

## **Section 2 Study of Measures against Megathrust Earthquake in the Vicinity of the Japan and the Chishima Trenches**

### **(1) Background of the Study**

The government has focused on disaster risk reduction measures against Subduction Zone Earthquakes along the Japan and Chishima Trenches based on the "Basic Plan for Promotion of Disaster Management for Trench-type Earthquakes in the Vicinity of the Japan and Chishima Trenches" and other plans. Based on the recommendation of the National Disaster Management Council's, the "Committee for Technical Investigation on Earthquake and Tsunami Measures Based on Lessons Learned from the 2011 off the Pacific coast of Tohoku Earthquake" (September 28, 2011), the government reviewed its measures with the assumption of a maximum-class earthquake and tsunami, taking all possibilities into account. This is for the purpose of establishing comprehensive tsunami measures to give top priority to protect the lives of residents and others and to take all available measures.

In February 2015, the "Study Group on a Megaquake Model in the Vicinity of the Japan and Chishima Trenches" (hereinafter referred to as "Study Group" in this section) was established in the Cabinet Office. In April 2020, the Study Group published the results of its study after studying the seismic intensity distribution and tsunami height due to the largest class of earthquakes and tsunamis. In the same month, the "Working Group for Studying Megaquake Countermeasures in the Vicinity of the Japan and Chishima Trenches (hereinafter in this section referred to as "Japan and Chishima Trenches WG") was established under the Disaster Management Implementation Committee. In December 2021, the Japan Chishima Trenches WG compiled and published the results of the estimated human life, material, and economic damages due to a maximum-class earthquake and tsunami. In March 2022, the Working Group compiled and published disaster risk reduction measures in response to these estimated damages.

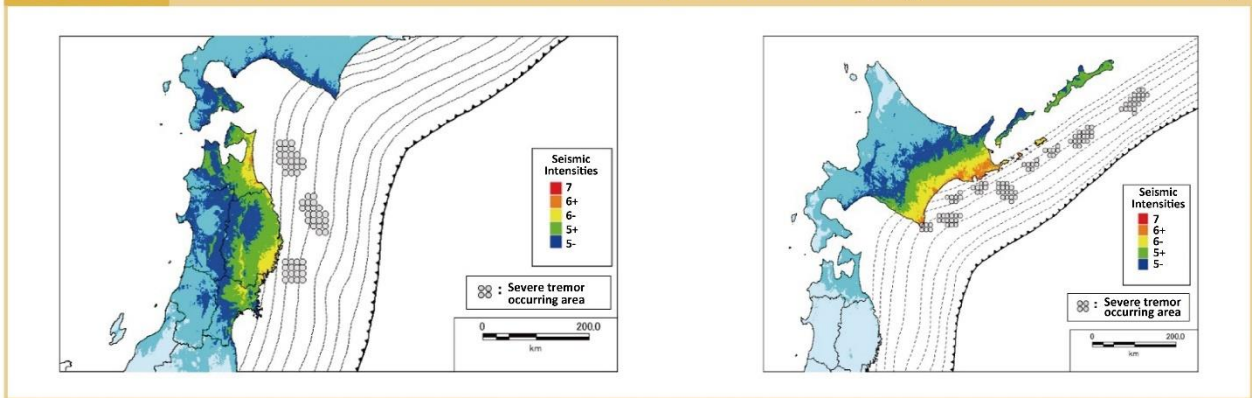
### **(2) Estimation results of the epicentral area, seismic intensity distribution and tsunami height for the largest class of earthquake**

The Study Group examined the tsunami fault model of the largest class in the large slip zone of the north area due to the 2011 off the Pacific coast of Tohoku Earthquake (the area along the Japan Trench and the Chishima Trench north of Iwate Prefecture) based on the estimation from tsunami sediment data for the past 6,000 years. The Japan Trench model covered the area along the Japan Trench in the offshore region from Iwate Prefecture to the Hidaka region of Hokkaido, while the Chishima Trench model included the area along the Chishima Trench from Cape Erimo to the east part of Chishima Trench.

