Insights into the dynamical characteristics of microseism oscillations

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Microseism time-series are non-stationary, non-linear and stochastic. These characteristics can be produced by a forced, non-linear, damped oscillator, which also can explain notable observed features such as (a) variations in the frequency of the primary peak (~0.14 Hz) and secondary peak (0.07 Hz) of microseism (b) variations of amplitude of power spectrum in stormy and rainy conditions. Numerical simulations suggests that (1) the primary peak is caused by competitive interactions between the medium's resonant response and external harmonic forces and (2) the secondary peak is generated by the activity of coastal waves or as a subharmonic of the resonant frequency and finally (3) large amplitude variations between stormy and quiet days are due to variations in source (storm) distances. Further study was conducted on microseisms recorded at eastern Pyrenees, ~50 Km away from the Mediterranean Sea. Results show strong evidences that microseism time-series are stochastic. A toy model consisting of a forced, damped nonlinear oscillator, whereby the force term is made of two harmonic forces and additive white noise, was used to understand the underlying mechanism(s). Conclusions were made that noise contribution is essential in modeling spectral properties of recorded microseisms and to assimilate it to the ever-present local, high frequency noise.

References

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