

KEYNOTE ABSTRACT

Structural and Mechanical Controls on Earthquake Ruptures Along the Eastern Makran Subduction Zone

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The co-seismic rupture of subduction megathrust earthquake exerts a major control on the earthquake magnitude and size of resulting tsunami, understanding what factors control the co-seismic rupture is thus essential to assess a margin's ability to generate large earthquakes and tsunamis. The morphology and frictional strength of the plate boundary fault at subduction zones have long been proposed to control the seismic rupture propagation during megathrust earthquakes, but with controversial views. This is largely because there is very few the direct observation of the spatial relationship between these key parameters. The eastern Markan Subduction Zone has favorable conditions for large earthquakes, such as the 1945 Mw 8.1 and 2017 Mw6.3 earthquakes. Rupture of these two events have been well constrained to a relatively concentrated spatial distribution. Along strike, the Little Murray Ridge has been subducted partially beneath the Makran wedge, adding structural complexes. Here, we used the high-resolution seismic profiles, multibeam bathymetry along the eastern Makran accretionary wedge to map the fine structure of plate interface fault, which is combined with the Critical Taper Theory to estimate the spatial variation of basal strength. We then compared these structural and mechanical variations along the megathrust with the distribution of the two historical ruptures. We observed that low shear strength in non-ridge subducted segments facilitates the 1945 and 2017 rupture propagation, contrasting with high-strength area associated with the ridge subduction impeding them. The research underscores the significant control of fault morphology and strength in seismic rupture behavior, offering insights for seismic hazard assessment in subduction zones.