The magnitudes of the earthquake estimated from these tsunami fault models are 9.1 on the moment magnitude scale (M<sub>w</sub>) for the Japan Trench model and 9.3 on the M<sub>w</sub> for the Chishima Trench model. When this tsunami fault shifts, strong shaking is expected over a wide area from Iwate Prefecture to the Pacific side of Hokkaido (FIG. 3-2-1).

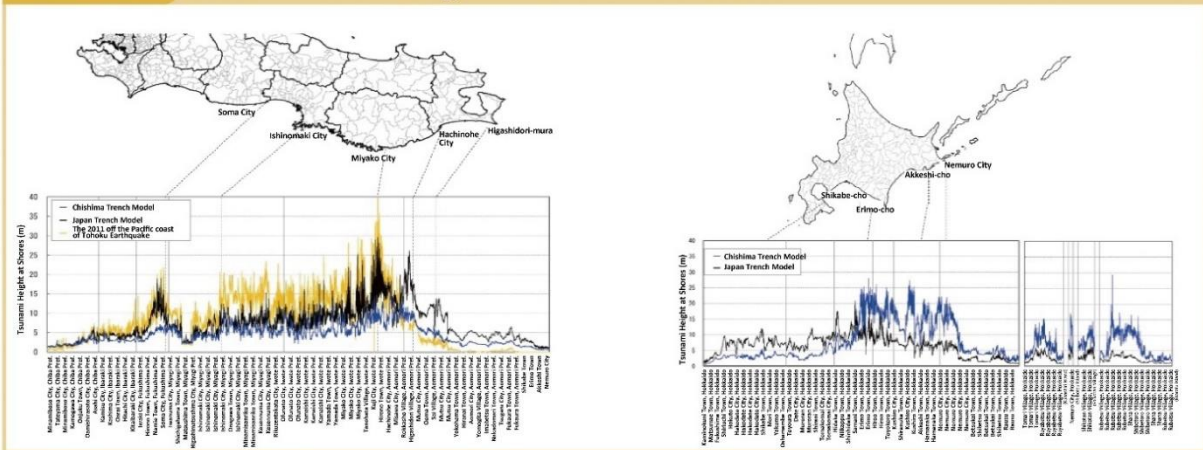
Compared to the 2011 off the Pacific coast of Tohoku Earthquake, the tsunami heights estimated in this study are higher in north of Aomori Prefecture. In Iwate Prefecture, the tsunami heights estimated in this study are higher in north of Miyako City, depending on the coastal topography (FIG. 3-2-2).

**FIG. 3-2-1 Distribution of Seismic Intensities (Left: Japan Trench Model, Right: Chishima Trench Model)**



Source: Summary Report Reference Charts of Study Group on Megaquake Model in the Vicinity of the Japan and Chishima Trenches  
 (Reference: [https://www.bousai.go.jp/jishin/nihonkaiko\\_chishima/model/index.html](https://www.bousai.go.jp/jishin/nihonkaiko_chishima/model/index.html))

**FIG. 3-2-2 Calculated Height of Tsunami at Shores**



Source: Summary Report Reference Charts of Study Group on Megaquake Model in the Vicinity of the Japan and Chishima Trenches  
 (Reference: [https://www.bousai.go.jp/jishin/nihonkaiko\\_chishima/model/index.html](https://www.bousai.go.jp/jishin/nihonkaiko_chishima/model/index.html))

**(3) The Results of Estimated Damages**

The results of estimated damages vary greatly depending on the assumptions made for the timing and period of the earthquake, but the points for both the Japan Trench Model and the Chishima Trench Model are summarized respectively (FIG. 3-2-3).

In the estimated damages, since the disaster area is in a snowy and cold region, after surviving the tsunami, some people would be exposed to cold conditions outdoors for a long time and become unable to evacuate to a secondary location. They are defined as those who need to deal with hypothermia, and the number of such people is newly calculated as the number of those at risk of death from hypothermia.

