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Analyses of surface motions caused by the Mw 9.0 2004 Sumatra earthquake.

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The Sumatra, Indonesia, earthquake on December 26th was one of the most devastating earthquakes in history. With a magnitude of Mw = 9.0 it is the forth largest earthquake recorded since 1900. It occurred about one hundred kilometers off the west coast of northern Sumatra, where the relatively thin Indoaustralian plate moves beneath the thicker Burma plate resulting in stress accumulation. The average velocity of the Indoaustralian plate toward the Burma plate is about 6 cm/year. However, on December 26 2004, the two plates moved by distance of several meters releasing the stress accumulated over hundreds of years. The result was a devastating tsunami hitting coastlines across the Indian Ocean killing more than 225,000 people in Sri Lanka, India, Indonesia, Thailand and Malaysia.

An earthquake of this magnitude is expected to involve a displacement on the fault on the order of 10 meters. But, what was the actual amplitude of the surface motions that triggered the tsunami? This can be constrained using the amplitudes of elastic waves radiated from the earthquake, or by direct measurements of deformation. Here we present estimates of the deformation based on continuous Global Positioning System (GPS) observations in the vicinity of the earthquake.