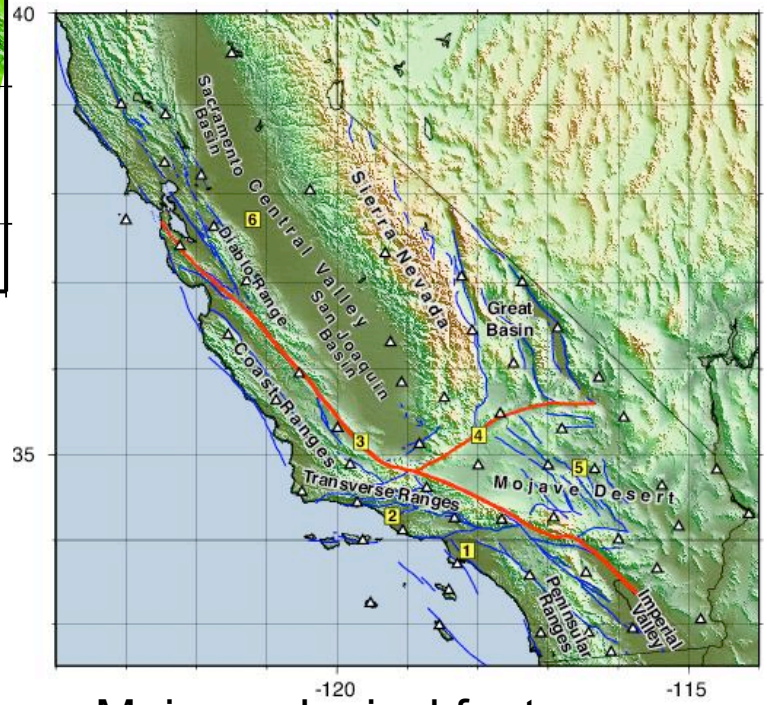


Main geological features

High resolution velocity map obtained from noise (Rayleigh 7.5 s)



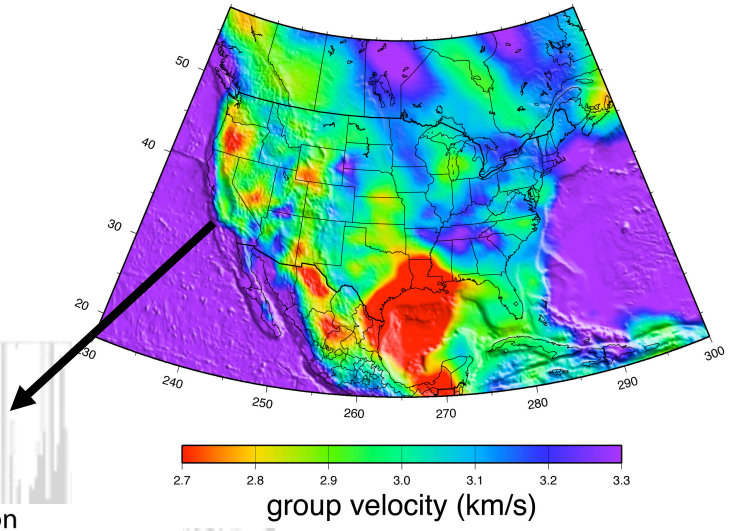
Sedimentary basins
(➔S wave velocity)

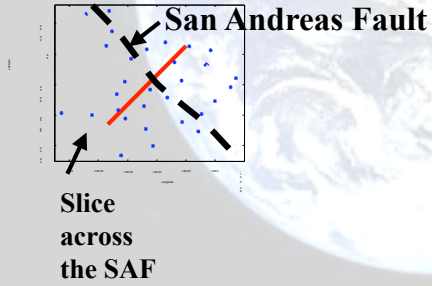


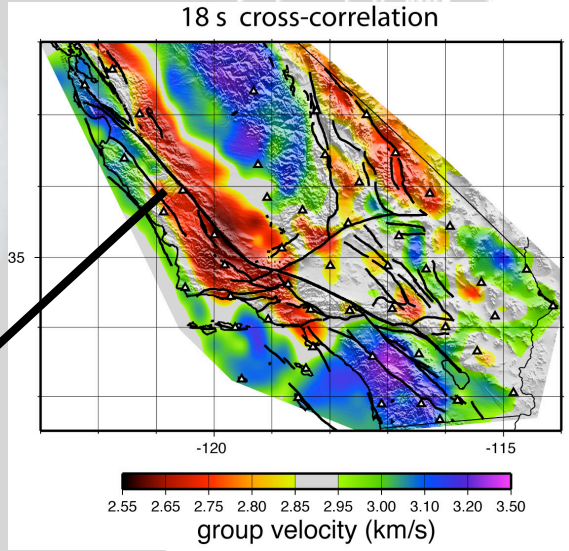
Main geological features

Utiliser les ondes sismiques pour comprendre les structures internes de la Terre à toutes les échelles

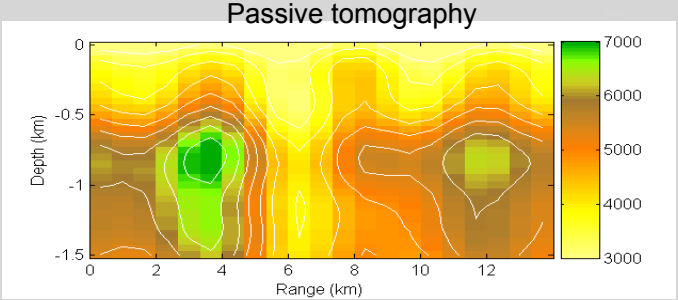
Croûte-lithosphére (~100 km)
Analyse de données déjà acquises:







Passive tomography



(Roux et al., 2005)