The April 1, 2014 Iquique, Chile Mw 8.1 earthquake rupture sequence

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Supplementary Materials

Figures S1-S6  
Animation S1
**Figure S1.** Map of the source regions of the 1868 Peru and 1877 north Chile megathrust ruptures (ellipses). All events in the USGS-NEIC catalog (including PAGER-CAT) with reported magnitude larger than 7.0 are shown with circles scale to magnitude and color-coded for source depth. Only events less that 70 km deep are included. Focal mechanisms for events less than 60 km deep in the gCMT catalog are shown at the NEIC epicentral locations scaled and color-coded in the same way. The motion of the Nazca plate relative to fixed South America for model MORVEL [DeMets et al., 2010] is indicated by the yellow arrows.
Figure S2. The preferred finite-source model for the April 1, 2014 Mw 8.1 Iquique mainshock based on a kinematic linear least-squares inversion of 101 teleseismic broadband P and SH waves in the period band 1.1-200 s. Corresponding waveform fits are shown in Figure S5. The moment rate function is shown at the top and the slip distribution and subfault source time function durations are shown below, with strength of slip color-coded and indicated by the vectors. The purple circles are 10 s intervals of the expanding rupture front with a rupture velocity of 1.5 km/s. The red star indicates the position of the hypocenter, corresponding to the map display of this model in Figure 1.
Figure S3. Waveform fits (observed black, red calculated) for teleseismic P and SH waves for the 2014 Iquique mainshock using the model shown in Figure S2. The station azimuths and epicentral distances are indicated below the station names, and the peak-to-peak ground motion in microns for each observation is labeled in blue. The data have normalized amplitudes with true relative amplitudes of predictions.
Figure S4. The preferred finite-source model for the April 3, 2014 $M_w$ 7.7 Iquique aftershock based on a kinematic linear least-squares inversion of 105 teleseismic broadband P and SH waves in the period band 1.1-200 s. Corresponding waveform fits are shown in Figure S5. The moment rate function is shown at the top and the slip distribution and subfault source time function durations are shown below, with strength of slip color-coded and indicated by vectors. The purple circles are 10 s intervals of the expanding rupture front with a rupture velocity of 1.5 km/s.
Figure S5. Waveform fits (observed black, red calculated) for teleseismic P and SH waves for the 2014 Iquique aftershock using the model shown in Figure S4. The station azimuths and epicentral distances are indicated below the station names, and the peak-to-peak ground motion in microns for the data is labeled in blue. The data have normalized amplitudes with true relative amplitudes of predictions.
Figure S6. Average source spectra and normalized cumulative energy as a function of frequency for the April 1, 2014 Iquique mainshock (top row) and April 3, 2014 aftershock (lower row). The total radiated energy, $E_r$, is computed for the broadband spectra by averaging individual estimates from broadband teleseismic P waves in the passband 0.05-2.0 Hz, and then scaling up for the proportion of energy at lower frequency. The source region parameters used in the calculation are shown for each case.

Source: $H_0 = 28.90$ km, $V_p = 7.21$ km/s, $V_s = 3.98$ km/s, $\rho = 3.12$ kg/cm$^3$, $H_{avg} = 28.90$ km, $\mu = 49.80$ GPa

$\phi = 357.0^\circ$, $\delta = 18.0^\circ$, $\lambda = 98.9^\circ$

$M_0 = 1.69 \times 10^{21}$ N-m; $M_w = 8.08$

Source: $H_0 = 40.0$ km, $V_p = 7.6$ km/s, $V_s = 4.4$ km/s, $\rho = 3.5$ kg/cm$^3$, $H_{avg} = 41.60$ km, $\mu = 59.60$ GPa

$\phi = 359.7^\circ$, $\delta = 16.4^\circ$, $\lambda = 99.7^\circ$

$M_0 = 4.38 \times 10^{20}$ N-m; $M_w = 7.691$