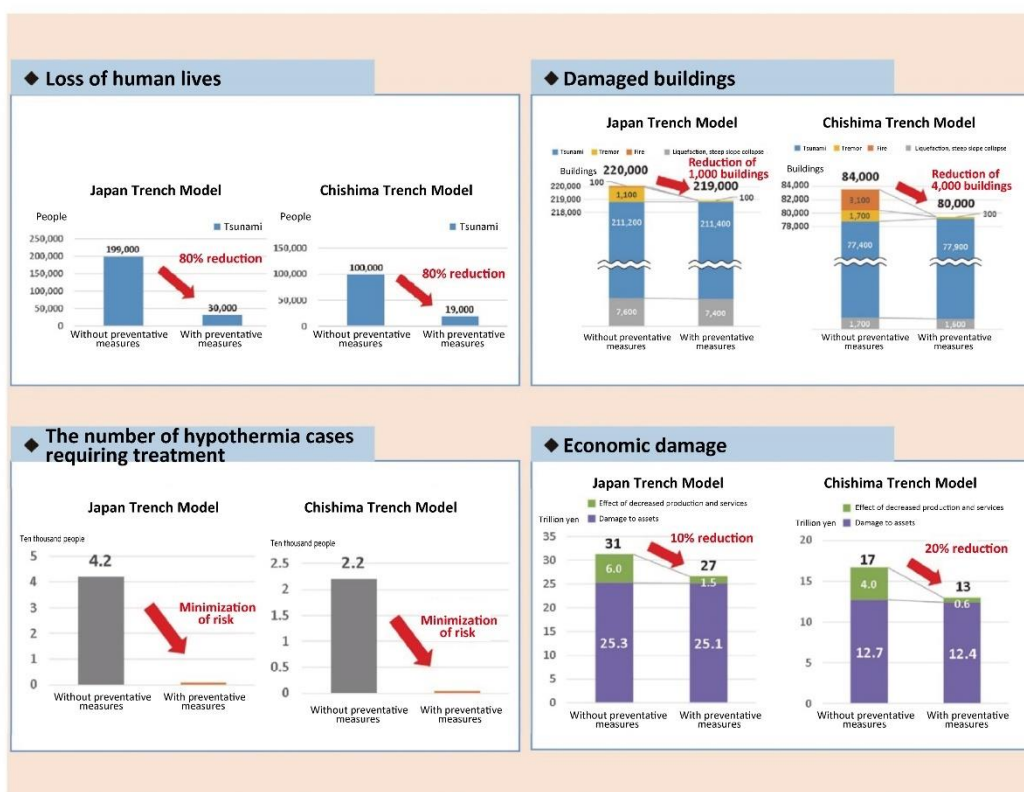
The estimated damages also indicate that thorough disaster risk reduction measures can reduce the number of fatalities by 80%, minimize the risk of hypothermia cases and reduce the amount of damage (FIG. 3-2-4).

**FIG. 3-2-3 Summary of Calculation Results of Damage by Megaquake in the Vicinity of the Japan and Chishima Trenches**

	Japan Trench Model	Chishima Trench Model
<b>Buildings Totally Lost</b>	Approx. 220,000 to 220,000 buildings	Approx. 81,000 to 84,000 buildings
<b>Fatalities</b>	Approx. 6,000 to 199,000 individuals	Approx. 22,000 to 100,000 individuals
<b>Injured</b>	Approx. 3,300 to 22,000 individuals	Approx. 2,600 to 10,000 individuals
<b>Individuals Requiring Rescue due to Tsunami Damage</b>	Approx. 66,000 to 69,000 individuals	Approx. 32,000 to 41,000 individuals
<b>Individuals Requiring Treatment for Hypothermia</b>	Approx. 42,000 individuals	Approx. 22,000 individuals
<b>Economic Damage</b>	Approx. 31 trillion yen	Approx. 17 trillion yen

