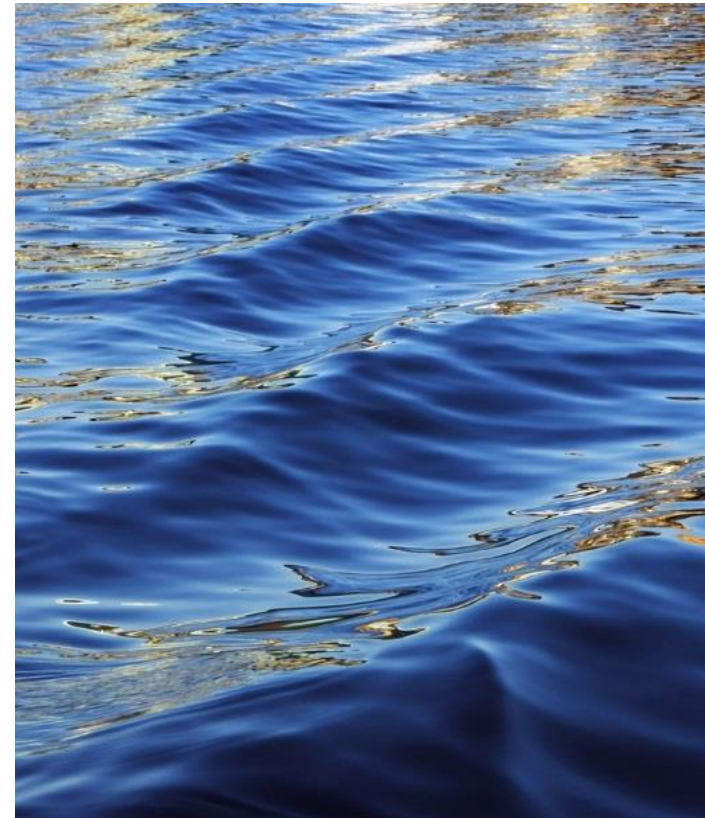




Natural Disasters in Japan



What is A NATURAL DISASTER?

Worksheet 1

Do you remember these recent DMV area natural disasters?



Washington Monument damaged after 2011 earthquake, closed and covered in scaffolding for repairs. (photo by [Jade Phoenix Pence](#).)

A 5.8 **earthquake** hit the Washington (DC) area on August 23, 2011.

[What Caused the 2011 D.C. Earthquake?](#)



The day after Snowzilla, Washington DC (photo by [Christoph Koettl](#).)

Winter Storm Jonas buried a large portion of the Northeast urban corridor with more than 2 feet of snow from the Washington, D.C. area to New York City Jan. 22 - 24, 2016.

[January 2016 United States blizzard facts for kids](#)

Research the impact of past natural disasters on the local community by asking family, friends, and neighbors to share their experience in a natural disaster. What was the disaster? How did it impact them?

What is A NATURAL DISASTER?

Worksheet 2

a.



(Brookings, 2014)

What are they doing? For what?

b.



(QUARTZ, 2019)

What are they wearing?
What are they doing?
For what?

c.






(Trends in Japan, 2017)

What is this? For what?

Check-out these resources!

- [Disaster Management in Japan](#)
- [Japan steps up crisis response efforts on national Disaster Prevention Day](#)
- [Japan holds earthquake drills ahead of earthquake anniversary](#)

a	b	c
		
<p>School children in Japan practicing an earthquake drill. Children learn to duck under a table or desk to avoid falling objects in the event of an earthquake.</p>	<p>School children in Japan practicing an earthquake drill. Children are told to wear a disaster prevention hood to protect around their head and to cover their nose and mouth with a towel to avoid breathing the harmful air caused at earthquake.</p>	<p>Furniture in all the Japanese households are secured with tension rods or brackets, which are set between furniture and the ceiling to keep furniture from tipping over in the event of a temblor.</p>

Do you know what you should do when an earthquake occurs in Japan?

