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EDUCATION

2000/09-2004/06 Ph.D., Institute of Geophysics, National Central University, Taiwan
1997/09-1999/06 M.S., Institute of Applied Geology, National Central University, Taiwan
1993/09-1997/06 B.A., Department of Earth Sciences, National Central University, Taiwan

EMPLOYMENT

2015/09-present Research fellow**,** Institute of Earth Sciences, Academia Sinica, Taiwan
2010/10-2015/08 Associate research fellow**,** Institute of Earth Sciences, Academia Sinica, Taiwan
2006/08-2010/10 Assistant research fellow**,** Institute of Earth Sciences, Academia Sinica, Taiwan
2004/09-2006/08 Post-doctoral fellow, Seismological Laboratory, California Institute of Technology, USA.
2004/07-2004/09 Post-doctoral fellow, Institute of Earth Sciences, Academia Sinica, Taiwan,
1999/07-2000/08 Research assistant, Institute of Earth Sciences, Academia Sinica, Taiwan

HONORS & AWARDS

2021 Outstanding Research Award, Ministry of Science and Technology, ROC
2021 Grand Challenge Program, Academia Sinica
2017 Han-Zhuo Wang Medal Award, Geological Society of China
2017 Promising Women in Science Award, Wu Chieh Shiung Education Foundation
2016 Career Development Award, Academia Sinica
2012 Ta-You Wu Memorial Award, National Science Council (NSC-Taiwan)
2010 Academia Sinica Research Award for Junior Research Investigators

PROFESSIONAL SERVICE

- Steering committee of International Research Project"From Geodynamics to Extreme Events" between Taiwan and France (2021-2024)
- Associate Editor, *Geological Society of America Bulletin (2016-now)*
- Member, The Committee for IAG/IUGG, Taipei (2016-now)
- Steering committee of sub-commission 3.2 for Crustal Deformation, IAG/IUGG (2015-now)

RESEARCH INTEREST

My research focuses on studying the earthquake cycle deformation of the continental thrust faults and megathrust faults at subduction zones. I use GNSS (Global Navigation Satellite System), seismic, and geological data to investigate fault coupling, frictional properties, fault zone rheology, and slow-moving landslides. In particular, active deformation at subduction zones mostly lies beneath the seafloor and is poorly resolved by terrestrial geodetic techniques. Seafloor geodetic measurements are crucial to study the spatial extent of the locked zone and transient slip events on the subduction megathrust. My research group and I have investigated different seafloor geodetic techniques including GNSS-acoustic observations and ocean-bottom absolute pressure gauge, aiming at establish a geodetic observatory network in the Taiwan plate boundary zone. In addition, Delineation of physical factors that contribute to earthquake triggering is a challenging issue in seismology. Studying earthquake triggering spanning over a variety of timescales ranging from seconds to years and spatial scales in different tectonic regions is key to understanding the physical mechanisms. To better resolve earthquake triggering mechanisms, I explore the association of seismic rate with changes of hydrological loading over multiple spatiotemporal scales and study the response of seismicity to various natural processes.

RESEARCH HIGHLIGHTS

1. Strain partitioning at the southern Ryukyu subduction zone

The southern Ryukyu subduction zone is one of the potential sources for tsunamigenic earthquakes. Despite a great seismic risk, the deformation pattern remains poorly known, primarily due to the absence of seafloor constraints. With GNSS-acoustic measurements over years, we characterize the convergence rate across this margin growing from 92 mm/yr offshore eastern Taiwan to 123 mm/yr near the Gagua Ridge. The new data suggest the subduction interface is capable of hosting M_w 7.5-8.4 earthquakes. The orientations of seafloor movement and P-axes in the Nanao Basin are both subnormal to the trench, notably deviate from the direction of plate convergence. By considering the combined effect of plate convergence and backarc rifting, different trends between the forearc convergence, *P*-axes, and seafloor movement may indicate some degree of slip-partitioning.

2. Synchronized and asynchronous modulation of seismicity by hydrological loading

We analyze hydrological modulation of seismicity in Taiwan using groundwater level data and GNSS time series. In western Taiwan, the seismicity rate reaches peak levels in February-April and drops to its lowest values in July-September, exhibiting a direct correlation with annual water unloading. The elastic hydrological load cycle may be the primary driving mechanism for the observed synchronized modulation of earthquakes, as also evidenced by deep earthquakes in eastern Taiwan. However, shallow earthquakes in eastern Taiwan (<18 km) are anti-correlated with water unloading, which is not well explained by either hydrological loading,

fluid transport or pore pressure changes, and suggests other time-dependent processes. The moderate correlation between stacked monthly trends of large historic earthquakes and present-day seismicity implies a modestly higher seismic hazard during the time of low annual hydrological loading.

3. Lower-crustal rheology and thermal gradient in the Taiwan orogenic belt

The strength of the lithosphere controls tectonic evolution and seismic cycles, but how rocks deform under stress in their natural settings is usually unclear. We constrain the rheological properties beneath the Taiwan orogenic belt using the stress perturbation following the 1999 Chi-Chi earthquake and fourteen-year postseismic geodetic observations. The evolution of stress and strain rate in the lower crust is best explained by a power-law Burgers rheology with rapid increases in effective viscosities from ~10^{17} to ~10^{19} Pa s within a year. The short-term modulation of the lower-crustal strength during the seismic cycle may alter the energy budget of mountain building. Incorporating the laboratory data and associated uncertainties, inferred thermal gradients suggest an eastward increase from 19.5±2.5°C/km in the Coastal Plain to 32±3°C/km in the Central Range. Geodetic observations may bridge the gap between laboratory and lithospheric scales to investigate crustal rheology and tectonic evolution.

