R7-B01 Earthquake uplift on the Sotoura coast

In the earthquake of 1 January 2024, where and by how much was the coast of Sotoura on the Noto Peninsula lifted up, how reliable are those values, and what did the uplift change in the ports, the beaches and the shallow sea?

Readers

Fishers, fishery cooperatives, local governments (those in charge of fisheries, ports and coasts), research institutions and others without specialist knowledge, who want to check, with figures and sources, where and by how much the coast of Sotoura was lifted up, how reliable those values are, and what the uplift changed in the ports, the beaches and the shallow sea.

Takeaways

1. In the Noto Peninsula Earthquake of 1 January 2024, the coast of Sotoura (the Sea of Japan side of the Noto Peninsula) was lifted up. This is called uplift. The uplift that researchers from universities and other bodies measured at 510 sites on the coast was 0.1–5.2 m. The largest is 5.21 m, south of Cape Saruyama in the north-west of the peninsula. Around Kurasaki on the north coast, too, there are places where the uplift is large, at about 2.7 m. On the Nanao Bay and Toyama Bay sides, no uplift large enough to move the coastline was seen.
2. The values of uplift differ with who measured them and how. The values of the Geospatial Information Authority of Japan are a maximum of 4.10 m by survey on the ground and a maximum of about 4 m by satellite analysis. The national government treats both as provisional values. In the provisional values that the prefecture compiled for each fishing port, the 4.1 m of Kaiso Fishing Port is the largest. Even for the same Kaiso, there is a range of 3.6–4.1 m depending on the source. When using a value, it is necessary to state with it who measured it, when, and using what as the marker.
3. The coastline moved seaward along a total of about 100 km of the north and north-west coasts. About 4.4 km^2 that had been seabed became land. In a report that measured down to the bottom of the sea with a laser from an aircraft, it is 4.56 km^2. The width by which the coastline advanced was about 240–250 m at the maximum. In the national government's survey of areas, the areas of Wajima City, Suzu City and Shika Town increased by 4.74 km^2 in total. This is the difference between the value for 1 April 2025 and the value for 1 July, which reflects the earthquake. This value also includes changes for reasons other than uplift.
4. After the earthquake too, Sotoura has slowly been sinking (observations up to December 2025). In the prefecture's material, the subsidence up to December 2024 is about 0.1 m at the maximum. Numerical values for the amount of subsidence from 2025 onwards are not to be found. How often the uplift repeats is also not yet known. Estimates of the interval between large uplifts of the 2024 class range from about 500 years to several thousand years, depending on the method of estimation and on the assumed age of the old landforms. In the north-west of the peninsula, small uplifts of less than 1 m may also have occurred at intervals of about 300 years at the shortest.
5. The uplift changed the ports, the beaches and the shallow sea all at once. At many fishing ports of Sotoura, the inside of the port dried out or became shallow. In the national government's summary as of the end of September 2026, at 13 of the 16 fishing ports of Sotoura that had uplift or the like, landing of catches had become possible through temporary works and the like. For 2 ports, the policy is to have nearby fishing ports take over their functions. The new beaches near the fishing ports of Kaiso and Kuroshima moved several tens of metres with the waves. A survey commissioned by the Fisheries Agency takes the view that they largely settled in about 2 years. Because this is a sea where the difference between high and low tide is small, the living things of the rocky shore and the shallow seaweed and seagrass beds dried out all together.

After reading	When using a value of the uplift of Sotoura in documents or plans, state with it which source the value is from, and the date, method and place of measurement. The methods of measurement include traces of seaweed, the national government's control points, satellites, and airborne laser. The prefecture's values for each fishing port are provisional values of August 2024, and are representative values for the positions of quays and the like. Because the ground has been sinking little by little after the earthquake too (observations up to December 2025), if there are values from a new survey, compare with them.

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1. Key points

- In the Noto Peninsula Earthquake of 1 January 2024, the coast of Sotoura (the Sea of Japan side of the Noto Peninsula) was lifted up. This is called uplift. The uplift that researchers from universities and other bodies measured at 510 sites on the coast was 0.1–5.2 m. The largest is 5.21 m, south of Cape Saruyama in the north-west of the peninsula. Around Kurasaki on the north coast, too, there are places where the uplift is large, at about 2.7 m. On the Nanao Bay and Toyama Bay sides, no uplift large enough to move the coastline was seen. [S1]
- The values of uplift differ with who measured them and how. The values of the Geospatial Information Authority of Japan are a maximum of 4.10 m by survey on the ground and a maximum of about 4 m by satellite analysis. The national government treats both as provisional values. In the provisional values that the prefecture compiled for each fishing port, the 4.1 m of Kaiso Fishing Port is the largest. Even for the same Kaiso, there is a range of 3.6–4.1 m depending on the source. When using a value, it is necessary to state with it who measured it, when, and using what as the marker. [S1, S2, S3, S4]
- The coastline moved seaward along a total of about 100 km of the north and north-west coasts. About 4.4 km^2 that had been seabed became land. In a report that measured down to the bottom of the sea with a laser from an aircraft, it is 4.56 km^2. The width by which the coastline advanced was about 240–250 m at the maximum. In the national government's survey of areas, the areas of Wajima City, Suzu City and Shika Town increased by 4.74 km^2 in total. This is the difference between the value for 1 April 2025 and the value for 1 July, which reflects the earthquake. This value also includes changes for reasons other than uplift. [S1, S5, S6, S7, S8]
- After the earthquake too, Sotoura has slowly been sinking (observations up to December 2025). In the prefecture's material, the subsidence up to December 2024 is about 0.1 m at the maximum. Numerical values for the amount of subsidence from 2025 onwards are not to be found. How often the uplift repeats is also not yet known. Estimates of the interval between large uplifts of the 2024 class range from about 500 years to several thousand years, depending on the method of estimation and on the assumed age of the old landforms. In the north-west of the peninsula, small uplifts of less than 1 m may also have occurred at intervals of about 300 years at the shortest. [S9, S10, S11, S12, S17]
- The uplift changed the ports, the beaches and the shallow sea all at once. At many fishing ports of Sotoura, the inside of the port dried out or became shallow. In the national government's summary as of the end of September 2026, at 13 of the 16 fishing ports of Sotoura that had uplift or the like, landing of catches had become possible through temporary works and the like. For 2 ports, the policy is to have nearby fishing ports take over their functions. The new beaches near the fishing ports of Kaiso and Kuroshima moved several tens of metres with the waves. A survey commissioned by the Fisheries Agency takes the view that they largely

settled in about 2 years. Because this is a sea where the difference between high and low tide is small, the living things of the rocky shore and the shallow seaweed and seagrass beds dried out all together. [S3, S13, S14, S15, S16]

2. What is happening

Japan and the world: what it means for an earthquake to lift up a coast

Uplift is the ground being lifted up. In an earthquake in which a fault near the sea (a surface along which the underground bedrock slips) moves, a coast can be lifted up by as much as several metres all at once. When that happens, rocky shores and seabed that had been in the sea until then become land, and the coastline (the line of the boundary between sea and land) moves seaward. On the surface of the dried-out rock, the remains of dead seaweeds, shellfish and the like are left as a white band, which serves as a marker of the height of the sea surface before the earthquake. Such white bands were also recorded in the 1964 earthquake in Alaska and the 2016 earthquake in New Zealand. [S20, S22]

On a coast that is uplifted again and again, a landform like a staircase is made. This is called a marine terrace. Each of the steps was made when a flat rocky shore or the like that had been near the sea surface was lifted up by a large uplift. In the southern part of the Boso Peninsula, terraces were made by the uplift of the 1923 Kanto earthquake and the 1703 Genroku earthquake, and it is thought that the wide steps were made by earthquakes of the Genroku type, in which the uplift is large, and the narrow steps by earthquakes of the Taisho type. A researcher of AIST (the National Institute of Advanced Industrial Science and Technology) explains that the national government's Headquarters for Earthquake Research Promotion makes its long-term evaluation of Kanto earthquakes (an evaluation of how likely future earthquakes are to occur) on the basis of the terraces of the Boso Peninsula. [S17]

Japan and the world: past examples, and what was studied afterwards

In Japan too, there are several records of a coast being uplifted by about 1–6 m at the maximum in an earthquake (the maximum value for each earthquake in Table 1; this paper's summary). In the table in which the Geospatial Information Authority of Japan compared survey results, the largest vertical movement was an uplift of about 2 m in the 1923 Kanto earthquake and an uplift of about 4 m in the 2024 Noto Peninsula Earthquake. From the terraces of the Boso Peninsula, it is estimated that there was an uplift of about 6 m at the maximum in the 1703 Genroku earthquake. The coastline near Shirahama on the Boso Peninsula is said to have been, before the Genroku earthquake, up to about 500 m further inland than it is now. [S2, S17, S18, S19]

There are also examples in which what had been sea became land through uplift and the way the land was used changed. At Kisakata in Akita Prefecture, in the earthquake of 1804, a lagoon (a shallow lake near the sea) about 2 km in diameter and 2 m deep was uplifted and became land or marsh. The material of the meteorological observatory (based on the "Comprehensive List of Destructive Earthquakes in Japan" (Nihon Higai Jishin Soran)) gives the uplift as 2 m at Kisakata and 1.3 m at Konoura, 6 km to its north. A paper of 1979 that measured the height of the traces of the old coastline gives the range where uplift is clear as 25 km along the coast, and the uplift near Kisakata as 180 cm at the maximum. Paddy fields spread around the dried-out lagoon, and Kisakata became a national Natural Monument in 1934. [S18]

The flat rocky shore of Iwami Tatamigaura at Hamada in Shimane Prefecture has been said to have come above the sea surface in the earthquake of 1872 (the description of the national Natural Monument). A survey 40 years after the earthquake, reported in 1913, gave the uplift around Tatamigaura as 2–6 shaku (about 60–180 cm) (as quoted in a lecture abstract of 2020). A paper of 2020 gave the uplift as 0.8–1.1 m in the northern part and 0.3–

0.4 m or less in the central and southern parts, from the height and age of the traces of serpulid tube worms (small organisms that make calcareous tubes) attached in rock caves, the topography measured by drone, and a pictorial map of 1817. This paper states that in the pictorial map of 1817, most of the rocky shore is already drawn above the sea surface. Iwami Tatamigaura became a national Natural Monument in 1932. [S19, S18]

Overseas, even larger uplifts have been recorded. In the 1964 Alaska earthquake, a wide area was uplifted by an average of 6 feet (about 1.8 m; this paper's conversion), and the maximum on land was 38 feet (about 11.6 m; likewise) on Montague Island. The report of the U.S. Geological Survey (USGS) states that the shape of the coast changed greatly through uplift and subsidence, and that there was great damage to the living things near the shore and to coastal facilities. [S20]

In Alaska, how the uplifted beaches were eroded afterwards was also studied. In the soft delta sediment of MacLeod Harbor on Montague Island, 52% of the material of the uplifted beach had already been lost by 15 months after the earthquake (June 1965). Of the amount eroded, 97% was by rivers, and 0.8% was by the sea. On the other hand, on rock beaches, no noticeable erosion was seen during the 15 months. [S20]

