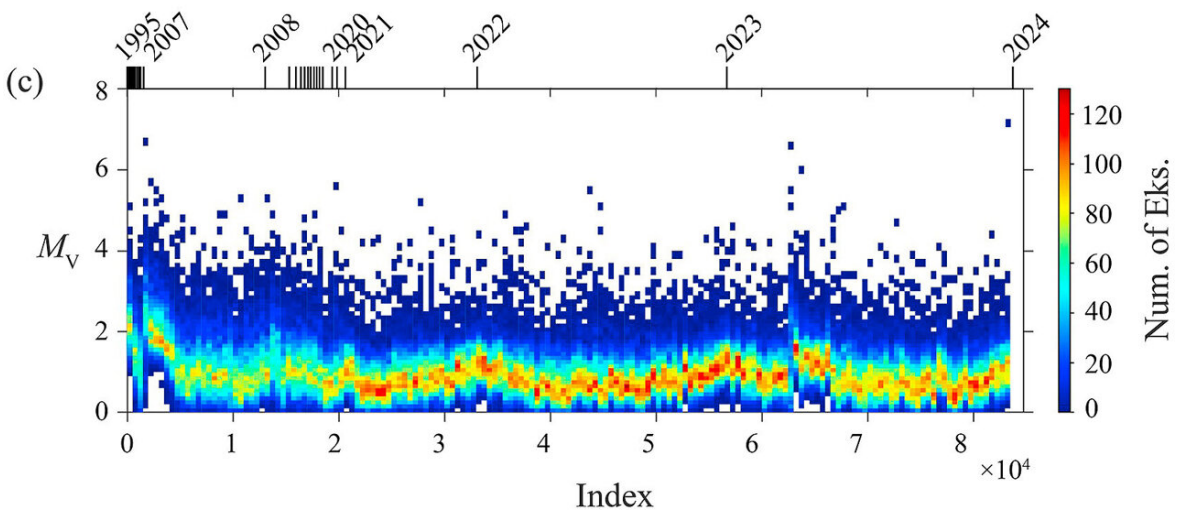
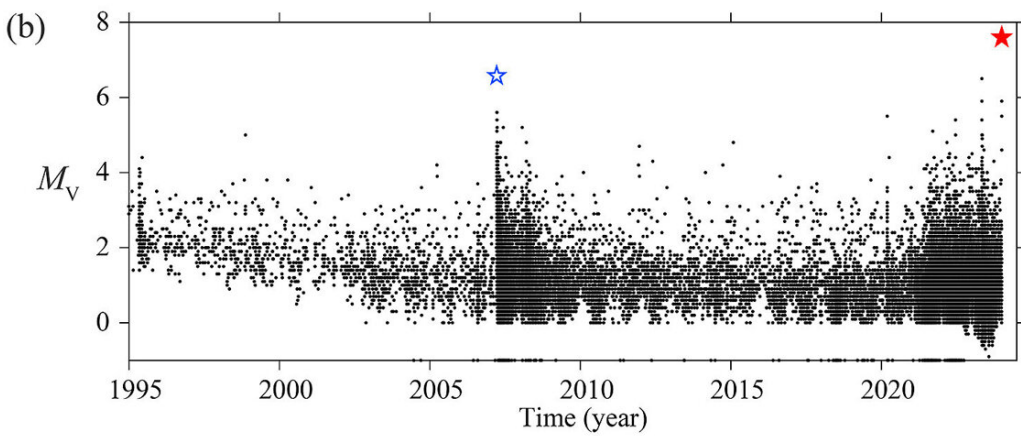
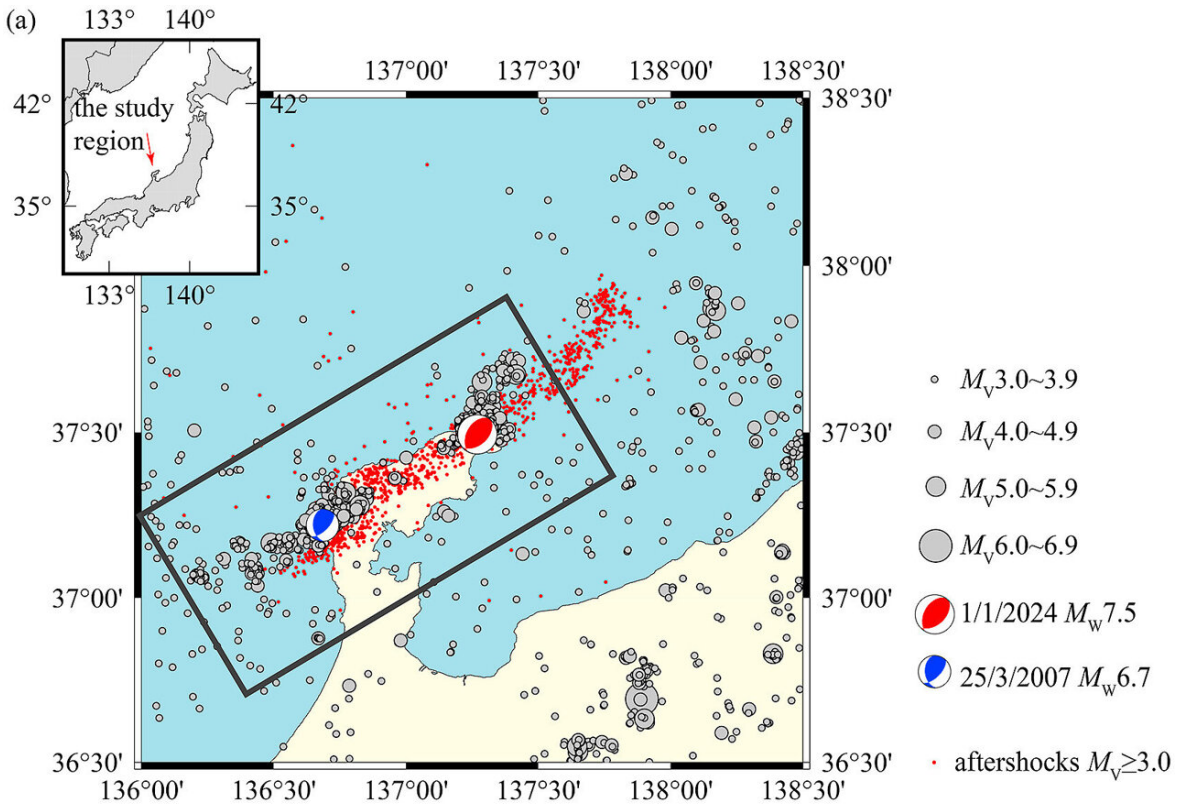


