

Sea cliff landslides caused by the 2011 Tohoku earthquake and the 2011 Fukushima-Hamadori earthquake in the Joban coast

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Many of sea cliff landslides caused by large earthquakes in March and April 2011 occurred along the Joban coast facing the Pacific Ocean. We measured geomorphic parameters (e.g., length, width, volume) of 177 sea cliff landslides from the north Ibaraki to the north Fukushima. Then, we clarified the morphological characteristics of landslides by using airphoto analysis and field investigation, and examined the relationship between landslide morphology, local geology and seismic acceleration parameters (QuiQuake by AIST).

Landslides were mainly classified into the following 2 types. [Type 1, n=89] The upper part of sea cliff (unconsolidated marine or terrestrial sands and gravels, or aeolian tephra) collapsed, but lower part (marine sedimentary rocks) remained stable. [Type 2, n=79] The whole of sea cliff collapsed regardless of local geology. Nine landslides could not be classified due to the resolution problems of airphoto. Average volume of landslide block was $2.2 \times 10^3 \text{ m}^3$ for Type 1 and $7.6 \times 10^3 \text{ m}^3$ for Type 2. A middle scale landslide with almost 10^5 m^3 volume of a landslide block was included in an unclassified type. Landslides of Type 1 were frequently found in the southern and the northern Joban coast such as Hitachi, Kita-ibaraki and Sohma. Landslides of Type 2 were present in the middle part of Joban coast such as Kita-ibaraki and Futaba. The landslides tended to concentrate in the areas where high seismic acceleration was estimated on March 11 2011 such as Hitachi, Futaba and Tomioka.