In the 2010 Maule earthquake in Chile, the height of the land changed by +2.5 m to −1 m along about 500 km of coast (from markers on the coast and rivers). A study that measured, several weeks after the earthquake, by the height of living things that attach in bands (calcareous seaweeds, large seaweeds, mussels) gives the uplift as about 0.2–3.1 m. Where the uplift was large, the main living things of the intertidal zone (the part of the rocky shore that is under the sea at high tide and comes out as land at low tide) and of the shallow sea died in large numbers. In a study that surveyed sandy beaches just before and just after the earthquake, in the uplifted southern section, the sandy beach became wide and flat and the places where living things can live increased, while there were also places where the shallow rocky seabed was lifted up and the sandy beach of the low intertidal zone disappeared. [S21]

In the 2016 Kaikoura earthquake in New Zealand, the vertical movement along about 110 km of coast differed greatly from place to place, at −2.5 to 6.5 m (from airborne laser, survey on the ground and satellite). According to the reports of Fisheries New Zealand, paua (a relative of abalone) died in large numbers at every stage of growth because of the uplift, and the habitat of juvenile shellfish at water depths of less than 2 m was lost. On the basis of an initial estimate that about 21% of the fishing grounds had been lost, among other things, the fishing of paua on this coast was stopped from November 2016. During the closure too, the stock continued to be surveyed at 35 sites, and on conditions such as that shellfish born after the earthquake were widely seen, fishing was reopened for the first time on 1 December 2021, for 3 months only. [S22]

Table 1 Main examples in Japan and overseas of coasts lifted up by earthquakes

Earthquake	Value of uplift	Method of measurement and source	What happened afterwards, and what was studied
1703 Genroku earthquake (Boso Peninsula)	About 6 m at the maximum	Estimate from the height of terraces (explanatory article)	The coastline near Shirahama was, before the earthquake, up to about 500 m further inland than now
1804 Kisakata earthquake (Akita Prefecture)	2 m at Kisakata; 180 cm at the maximum	Records (material of the meteoro - logical observatory); height of the traces of the old coastline (paper of 1979)	The lagoon became land, and then paddy fields. Natural Monument in 1934
1872 Hamada earthquake (Shi - mane Prefecture)	About 60–180 cm; 0.8–1.1 m in the northern part	Survey 40 years after the earthquake; traces of living things and topogra - phy (paper of 2020)	Iwami Tatamigaura became a Natural Monument in 1932

Earthquake	Value of uplift	Method of measurement and source	What happened afterwards, and what was studied
1923 Kanto earthquake	About 2 m	Survey (comparison table of the Geospatial Information Authority of Japan)	Terraces were made near the southern tip of the Boso Peninsula
1964 Alaska earthquake (USA)	Maximum on land 38 feet (about 11.6 m)	Report of the U.S. Geological Survey	At MacLeod Harbor, 52% of the material of the uplifted soft beach was lost in 15 months
2010 Maule earthquake (Chile)	+2.5 m to −1 m; about 0.2–3.1 m	Markers on the coast and rivers; living things that attach in bands	Mass death of the living things of the intertidal zone and the shallow sea. Sandy beaches became wide and flat
2016 Kaikoura earthquake (New Zealand)	−2.5 to 6.5 m	Airborne laser, survey on the ground, satellite	Fishing of paua stopped from November 2016 and reopened in December 2021
2024 Noto Peninsula Earthquake	About 4 m (survey); 0.1–5.2 m (510 sites)	Geospatial Information Authority of Japan; paper by researchers from universities and other bodies	The "Region (Sotoura)" sections of this chapter

Note: The values are as each source states them. Because both the methods of measurement and the periods differ, the sizes of the values cannot be compared as they stand (Chapter 5). [S17, S18, S19, S2, S20, S21, S22, S1]

Region (Sotoura): the earthquake, and the extent of the uplift

At about 16:10 on 1 January 2024, an earthquake occurred with its hypocentre in the Noto region of Ishikawa Prefecture. The magnitude, which expresses its size, was 7.6 (the value of the Japan Meteorological Agency), the depth of the hypocentre was 16 km, and the maximum seismic intensity was 7. The paper this paper cites gives 7.5 in moment magnitude (Mw), a different way of measuring. The national government's Earthquake Research Committee estimates that the fault that caused this earthquake (the source fault) extends for about 150 km from north-east to south-west. This fault runs just off the coast of Sotoura, almost parallel to the shore (the fault, and preparing for the next earthquake, are dealt with in R7-B02 "The active faults just off the coast, and preparing for the next earthquake and tsunami"). [S2, S1, S23]

In this earthquake, 720 people died, including disaster-related deaths, and the whereabouts of 2 people are not known (the national government's preliminary figures as of 31 March 2026; including Niigata Prefecture and Toyama Prefecture). Homes, roads and ports also suffered great damage. Of these, this paper deals with the uplift of the coast and the changes it brought to the ports, the beaches and the shallow sea. [S37, S13]

Sotoura is the coast on the Sea of Japan side of the Noto Peninsula. In this paper, it means the coast of Shika Town, Wajima City (including Monzen, Hegurajima and Nanatsujima), and the north coast of Suzu City as far as Jike. The coast on the inner side of the peninsula (the Toyama Bay side) is called Uchiura. The uplift of this earthquake was concentrated in Sotoura. The paper in which researchers from Hiroshima University, Kanazawa University and other bodies measured the uplift at 510 sites on the coast (2026; hereafter, the 510-site paper) states that no change was seen in the coastlines of Nanao Bay and Toyama Bay. On the other hand, in the prefecture's table of fishing ports, Kodomari Fishing Port on the Toyama Bay side of Suzu City was uplifted by 0.5 m and Takojima Fishing Port and Iida Port by 0.2 m, and Ukai Fishing Port subsided by 0.4 m (provisional values of representative values for quays and the like; Chapter 5). In Nanao Bay, conversely, the ground sank, and there were places where the land behind ports and the like was flooded; this is dealt with in R7-A19 "Land subsidence and flooding in Nanao Bay". [S1, S3, S9, S29]

The uplift becomes smaller the further south one goes from Cape Saruyama on the west coast, and the further towards the eastern tip one goes from Kurasaki on the north coast. The preliminary report (14 January 2024) of a group of researchers of the Association of Japanese Geographers states that uplift was recognised as far as about 22 km south of Cape Saruyama on the west coast, and in the east as far as Awazu in Misaki-machi, Suzu City (about 5 km south of Cape Rokko). In the prefecture's values for each fishing port, Shika Town had Akasaki 0.45 m, Togi 0.6 m, Ryoke 0.3 m and Shitsumi 0.23 m, and Fukura Port, Akasumi, Abuya, Takahama and Oshima were 0.1 m or less. The values of the 510-site paper on the east coast south of Cape Rokko are Cape Kongo 0.73 m and Awazu 0.23 m. On the offshore islands, Hegurajima Fishing Port was 0.1 m or less in the prefecture's values, and we found no source showing a value of uplift for Nanatsujima. [S6, S3, S1]

In the north-eastern part of the Noto Peninsula, uplift had been progressing little by little since before the earthquake. According to the Earthquake Research Committee, earthquakes increased from December 2020, and by the M6.5 earthquake of 5 May 2023, there had been about 4 cm of uplift at the observation point in Suzu. In the M6.5 earthquake, there was about 13 cm of uplift at the observation point at Noroshi in Suzu City. In the survey by researchers of AIST and other bodies, east of Dogasaki in Takaya-machi, Suzu City, there was an uplift of 0.24 m in the 2023 earthquake and 1.48 m in the 2024 earthquake, and the total from October 2022 was 1.72 m (as of 1 March 2024). [S23, S4]

Region (Sotoura): the size of the uplift from place to place

The 510-site paper measured, from mid-February to early April 2024 and in September, the height of the traces of dried-out seaweed at 510 sites along the coast by satellite positioning (GNSS; a system that measures position with the radio waves of artificial satellites) (the method of measurement is in Chapter 3). The uplift was 0.1–5.2 m, and the value for each single site has a range of ±0.33 m. The largest is 5.21 m, 400 m south of Cape Saruyama. Near Cape Saruyama there are also points of 5.43 m and 5.70 m, but because they are too large compared with the surrounding values, they are excluded as possibly having been affected by something other than the earthquake, such as a landslide. [S1]

There are two places where the uplift is large, and their sizes differ. One is around Cape Saruyama in the north-west, where the paper's values are Yoshiura 4.60 m, Ikasu 4.07 m, Kaiso 3.99 m and Kuroshima 3.46 m. The other is around Kurasaki on the north coast, with Kurasaki 2.64 m and a coast near it (written in the paper as Nakata Beach) 2.70 m. The further from the two peaks, the smaller the uplift becomes; for example, Akakami on the west coast 1.24 m, Wajima Port 1.22 m and Cape Rokko 1.04 m. The shape of these two peaks is said also to agree with the satellite analysis of the Geospatial Information Authority of Japan. [S1]

The paper by researchers from Tohoku University and other bodies (2024; hereafter, the Tohoku University and others paper) reconstructed the movement of the ground in three dimensions from satellite radar images, and gave the maximum uplift as 4.4 m at the western end of the peninsula. In the north-eastern part (near longitude 137.1 degrees east) there is also another peak of 2.4 m, and the northern part of the peninsula moved westward by about 2 m at the maximum. In the field survey of 52 sites from January to early March 2024 too, there were two peaks, Yoshiura Fishing Port 4.3 m and Otani Fishing Port about 2 m, and a trough at Unyu Fishing Port 0.2 m, which agreed with the satellite results. [S7]

The values of the Geospatial Information Authority of Japan are about 4 m at the maximum. In the analysis of radar images from the artificial satellite "Daichi-2" (updated 19 January 2024), the western part of Wajima City was uplifted by about 4 m at the maximum and moved westward by about 2 m at the maximum, and the northern part of Suzu City was uplifted by about 2 m at the maximum and moved westward by about 3 m at the maximum. The Geospatial Information Authority of Japan states that these values are provisional values and have not been checked on the ground. In the emergency survey on the ground on 20–21 January 2024, it confirmed an uplift of 4.10 m and a westward movement of 1.48 m at the triangulation point (a point that the

national government has placed as a reference for position) "Ikasu". The Geospatial Information Authority of Japan treats this value too as a provisional value. On 20 February 2024, it announced that it had confirmed an uplift of about 4 m in a field survey at Kaiso Fishing Port. [S2]

Uplift was also recorded at the national government's GNSS continuous observation stations (observation facilities that receive GNSS signals and determine position precisely; about 1,300 locations nationwide). At "Wajima 2" in Wajima City, there was an uplift of about 1.3 m and a movement of about 2.0 m to the south-west (announced on 9 January 2024). At the observation equipment placed at Noroshi in Suzu City, there was an uplift of about 1.0 m (announced on 15 January). The Geospatial Information Authority of Japan states that both values may have been affected by tilting of the observation point or by movement at that place alone. Because the GNSS continuous observation stations are limited in number, the values for each place on the coast are obtained mainly by other methods of measurement. [S2]