Earthquake research traces the pace of an approaching 'seismic dragon king'

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(a) Distribution of earthquakes with M_V no less than 3.0, from the JMA catalogue, with the rectangular highlighting the study region in this editorial around the Noto Peninsula. Time period is from January 1, 1995 to the occurrence of the M_W 7.5/ M_V 7.6 earthquake on January 1, 2024. Red dots are the aftershocks above M_V 3.0 from January 1, 2024, to January 15, 2024, approximately indicating the rupture of the M_W 7.5 earthquake. This analysis, focusing on the swarm, only covers the nucleation point of the M_W 7.5 earthquake, as shown by its focal mechanism in red. The 2007 M_W 6.7 earthquake is marked by its focal mechanism in blue. (b) Magnitude statistics of the catalogue around the Noto Peninsula (within the rectangular), indicating the transition period of seismological monitoring around 2006. The 2007 M_W 6.7 earthquake is marked as a hollow star in blue, and the 2024 M_W 7.5 earthquake is marked as a solid star in red. (c) Magnitude statistics of the catalogue around the Noto Peninsula (within the rectangular) using the index of events, further confirming the completeness magnitude around 1.0 and 2007–2008 the final transition of seismological monitoring. Credit: *Earthquake Research Advances* (2024). DOI: 10.1016/j.eqrea.2024.100290

The 'Dragon King' theory was proposed based on the physics of complexity. According to this theory, 'Dragon King' events deviate from the power law distribution as a statistical outlier and, noticeably, have predictability.

On January 1, 2024, a significant moment magnitude M_w 7.5 earthquake struck beneath Japan's Noto Peninsula. Prior to this [seismic event](#), extensive studies had been undertaken in the region, primarily focusing on the earthquake swarm originating beneath the Noto Peninsula in November 2020.

Examining the scaling law of the selected sequence using data from the Japan Metrological Agency (JMA)'s focal mechanism catalog, a team of

researchers from China identified the Mw7.5 earthquake as exhibiting characteristics of a 'seismic dragon king.'

"We applied the load-unload response ratio (LURR) to analyze earthquakes in close proximity to the Noto Peninsula, where pre-mainshock seismicity primarily delineated the aftershock zone of the 2007 Mw6.7 Noto-Hanto earthquake and the ongoing earthquake swarm," explains first author of the study, Yue Liu.

"The minimum magnitudes of smaller events gradually decreased from approximately Mv 2 to 0 between 1995 and 2006, likely attributed to the integration of the Hi-net and other dense seismic networks during this period."

The team [reported](#) their findings in *Earthquake Research Advances*.

The LURR method, proposed by Xiangchu Yin, who serves as the senior and co-corresponding author of this study, has seen successful application in various earthquakes globally.

This approach, grounded in damage mechanics, leverages seismic event responses to tidal stress fluctuations induced by [celestial bodies](#) like the sun and moon to gauge the mechanical state of the medium. Liu, a student of Yin, observed a precise alignment between the variation in LURR preceding the Mw7.5 earthquake and theoretical predictions.

Further investigations by the team are underway; Yin, however, cautioned about exercising prudence in interpreting findings from retrospective case studies, emphasizing the need to approach such analyses with caution despite their potential to enhance understanding of earthquake mechanics. Meanwhile, Yongxian Zhang, another student of Yin and co-corresponding author, highlighted the prevalence of seismic swarms in China and worldwide.

More information: Yue Liu et al, Tracing the pace of an approaching 'seismic dragon king': Additional evidence for the Noto earthquake swarm and the 2024 MW 7.5 Noto earthquake, *Earthquake Research Advances* (2024). [DOI: 10.1016/j.eqrea.2024.100290](https://doi.org/10.1016/j.eqrea.2024.100290)

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