Relationships between seismogenic areas and crustal vibration before earthquakes

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Earthquake catalogs with a duration of 10 years in Taiwan and Japan are constructed by using dense seismic arrays that are utilized to determine seismogenic zones in this study. We assume that entire earthquakes are “crack” in the crust. In contrast, earthquakes with relatively-large (M >= 3) magnitude are “break”. The “cracks” occurred within epicentral distances ranging from 0 km to 400 km during a period of 60 days before and after the “beaks” that are utilized to construct spatiotemporal seismicity maps. We superimpose entire spatiotemporal seismicity maps and find that the increase seismicity initially concentrates in the fault zones. The increase seismicity gradually expands outward to over 50 km away from the epicenters approximately 40 days before the “breaks” and become more rapidly around the fault zones approximately 20 days before. These suggest that seismogenic zones, which can be referred to areas with increase seismicity, associated with the “breaks” being more than 50 times to regions of the fault rupture. We compute resonant frequencies of areas with increase seismicity by using a resonant frequency model. Resonant frequencies vary from ~3×10^{-4} Hz to ~10^{-3} Hz (i.e., variable frequency) that can be observed along with changes of the areas migrating from exterior areas to approach the fault zones. The variable frequency can also be supported by the observation of continuous seismic waveforms through superimposition processes. These results suggest that the variable frequency of ground vibrations is a function of the areas with increase seismicity leading to earthquakes.

Keywords: Foreshocks, Seismogenic zones, Crustal vibrations, Crustal resonance