Worksheet 3

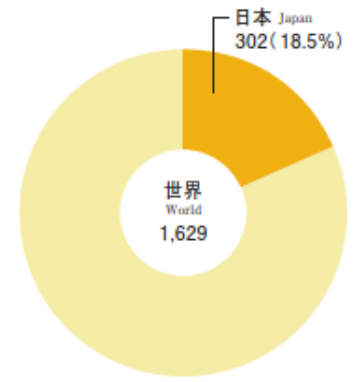
Earthquakes are a common occurrence in Japan; therefore, earthquake drills are regularly held at schools in Japan. There are some simple measures you can take to be prepared and minimize danger. Let's try!

What is a natural disaster?

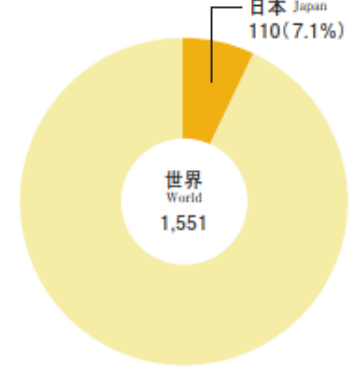
Japan is the country most exposed to natural disasters among developed countries.

The ratio of Natural Disasters in Japan to Those in of the World

マグニチュード6.0以上の地震回数 (2004年~2013年)
Number of earthquakes with magnitude of 6.0 or greater (2004-2013)



活火山数 (2014年現在)
Number of active volcanos (2014)



