Ambient noise attenuation tomography of Love & Rayleigh waves applied to the Ramona reservation linear array across the San Jacinto Fault Zone

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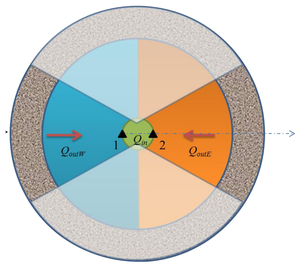
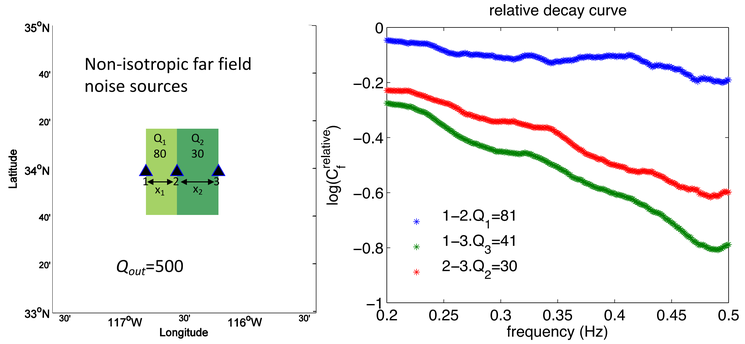
Summary

- Our attenuation inversion method is based on Liu et al. (2015) using linear triplet of stations
- Application to the dense 3C linear array crossing the San Jacinto Fault in Ramona, CA
  - Fundamental mode Rayleigh and Love wave phases
  - Attenuation tomography maps reveal new information in addition to velocity tomography
  - Shear velocity radial anisotropy and possible shear attenuation anisotropy

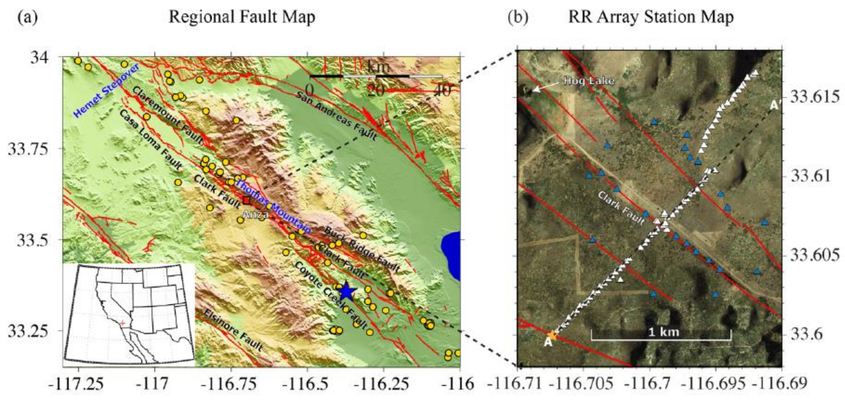
Theory: linear triplet of stations & amplitude ratios





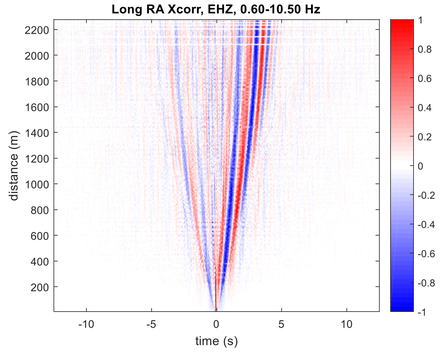
- Stationary phase zone
- Forward model: linear triplet of stations and different Q values
- Inversion: take log of amplitude ratios and apply linear regression for Q

Linear Ramona array and San Jacinto Fault (Clark Fault)