From just after the earthquake, research institutions also measured on the ground. On 8 January 2024, AIST measured the height of the upper edge of the oysters and serpulid tube worms attached to the wall of the seawall at Kaiso Fishing Port, and gave it as 3.8–3.9 m above the sea surface. The later paper (2024) gives the uplift at Kaiso as about 3.6 m, from the height of the cliff in front of the dried-out rock bench north of the fishing port, corrected for the height of the tide. The preliminary reports of the Earthquake Research Institute of the University of Tokyo and other bodies gave, as provisional values before correction for the height of the tide, about 4.1 m at Ikasu Fishing Port, about 3.3 m at Minazuki Fishing Port, about 0.25 m at Akasaki Fishing Port in Shika Town, and so on. [S4, S24]

The national government and the prefecture have also summarised the sizes by segment and by coast. The national government's long-term evaluation (2025), citing other papers, states that for each segment of the fault the coast was uplifted by 4 m or more in the Saruyama-oki segment, 2 m or more in the Wajima-oki segment, and 1 m or more in the Suzu-oki segment. The material of the review committee for the prefecture's basic plan for coastal protection (November 2025) compares airborne laser surveys from before and after the earthquake (2016 and 2024), and gives an uplift of 4 m or more near the Ikasu coast and of less than 1 m near the Misaki coast at the tip of the peninsula. [S12, S9]

The prefecture compiled the values of uplift for each fishing port in its reconstruction policy of August 2024 (Table 2). These values are representative values measured at the positions of the quays and the like of each port. The prefecture notes that they are provisional values based on survey values from its investigation, materials of the cities and towns, and the like, and that they may change in future. The fishing ports that were uplifted by 3 m or more are the 4 fishing ports of Minazuki, Fukami, Kaiso and Kuroshima in Wajima City, and the largest is the 4.1 m of Kaiso Fishing Port. The ports that were uplifted by 1 m or more are all in Wajima City and Suzu City. [S3, S27]

Table 2 Values of uplift for each fishing port of Sotoura (the prefecture's provisional values, August 2024)

City or town	Fishing ports and values of uplift
Shika Town	Akasaki 0.45 m, Togi 0.6 m, Ryoke 0.3 m, Shitsumi 0.23 m. Fukura Port, Akasumi, Abuya, Takahama and Oshima are 0.1 m or less
Wajima City	Sosogi 1.5 m, Nafune 2.2 m, Wajima Port 1.5 m, Hikariura 1.5 m, Unyu 1.0 m, Osawa 2.5 m, Minazuki 3.6 m, Fukami 3.7 m, Kaiso 4.1 m, Kuroshima 3.7 m, Akakami 1.6 m, Tsurugiji 1.1 m, Hegurajima 0.1 m or less
Suzu City (So - toura side)	Maura 2.0 m, Nagahashi 2.8 m, Noroshi (Takaya district 1.8 m, Orito district 1.2 m, Noroshi district 0.8 m), Jike 0.7 m

Note: From the table (ground deformation at the mooring facilities of fishing ports) in the prefecture's "Reconstruction policy for the fisheries-related ports of Noto". Wajima Port and Fukura Port are commercial

ports managed by the prefecture, and the others are fishing ports. The values are provisional values of representative values measured at the positions of quays and the like, and are not the maximum values for the coast or seabed around the port. Kodomari, Takojima, Iida Port and Ukai in Suzu City, in the same table, were excluded as ports on the Uchiura side (placing Kodomari outside the scope is this paper's judgement). [S3, S27]

The bottom of the sea was also uplifted. The method of shining laser light from an aircraft and measuring the topography from the land to the bottom of the shallow sea is called airborne laser bathymetry. A report that compared the topography before the earthquake (September–October 2022) and after it (April–May 2024) by this method (2026; written for a short special feature in an academic society's journal by staff of the company that did the survey; hereafter, the airborne laser bathymetry report) gives the maximum uplift as 5.2 m, the maximum horizontal movement as 2.5 m, and the area that newly came above the sea surface through uplift as 4.56 km^2 (values from the English abstract). An article explaining the same survey (2025) gives the uplift of about 5.2 m at the maximum as a value for the seabed near Cape Saruyama, and states that it exceeded the maximum of 4.1 m that had been spoken of for the land. [S5, S25]

Further offshore too, the seabed rose. The Japan Coast Guard measured the topography of the seabed with sound waves from ships and compared it with past data, and has confirmed that the seabed was uplifted over about 80 km along the active faults from the north-west to the north-east of the peninsula (announcements of February, June and December 2024; the maximum is about 3–4 m depending on the place). The changes in the offshore seabed are dealt with in R7-B02 "The active faults just off the coast, and preparing for the next earthquake and tsunami" and R7-B04 "The changed topography of the shallow sea, and the lack of maps and observations that fishers can use". [S26]

Region (Sotoura): the newly made land, and the coastline

Through the uplift, the coastline of Sotoura moved seaward. The 510-site paper states, from the aerial photographs of the Geospatial Information Authority of Japan, that the coastline moved seaward along a total of about 100 km of the north and north-west coasts, and that about 4.4 km^2 (square kilometres) of seabed became land. Coasts that advanced by 100 m or more are commonly seen, with about 240 m at Kuroshima, about 200 m at Ikasu, and more than 150 m west of Nafune, at Nie and at Cape Rokko. [S1]

The 510-site paper takes the view that the width by which the coastline advanced depends not only on the size of the uplift but also on the topography and geology of the coast. At Cape Saruyama, even with an uplift of more than 4 m (according to the satellite analysis of the Geospatial Information Authority of Japan), the coastline hardly moved. On sandy beaches, the size of the uplift and the width of the advance corresponded well. The Tohoku University and others paper states that the length of the advance was about 60 times the amount of uplift (an average coastal slope of about 1.7%). [S1, S7]

The value of the area that became land is about 4.4–4.56 km^2 depending on the source. The preliminary report of the group of the Association of Japanese Geographers (14 January 2024) gives about 4.4 km^2, the Tohoku University and others paper 4.5 km^2, and the airborne laser bathymetry report 4.56 km^2. Separately from these, in the areas that the Geospatial Information Authority of Japan published in September 2025, the area of Ishikawa Prefecture as of 1 July had increased by 4.74 km^2 from that as of 1 April, of which Wajima City was 2.78 km^2, Suzu City 1.72 km^2 and Shika Town 0.24 km^2 (the total of the 3 municipalities is the same as the increase for the prefecture; this paper's calculation). The Geospatial Information Authority of Japan states that this increase or decrease also includes the deposition and erosion of sandy beaches, land reclamation, and differences in the fineness of the map data, and so does not show only the uplifted area. [S6, S7, S5, S8]

The material of the review committee for the prefecture's basic plan for coastal protection (November 2025) states that after the earthquake the shoreline (the line of the water's edge) of Sotoura advanced by 200 m or more, while Uchiura has not changed greatly. There are also places where, through the uplift, detached

breakwaters (embankments that weaken the waves) placed offshore were taken in on the land side, and the review of how to protect the coast is dealt with in R7-B05 "Remaking the basic plan for coastal protection (uplift and growing waves)". [S9, S27]

New marine terraces were also made by the uplift. AIST states that north of Kaiso Fishing Port, a wave-cut bench (a flat rocky shore made by being cut by the waves) that had been near the mean sea surface dried out, and the cliff in front of it (originally a cliff in the sea) became the cliff of a terrace as it was. On the coast of the northern part of the Noto Peninsula, there were already 3 steps of terraces (the L1–L3 surfaces) thought to be of the Holocene (from about 10,000 years ago to the present), and the terrace this time corresponds to the 4th step (the L4 surface). What has been confirmed at Ikasu, near Kaiso, are the L1 surface and the L2 surface. The Earthquake Research Committee too, in its evaluations of January–February 2024, recognised new marine terraces on the north-west coast, and stated that there were places over a wide area of the north coast that had become land through uplift. [S4, S11, S23]

The land that newly became land has already begun to be used. The Ministry of Land, Infrastructure, Transport and Tourism states that, for the whole of the section of National Route 249 that the national government is repairing by proxy (about 53 km), it plans to finish the full-scale restoration (full restoration) by spring 2029 if the acquisition of land and the works on large structures go smoothly, and that, of this, in the Senmaida and Okawahama work sections, it will use the uplifted coast to build the road in a position different from the original road. In August 2026, Kyodo News reported that the national government (the Hokuriku Local Finance Bureau) has a policy of selling to the city about 6,500 m^2 of national land at Nie-machi, Suzu City, that was made by the uplift of the seabed, and that the city plans to build 10 units of disaster public housing there. The uses of the land that became land, and their coordination with the protection of the coast and with nature, are dealt with in R7-B06 "The newly emerged land and the uses of the coast". [S32, S33]

Region (Sotoura): movement after the earthquake

After the earthquake, the Noto Peninsula has slowly been sinking. The slow movement of the ground that continues after a large earthquake is called postseismic deformation. At the GNSS continuous observation stations of the Geospatial Information Authority of Japan, from the day after the earthquake (2 January 2024) to 15–21 December 2024, Wajima sank by 9.3 cm, Wajima 2 by 7.9 cm, Shika A by 2.7 cm and Hegurajima by 1.8 cm (provisional values, taking the Misumi point in Shimane Prefecture as the reference and removing the steady movement and seasonal changes obtained from the one year of 2019–2020 before the earthquake; read from a figure). During this period, the earthquakes of June 2024 (M6.0) and November (M6.6) also occurred. The material of the prefecture's review committee states that, as of December 2024, subsidence of about 0.1 m at the maximum had occurred. [S2, S9]

The sinking movement was continuing in 2025 too. The material of Kyoto University, Kanazawa University and Tohoku University (data up to early December 2025) states that, compared with the one year just after the earthquake, the movement became smaller in the one year after that. It states that in the vertical direction the subsidence of the peninsula continues, and that recently it has been sinking at an almost constant rate. The amount of sinking is shown only in figures, and no numerical values are written. The Earthquake Research Committee (14 January 2026) also states that the postseismic deformation is continuing while slowing down. [S10, S23]

In the monthly announcements on crustal deformation by the Geospatial Information Authority of Japan, the postseismic deformation of the Noto Peninsula was listed, in the announcements of April, July and August 2025, only in the "supplementary explanation" column, which summarised the changes over one year. From the announcement of September 2025 this column disappeared, and the Noto Peninsula is not listed (checked by this paper up to the announcement of October 2026). We found no published material that shows in numerical

values the amount of subsidence at the points of Sotoura from 2025 onwards. At the prefecture's committee, the chair asked which topography should be used in the tsunami calculations while the uplifted ground is sinking little by little, and the prefecture said it would coordinate with the division in charge (R7-B05 "Remaking the basic plan for coastal protection (uplift and growing waves)"). [S2, S9]

Region (Sotoura): the interval at which uplift repeats

The northern part of the Noto Peninsula is thought to have been uplifted with each earthquake over a long time. AIST states that the peninsula has marine terraces from about 770,000 years ago onwards, which show that it has been uplifted over a long time. The 510-site paper states that, because the terrace of the Last Interglacial (said to be about 125,000 years ago) is at 110 m above sea level at the high places of the north coast, and its shape tilting lower towards the south agrees with the shape of the 2024 uplift, large earthquakes like that of 2024 have repeatedly lifted up the northern part of the peninsula. [S4, S1, S12]