Source: the Cabinet Office document

**FIG. 3-2-4 Effect of Disaster Risk Management Measures on a Megaquake in the Vicinity of the Japan and Chishima Trenches**



Source: Cabinet Office data

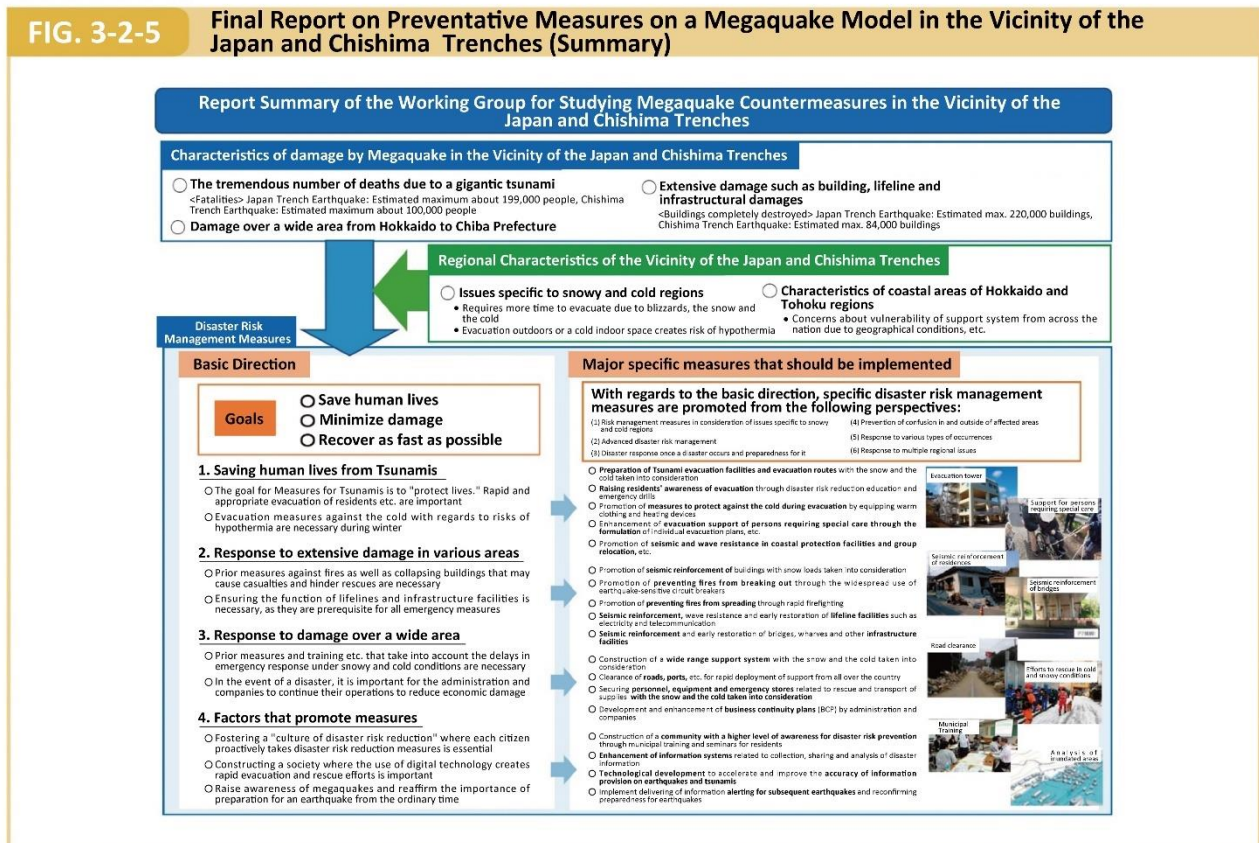
Not only the government, but also local communities, residents, companies and all other parties are required to calmly accept the estimated damages as their own and act without any pessimism.

