Investigating seismic background noise with six degrees of freedom ground motion measurements

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The movement in the oceans perpetually generates vibrations in the earth crust, which are recorded by seismic sensors across the globe as a continuous background noise. The analysis of this ambient seismic noise brings us tools, such as noise interferometry, with which we can improve our understanding of transient processes in the Earth crust, and produce detailed images of its structure. At the same time, the variations in the seismic noise also provides us with information about the source phenomena that generate it.

A single seismic station that is able to record both rotations and translation can replace some functionality of an array of seismometers: with a single point measurement, the direction towards a seismic source can be determined. We use the densely-spaced Pinyon Flat array to calculate 3 components of array-derived-rotations, and use these to map oceanic sources of ambient noise in the Pacific Ocean. These source directions are compared to those obtained with classic beamforming methods.

Furthermore, we examine the ocean-generated noise recorded by the G-Ring and ROMY ring lasers, and show that both are able to detect the secondary microseism band signal. We investigate the possibility of retrieving the rotational impulse response through noise interferometry with rotational signals by cross-correlating signals recorded at both locations.