The interval estimated from the terraces changes greatly with the assumed age of the terraces. A paper of 2020, before the earthquake, assumed the age of the L1 surface, the uppermost of the 3 low terraces of the north coast (the L1–L3 surfaces), to be 6,000 years ago or 3,500 years ago, and estimated the interval at which large uplift repeats in the Saruyama-oki segment at about 2,000 years or about 1,200 years, and in the Wajima-oki and Suzu-oki segments at about 900–1,400 years or about 500–800 years. From the remains of dried-out living things, it states that in Saruyama-oki there were uplifts of 0.7 m around the 9th century and 0.8 m around the 12th–13th centuries, and that there is a possibility of an interval of about 300 years at the shortest. It states that the most recent activity of the western part of the Wajima-oki segment is thought to be the historical earthquake of 1729. However, the authors state that, because there are no data on the age of the terraces and there are also not a few uncertain points in the method of estimation, the intervals are reference values for the evaluation of active faults. [S11]

Whether a terrace is made or not differs with the size of the uplift. In the 2007 Noto Peninsula earthquake (M6.9) the coast was uplifted by 0.5 m at the maximum, and in the M6.5 earthquake of 2023 by 20-odd cm even at the maximum (0.24 m east of Dogasaki), but no wide area dried out and no terrace was made. In the 2007 earthquake Tsurugiji Fishing Port was also uplifted, and to remove the difference in level from the water surface, a step of about 50 cm had been added to the quay (this time it was uplifted by about 1 m). In the area uplifted in 2007, an earthquake accompanied by similar uplift is said to have occurred about 1,000 years ago as well (quoted from a study of 2009). A researcher of AIST states that it is highly likely that the L1–L3 surfaces were also made by earthquakes of about the same size as that of 2024, while, because the heights and distribution of the terraces vary from place to place, each single past event was not necessarily an earthquake of the same extent and amount of slip. For example, in the north-western part, which includes Kaiso, there is almost no L3 surface. The researcher also writes that it is important to clarify the age of each terrace. [S4, S11, S17, S27]

A lecture abstract by a researcher of AIST (a lecture of June 2024; the abstract was made public in May) states that in the most recent thousand years, uplift has occurred by several tens of cm at a time in each segment at intervals of about several hundred to a thousand years, and that it can be said that large uplifts of the 2024 class were occurring at intervals of a thousand to several thousand years. There are not yet any data on the age of the terraces, and these are values for the case where the terraces are considered to have been made after the peak of the Jomon transgression (around about 6 thousand years ago), when the sea surface was at its highest. An explanatory article by the same researcher (May 2024) states that it is very difficult to predict the exact timing of such low-frequency events. [S17]

The national government's long-term evaluation (published June 2025, corrected in November) considers that the 3 segments of the Noto Peninsula north coast fault zone (Saruyama-oki, Wajima-oki and Suzu-oki) moved as a whole in the earthquake of 1 January 2024. Having stated that the age of the terraces is not known, it assumed

that the uppermost terrace was made about 6 thousand years ago and that there were 3 earthquakes in about 6 thousand years, and gave the average interval as about 2 thousand years. Under this assumption, the national government gave the probability of an earthquake occurring on this fault zone during the next 30 years as almost 0% for every segment (taking 1 January 2025 as the reference). Separately from this, the national government gives the probability that an M7.0 or greater earthquake will occur on an active fault in some sea area within the next 30 years, in the eastern zone that includes the surroundings of the Noto Peninsula, as 12–14% (a 95% confidence interval showing the range of the estimate; the median is 13%). The probabilities, and preparing for the next earthquake and tsunami, are dealt with in R7-B02. [S12]

Table 3 Estimates of the interval at which uplift repeats (differences by source)

Source	Interval	What was counted as one event, and what was assumed
Paper of 2020 (Saruyama-oki segment)	About 2,000 years, or about 1,200 years	Uplift of terraces. The age of the L1 surface assumed to be 6,000 years ago, or 3,500 years ago
Paper of 2020 (Wajima-oki and Suzu-oki segments)	About 900–1,400 years, or about 500–800 years	The same
Paper of 2020 (Saruyama-oki, remains of living things)	Possibly about 300 years at the shortest	Uplifts of 0.7–0.8 m (around the 9th century, around the 12th–13th centuries)
Lecture abstract by a researcher of AIST (2024)	Several hundred to a thousand years	Uplift of several tens of cm in each segment (the most recent thousand years)
Lecture abstract by a researcher of AIST (2024)	A thousand to several thousand years	Large uplifts of the 2024 class. The case where the terraces are considered to have been made later than about 6 thousand years ago
The national government's long-term evaluation (2025)	About 2,000 years (the value used in the evaluation)	Assumes 3 earthquakes in about 6 thousand years
The national government's long-term evaluation (2025)	About a thousand years (Saruyama-oki, Wajima-oki)	From the offsets of the seabed strata explored with sound waves. Because it differs from the value from the terraces by more than double, it was not used in the evaluation
The national government's long-term evaluation (2025)	Saruyama-oki 0.8–1.4 thousand years, Wajima-oki 0.9–1.6 thousand years, Suzu-oki 3.3 thousand years or less	From the slip per event estimated from the length of the fault, and the average slip rate. Saruyama-oki and Wajima-oki are shorter than the interval from the terraces, and Suzu-oki is longer

Note: Every source states that the age at which the L1–L3 surfaces dried out is not yet known. The authors of the paper of 2020 treat the intervals as reference values. [S11, S17, S12]

Region (Sotoura): what changed in the ports, the beaches and the shallow sea

The uplift changed the ports, the beaches and the shallow sea of Sotoura all at once. Here we show briefly what changed, and leave the details to the other materials of this series.

In the ports, the inside of the port dried out or became shallow, and there came to be ports that boats could not enter or leave, and ports where the quay was too high and it was hard to land cargo. The prefecture and the Fisheries Agency divide the uplifted ports into 3 types by the size of the uplift (the type where the water area of

the port dried out, the type where the water area remains but is shallow and the quay is also too high, and the type that can be used depending on the tide and the like), and the prefecture states that it was damage of a kind never experienced before in Japan. [S3, S28]

In the national government's summary as of 30 September 2026, at 13 of the 16 fishing ports of Sotoura that had uplift or the like, the function of landing catches had returned through temporary works and the like, and for 2 fishing ports the policy is to have nearby fishing ports take over their functions. In the prefecture's table (as of 31 March 2026), the fishing ports of Sotoura that could not be used were the 3 ports of Maura, Fukami and Kuroshima. The situation and restoration of the small fishing ports are dealt with in R7-B19 "The small fishing ports of the Sotoura coast (ports that cannot be used, and the policy of consolidation)". How the ports being unusable affected fishing and livelihoods is dealt with in R7-B22 "The fall in landings on the Sotoura coast (the delay in the Wajima district)" and R7-B24 "The income of fishers hit by the disaster, and the gaps in support", and the role of fishing ports as the entrance for support from the sea at the time of a disaster in R7-B29 "The isolated fishing villages at the tip of the peninsula, and the disaster-prevention role of fishing ports". [S13, S29]

At Wajima Port, said to be the port with the most fishing boats in the prefecture, the grounding of boats and a shortage of water depth inside the port were confirmed, due to an uplift of the seabed of about 1.5 m. Wajima Port is dealt with in R7-B17 "Wajima Port (the prefecture's largest fishing base): the shortage of water depth and the restoration". The national government states that in the uplifted ports there were fishing boats that could not move because of grounding or damage, and fishing boats are dealt with in R7-B20 "Damage to fishing boats, and boats that cannot move in uplifted ports". [S30, S13]

On the beaches, the newly made sandy beaches changed shape with the waves, and the shoreline between Kaiso Fishing Port and Kuroshima Fishing Port moved several tens of metres between November 2024 and January 2026, but a survey commissioned by the Fisheries Agency takes the view that the sections on the side of both fishing ports largely settled in 2 years from the uplift. At Togi Fishing Port too, where the uplift was 0.6 m, the basin (the water area inside a port where boats are moored) was filled in, and the sediment was removed (the prefecture's material of 2024). The movement of sand and the silting-up of fishing ports are dealt with in R7-B03 "Sandy beaches that keep moving after the uplift, and the silting-up of fishing ports". [S14, S3]

In the shallow sea, the topography of the seabed and the habitats of living things changed. The article explaining the airborne laser bathymetry states that new rocky areas have appeared where there had been sandy ground, and that these could become new seaweed and seagrass beds (places where seaweeds and the like grow thickly) and fishing grounds (the topography of the shallow sea is dealt with in R7-B04). In Sotoura the difference between high and low tide is small, and at Wajima it is about 50 cm at the maximum throughout the year (in Tokyo it is about 2 m at the maximum). For that reason, the announcement by researchers of Kanazawa University and other bodies writes that, with the 4 m class uplift, on the coasts of Kaiso and Kuroshima that were surveyed, the situation became one in which the living things around the intertidal zone had, for the time being, returned to zero (R7-B07 "The wipe-out of the living things of the intertidal zone and shallow rocky reefs, and the recovery afterwards"). In the diving survey (June 2025) that the Kanazawa Association of Corporate Executives, a business association, carried out with a grant from The Nippon Foundation, the coast had dried out by about 100 m at Kaiso and about 65 m at Noroshi, and the seaweed and seagrass beds that had been there had disappeared (R7-B08 "Shallow seaweed and seagrass beds left dry by uplift, and the decrease in the area of beds on the Sotoura coast"). The effects on the abalone and turban shells of the shallow rocky shore are dealt with in R7-B13 "The mass die-off of abalone and turban shells, and the fall in catches lasting several years", and the effects on the rocky shores where rock nori and wakame are picked in R7-B14 "The rocky shores for rock nori and wakame (drying-out of nori fields, footing, processing sites)". [S25, S15, S16]

The uplift also affected the observation of the sea. The Japan Meteorological Agency's tsunami observation point at Nagahashi, Suzu City, became unable to observe tsunamis because its surroundings were uplifted, and

the Japan Meteorological Agency placed simple observation equipment at Wajima Port on 7 January 2024 and resumed the monitoring of tsunamis in the northern part of the peninsula on the 8th (the lack of observations is dealt with in R7-B04). [S26, S36]

3. Existing measures, and how they are assessed

The uplift happened all at once through the movement of the fault that caused the earthquake. The efforts given in the materials this paper looked at are four: measuring and recording the uplift, correcting the survey references and the maps, deciding the methods of repairing the uplifted ports, and preparing for uplift in other regions. There are numbers that show progress (such as the number of ports where landing of catches has returned), but we found no assessment that compared the merits and demerits of each effort.