出典: 防災白書 Source: White Paper on Disaster Management

昭和20年以降の我が国の主な自然災害の状況 Major Natural Disaster in Japan since 1945

年月日 Date	災害名 Disaster	死者・行方不明者数 Number of Deaths and Missing	年月日 Date	災害名 Disaster	死者・行方不明者数 Number of Deaths and Missing
昭和 20. 1.13 1945	三河地震 (M6.8) Mikawa Earthquake	2,306人	昭和 52. 8. 7 ~ 53.10. 1977	有珠山噴火 Mt. Usu Eruption	3人
昭和 20. 9. 17 ~ 18 1945	枕崎台風 (広島、西日本) Typhoon Makurazaki	3,756人	昭和 53. 1.14 1978	伊豆大島近海地震 (M7.0) Izu-Oshima-kinkai Earthquake	25人
昭和 21.12.21 1946	南海地震 (M8.0) Nankai Earthquake	1,443人	昭和 53. 6.12 1978	宮城県沖地震 (M7.4) Miyagi-ken-oki Earthquake	28人
昭和 22. 8.14 1947	浅間山噴火 (群馬県) Mt. Asama Eruption	11人	昭和 54.10.17 ~ 20 1979	台風第20号 (全国 (特に東海、関東、東北)) Typhoon 20	115人
昭和 22. 9.14 ~ 15 1947	カスリーン台風 (東北以北) Typhoon Catherine	1,930人	昭和 55.12. ~ 56. 3. 1980	雪害 (東北、北陸) Snow Disaster	152人
昭和 23. 6.28 1948	福井地震 (M7.1) Fukui Earthquake	3,769人	昭和 57. 7. ~ 8. 1982	7、8月豪雨及び台風第10号全国 (特に長崎、熊本、三重) Torrential Rains and Typhoon 10	439人
昭和 23. 9.15 ~ 17 1948	アイオン台風 (四国~東北 (特に岩手)) Typhoon Iou	838人	昭和 58. 5.26 1983	日本海中部地震 (M7.7) Nihon-kai-chubu Earthquake	104人
昭和 25. 9. 2 ~ 4 1950	ジェーン台風 (四国以北 (特に大阪)) Typhoon Jane	539人	昭和 58. 7.20 ~ 29 1983	梅雨前線豪雨 (山陰以東 (特に島根)) Torrential Rains	117人
昭和 26.10.13 ~ 15 1951	ルース台風 (全国 (特に山口)) Typhoon Ruth	943人	昭和 58.12. ~ 59.3. 1983	雪害 (東北、北陸 (特に新潟、富山)) Snow Disaster	131人
昭和 27. 3. 4 1952	十勝沖地震 (M8.2) Tokachi-oki Earthquake	33人	昭和 59. 9.14 1984	長野県西部地震 (M6.8) Nagano-ken-seibu Earthquake	29人
昭和 28. 6.25 ~ 29 1953	大雨 (前線九州、四国、中国 (特に北九州)) Torrential Rains	1,013人	平成 2.11.17 ~ 1990	雲仙岳噴火 Mt. Unzen Eruption	44人
昭和 28. 7.16 ~ 24 1953	南紀豪雨 (東北以西 (特に和歌山)) Torrential Rains	1,124人	平成 5. 7.12 1993	北海道南西沖地震 (M7.8) Hokkaido-nansei-oki Earthquake	230人
昭和 29. 5. 8 ~ 12 1954	風害 (低気圧北日本、近畿) Storm Disaster	670人	平成 5. 7.31 ~ 8. 7. 1993	平成5年8月豪雨 (全国) Torrential Rains	79人
昭和 29. 9.25 ~ 27 1954	洞爺丸台風 Typhoon Toyamaru	1,761人	平成 7. 1.17 1995	阪神淡路大震災 (M7.3) Great Hanshin-Awaji Earthquake	6,437人