REPRESENTATIVE PUBLICATIONS (2012-2022, *: corresponding author)

1. Chen, H.Y., **Y. J. Hsu***, R. Ikuta, H. Tung, C. S. Ku, H. H Su, C. H. Tang, M. Ando and T. Tsujii, (2022), Strain partitioning in the southern Ryukyu margin revealed by seafloor geodetic and seismological observations, *Geophys. Res. Lett*., 46, https://doi.org/10.1029/2022GL098218
2. Jiang, Z., **Y. J. Hsu**, L. Yuan, M. Tang, X. Yang, and X. Yang (2022), Hydrological drought characterization based on GNSS Imaging of vertical crustal deformation across the contiguous United States, *Sci. Total Environ., 823,* https://doi.org/10.1016/j.scitotenv.2022.153663.
3. Jiang, Z. S. **Y. J. Hsu**, L. G. Yuan, S. Cheng, W. Fang, M. Tang, and X. G. Yang (2021), Insights into hydrological drought characteristics using GNSS-inferred large-scale terrestrial water storage deficits, *Earth Planet. Sci. Lett.,* https://doi.org/10.1016/j.epsl.2021.117294
4. **Hsu, Y. J.***, H. Kao, R. Bürgmann, Y. T. Lee, H. H. Huang, Y. F. Hsu, Y. M. Wu, and J. Zhuang (2021), Synchronized and asynchronous modulation of seismicity by hydrological loading: A case study in Taiwan, *Sci. Adv. 16*, eabf7282, doi:10.1126/sciadv.abf7282.
5. Jiang, Z. S. **Y. J. Hsu**, L. G. Yuan, and D. F. Huang (2021), Monitoring time-varying continental water storage changes using daily GNSS measurements in Yunnan, southwest China, *Remote Sen. Enviro., 254*, doi:10.1016/j.rse.2020.112249
6. **Hsu, Y. J.***, Y. Fu, R. Bürgmann, S. Y. Hsu, C. C. Lin, C. H. Tang, and Y. M. Wu (2020), Assessing seasonal and interannual water storage variations in Taiwan using geodetic and hydrological data, *Earth Planet. Sci. Lett., 550*, doi: 10.1016/j.epsl.2020.116532
7. Tang, C.-H., **Y. J. Hsu**, S. Barbot, J. D. P. Moore, W.-L. Chang (2019), Lower-crustal rheology and thermal gradient in the Taiwan orogenic belt illuminated by the 1999 Chi-Chi earthquake, *Sci. Adv.*, 5, eaav3287.
8. **Hsu, Y. J.** *, Y. R. Lai, R. J. You, H. Y. Chen, L. S. Teng, Y. C. Tsai, C. H. Tang, and H. H. Su (2018), Detecting rock uplift across southern Taiwan mountain belt by integrated GPS and leveling data, *Tectonophysics,* doi:10.1016/j.tecto.2018.07.012.
9. Moore D. P. J., H. Yu, C. H. Tang, T. Wang, S. Barbot, D. Peng, S. Masuti, J. Dauwels, **Y. J. Hsu**, V. Lambert, P. Nanjundiah, S. Wei, E. Lindsey, L. J. Feng and B. Shibazaki (2017),

Imaging the distribution of transient viscosity following the 2016 Mw 7.1 Kumamoto earthquake, *Science*, 356(6334), 163-167, doi: 10.1126/science.aal3422.

10. **Hsu, Y. J.** *, S. B. Yu, J. Loveless, T. Bacolcol, R. Solidum, A. Luis Jr, A. Pelicano, and J. Woessner. (2016), Interseismic deformation and moment deficit along the Manila subduction zone and the Philippine fault system, *J. Geophys. Res.*, *121, 7639–7665, doi:10.1002/2016JB013082*

11. **Hsu, Y. J.*** , Y. S. Chang, C. C. Liu, H. M. Lee, A. T. Linde, S. I. Sacks, G. Kitagawa, and Y. G. Chen (2015), Revisiting borehole strain, typhoons, and slow earthquakes using quantitative estimates of precipitation induced strain changes, *J. Geophys. Res., 120*, doi: 10.1002/2014JB011807.
12. **Hsu, Y. J.*** , R. F. Chen, C. W., Lin, H. Y. Chen, and S. B. Yu (2014), Seasonal, long-term, and short-term deformation in the Central Range of Taiwan induced by landslides, *Geology, 42,* 991-994, doi:10.1130/G35991.1
13. **Hsu, Y. J.*** , M. Ando, S. B. Yu, and M. Simons (2012). The potential for a very large earthquake along the southernmost Ryukyu subduction zone, *Geophys. Res. Lett*., 39, doi:10.1029/2012GL052764.
14. **Hsu, Y. J.*** , S.B. Yu, T. R.A. Song, and T. Bacolcol (2012), Plate coupling along the Manila subduction zone between Taiwan and northern Luzon, *J. Asian Earth Sci. 51,* 98-108, doi:10.1016/j.jseaes.2012.01.005.