1. Evacuating quickly and proactively in the event of either strong tremors or weak but long tremors.
2. For a strong quake, conducting diagnosis of earthquake resistance and seismic reinforcement of buildings in advance, and securing furniture in place.
3. Focusing on extinguishing fires in the initial phase.

The measures as above are requested to implement for decreasing the number of victims as much as possible.

#### (4) Final Report

Based on the results of estimated damages, the Japan and Chishima Trenches WG summarized the characteristics and issues of the relevant earthquake, clarified the basic direction of countermeasures and compiled specific measures to be implemented in the final report (FIG. 3-2-5).



Source: Cabinet Office data (Published March 22, 2022)  
 (Reference: [https://www.bousai.go.jp/jishin/nihonkaiko\\_chishima/WG/index.html](https://www.bousai.go.jp/jishin/nihonkaiko_chishima/WG/index.html))

The damage due to a major earthquake along the Japan and Chishima Trenches is characterized by "an enormous number of fatalities caused by a massive tsunami," "extensive damage to buildings, lifelines and infrastructure" and "damage over a wide area from Hokkaido to Chiba Prefecture." In addition to these characteristics, the following basic directions were presented by taking into consideration the impact of "issues unique to snowy and cold regions" and "characteristics of Hokkaido and the coastal areas of the Tohoku region," which were the characteristics of the regions where the damage was expected to occur.

#### 1. Securing Human Life from Tsunami

The goal of measures against tsunami is to "save lives" from tsunami. It is possible to reduce damage by improving evacuation awareness and utilizing / improving evacuation towers and other facilities. It is necessary to take measures on (1) improving residents' evacuation awareness through disaster risk reduction education and drills, (2) shortening evacuation distances and time by developing tsunami evacuation towers and evacuation routes and (3) mitigating risk of hypothermia at evacuation sites and shelters.

## 2. Responding to Extensive Damage

While the main cause of casualties is tsunami, fires and collapsed buildings are the second most frequent cause of deaths, and occurrences of people with difficulties in escaping by themselves, blocked roads, fires and evacuees also become cause of the spread of damage. To respond to these factors, it is necessary to promote earthquake resistance of buildings, measures to prevent fires from breaking out and spreading, and earthquake resistance and fire-resistance of lifelines and infrastructure facilities.

## 3. Response to Damage over a Wide Area

A massive earthquake along the Japan and the Chishima Trenches will cause damage over a wide area, such as a tsunami of 3 meters or more in height from Chiba Prefecture to Hokkaido according to both the Japan Trench model and the Chishima Trench model. However, there are concerns that wide-area support from Honshu and other regions will not be sufficiently effective, for rescue and relief supply transport activities will take time under snowy and cold conditions. Therefore, it is necessary to promote the establishment of a wide-area support system by considering the snowy and cold climate, to ensure the stockpiling of personnel and equipment for rescue and relief supplies distribution, and to formulate and enhance business continuity plans (BCP) for the administration and companies.

## 4. Matters to Promote Measures

In promoting measures, it is necessary to comprehensively promote efforts such as building local communities with high disaster awareness, accumulating scientific knowledge and utilizing digital technology. In addition, when an earthquake of Mw 7.0 or greater occurs in the vicinity of the assumed epicentral area of a major earthquake along the Japan and the Chishima Trenches, the possibility of the occurrence of a major earthquake will be higher than usual. Therefore, information should be disseminated to encourage caution in preparation for a subsequent massive earthquake. In response to this information, the administrations, companies, and citizens should check to make sure they are prepared for this type of earthquake from ordinary times, and it is necessary for them to prepare to mitigate damage, including smooth evacuation in the event of a subsequent earthquake.

In addition, based on the estimated damages, the "Bill for Partial Amendment of the Act on Special Measures concerning Advancement of Countermeasures against Earthquake Disaster in Relation to Subduction Zone Earthquake Around Japan and Chishima Trenches" was submitted to the Diet under the legislation introduced by Diet members, and it was passed and enacted on May 13, 2022 after deliberation by both the House of Representatives and the House of Councilors.