Measuring and recording the uplift

From just after the earthquake, the uplift was measured by national bodies and by researchers using separate methods. The Geospatial Information Authority of Japan took aerial photographs at a scale of 1:10,000 from 2 January 2024, covered the land of the northern part of the peninsula by 17 January, and made them public straight away. It also carried out the analysis of satellite radar images, the re-measurement of the national control points, and continuous observation at the GNSS continuous observation stations. Researchers measured the heights of many sites on the coast, using the traces of dried-out living things as markers. The shallow sea was measured by airborne laser bathymetry, and the offshore seabed by sound waves from the ships of the Japan Coast Guard. [S1, S2, S25, S26]

The method of measuring by markers on the ground is as follows. The 510-site paper used the upper edge of the traces where pirihiba (Corallina pilulifera), a red seaweed called "akamo" locally, had dried out and turned white. From the height of the upper edge (E), it obtains the amount of uplift (U) by $U = E - 0.27 \pm 0.33$ m. The 0.27 m is the elevation of the mean sea surface at Wajima Port over the one year of 2023, and the $\pm$0.33 m is the range that contains 95.4% of the daily mean sea surfaces of 2023. Between summer and winter, the mean sea surface differs by about 0.6 m (2021–2023). The Tohoku University and others paper confirmed, at Kami-Osawa-machi, Wajima City, that the upper edge of living pirihiba is about 0.2 m below the mean sea surface, and that oysters tend to attach up to places about 0.2 m higher than pirihiba. [S1, S7]

Every method of measurement has things it can show and limits (Table 4). Across the differences in method, the broad shape agrees. The maximum uplift came out at almost the same value by separate methods: the marker on land (5.21 m) and the topographic data of the seabed (about 5.2 m). That the seabed value is for the vicinity of Cape Saruyama is according to the explanatory article. The shape with peaks near Cape Saruyama and near Kurasaki agrees between the researchers' values on the ground and the national government's satellite analysis. On the other hand, the values for each place differ by several tens of cm because of differences in the marker and the reference. The data of the 510-site paper are not made public, under the policy of the organisation that acquired them. For the airborne laser bathymetry report too, only subscribers can read the main text. [S1, S2, S5, S25]

Table 4 Methods of measuring uplift, and what each can show

Method of measurement (main sources)	What it can show	Limits	Main values
Satellite radar images (Geospatial Information Authority of Japan; the Tohoku University and others paper)	The extent over an area, and horizontal movement	The national government's values are provisional values and have not been checked on the ground	About 4 m at the maximum (national government); 4.4 m (paper)
Survey of the national control points; GNSS continuous observation stations (Geospatial Information Authority of Japan)	The accurate movement of fixed points	The number of points is limited. The values of the emergency survey are provisional values	4.10 m (Ikasu); about 1.3 m (Wajima 2; possibly affected by tilting and the like)
Traces of dried-out living things (the 510-site paper, AIST and others)	Values for many sites on the coast	A range of ±0.33 m at one site. Differs by several tens of cm with the kind of marker	0.1–5.21 m (510 sites)
Values for the quays of fishing ports (prefecture)	Values for each port	Provisional values of representative values for quays and the like	4.1 m at the maximum (Kaiso Fishing Port)
Airborne laser bathymetry (Map of the Sea)	The continuous topography from the land to the bottom of the shallow sea	The main text of the report is for subscribers only. Maps for fishers exist for only some districts	5.2 m at the maximum; 4.56 km^2
Sound waves from ships (Japan Coast Guard)	The topography of the offshore seabed	Because it is compared with old data, the year compared with differs from place to place	About 3–4 m at the maximum
Comparison of the seabed strata explored with sound waves (AIST)	The vertical offset of the seabed on both sides of the fault	Errors of about 1 m are possible in parts	2–4 m in many places

Note: The satellite and control points are according to the Geospatial Information Authority of Japan and the Tohoku University and others paper; the traces of living things, the 510-site paper and AIST; the quays, the prefecture; the airborne laser bathymetry, the report, the explanatory articles and news reports; and the sound waves from ships, the announcements of the Japan Coast Guard. [S2, S7, S1, S4, S3, S5, S25, S35, S26]

Correcting the survey references, the maps and the nautical charts

Because the ground moved, the references for position and height were also corrected. The Geospatial Information Authority of Japan re-measured the positions and heights of the control points and revised them in turn from February 2024 to May 2025, but in the northern part of the Noto Peninsula, because the movement of the ground and its differences from place to place are too large, it has not issued correction values for correcting the values from before the earthquake. [S2]

As for maps of the shallow sea for fishers, as of the news report of September 2025, ones based on the airborne laser bathymetry had only been distributed to the 2 districts of Wajimazaki and Najimi. As for nautical charts for navigation, there were none for Sotoura in the Japan Coast Guard's list of new editions for 2025–2026. This paper has not checked the new editions of 2024, or corrections made through the notices that announce corrections to charts. The maps and observations of the shallow sea are dealt with in R7-B04 "The changed topography of the shallow sea, and the lack of maps and observations that fishers can use". [S34, S35]

Methods of repairing the uplifted ports

The national government and the prefecture newly set out how to repair the uplifted ports. The Fisheries Agency, in a review meeting of experts, compiled the methods and procedures for restoring uplifted fishing ports in July 2024, and the prefecture adopted the policy of first bringing fishing back through temporary works, and of choosing the method for the full-scale works (full restoration) port by port while talking with the fishers (the reconstruction policy of August 2024). How each port is repaired, and the effects, are dealt with in R7-B19 "The small fishing ports of the Sotoura coast (ports that cannot be used, and the policy of consolidation)", and Wajima Port in R7-B17 "Wajima Port (the prefecture's largest fishing base): the shortage of water depth and the restoration". [S28, S3]

Preparation in other regions

In other regions too, the need to prepare for uplift has been pointed out. A researcher of AIST writes that there are also marine terraces on the eastern margin of the Sea of Japan, such as Sado Island, and at Omaezaki, Shionomisaki, Cape Muroto and Cape Ashizuri, and that because these could be uplifted greatly in future, it is necessary to proceed with earthquake measures for ports that assume uplift of the coast (an explanatory article for general readers). A report commissioned by the Fisheries Agency introduces an example in which Kochi Prefecture estimated by calculation the amount of uplift at the fishing ports in the prefecture and sorted out the dangers, and confirmed that at Murotomisaki Fishing Port and others there would be water depth that does not hinder the navigation of boats even after uplift. The same report states that measures by means of structures that assume uplift are difficult. In the materials this paper looked at, this one case of Kochi Prefecture was the only example of an inspection of ports assuming uplift. [S17, S14]

4. What is changing

The uplift happened all at once on 1 January 2024, but the ground and the coast have moved since then too, and the evaluations and plans of the national government and the prefecture are also being remade (as of 4 November 2026). Much of what this chapter deals with is evaluations, policies, plans and schedules of the national government and the prefecture.

Movement of the ground and the coast

The ground was continuing to sink slowly at least until December 2025. In the prefecture's material it had sunk by about 0.1 m at the maximum by December 2024, and in the observations of the one year after that too, subsidence at an almost constant rate was continuing (Chapter 2). We found no outlook showing how far it will sink and how much of the uplift will remain. [S9, S10]

The new beaches and rocky areas will change shape little by little with the waves. The 510-site paper expects that the sandy beaches changed greatly through the uplift but will return to similar landforms by the next earthquake. The Tohoku University and others paper states that the newly emerged rock benches will be eroded by the waves, but that the widest ones will probably remain as marine terraces. On Montague Island in Alaska, in the soft delta sediment of MacLeod Harbor, about half (52%) of the material of the uplifted beach was lost in 15 months, while no noticeable erosion was seen on rock beaches (Chapter 2; a study of one island). [S1, S7, S20]

The plan for protecting the coast is also being remade. The prefecture is remaking the basic plan for coastal protection of the Noto Peninsula coast in the light of the uplift and climate change, and plans to adopt it in fiscal 2026 (the 3rd meeting of the committee had not been made public as of 4 November 2026). The content is dealt with in R7-B05. [S9]

Evaluations and plans of the national government and the prefecture

- 15 January and 9 February 2024: Evaluations by the national government's Earthquake Research Committee. It recognised new marine terraces on the north-west coast, and stated that there were places over a wide area of the north coast that had become land through uplift. [S23]
- February 2024 to May 2025: The Geospatial Information Authority of Japan revised in turn the positions and heights of the control points in Ishikawa Prefecture and elsewhere. [S2]
- 30 August 2024: The prefecture adopted the "Reconstruction policy for the fisheries-related ports of Noto" and included in it the provisional values of uplift for each fishing port (the PDF on the prefecture's website is the revised version of December 2024). [S3]
- 27 June 2025 (corrected on 5 November): The national government's long-term evaluation. It stated that the whole of the Noto Peninsula north coast fault zone moved in 2024, and gave the 30-year probability as almost 0%. [S12]
- 26 September 2025: The Geospatial Information Authority of Japan published areas that reflect the earthquake. [S8]
- 14 January 2026: The national government's Earthquake Research Committee. It stated that the postseismic deformation is continuing while slowing down. [S23]
- 20 January 2026: Announcement of the 510-site paper (the paper was made public online in October 2025). [S1]
- 11 May 2026: Publication of the airborne laser bathymetry report. [S5]
- Policies and plans for ports and coasts: the Fisheries Agency's technical review material (July 2024); the prefecture's reconstruction policy (August 2024; the short term is to the end of fiscal 2025, the medium term to the end of fiscal 2028, and the long term to the end of fiscal 2032); the Wajima Port restoration and reconstruction plan (adopted June 2025, changed January 2026); and the remaking of the prefecture's basic plan for coastal protection (planned to be adopted in fiscal 2026). The content and progress are dealt with in R7-B05, R7-B17 and R7-B19. [S28, S3, S30, S9]

5. What is not yet known

Things for which there are no figures

- We found no numerical values for the amount of subsidence at the points of Sotoura from 2025 onwards. Up to December 2024 there are the values of the Geospatial Information Authority of Japan (read from a figure) and the values of the prefecture's material, and the material of Kyoto University and others up to December 2025 shows the sinking movement only in figures. We also found no outlook on how far it will sink and how much of the uplift will remain. [S2, S9, S10]
- We found no value of uplift for Nanatsujima (Hegurajima Fishing Port is 0.1 m or less in the prefecture's values). [S3]
- The ages of the terraces of Sotoura (the L1–L3 surfaces) have not yet been measured. The estimates of the interval are all based on assumed ages (Table 3). [S11, S12]
- The data of the 510-site paper are not made public, under the policy of the organisation that acquired them. The main text of the airborne laser bathymetry report is open only to subscribers, and this paper read only the English abstract. Where the maximum of 5.2 m and the horizontal maximum of 2.5 m are values for is not written in the abstract. [S1, S5]

