ICNEM
International Conference on Nonlinear Elasticity in Materials

Contribution ID: **7** Type: **not specified**

Study on Post-seismic Slow Dynamic Recovery of Seismic Velocity in Tengchong Volcanic Area, Yunnan

Tuesday 15 July 2025 09:00 (35 minutes)

The Tengchong Volcanic Field (TCV), located in the southeastern margin of the Tibetan Plateau, is a large-scale active volcanic system. Geological surveys identify 68 Cenozoic volcanic centers distributed throughout the region. This volcanic system features extensive magma degassing, vigorous hydrothermal circulation, and intense volcanic and seismic activity, posing a potential threat of explosive eruptions. Therefore, investigating temporal variations in seismic velocity (dv/v) in the TCV helps reveal subsurface property changes and improves understanding of regional tectonic evolution. It also enables the detection of potential precursory signals of earthquakes or volcanic eruptions, providing critical scientific support for the forecasting and mitigation of geological hazards in the region.

We deploy 78 seismic stations across the Tengchong Volcano-Geothermal National Geopark and record multiple seismic events during the observation period. To monitor co-seismic velocity drops and post-seismic slow dynamic recovery, we apply the Coda Wave Interferometry (CWI) technique. The results show a significant reduction in seismic velocity immediately following earthquakes, followed by a gradual recovery over time. This phenomenon reflects a slow dynamic recovery process at the crustal scale, which closely relates to rock properties, regional tectonic settings, and source mechanisms(Johnson, 2006, TenCate, 2011, Sens-Schönfelder et al., 2018, Snieder et al., 2017). By projecting dv/v values onto a horizontal plane and combining them with surface wave tomography, we analyze the spatial distribution of velocity changes.

The results indicate that regions with stronger velocity perturbations are more sensitive to seismic events and tend to experience localized stress accumulation triggered by seismic shaking. In addition, subsurface heterogeneity leads to significant spatial variability in sensitivity to seismic perturbations. This spatial variation not only reveals the non-uniformity of the regional stress field but also provides additional constraints for fault zone imaging using tomography, thereby advancing our understanding of the dynamic evolution of regional tectonic structures.

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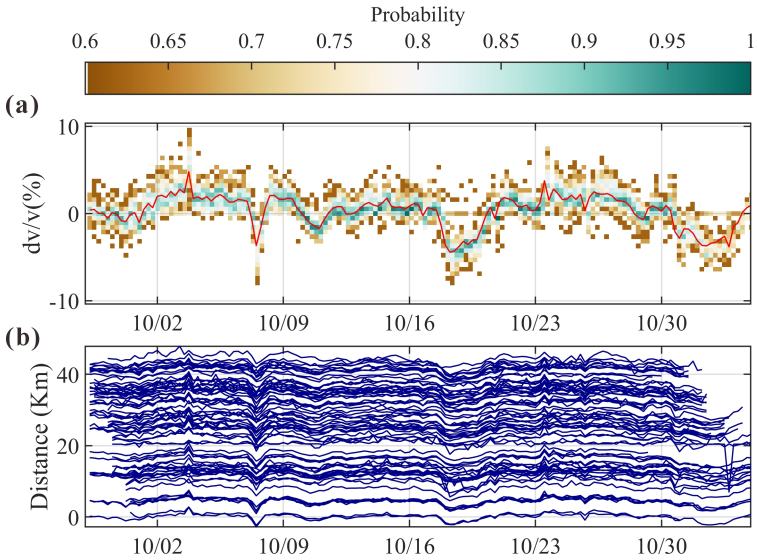

Figure 1: Time series monitoring of dv/v.(a) The probability density distribution of dv/v, (b) The trace of dv/v.

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Session Classification: Geophysical observations

Track Classification: Geophysical observations