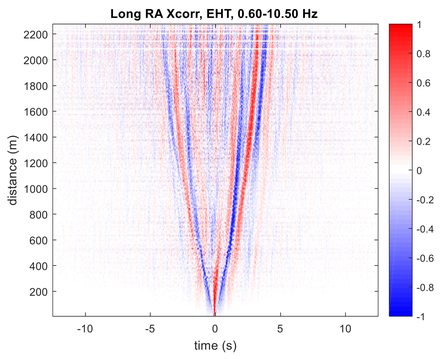


Map from Wang et al., 2020

ZZ component: Rayleigh wave

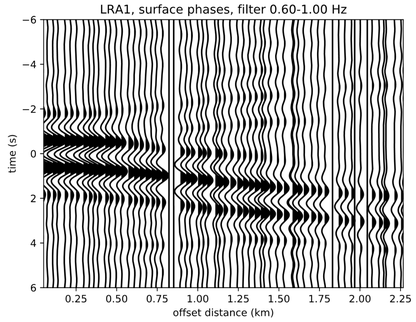


TT component: Love wave

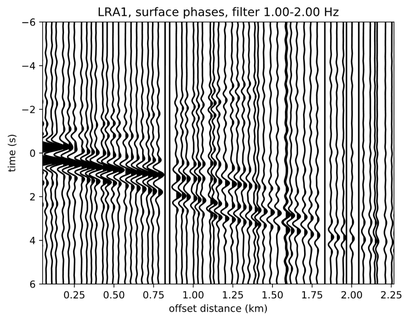


Extracting amplitude information from ZZ (vertical) & TT (transverse) components

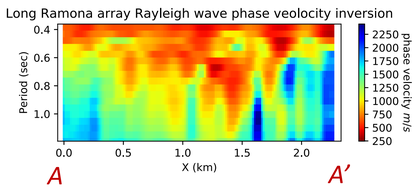
(ZZ) Leftmost virtual source: 0.6-1.0 Hz



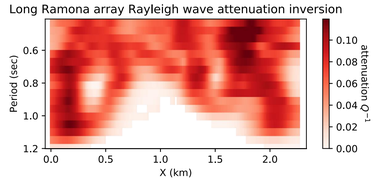
(ZZ) Leftmost virtual source: 1.0-2.0 Hz



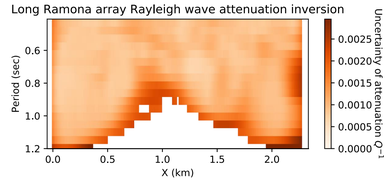
Rayleigh wave phase velocity and attenuation



- Phase velocity inversion
- Linear least-square with neighboring smoothing

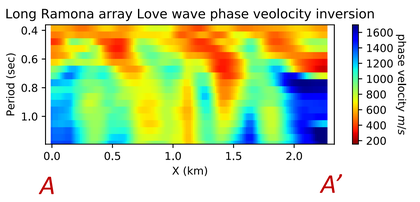


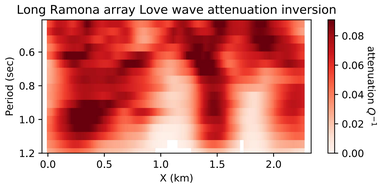
- Attenuation Q^{-1} inversion
- Linear least-square with neighboring smoothing

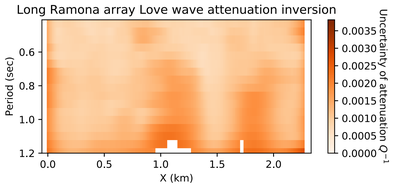


- Attenuation Q^{-1} uncertainty
- Derived from noise cross-correlation amplitude uncertainty

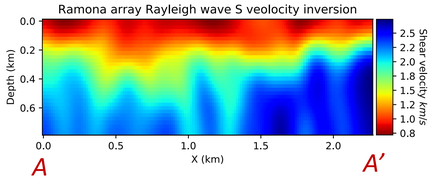
Love wave phase velocity and attenuation



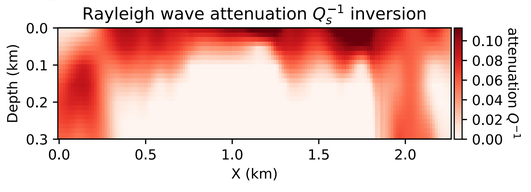




Shear velocity and attenuation tomography from Rayleigh wave

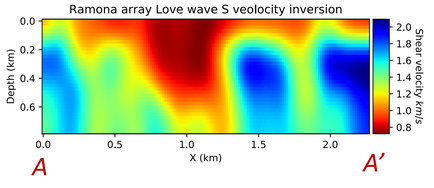


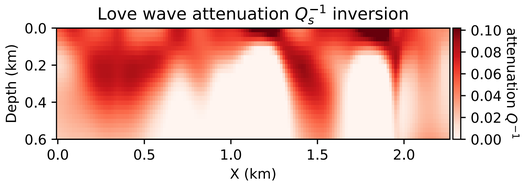
- Shear velocity inversion using MCMC
- Gaussian smoothing filter



- Shear attenuation depth conversion based on inverted shear velocity

Shear velocity and attenuation tomography from Love wave





Conclusion

- We derive reliable amplitude information with uncertainty and improve the linear triplet attenuation inversion approach
- Shear attenuation tomography results are preliminary and they complement the shear velocity tomography results
- Our attenuation tomography results for the Ramona array generally agree with the geological map of regional fault traces for Clark Fault

References

Liu, X., Ben-Zion, Y., & Zigone, D. (2015). Extracting seismic attenuation coefficients from cross-correlations of ambient noise at linear triplets of stations, *Geophys. J. Int.*, 203, 1149–1163, https://doi.org/10.1093/gji/ggv357

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