The Maule Mw 8.8 earthquake: modelling using 1 Hz cGPS and seismic data

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The Maule earthquake of 27 February 2010 ruptured the plate interface of central Chile starting from a region that had been locked since the Mw 8.5 earthquake of 1835. The 2010 earthquake ruptured the gap but propagated well beyond it into the rupture zones of the 21 May 1960 and 1 December 1928 earthquakes to the South and North, respectively. We use all available data to model rupture propagation during this earthquake using campaign and continuous GPS data, far field body waves and a number of accelerograms both from Chile and Argentina. The 1 Hz cGPS data were validated by comparing them with collocated accelerometers at the El Roble station near Valparaiso. The horizontal 1Hz cGPS data and the accelerograms coincide for frequencies lower than 0.1 Hz. Several accelerograms are available for the main event but not all of them could be integrated for frequencies higher than 0.1 Hz because of their limited dynamic range. We use these data to create a seismic section extending from Concepcion in the South of the rupture zone to Vallenar, about 1000 km north of the epicenter. The waveforms vary smoothly and can be stacked in order to characterize the Northern segment of the rupture. We combine this data with GPS and far field body waves in order to estimate the overall features of the earthquake. The rupture process consisted of two large rupture patches. The first patch was located in the Southern part of the rupture roughly from the Itata river to the Arauco peninsula. The second, stronger patch was located in the Northern part of the rupture zone where rupture propagated northwards from roughly Pelluhue to Pichilemu and perhaps slightly Northwards. Unfortunately, the first patch is not well resolved because of poorer coverage of cGPS and accelerograms in the South. A remarkable feature of the earthquake is that accelerograms have a much shorter duration - close to 60s - at high frequencies than the source time function observed in far field body waves (more than a 100 s). Peak accelerations were also low, from 30 to 40 % of g in the epicentral area, slightly higher in the sedimentary valleys of central Chile. The Northern sites show directivity, with 60 s duration for stations from Santiago to the North. Duration in Argentinian stations located near the centre of the fault is longer, of the order of 100 s similar to that observed in the far field. We used 1 Hz cGPS stations deployed in the Coquimbo region - 700 to 1000 km North of the hypocenter - in order to follow the propagation of a large shear wave pulse across the array that we stacked and back-projected into the source. This pulse is composed of almost pure SH and Love waves generated by the Northern patch of the rupture. We are currently proceeding with the kinematic inversion of

these data. Continuous 1 Hz GPS successfully supplement and replace strong motion accelerograms at frequencies lower than 0.1 Hz.