Dynamic Versus Static Coulomb Stress Triggering of Earthquakes on the North Anatolian Fault, Turkey

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The Coulomb Failure Stress Changes dCFS(t) from an earthquake can be separated into static or permanent (dCFS) and dynamic, time-varying fields. dCFS is controlled only by the fault area, orientation, and slip distribution, while the dynamic portion of dCFS(t) additionally depends on the complexity of the rupture propagation and the resulting radiated waves (Harris et al, 1991; Harris and Day, 1993). Numerous studies have shown correlation of areas of positive dCFS from an earthquake with increased seismic activity (e.g., Das and Scholz, 1981; Stein, 1999). Recent studies of dCFS(t) have pointed out the importance of using dynamic rather than static Coulomb Failure Stress changes for explaining seismic triggering. For example, dCFS(t) constrains directivity effects for large historical earthquakes (e.g., Kilb et al., 2002; Kilb, 2003) which are not included in dCFS estimates. However, these studies of dCFS(t) used somewhat simplified models of the rupture propagation, compared to recent estimates of realistic seismic source parameters. dCFS(t) is significantly affected by variations in slip distribution, rupture velocity, and focal mechanism, and we correlate dCFS(t) with the time varying shear and normal stress to illustrate the origin of the resulting patterns. The variation of dCFS(t) is illustrated for a series of seven large earthquakes from 1939 to 1999 on the North Anatolian Fault, Turkey.

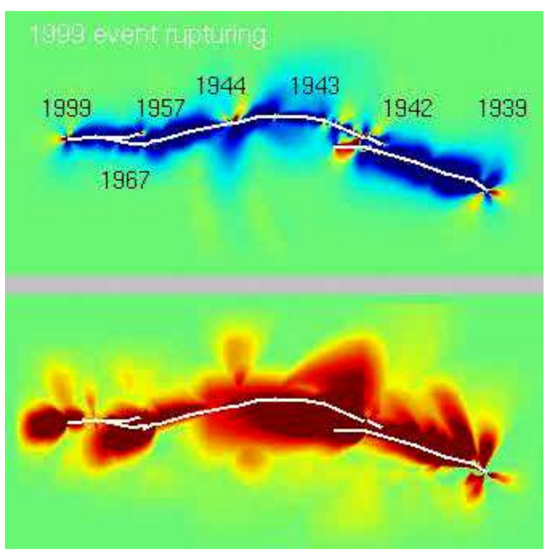

Figure 1: (top) Static and (bottom) peak dynamic Coulomb Failure Stress for the North Anatolian earthquake series. Hot (cool) colors depict stress increase (decrease). Numbers indicate the years of the 1939-1999 westward propopagating series of earthquakes. White lines depict fault traces.