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Theoretical and observational results on damage related radiation

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Analytical results indicate that changes of elastic moduli in earthquake rupture zones produce damage-related-radiation (DRR) given by the product of the changes of elastic moduli and the elastic strain at the source. A tensorial decomposition indicates that the DRR has a large isotropic component expected to produce dynamic dilatation and enhanced P radiation. Since significant changes of elastic moduli during earthquake rupture occur in a small/narrow zone, the DRR involves primarily high frequency waves. The dynamic dilatation near the rupture front can significantly reduce the heat generation by the rupture, lead to pulse-type propagation, and produce rock fragmentation. Numerical simulations confirm these expectations. Analyses of seismograms recorded close to earthquake rupture zones reveal elevated P/S wave ratios and isotropic high frequency radiation consistent with the theoretical results. Geological studies of deeply exhumed faults in dry rocks show evidence of pulverization and delayed heating in earthquake rupture zones consistent with strong dynamic dilatation near the rupture fronts.

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