Limits to comparison

- The values of uplift change with the thing measured (traces of seaweed or oysters, control points, quays, topographic data), the place (cape or port, land or seabed), whether or not there is correction for the height of the tide, and the handling of outlying values. The 510-site paper states that the value differs with the marker even at the same place, and that, compared with the difference in topography measured by drone laser, the upper edge of pirihiba was several tens of cm higher and the inner edge of the rock bench was 0.3–0.8 m larger. [S1]
- The times of measurement also differ. The surveys on the ground were from 2 January 2024 by the Earthquake Research Institute of the University of Tokyo and other bodies, on 8 January by AIST, on 20–21 January for the triangulation point of the Geospatial Information Authority of Japan, from January to early March for the Tohoku University and others paper, and from mid-February to early April and in September for the 510-site paper, and the airborne laser bathymetry was in April–May. For the prefecture's values for fishing ports, the dates of measurement are not written (the ordering of the times is this paper's summary). During that time too the ground was sinking, and the subsidence up to December 2024 is about 0.1 m at the maximum. [S1, S2, S3, S4, S5, S7, S9, S24]
- The satellite values show a wide area, but the national government's values are provisional values and have not been checked on the ground. The prefecture's values for each fishing port are provisional values of a representative value at a single point such as a quay, and are not the maximum values for the coast or seabed around the port. [S2, S3, S27]
- A coastline read from aerial photographs is affected by the height of the tide on the day they were taken. The group of the Association of Japanese Geographers gives the difference between high tide and low tide around the dates of photography as about 35 cm at the maximum, and the accuracy of the data as about that of a 1:25,000 map. [S6]
- The extent of "Sotoura" differs from source to source. For example, the number of fishing ports of Sotoura differs between 16 and 22 depending on the source, and the breakdown is not written (for details, see R7-B19). [S3, S14, S13]
- The examples in Japan and overseas differ in both method of measurement and period (Table 1). The old values are based on records and old surveys, and the new values on surveys of topography and of the traces of living things. The expressions the sources use, "among the longest in the world" (the press release of the 510-site paper; referring to the length over which the coastline advanced continuously), "among the largest coastal uplifts in Japan" (the press release of Kanazawa University and others) and "can be said to be the largest in the history of observation" (the explanatory article by a researcher of AIST; a comparison since earthquake observation began in Japan in the Meiji era), are each source's own wording. In height of uplift, 1964 Alaska (maximum on land 38 feet) and 2016 Kaikoura (6.5 m at the maximum) are larger values. [S1, S15, S17, S20, S22]

Figures that disagree

- The values of uplift for the same place differ from source to source (Table 5). This is thought to be because the thing measured, the position and time of measurement, the correction for the height of the tide, and whether or not the value is provisional differ, and there are also cases, like Unyu, where the reason is not known. When using a value, it is necessary to show which source it is from.

Table 5 Values of uplift that differ by source at the same place

Place	Value	Source and method of measurement
Kaiso	3.99 m	The 510-site paper (traces of pirihiba, satellite positioning)

Place	Value	Source and method of measurement
Kaiso	About 4 m	Geospatial Information Authority of Japan (field survey, announced 20 February 2024)
Kaiso	4.1 m	Prefecture (representative value for the quays and the like of the fishing port, provisional value, August 2024)
Kaiso	3.8–3.9 m	AIST (upper edge of oysters and the like on the seawall, 8 January 2024)
Kaiso	About 3.6 m	Paper by AIST (cliff in front of the rock bench, corrected for the height of the tide); preliminary report of the Earthquake Research Institute of the University of Tokyo (corrected from 3.9 m, before tide correction)
Kaiso	3.6–3.9 m	Press release of Kanazawa University and others (March 2026)
Ikasu	4.07 m, 4.10 m, about 4.1 m	The 510-site paper; Geospatial Information Authority of Japan (triangulation point, 20–21 January 2024); Earthquake Research Institute of the University of Tokyo (Ikasu Fishing Port, before tide correction)
Yoshiura	4.60 m, 4.3 m	The 510-site paper; the Tohoku University and others paper (Yoshiura Fishing Port, field survey)
Kuroshima	3.46 m, 3.7 m	The 510-site paper; prefecture
Minazuki	About 3.3 m, 3.6 m, about 4 m	Earthquake Research Institute of the University of Tokyo (Minazuki Fishing Port, before tide correction); prefecture; Geospatial Information Authority of Japan (around Minazuki Bay, satellite, provisional value)
Osawa	2.67 m, 2.5 m	The 510-site paper; prefecture
Wajima Port	1.22 m, 1.5 m, about 1 m, about 1.5 m	The 510-site paper; the prefecture's table; the caption of a photograph in the prefecture's reconstruction policy; the plan for Wajima Port (uplift of the seabed)
Unyu	0.2 m, 1.0 m	The Tohoku University and others paper (Unyu Fishing Port, field survey); prefecture
Akasaki	About 0.25 m, 0.45 m	Earthquake Research Institute of the University of Tokyo (Akasaki Fishing Port, before tide correction); prefecture
Akakami	1.24 m, 1.6 m	The 510-site paper (Akakami on the west coast); prefecture (Akakami Fishing Port)

Note: The values are as each source states them. The reason for the difference at Unyu is not known from the sources. [S1, S2, S3, S4, S24, S15, S7, S30]

- The maximum uplift is 5.21 m in the 510-site paper (marker on land, south of Cape Saruyama), about 5.2 m by airborne laser bathymetry (seabed, near Cape Saruyama), 4.4 m in the Tohoku University and others paper (satellite), 4.10 m (triangulation point "Ikasu", provisional value) and about 4 m (satellite, provisional value) for the Geospatial Information Authority of Japan, and 4.1 m for the prefecture (Kaiso Fishing Port, provisional value). The thing measured, the place, and the handling of outlying values differ (the 510-site paper excluded 5.43 m and 5.70 m). The satellite values of the Tohoku University and others paper are values obtained for each area of about 90 m × 140 m and smoothed with the surrounding values (as stated in the methods of the paper). [S1, S5, S25, S7, S2, S3]
- As for horizontal movement, the abstract of the airborne laser bathymetry report gives "2.5 m at the maximum", while the article explaining the same survey gives an average of about 2.5 m and a maximum of 4.3 m near Shimizu-machi to Nagahashi-machi, Suzu City, and an average of about 2.2 m and a maximum of 3.0 m from near Cape Saruyama to around Kaiso Fishing Port. The satellite values of the Geospatial Information Authority of Japan are about 2 m at the maximum westward (western part of Wajima City) and

about 3 m (northern part of Suzu City), and the triangulation point "Ikasu" is 1.48 m. Because we have not been able to read the main text of the report, we could not check the reason for the difference. [S5, S25, S2]

- The length of the section where the coastline advanced is about 90 km in the preliminary report of the group of the Association of Japanese Geographers (the length joining the capes with straight lines every few km), and about 100 km in the 510-site paper. The area that became land is about 4.4–4.56 km^2, and which source was taken for the coastline before the earthquake, and the method of measurement, differ. The increase in area of the Geospatial Information Authority of Japan (4.74 km^2 for the 3 municipalities) is a different quantity that also includes changes in sandy beaches, land reclamation and the like. The maximum width of the advance is about 240 m (Kuroshima; the preliminary report and the 510-site paper), 250 m (the methods section of the Tohoku University and others paper; in the results section, 200 m at the maximum in the north-western part), about 250 m (the sandy beach east of Kaiso Fishing Port; the preliminary report of the Earthquake Research Institute of the University of Tokyo), and about 200 m (near Kuroshima-machi, the explanatory article on the airborne laser bathymetry; around Minazuki Bay, the satellite analysis of the Geospatial Information Authority of Japan). [S6, S1, S7, S24, S25, S2]
- The edge of the uplifted area also differs from source to source. The preliminary report of the group of the Association of Japanese Geographers takes the extent of uplift on the east coast as reaching as far as Awazu in Misaki-machi, Suzu City (about 5 km south of Cape Rokko), and the 510-site paper states that no change was seen in the coastlines of Nanao Bay and Toyama Bay. On the other hand, the prefecture's table of fishing ports lists, as provisional values, an uplift of 0.5 m at Kodomari Fishing Port in Suzu City, which this paper excluded as being on the Uchiura side, an uplift of 0.2 m at Takojima Fishing Port and Iida Port further south, and a subsidence of 0.4 m at Ukai Fishing Port. This is thought to be the difference between the movement of the coastline that can be seen in aerial photographs and values measured at the positions of quays (this paper's view). [S6, S1, S3]
- The estimates of the interval at which uplift repeats have a range: from about 500 years to several thousand years for large uplifts of the 2024 class, and from about 300 years if small uplifts of less than 1 m are also counted (Table 3). The national government's long-term evaluation states that small uplifts not accompanied by a terrace do not correspond to activity of a whole segment. Also, it states that, from the offsets of the seabed strata explored with sound waves, the interval comes to about a thousand years for Saruyama-oki and Wajima-oki, but that this differs by more than double from the "3 times in about 6 thousand years" seen from the terraces, and it used the about 2 thousand years from the terraces. [S11, S17, S12]
- In the overseas examples too, the values differ from source to source. The maximum on land in Alaska is 38 feet in the report of 1969 and 33 feet (about 10.1 m; this paper's conversion) in the announcement of 2014. The uplift at Maule is 2.5 m (markers on the coast and rivers) and 3.1 m (living things that attach in bands), and Kaikoura is 6.5 m (about 110 km, paper) and 6 m (about 120 km, the 2023 report of Fisheries New Zealand; about 100 km in the 2021 report). Kisakata is about 2 m (records) and 180 cm at the maximum (traces of the old coastline), and the size of the earthquake is M7.0 (meteorological observatory) and M7.1 (the value cited by the 510-site paper). Hamada is about 60–180 cm (the survey 40 years after the earthquake) and 0.8–1.1 m in the northern part (the paper of 2020). [S20, S21, S22, S18, S1, S19]
- A lecture abstract of the Disaster Prevention Research Institute of Kyoto University and others (2026), on the basis of the "Comprehensive List of Destructive Earthquakes in Japan", gives 29 cases in which a coast was uplifted or subsided among the 872 earthquakes of 592–2012, gives the largest uplift as the 6.0 m (Togane) of the 1872 Hamada earthquake, and gives the about 5.21 m of 2024 as the 2nd largest in the past. This 6.0 m differs greatly from the value of the paper that re-examined the Hamada earthquake (0.8–1.1 m in the northern part), and this paper has not checked the original records of the Comprehensive List. The English text of the abstract writes of the 29 cases as "uplift of sandy beach coasts", and its wording also differs from the Japanese text. [S31, S19]

- The article explaining the airborne laser bathymetry writes of Cape Saruyama as "the north-eastern part of the Noto Peninsula", but all the other sources give it as the north-western part, and this paper has taken it as the north-western part. The introduction of the 510-site paper gives the uplift of the Boso Peninsula as from the earthquakes of "1923 and 1854", but the large uplifts of the Boso Peninsula were due to the earthquakes of 1703 and 1923 (the explanatory article by a researcher of AIST), and this paper does not cite this part. [S25, S1, S17]

Reliability and the standpoint of the sources

Reliability differs from item to item. That the coast of Sotoura was uplifted in the earthquake of 1 January 2024, and that the place of largest uplift is near Cape Saruyama and another peak is near Kurasaki, are points on which two papers and the national government's surveys and satellite analysis agree, and the reliability can be said to be high. The maximum value is about 5.2 m by the marker on land (5.21 m) and the topographic data of the seabed (about 5.2 m), but 4.10 m at the national government's triangulation point and about 4–4.4 m by satellite analysis, differing by around 1 m with the method of measurement and the place. That on the Nanao Bay and Toyama Bay sides there was no uplift large enough to move the coastline is also a point on which the paper and the material of the prefecture's committee agree. However, the prefecture's table of fishing ports gives Kodomari, Takojima and Iida Port on the Toyama Bay side of Suzu City as uplifted by 0.2–0.5 m. The values for each place differ by several tens of cm with the marker and the reference, and the prefecture's values for fishing ports are provisional values, so the reliability is medium. For the subsidence after the earthquake, there are values from the national government's observations up to December 2024, and after that no numerical values are to be found, so the reliability is medium to low. For the interval at which uplift repeats, the ages of the terraces have not been measured and the national government's evaluation too is based on assumptions, so the reliability can be said to be low. The number and state of the ports are according to the materials of the national government and the prefecture and are reliable, but the values change with the point in time and the way of counting. That the living things of the rocky shore and the shallow seaweed and seagrass beds dried out is according to the press release of the universities and the report of the survey of the business association, and the reliability is medium.