昭和 32. 7.25 ~ 28 1957	津島豪雨 Torrential Rains	722人	平成 12. 6.25 ~ 17. 3.31 2000	三宅島噴火及び新島・神津島近海地震 Miyake Is. Eruption and Niijima and Kozushima Is. Earthquake	1人
昭和 33. 6.24 1958	阿蘇山噴火 Mt. Aso Eruption	12人	平成 16. 10.18 ~ 21 2004	台風第23号 (全国) Typhoon 23	98人
昭和 33. 9.26 ~ 28 1958	狩野川台風 Typhoon Kanogawa	1,269人	平成 16. 10.23 2004	平成16年(2004年)新潟県中越地震 (M6.8) Niigata-ken-Chuetsu Earthquake	68人
昭和 34. 9.26 ~ 27 1959	伊勢湾台風 Typhoon Ise-wan	5,098人	平成 17. 12 ~ 18. 3. 2005	平成18年豪雪 (北陸地方を中心とする日本海側) Heavy Snowfalls	152人
昭和 35. 5.23 1960	チリ地震津波 Chile Earthquake Tsunami	142人	平成 19.7.16 2007	新潟県中越沖地震 (M6.8) Niigata Earthquake	15人
昭和 38. 1. 1963	昭和38年1月雪害 (北陸、山陰、山形、滋賀、岐阜) Snow Disaster	231人	平成 20.6.14 2008	岩手宮城内陸地震 (M7.2) Iwate-Miyagi Inland Earthquake	23人
昭和 39. 6.16 1964	新潟地震 (M7.5) Niigata Earthquake	26人	平成 22.12. ~ 23.3. 2010	雪害 (北日本~西日本にかけて日本海側) Snow disasters	131人
昭和 40. 9.10 ~ 18 1965	台風第23、24、25号全国 (特に徳島、兵庫、福井) Typhoons 23, 24, 25	181人	平成 23.3.11 2011	東日本大震災 (M9.0) Great East Japan Earthquake	18,490人
昭和 41. 9.23 ~ 25 1966	台風第24、26号 (中部、関東、東北、特に静岡、山梨) Typhoons 24, 26	317人	平成 23.8.29 ~ 9.7 2011	平成23年台風第12号 (近畿、四国) Typhoon 12	94人
昭和 42. 7. ~ 8. 1967	7、8月豪雨 (中部以西、東北部) Torrential Rains	256人	平成 23.11 ~ 24.3. 2011 ~ 2012	平成23年11月からの雪害等 Deep snowfall from November 2011 onwards	133人
昭和 43. 5.16 1968	十勝沖地震 (M7.9) Tokachi-oki Earthquake	52人	平成 24.12 ~ 25.3. 2012 ~ 2013	平成24年12月からの雪害等 (北日本から西日本にかけて日本海側) Deep snowfall from December 2012 onwards	104人
昭和 47. 7. 3 ~ 15 1972	台風第6、7、9号及び7月豪雨全国 (特に北九州、島根、広島) Typhoons 6, 7, 9 and Torrential Rains	447人	平成 25.11 ~ 26.3. 2013 ~ 2014	平成25年11月からの雪害等 (北日本から西日本にかけて日本海側) Deep snowfall from November 2013 onwards	95人
昭和 49. 5. 9 1974	伊豆半島沖地震 (M6.9) Izu-hanto-oki Earthquake	30人	平成 26.7.30 ~ 8.26 2014	平成26年8月豪雨 (全国 (特に広島、京都、兵庫、徳島)) Torrential rains of August 2014	88人
昭和 51. 9. 8 ~ 14 1976	台風第17号及び9月豪雨全国 (特に香川、岡山) Typhoon 17 and Torrential Rains	171人	平成 26.9.27 2014	平成26年御嶽山噴火 (長野県、岐阜県) 2014 Eruption of Mount Ontake	63人
昭和 52. 1. 1977	雪害 (東北、近畿北部、北陸) Snow Disaster	101人			

