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The Aftershock Analyses of 27 February 2010 Chile M=8.8 Mega Earthquake

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In 1960, the biggest earthquake (M=9.5), the human ever recorded event, occurred in south Chile. Subsequently several mega earthquake (M >8) occurred, including the M=8.8 earthquake in 2010. This reflects that an incomplete release of tectonic energy exists in the Chile subduction system. The west coast of Chile is a long convergence plate boundary between the Nazca and the South American plate. The Nazca Plate subducts beneath the South American Plate toward the northeast with a convergence rate of about 6.5 cm/year, accumulating the stress in the lower part of the subducted plate to some extent resulting in destructive ruptures. On 27 February 2010, the Maule mega earthquake (M=8.8) occurred offshore central Chile. The epicenter (35.9° S, 72.73° W) is located at 115 km, NE of Concepción, the second biggest city in Chile. The main shock was a thrust-type subduction earthquake where the Nazca Plate subducted into the South America Plate (the Chile subduction system). The focal depth of main shock is 35 km which caused more than 500-km long rupture in the accretionary prism and produced a destructive tsunami of more than 20 m. It killed several hundreds of people and damaged countless buildings. Even up to today, aftershocks and volcanic activities continue to occur in this region. During May-August of last year, we shipped 20 OBSs to Chile and conducted two aftershock surveys in the tsunami-affected area. The OBSs recorded more than 4,000 aftershock events, magnitude from M=6.0 to 1.0. Results show that the aftershock data were concentrated into two masses: the landward side of the paleo-accretionary prism and the seaward side of the subducting plate, leaving a “white zone” in the frontal accretionary prisms. Both data sets consistently indicate the same result. The angle between the paleo-accretionary prism and the subduction plate seems to be greater than that of the frontal-accretionary prism. We suggest that the greater of the splay fault angle the higher the risk for the occurrence of a destructive tsunami. Even though our study covered only a short period of aftershocks it appears to show shows important basic characteristics of the 2010 Maule mega event.