The standpoint of the sources also needs care. The 510-site paper and the preliminary report of the group of the Association of Japanese Geographers of January 2024 include many of the same researchers, and are not independent confirmation (the agreement of the about 4.4 km^2 and the maximum of about 240 m is of values from the same line of research). The estimates of the interval from the terraces centre on the papers, lecture abstract and explanatory articles of the same researcher of AIST, and the national government's long-term evaluation also cites these. The airborne laser bathymetry report and the two explanatory articles are of the same "Map of the Sea" survey. The writers of the articles are the president of the Japan Hydrographic Association, which promoted the survey, and a person in charge at the company that did the survey, and the authors of the report are also people of the company that did the survey. This report is an article in a short special feature of an academic society's journal, and whether or not it has undergone peer review is not shown. The prefecture's values for fishing ports are provisional values based on the prefecture's surveys, the materials of the cities and towns, and the like, and the values of the Earthquake Research Institute of the University of Tokyo are provisional values before correction for the height of the tide. The report of the Kanazawa Association of Corporate Executives is the report of a survey that a business association carried out with a grant from The Nippon Foundation, and is not peer-reviewed. Of the airborne laser bathymetry report we read only the English abstract, and of the research on seashore living things by Kanazawa University and others we read only the press release.

The publisher of this paper (SeatecHIROSHIMA Ltd.) runs a business that controls the attachment of living things by surface treatment of materials. This covers both preventing fouling from attaching (antifouling) and making it

easier for eelgrass (a kind of seagrass) to take root for the regeneration of seaweed and seagrass beds. It is also developing a system that identifies the positions of oyster rafts and notifies ships of them. This paper does not cover the company's own technology or results. In Chapter 2, this paper touches briefly on the seaweed and seagrass beds that dried out through uplift, and on the view that the new rocky areas could become seaweed and seagrass beds (R7-B08). The regeneration of seaweed and seagrass beds overlaps with the field of the publisher's business. The relationships with the bodies taken up in this paper, and with bodies active in Sotoura, are as follows (as of 4 November 2026; based on information the publisher has made public, the publisher's contracts and records, and the research for this paper). With Ishikawa Prefecture, there is the relationship of having been selected (September 2025) for the prefecture's (Commerce, Industry and Labour Department, Industrial Policy Division) "survey project for attracting startups to Noto" (fiscal 2025 [Reiwa 7]). In this project, specialists accompany and support the selected companies in drawing up business plans and building connections in Noto (according to the prefecture's announcement). In October 2026, in the "Startup Business Plan Contest Ishikawa 2026" held by Ishikawa Prefecture and the Ishikawa Sunrise Industries Creation Organization (a public interest incorporated foundation), the publisher received the Best Entrepreneur Award for a plan on the subject of Nanao Bay (according to the announcement on the Organization's website). The Organization's website states that this award comes with a subsidy and with the free loan for 3 years of a facility that rents rooms to newly founded companies, among other things. In Noto, the publisher works in collaboration, under non-disclosure agreements, with Nanaibe LLC and Yamaguchi Suisan of Nanao City, with Atsumasa Nakamura of Kanazawa University, and with the Noto Fisheries Profit Improvement Council. With the Ishikawa Prefecture Fisheries Cooperative Association (which also has branches in Sotoura, and whose head is a member of the review committee for the prefecture's basic plan for coastal protection), there is the relationship that the publisher secured the site for its demonstration through its collaboration partner Nanaibe LLC. The publisher is not a member of the Noto Fisheries Profit Improvement Council. The area in Ishikawa Prefecture with which the publisher has been involved is mainly Nanao Bay, and Nanao Bay is dealt with in R7-A (Nanao Bay) of this series. In Sotoura (Shika Town, Wajima City and the north coast of Suzu City as far as Jike), the publisher is not active. Among the sources this paper cites, researchers of Kanazawa University have taken part in the 510-site paper, the material of Kyoto University and others, the press release on seashore living things by Kanazawa University and others, and the lecture abstract of the Disaster Prevention Research Institute of Kyoto University. The chair and one of the members of the review committee for the prefecture's basic plan for coastal protection, and the chair of the council on the fisheries-related ports, are also people of the same university. The name of Atsumasa Nakamura does not appear among the authors of these sources, nor in the lists of members of the committee and the council. With Hiroshima University, the publisher has taken part since October 2025, as one company of a consortium, in a research centre of the university (JST COI-NEXT). Michio Imai, the publisher's joint representative CEO, has served since 1 November 2026 as a researcher (part-time) at a research institute of the university (the institute for the future of the ocean and maritime affairs) (concurrently with being the publisher's joint representative CEO). In addition, the publisher joined joint research under the Town & Gown concept of Kure City and Hiroshima University (a concept under which the city and the university work together) (the research period is October 2025 to August 2026, and the contract was made in March 2026). This joint research is funded by a research grant of Kure City, and the publisher received an allocation of research funds from that grant (April 2026). It has also been selected for the research grant of Kure City for the 2nd year (from September 2026). The 510-site paper and the preliminary report of the group of the Association of Japanese Geographers, which this paper cites, have authors from Hiroshima University, but the researchers who are the publisher's partners in the joint research are not among the authors of either. This paper does not use the data or results of this joint research. With Tohoku University, there is the relationship that in October 2026 the publisher applied to a call for research of a research centre (COI-NEXT) centred on the university (the result had not come out as of 4 November 2026). The Tohoku University and others paper and the material of Kyoto University and others, which this paper cites, have authors from Tohoku University. As for Nagoya University, the

publisher's technology is supervised, in a personal capacity, by Kensuke Kuroda (representative of Nagoya Surface Technology; designated professor at the Institutes of Innovation for Future Society, Nagoya University). The 510-site paper and the preliminary report of the group of the Association of Japanese Geographers have 1 author from Nagoya University (the same person), but Kensuke Kuroda is not an author of either. Apart from the above, there are no relationships between the publisher and the bodies taken up in this paper (national bodies, the prefecture and the cities and towns, universities and research institutions, the companies and bodies named in this paper, and so on) or the bodies active in Sotoura (fisheries cooperatives, local bodies and so on) that would affect the content of this paper. The relationships meant here are transactions, funding, joint research, and officers or staff of the publisher concurrently serving as staff or officers of the body. This is the publisher's judgement, made after checking the information the publisher has made public, the publisher's contracts and records, and the research for this paper.

6. Sources

What we examined is materials that had been published by 4 November 2026. Centring on materials of the national government and the prefecture, peer-reviewed papers and reports of research institutions, we used figures that a separate researcher had checked against the very materials listed as sources (for the airborne laser bathymetry report, the English abstract only; where we used a value that has not been checked, we have indicated so in the text). Among the figures that papers and national government materials quote from other studies, there are some that we have not checked back to the original study, and we have marked these "quoted" in the text. Values read from figures are written as "read from a figure". Reliability: A = laws and regulations, statistics, materials of the national government and the prefecture; B = papers, reports of research institutions that state their method; C = explanatory materials for general readers, explanations by organisations, guidance with little description of method; D = news reports.

ID	Source (publisher, year)	Type	Reliability	Chapters used
S1	Goto et al. (Hiroshima University, Kanazawa University and others): Coast up - lifted by nearby shore-parallel active submarine faults during the 2024 Mw 7.5 Noto Peninsula earthquake (Geomorphology 493, 110069, 2026; CC BY; this paper's "510-site paper"); Kanazawa University, Hiroshima University and oth - ers: press release (in Japanese) (20 January 2026)	Paper	B	Chapters 1–5
S2	Geospatial Information Authority of Japan: Information on the 2024 (Reiwa 6) Noto Peninsula Earthquake (satellite analysis; changes in the coastline; emer - gency survey on the ground; crustal deformation, 3rd report; 4th report; com - parison with past earthquakes; crustal deformation of December 2024 (Reiwa 6), Attachment 8; monthly announcements [April 2025; July; August; September; October 2026]; response for public surveys; handling of control point results; GNSS continuous observation stations) (in Japanese) (2024–2026; the satellite and emergency survey values are provisional values)	Observation	A	Chapters 1–5
S3	Ishikawa Prefecture and the council for the reconstruction of the fisheries-re - lated ports of Noto: Reconstruction policy for the fisheries-related ports of Noto (adopted August 2024; the PDF on the website is the revised version of December 2024; the values for each fishing port are provisional values); outline of the council; summary of proceedings of the 1st meeting (in Japanese) (2024)	Plan	A	Chapters 1–5
S4	AIST, Geological Survey of Japan: emergency survey reports (2nd report; 4th report; 11th report) (2024); Shishikura et al.: emergence of the coast and marine terraces produced by the uplift accompanying the 2024 (Reiwa 6) Noto Peninsula Earthquake (The Quaternary Research (Daiyonki-Kenkyu) 63(2), 2024) (in Japanese)	Report	B	Chapters 1–3, 5

