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Stabilization of energy ratios in the long period seismic coda

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We study the energy partitioning and polarization of seismic waves in the long period (50-150s) seismic coda of large earthquakes. At short lapse time, normal mode calculations in PREM reproduce satisfactorily both the energy decay and polarization of the data. At late times ($t>20000$ s), we observe a complete depolarization of the horizontal components of the signal and a departure of the vertical to horizontal kinetic energy ratio from synthetic calculations in PREM by a factor larger than 5. While the calculated ratio steadily increases with time because of the relatively higher Q of the spheroidal modes, the data show a clear stabilization of the V/H kinetic energy ratio around 1.5. This observation implies that a significant amount of spheroidal energy is converted to toroidal energy by distributed heterogeneities inside the Earth. We propose to interpret the energy stabilization as a signature of multiple scattering of surface waves. In this propagation regime, an energy equipartition among all the modes in a narrow frequency band is expected, which results in an energy stabilization. In elastic media, the H/V kinetic energy ratio can be theoretically predicted based on the shape of the modes eigenfunctions. To test equipartition theory in a simple configuration, we calculate Spectral Element synthetics in a sphere with homogeneous background and distributed heterogeneities. We verify that various energy ratios indeed converge to the theoretical equipartition predictions. Our current research focuses on the prediction of equipartition energy ratios in a realistic heterogeneous earth both from theoretical and numerical calculations.