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Millennial to million year normal-fault interactions in the forearc of a subduction margin, Crete, Greece

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Faults located close to one another (e.g., <5 km) are likely to interact. We explore the impact of fault interactions on the thousand to million year growth patterns of the Eastern Mirabello Fault System (EMFS), an active NE-SW trending normal fault system in the upper-plate of the Hellenic subduction margin. Kinematic analysis of fault-displacement data shows that, over the last 2±0.5 Ma and along the entire fault-system length, the EMFS accommodated displacement at near constant rates (0.5±0.15 mm/a), with large faults in the system moving faster than small faults. This hierarchy does not however persist over shorter timescales (<16.5±0.5 ka), with faults/fault-segments accommodating slip episodically, with displacement rates of up to 5 times faster than their million-year values, or not moving at all. Despite this apparent short-term variability in displacement accumulation on individual faults (of fault segments), temporally stable rates are achieved post ∼16.5 ka when the entire fault system is considered. Thus, increased stability of displacement accumulation on individual faults over million-year timescales is also partly matched by increasing the spatial length scales of observation on shorter timescales (<∼16.5 ka), suggesting that each fault is a component of a kinematically coherent system in which all faults interact to accommodate displacement interdependently, a feature that may lead to clustered (or synchronous) rupture on multiple faults in the system.