



ID de Contribution: 60

Type: Talk

Temporal organization of large earthquakes along the Altyn Tagh Fault, China

vendredi 29 mars 2024 09:45 (15 minutes)

The understanding of the spatial-temporal distribution of past earthquakes is essential to assess the event recurrence behavior and to estimate the size of potential earthquakes along major strike-slip fault systems. However, the scarcity of paleoseismic data remains a major hurdle in this endeavor. We document a paleoseismic record over the last 8kyr along the central-eastern Altyn Tagh Fault (ATF). The mean recurrence time of these events is 1371 ± 625 yr with a COV of ~ 0.46 , suggesting a quasi-periodic behavior. In the same fault section, 90 horizontal offsets record an average coseismic slip of 5.1 ± 1.4 m for the most recent event (MRE) and suggest at least four older earthquakes plausibly with a similar slip distribution.

We find that at the local scale (fault section) the earthquake recurrence is quasi-periodic along the ATF. However, at the regional scale (fault system) the tectonic strain seems to be released in bursts of seismic activity punctuated by periods of relative quiescence. These bursty periods of seismic activity show mean interevent times of 475 ± 108 yr and are preceded by millennial long-lull periods of 1393 ± 230 . Such rupture behavior at the regional scale is evident from a site-to-site correlation of rupture ages along four fault sections of the ATF. Here, we also discuss about some pitfalls to consider when using the current methods to combine paleoseismic data. Finally, we propose a new approach to integrate paleoseismic event data from multiple sites into a single earthquake time history.

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Classification de Session: Talks: PhD students session