Characteristics of Source Rupture Process of the Earthquakes in Subduction Zones

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Recent researches revealed two distinct regions at subduction plate boundaries. One of which is the locked zone where the plates strongly couples together while the other is sliding zone where the plates have weak coupling. Locked zones generally reside at the depth of 10-60 km, surrounded by two sliding zones, unconsolidated sediments in the accretionary prism at updip and unlocked materials due to increasing temperature and pressure at downdip. Therefore, large earthquakes must initiate at either end of the locked zone because of its faster stress accumulation speed. In this research, stress accumulation processes in subduction zones are discussed through investigating regional characteristics in source rupture process. The method applied is the teleseismic body wave inversion on the large earthquakes of subduction plate boundaries between 1990 and 2004 when high-quality broadband wave data required for stable solution are available. The results showed numerous updip initiations at Tohoku to Hokkaido-Chishima; however, for most regions, simple classification into updip and downdip initiations was difficult. This may imply almost the same stress accumulation at updip and downdip, as well as some strong influences at sub-regional level. Another characteristics shown by the inversion is a peculiar process in which the rupture starts at an asperity within the seismogenic zone and propagates into shallow region to release large amount of moment. This large moment release mostly located closer to trench axis than generally ascribed seismogenic region. This infers triggering of rupture at shallow region by the rupture started in seismogenic region.