Worksheet 4

Task 1: Research Natural Disasters That Have Occurred in Japan and Its Scientific Mechanism

1. Create Groups of 4
2. Choose A Natural Disaster in Japan
(Earthquake / Tsunami / Typhoon / Volcanic Eruption)
3. Research on the Natural Disaster

➔ **Create an exhibit and share what you found with the class!**
You can create a poster, a computer graphic video, using a clay, etc. to present

Check out these videos:

- [Japan Earthquake Pictures, Video. Disaster in the Pacific 3/11/2011](#)
- [Rare Video: Japan Tsunami | National Geographic](#)
- [Rescue efforts underway in Japan after deadly Typhoon Hagibis kills at least 14 people](#)
- [Video: Japan volcano shoots rock & ash on Mount Ontake - BBC News](#)

Other Videos:

- [LOOKING BACK ON HEISEI - Great Hanshin Earthquake](#)
- [Tsunami in Kesenuma-city at the Great East Japan Earthquake, 03,11,2011](#)
- [Typhoon Jebi hits Japan](#)
- [Japanese Volcano Eruption](#)

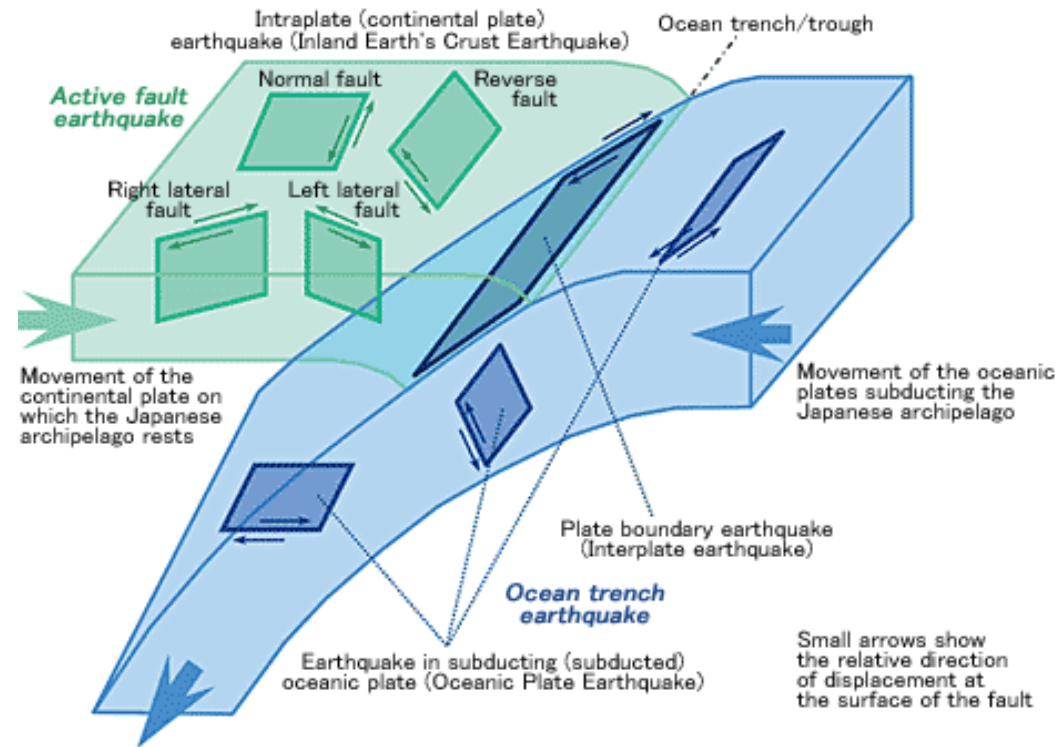
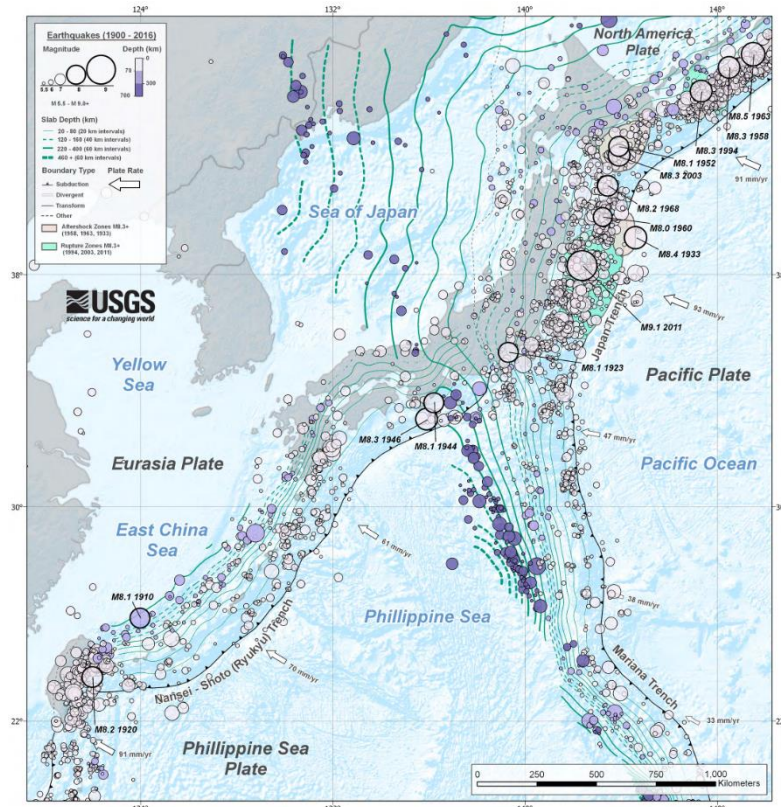


[Rescuing a victim at the Great East Japan Earthquake](#)

Mechanism of Natural Disasters in Japan

How do **Earthquakes (地震)** occur? -Plate Tectonics

- ✓ Japan being wedged among four major tectonic plates: **North American Plate, Pacific Plate, Eurasian Plate, and Philippine Plate.**
- ✓ Plates move relative to one another. Slip on faults that define the plate boundaries commonly results in earthquakes.



