

Characteristics of the 2011 Tohoku-Oki earthquake

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The 2011 M9.0 Tohoku-Oki earthquake is the largest earthquake that occurred in and around Japan since the beginning of the recorded history, and is the first M9-class earthquake that is closely recorded by a dense seismograph network. The ground motions from this major event were recorded by 1223 K-NET and KiK-net stations. The peak ground accelerations (PGA) exceeded gravity at 20 sites; the largest PGA, of 2933 gals, was observed at the K-NET Tsukidate station (MYG004). The area where the observed JMA seismic intensities exceeded 6+ spans for about 300 km along the east coast of Honshu and intensities larger than 5- were observed for most prefectures in the Tohoku and Kanto districts. Strong motions of this earthquake are characterized by large seismic intensities and PGAs, long durations, and wideness of the area that experienced intense shaking. Although the tsunamis were the primary cause of damage, the strong shaking, liquefaction and landslides also brought serious destruction. However, it was reported that the damage ratios of houses and buildings directly due to shaking were not as high as for the former earthquakes having comparable seismic intensities and PGAs. The recorded ground motions at most stations where the seismic intensities and PGAs were large had dominant periods shorter than 0.5 s and relatively poor power in the 1 - 2 s period range which has strong influence on the damage of few-stories wooden houses. The main reason for the short-period predominance is the amplification due to the low-velocity superficial layer and can be roughly explained by empirical amplification factors for 0.1 - 0.5 s periods rather than 1 - 2 s.

Keywords: 2011 Tohoku-oki earthquake, seismic intensity, PGA, PGV, K-NET, KiK-net