Liquefaction distribution and characteristics during the 2024 Noto Peninsula Earthquake

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1. Introduction.
The Noto Peninsula earthquake of 1 January 2024 caused liquefaction over a wide area in the Hokuriku region (Fukui, Ishikawa, Toyama and Niigata). Liquefaction is a recurring hazard in the same location and region, and surveying and understanding the locations of liquefaction is extremely important for predicting and mitigating future liquefaction damage. In order to improve the accuracy of immediate estimation of liquefaction damage, the author has collected as much information as possible on liquefaction sites, including the 2011 off the Pacific coast of Tohoku Earthquake1) , and has examined the relationship between the geomorphological classification at the site and the estimated intensity of shaking (e.g. intensity of earthquake), and then examined the liquefaction probability. 2)3). In the Noto Peninsula earthquake, a liquefaction damage survey was conducted with the aim of creating a data archive of liquefaction damage locations and examining the sophistication of liquefaction hazard maps and liquefaction probability.

2. Survey of liquefaction damage sites
The survey was conducted in the above four prefectures over a 19-day period between 6 January and 22 March 2024 (as of the end of March 2024). The furthest points from the epicentre where liquefaction occurred during the survey were Fukui Port in Sakai City, Fukui Prefecture, on the west (southwest) side, and the area around Niigata West Port in Chuo-ku, Niigata City, on the east (northeast) side. Both locations are approximately 170-180 km away from the epicentre and have been identified over a wide area of approximately 350 km. In order to prepare for efficient field surveys, information on earthquake damage from local authorities, liquefaction-related information posted on the WEB and SNS, etc. was collected, and liquefaction history information, geomorphological classification published on the Earthquake Hazard Station (J-SHIS) of the National Research Institute for Earth Science and Disaster Prevention, and aerial photographs4) of the Geospatial Information Authority of Japan (GSI), etc. were used to read the liquefaction history. The locations where liquefaction such as sand eruptions were suspected and other reference information that could be read from the microtopography classification and the aerial photographs4) published by the National Research Institute for Earth Science and Disaster Prevention (NIED) and other sources, were surveyed in the field after building this integrated information in the developed survey tool (not yet published).

3. Characteristics of the distribution of liquefaction sites
Figure 1 compares some of the results (Ishikawa and Toyama) of the survey of liquefaction damage points on a 250 m mesh (one-quarter regional mesh) with the geomorphological classification and estimated seismic intensity distribution5). At present, damage has been confirmed in 32 municipalities in four prefectures, with a total of 2013 locations (number of meshes). By prefecture, Ishikawa Prefecture has the highest number of locations (1423), followed by Toyama Prefecture (356), Niigata Prefecture (219) and Fukui Prefecture (15).

4. Summary
One of the major characteristics of the liquefaction damage caused by the Noto Peninsula earthquake is

that liquefaction with large-scale lateral flow was observed in the lowland hinterland on the land side of the dunes at an estimated intensity of 5 or lower to 5 or higher. In particular, in the lowland areas behind the dunes in Kanazawa City, Uchinada Town, Kahoku City and the Nishi Ward of Niigata City (Terao, Sakaiwa and Ono areas), the amount of sand eruptions was large and extensive damage was observed, including large tilting and sinking of houses. The reason for the large damage despite the relatively small seismic intensity may be that the earthquake was of a larger magnitude (M7.6) than, for example, the Kumamoto (M7.3) and the Southern Hyogo (M7.3) earthquakes, which may have affected the length of the seismic motion duration. In the future, liquefaction location information will be compiled, liquefaction hazard maps and liquefaction rates will be studied for upgrading, and liquefaction damage location information (250 m mesh) will be made available as soon as possible.

Keywords: Liquefaction, Strong ground motion, Geomorphological classification

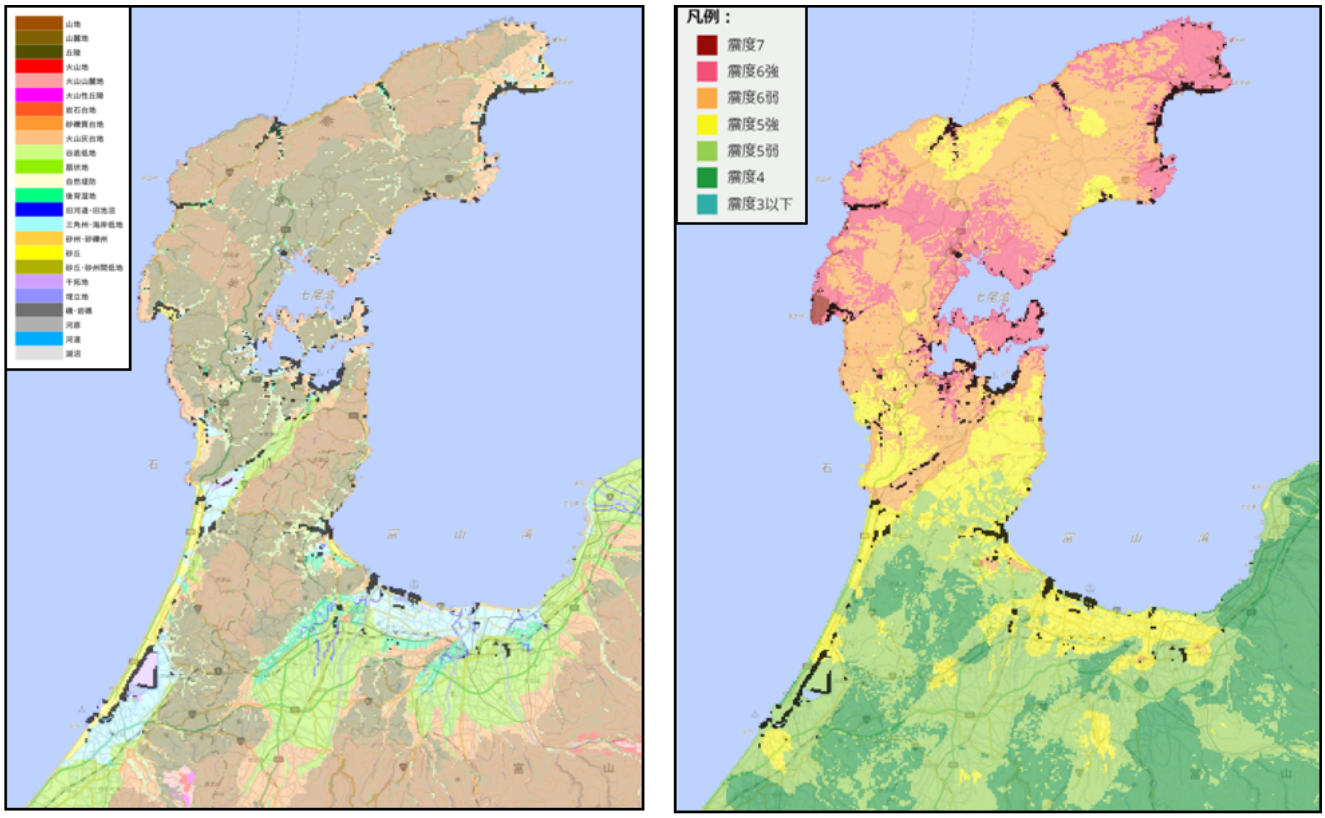

Fig 1　液状化地点の250mメッシュ（■）と背景図が微地形区分（左）と推計震度分布（右）