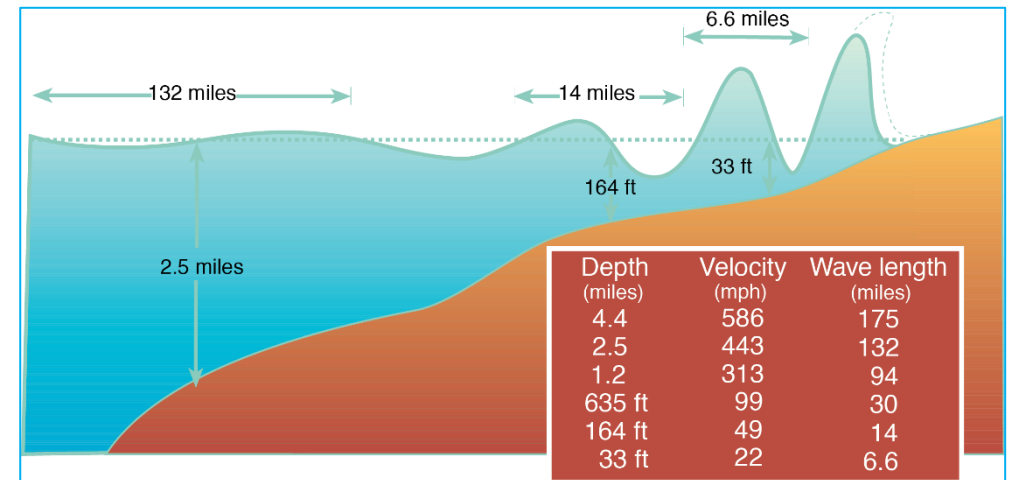
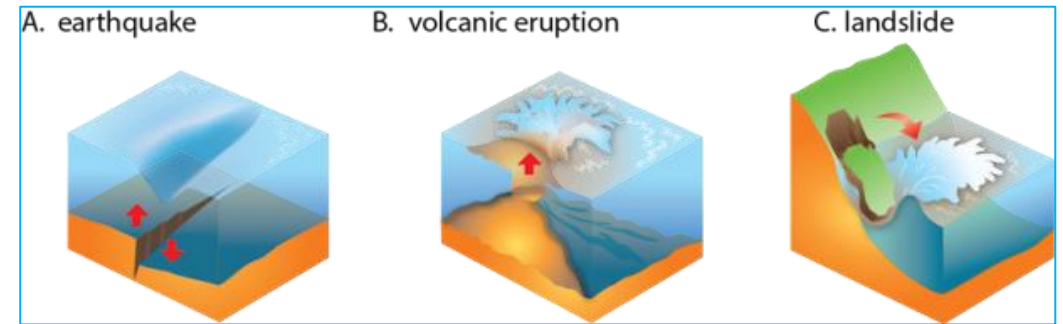
Source: Materials formulated by the Earthquake Research Committee

Check-out these resources!

- [Japan's Earthquakes & Tectonic Setting](#)
- [Japan's Explosive Geology Explained](#)
- [Types of Earthquakes and their Mechanisms](#)
- [The Science of Japan's Quake & Aftershocks \(With Video!\)](#)
- [How Japan's Rail Network Survived the Earthquake](#)

How do **Tsunamis (津波)** occur?

