

# Potential mechanisms of ground vibration before earthquakes

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## Abstract

Continuous ground velocity and surface displacement data retrieved from broadband seismometers and ground-based GNSS stations were examined, respectively, to mitigate limitation of dynamic ranges of instruments. Significant enhancements of amplitude at frequency of  $8 \times 10^{-5}$ – $2 \times 10^{-4}$  Hz (i.e., approximately 3.5–5.5 hours in period) distributed in areas with epicentral distance  $< 300$  km that was commonly observed about 10–15 days before sample earthquakes. Despite of fault types of earthquakes, we assumed that earthquake-related stress loads in an object with a cylinder sharp perpendicular to the Earth's surface, where the top is the surface and the height is a thickness of the crust, exciting crustal vibrations in the associated frequency band. If enhancements are dominated by resonance of a stressed cylinder, mass of it is about  $3.75 \times 10^{18}$ – $2.34 \times 10^{19}$  kg. A radius of a cylinder is approximately ranged between 100 km and 300 km, while the density and the height is given by  $2700 \text{ kg/m}^3$  and 30 km, respectively. Common behaviors of crustal resonance at low frequency result in uplift and depression of the Earth's surface in wide areas that would be dominant ground motion exciting numerous pre-earthquake anomalous phenomena what we are looking for a long time.