

# The precursory phase of large earthquakes

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## Editor's summary

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## Editor's summary

Unlike some volcanic eruptions, no clear set of precursor signals have been identified for large earthquakes. Bletery and Nocquet analyzed high-rate GPS time series before 90 different earthquakes that were magnitude 7 and above to find a precursor signal (see the Perspective by Bürgmann). They observed a subtle signal that rose from the noise about 2 hours before these major earthquakes occurred. This work may allow fault monitoring for this precursor phase with denser and higher-precision instrumentation. —Brent Grocholski

## Abstract

The existence of an observable precursory phase of slip on the fault before large earthquakes has been debated for decades. Although observations preceding several large earthquakes have been proposed as possible indicators of precursory slip, these observations do not directly precede earthquakes, are not seen before most events, and are also commonly observed without being followed by earthquakes. We conducted a global search for short-term precursory slip in GPS data. We summed the displacements measured by 3026 high-rate GPS time series—projected onto the directions expected from precursory slip at the hypocenter—during 48 hours before 90 (moment magnitude  $\geq 7$ ) earthquakes. Our approach reveals a  $\approx 2$ -hour-long exponential acceleration of slip before the ruptures, suggesting that large earthquakes start with a precursory phase of slip, which improvements in measurement precision and density could more effectively detect and possibly monitor.



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