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The catastrophic 1456 multiple earthquake: CFF test of interaction among deep oblique strike-slip faults in southern Italy

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In December 1456-January 1457 a major earthquake sequence took place across the central and southern Apennines (southern Italy, Calabrian Arc excluded), including southeastern Apulia. A recent re-evaluation of the (a) revised damage pattern for this multiple earthquake, (b) deeper seismicity of the southern Apennines – Adriatic foreland interface and (c) deep-seated regional E-W structures, led to the identification of at least four seismogenic sources, responsible for the main sub-events of the multiple 1456 earthquake.

Based on various seismological, macroseismic and tectonic constraints, these causative faults are thought to exhibit an oblique right-lateral motion along fault segments roughly E-W oriented. Such segments are portions of well-known inherited regional E-W trending shear zones (like the Molise-Gondola shear zone), at various latitudes between (from north to south) the Maiella Mts. and the Vulture volcanic complex. This system would therefore imply the cascade reactivation of such shear zones favorably oriented with respect to present stress field, with a transtensional mechanism. More than one catastrophic historical earthquake that occurred in southern Italy suggests the nearly simultaneous
activation of multiple sources across widely spaced (+/- 30 km) portions of independent E-W faults. Being the strongest (by magnitude and damage area) among these major earthquakes, the 1456 sequence can be considered as a template for such mechanism of multiple activation of distant sources yet within a short time window.

This hypothesis invokes a possible stress interaction between multiple sources falling

within neighboring domains. We investigated Coulomb stress changes related to the main sub-events of the multiple 1456 earthquake to analyze fault interaction and stress transfer mechanisms. An evident positive correlation between the calculated Coulomb stress increase and two major seismogenic sources is found. Therefore, the spatial redistribution and enhancement of static stress caused by the stronger events may promote rupture on adjacent faults that are close to the failure threshold. A more general case may be considered imposing a pre-existing stress field or assuming different values for the friction coefficient.

To the extents of present knowledge and investigation, these E-W trending earthquake sources are active between ca. 10 and 20 km at depth in the sector of the southern Apennines east of the chain axis, that is to say in the seismogenic macroregion bounded by the thrustbelt (to the west) and by the Apulian foreland (to the east). The stress patterns caused by these faults are consistent with the large NW-SE trending pure extensional sources found along the southern Apennines axis.