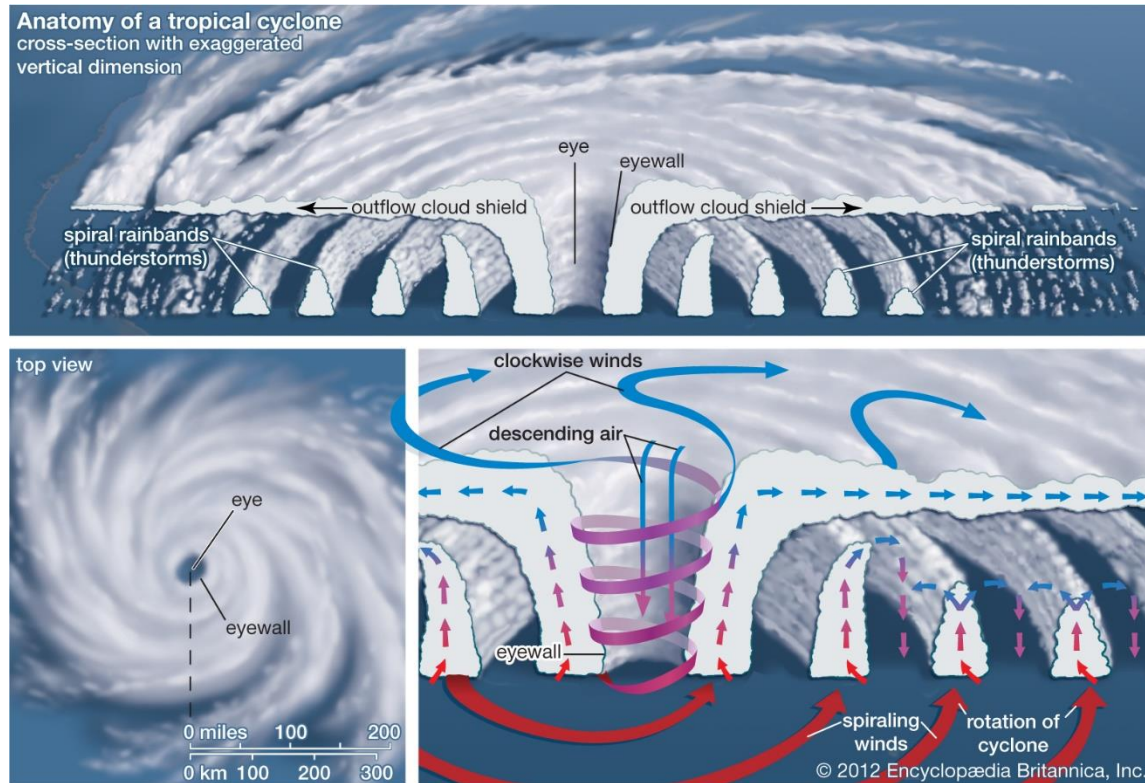
- ✓ Tsunamis are large, potentially deadly and destructive sea waves, most of which are formed as a result of submarine **earthquakes**. They can also result from the **eruption** or **collapse** of island or **coastal volcanoes** and from **giant landslides** on marine margins. Note that 72% of tsunamis are generated by earthquakes.
- ✓ Tsunamis can occur any day of the year and any time of the day. There is **no tsunami season**. They have nothing to do with the weather or the tides.
- ✓ **Offshore** and **coastal** features affect the size and impact of tsunami waves. Reefs, bays, river mouths, undersea features, and beach slope all modify the tsunami as it hits the coastline. When the tsunami strikes as a wall of water, sea levels can rise many meters. Water level has risen to more than 50 feet (15 meters) for tsunamis of distant origin and over 100 feet (30 meters) for tsunami waves generated near the epicenter.
- ✓ Tsunami waves in the deep ocean can travel at high speeds for long periods of time for distances of thousands of kilometers and lose very little energy in the process. **The deeper the water, the greater the speed of tsunami waves will be.**



Check-out these resources!

- [What causes tsunami?](#)
- [How tsunamis work - Alex Gendler](#)
- [Tsunamis](#)
- [Do-it-yourself experiments-Tsunami](#)
- [How Earthquakes Trigger Tsunamis - Bang Goes The Theory, Preview](#)
- [Pacific Tsunami Museum](#)

How do *Typhoons* (台風) occur?



- ✓ Tropical cyclone, also called typhoon or hurricane, an intense circular storm that originates over warm tropical oceans and is characterized by low atmospheric pressure, high winds, and heavy rain.
- ✓ Warm air full of moisture rises from the ocean surface. It forms rotating bands of clouds. Cool air sink into the middle of the storm, forming its “eye.” The rising and sinking air drives the air’s swirling movement. Hurricane winds rotate counterclockwise in the Northern Hemisphere.
- ✓ Warming ocean waters have been correlated with increasing frequencies of tropical storms and typhoons over the last several decades. Moreover, the damage from these storms is exacerbated by rising sea levels globally.
- ✓ A storm surge is one of the greatest dangers that these storms pose to coastal areas. As a tropical cyclone spins toward land, its winds can push seawater ashore. This may temporarily flood the land to depths of 1 to 4 meters (3 to 13 feet) or more. A storm surge can be especially dangerous if it coincides with high tide; this can push an even higher wall of water onshore.

