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Dynamic stressing of a global system of faults results in rare seismic silence

SAN FRANCISCO, March 11, 2014 – In the global aftershock zone that followed the major April 2012 Indian Ocean earthquake, seismologists noticed an unusual pattern – a dynamic "stress shadow," or period of seismic silence when some faults near failure were temporarily rendered incapable of a large rupture.

The magnitude (M) 8.6 earthquake, a strike-slip event at intraoceanic tectonic plates, caused global seismic rates of M≥4.5 to spike for several days, even at distances tens of thousands of kilometers from the mainshock site. But beginning two weeks after the mainshock, the rate of M≥6.5 seismic activity subsequently dropped to zero for the next 95 days.

Why did this rare period of quiet occur?

In a paper published today in the *Bulletin of the Seismological Society of America* (*BSSA*), Fred Pollitz of the U.S. Geological Survey and co-authors suggests that the Indian Ocean earthquake caused short-term dynamic stressing of a global system of faults. Across the planet, there are faults that are "close to failure" and ready to rupture. It may be, suggests Pollitz and his colleagues, that a large quake encourages short-term triggering of these close-to-failure faults but also relieves some of the stress that has built up along these faults. Large magnitude events would not occur until tectonic movement loads stress back on to the faults at the ready-to-fail levels they reached before the main shock.

Using a statistical model of global seismicity, Pollitz and his colleagues show that a transient seismic perturbation of the size of the April 2012 global aftershock would inhibit rupture in 88 percent of their possible M≥6.5 earthquake fault sources over the next 95 days, regardless of how close they were to failure beforehand.

This surprising finding, say the authors, challenges the previously held notion that dynamic stresses can only increase earthquake rates rather than inhibit them. But there are still mysteries about this process; for example, the global rate of M≥4.5 and M≥5.5 shocks did not decrease along with the larger shocks.

"The profound reach of the M8.6 11 April 2012 Indian Ocean earthquake: short-term global triggering followed by a longer-term global shadow" is co-authored by Fred

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Pollitz, Ross Stein and Volkan Sevilgen of the U. S. Geological Survey, and Roland Burgmann of University of California, Berkeley. The paper is published online on March 11, 2014 by *BSSA* and will appear in the journal's April print edition.

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For a copy of the paper, please contact press@seismosoc.org.