



Characterisation of long period strong motion for large earthquakes in Chile

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Several large earthquakes with magnitudes up to 7.8 have occurred in Northern Chile in the last two years at different depths under the subduction zone. These events were recorded by new digital accelerometric stations deployed by the University of Chile, GFZ (Germany) and IPGP (France) in expectation of a future very large earthquake in Northern Chile. These events include the $M_w=7.8$ Pica earthquake of June 2005, a tensional event inside the subducted plate, the $M_w=7.7$ thrust event of 13 November 2007 and its main aftershocks, including the slab compression event of 16 December 2006. Accelerograms of these events were recorded at distances from 20 to a few hundred km, typical of the distances expected in subduction zones. In the period range 1 to 10 sec these events are dominated by as a small number of strong pulses of acceleration up to 20 % g and particle velocity jumps of up to 20 cm/s that occur over time periods of less than 2 s. Such series of large impulses is what is expected from sudden changes in rupture speed as the seismic rupture encounters geometrical obstacles along the fault zone. At these low frequencies and medium size distances the effect of attenuation is limited to small broadening of the acceleration pulses and rounding off of the velocity records. In the case of the 2005 earthquake we clearly recognize a large stopping phase in several stations that can only be explained by an abrupt, almost complete reduction of rupture speed or a massive stress drop equivalent to an asperity of about 100 MPa. In the case of the recent subduction zone earthquake clear stopping phases delimit the main low frequency pulse. These stopping phases have been mistakenly identified as a multiple event. Smaller aftershocks of magnitudes less than 7 appear as very simple pulses that can be very accurately explained by the radiation of simple elliptical faults with variable stress drop. Robust estimates of source

parameters for these simple earthquakes will be discussed.