ID	Source (publisher, year)	Type	Reliability	Chapters used
S5	Kurimoto et al. (Asia Air Survey): topographic changes in the shallow sea area caused by the 2024 (Reiwa 6) Noto Peninsula Earthquake, from data acquired by airborne laser bathymetry (ALB) (in Japanese) (Journal of the Japan Society of Photogrammetry and Remote Sensing 65(2), 2026; an article in a short special feature of an academic society's journal, with no statement of the dates of receipt and acceptance; English abstract only checked; this paper's "airborne laser bathymetry report")	Report	B	Chapters 1–5
S6	Research group on the tectonic landforms of the 2024 (Reiwa 6) Noto Peninsula Earthquake (Association of Japanese Geographers): Results of the examination of coastal landform changes due to the 2024 (Reiwa 6) Noto Peninsula Earthquake (3rd report) (in Japanese) (14 January 2024; preliminary report; CC BY)	Report	B	Chapters 1, 2, 5
S7	Fukushima et al. (Tohoku University and others): Landscape changes caused by the 2024 Noto Peninsula earthquake in Japan (Science Advances 10, 2024; CC BY; this paper's "Tohoku University and others paper")	Paper	B	Chapters 1–5
S8	Geospatial Information Authority of Japan: Areas of the prefectures and municipalities of Japan as of 1 July 2025 (Reiwa 7); Material 1 (in Japanese) (26 September 2025; includes increases and decreases for reasons other than uplift)	Statistics	A	Chapters 1, 2, 4
S9	Ishikawa Prefecture: Review committee for the Noto Peninsula Coast Basic Plan for Coastal Protection (2nd meeting, Material 3; 2nd meeting, summary of the meeting; 1st meeting, summary of the meeting; list of members) (2025); Noto Peninsula Coast Basic Plan for Coastal Protection (changed December 2024 (Reiwa 6)) (in Japanese)	Meeting	A	Chapters 1, 2, 4, 5
S10	Disaster Prevention Research Institute, Kyoto University; Institute of Science and Engineering, Kanazawa University; Graduate School of Science, Tohoku University: Crustal deformation of the Noto Peninsula (December 2025) (in Japanese) (material of the 423rd meeting of the Earthquake Research Committee, 2026; the amount of sinking is shown only in figures)	Report	B	Chapters 1, 2, 4, 5
S11	Shishikura et al.: activity of offshore active faults seen from the height distribution of the low terraces and of the assemblages of emerged remains of living things on the northern coast of the Noto Peninsula (in Japanese) (Active Fault Research 53, 2020; the authors treat the intervals as reference values)	Paper	B	Chapters 1, 2, 5
S12	Headquarters for Earthquake Research Promotion, Earthquake Research Committee: Long-term evaluation of offshore active faults in the central and southern Sea of Japan (first edition) (main text; outline) (in Japanese) (published 27 June 2025, corrected 5 November)	Evaluation	A	Chapters 1, 2, 4, 5
S13	Cabinet Office: Efforts so far and the future response policy for the Noto Peninsula earthquake and heavy rain (as of 30 September 2026) (in Japanese)	Material	A	Chapters 1, 2, 5
S14	Fisheries Agency: reports of the fiscal 2025 (Reiwa 7) commissioned projects for surveys on fisheries infrastructure development (survey examining the advancement of design methods for fishing port and fishing ground facilities; survey examining disaster response measures in disasters on peninsulas and in remote areas) (in Japanese) (March 2026)	Report	A	Chapters 1–3, 5
S15	Kanazawa University; Natural History Museum and Institute, Chiba; Kyushu University: The coastal ecosystem of the Sea of Japan "exposed" by the coastal uplift of the 2024 Noto Peninsula Earthquake is revealed (in Japanese) (press release, 3 March 2026; the paper is in Plankton and Benthos Research 21)	Explanatory	C	Chapters 1, 2, 5
S16	Kanazawa Association of Corporate Executives: Fiscal 2025 (Reiwa 7) report of the survey of the effects of the earthquake disaster on the Noto Peninsula coast (in Japanese) (March 2026; the report of a survey by a business association; a grant from The Nippon Foundation; not peer-reviewed)	Report	C	Chapters 1, 2

ID	Source (publisher, year)	Type	Reliability	Chapters used
S17	Shishikura (AIST): Great earthquakes of the past told by coastal terraces (Chishitsu News 605, 2005); Could the coastal uplift caused by the Noto Peninsula Earthquake have been anticipated? (Ocean Newsletter 570, 2024); The history of Noto Peninsula earthquakes known from traces of uplift (Tokyo Geographical Society, lecture abstract, 2024) (in Japanese)	Explanatory	C	Chapters 1–3, 5
S18	Akita Local Meteorological Observatory: The 1804 Kisakata earthquake (undated; based on the "Comprehensive List of Destructive Earthquakes in Japan"); Hirano et al.: crustal deformation accompanying the Kisakata earthquake (1804) (The Quaternary Research (Daiyonki-Kenkyu) 18(1), 1979, B); Agency for Cultural Affairs, Cultural Heritage Online: Kisakata; Iwami Tatamigaura (accessed November 2026) (in Japanese)	Material	A	Chapters 2, 5
S19	Shishikura et al.: the uplift of Iwami Tatamigaura due to the 1872 Hamada earthquake (Zisin (Journal of the Seismological Society of Japan), 2nd series, 73, 2020); lecture abstract (Historical Earthquakes (Rekishi Jishin) 35, 2020, C) (in Japanese)	Paper	B	Chapters 2, 5
S20	U.S. Geological Survey (USGS): Plafker: crustal deformation of the 1964 Alaska earthquake (1969); Kirkby and Kirkby: erosion and deposition on uplifted beaches (1969); 50th anniversary announcement (2014, C)	Report	B	Chapters 2, 4, 5
S21	Uplift in the 2010 Maule earthquake in Chile and the living things of the coast: Farías et al. (Science 329, 2010); Castilla et al. (Marine Ecology Progress Series 418, 2010); Jaramillo et al. (PLoS ONE 7, 2012)	Paper	B	Chapters 2, 5
S22	Clark et al.: vertical movement of the coast in the 2016 Kaikoura earthquake (Earth and Planetary Science Letters 474, 2017); Fisheries New Zealand: surveys of the paua stock (FAR 2023/26; FAR 2021/26)	Paper	B	Chapters 2, 5
S23	Headquarters for Earthquake Research Promotion, Earthquake Research Committee: evaluations of the 2024 (Reiwa 6) Noto Peninsula Earthquake (2 January 2024; 15 January; 9 February); evaluation of recent seismic activity (14 January 2026) (in Japanese)	Evaluation	A	Chapters 2, 4
S24	Earthquake Research Institute, the University of Tokyo: Coastal uplift caused by the 2024 (Reiwa 6) Noto Peninsula Earthquake (M7.6): preliminary report to preliminary report No. 4 (in Japanese) (January 2024; provisional values before tide correction)	Report	B	Chapters 2, 5
S25	Explanations of the "Map of the Sea" survey: Kato (Japan Hydrographic Association): Map of the Sea PROJECT: towards the reconstruction of Noto (Ocean Newsletter 593, 2025); Takayanagi (Asia Air Survey): preparation of precise seabed topographic maps of the shallow sea area in the source region of the 2024 (Reiwa 6) Noto Peninsula Earthquake (Suiro 210, 2024) (in Japanese)	Explanatory	C	Chapters 2, 3, 5
S26	Japan Coast Guard: Uplift of about 3 metres confirmed on the seabed off the Noto Peninsula (8 February 2024); Uplift of about 4 metres confirmed on the seabed off the north of Suzu City as well (11 June); Seabed uplift confirmed off the north-east of Suzu City and elsewhere (10 December); research results presentation meeting: Kawamura and Minami: detection on the seabed of tsunami deposits from the tsunami of the 2024 (Reiwa 6) Noto Peninsula Earthquake (30 January 2025) (in Japanese)	Observation	A	Chapters 2, 3
S27	Japanese Institute of Fisheries Infrastructure and Communities: Goto and Hashida: the state of damage to the fishing ports uplifted in the Noto Peninsula Earthquake, and moves towards the resumption of fishing (in Japanese) (November 2025, on the Fisheries Agency's website)	Report	B	Chapters 2, 5

ID	Source (publisher, year)	Type	Reliability	Chapters used
S28	Fisheries Agency: Technical review meeting on the restoration and reconstruction of fishing areas after the 2024 (Reiwa 6) Noto Peninsula Earthquake (technical review material, summary version; detailed version) (in Japanese) (July 2024)	Material	A	Chapters 2–4
S29	Ishikawa Prefecture Fisheries Division: State of restoration of the fisheries-related ports (in Japanese) (as of 31 March 2026)	Material	A	Chapter 2
S30	Hokuriku Regional Development Bureau, Ishikawa Prefecture and Wajima City: Wajima Port restoration and reconstruction plan (in Japanese) (adopted June 2025, changed 30 January 2026)	Plan	A	Chapters 2, 4, 5
S31	Arita et al.: report of a long-term monitoring survey of the process of deformation of the sandy beach of the Kaiso coast uplifted in the 2024 (Reiwa 6) Noto Peninsula Earthquake (in Japanese) (Disaster Prevention Research Institute, Kyoto University, research presentation meeting, abstract, 2026; the part taken as a secondary quotation from the Comprehensive List has not been checked)	Report	C	Chapter 5
S32	Ministry of Land, Infrastructure, Transport and Tourism: Outlook for the full restoration of National Route 249 (in Japanese) (2 September 2025)	Announcement	A	Chapter 2
S33	Kyodo News: Policy of selling to the city the uplifted national land at Nie-machi, Suzu City (in Japanese) (3 August 2026, on the website of the Kumamoto Nichinichi Shimbun; we did not find the press release of the Hokuriku Local Finance Bureau)	News	D	Chapter 2
S34	Japan Coast Guard, Hydrographic and Oceanographic Department: Notice of the publication of charts and nautical publications (in Japanese) (updated 30 October 2026; the list of new editions of nautical charts for 2025–2026)	Material	A	Chapter 3
S35	nippon.com: Briefing for fishers on the "Map of the Sea" (Wajima) (in Japanese) (12 September 2025)	News	D	Chapter 3
S36	Japan Meteorological Agency: On the resumption of the observation and monitoring of tide levels in the northern part of the Noto Peninsula (in Japanese) (16 January 2024)	Announcement	A	Chapter 2
S37	Major disaster management headquarters (the Cabinet Office's disaster management page): On the state of damage and other matters relating to the 2024 (Reiwa 6) Noto Peninsula Earthquake (in Japanese) (as of 16:00 on 31 March 2026; preliminary figures, and the numbers may change in future; the damage to people and homes is information of the Fire and Disaster Management Agency)	Material	A	Chapter 2

Related materials: R2 Seaweed and seagrass beds and the living things of the sea, R6 What is changing (why now), R7-A19 Land subsidence and flooding in Nanao Bay, R7-B02 The active faults just off the coast, and preparing for the next earthquake and tsunami, R7-B03 Sandy beaches that keep moving after the uplift, and the silting-up of fishing ports, R7-B04 The changed topography of the shallow sea, and the lack of maps and observations that fishers can use, R7-B05 Remaking the basic plan for coastal protection (uplift and growing waves), R7-B06 The newly emerged land and the uses of the coast, R7-B07 The total die-off of living things in the intertidal zone and on shallow rocky reefs, and their recovery afterwards, R7-B08 Shallow seaweed beds dried out by uplift, and the decrease in the area of seaweed beds in Sotoura, R7-B13 The mass die-off of abalone and turban shells, and the fall in catches lasting several years, R7-B14 The rocky shores for rock nori and wakame (drying-out of nori fields, footing, processing sites), R7-B17 Wajima Port (the prefecture's largest fishing base): the shortage of water depth and the restoration, R7-B19 The small fishing ports of the Sotoura coast (ports that cannot be used, and the policy of consolidation), R7-B20 Damage to fishing boats, and boats that cannot move in uplifted ports, R7-B22 The fall in landings on the Sotoura coast (the delay in the Wajima district), R7-B24 The

income of fishers hit by the disaster, and the gaps in support, R7-B29 The isolated fishing villages at the tip of the peninsula, and the disaster-prevention role of fishing ports, I1 List of assessments