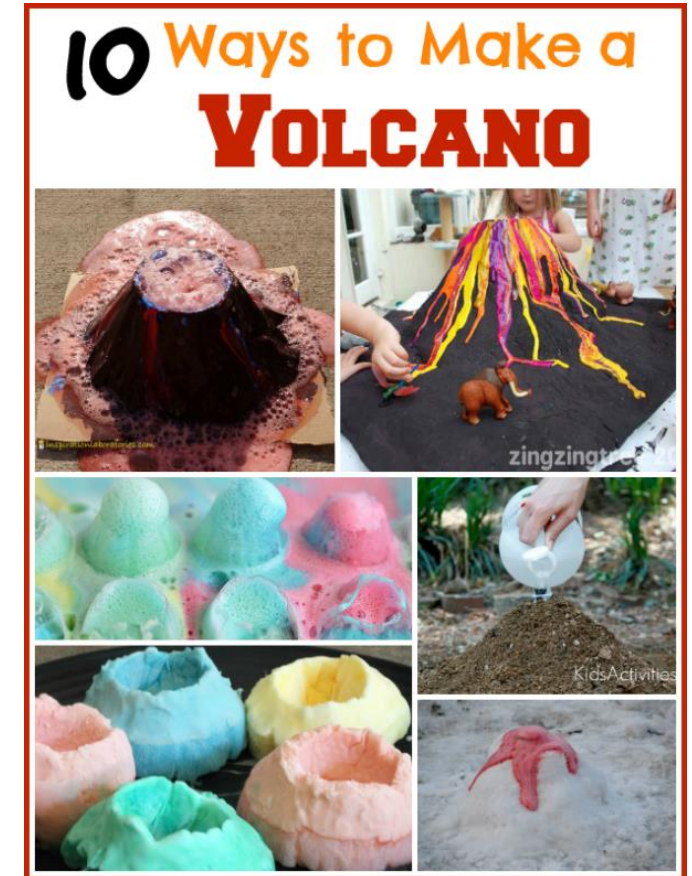
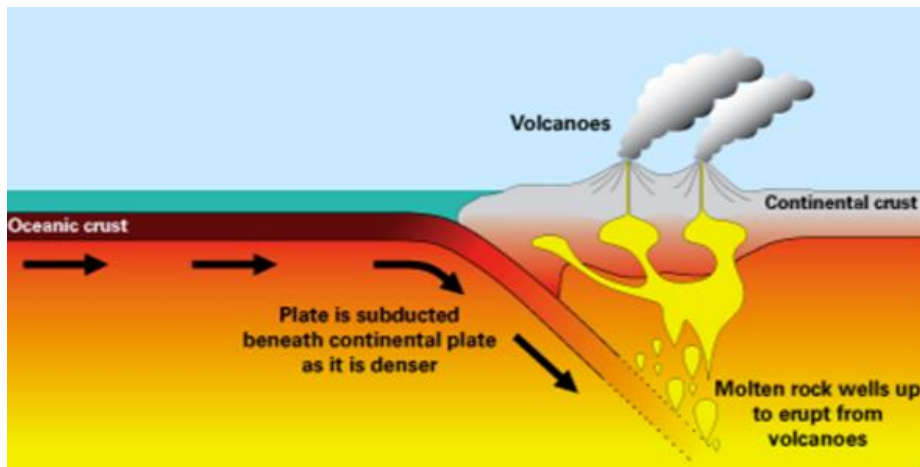
Check-out these resources!

- [What are hurricanes, typhoons and tropical cyclones?](#)
- [Scientific Explanation of Typhoons](#)
- [How Do Hurricanes Form?](#)
- [Climate Mechanism for Stronger Typhoons in a Warmer World](#)
- [Explainer: Hurricanes, cyclones and typhoons](#)

How does climate change affect typhoons?

How do **Volcanic Eruptions (火山噴火)** occur?

- ✓ Scientists estimate 20 volcanoes worldwide are erupting on the land. Still more are probably erupting underwater, but scientists don't have enough instruments to detect them. Many of these submarine eruptions theoretically occur along mid-ocean ridges, where an estimated 80 percent of Earth's magma erupts unnoticed.
- ✓ On Earth, the erupted material can be liquid rock ("lava" when it's on the surface, "magma" when it's underground), ash, cinders, and/or gas. There are three ways that magma rises:
 1. When pieces of Earth's crust called tectonic plates slowly move away from each other. The magma rises up to fill in the space. When this happens underwater volcanoes can form.
 2. When these tectonic plates move toward each other. When this happens, part of Earth's crust can be forced deep into its interior. The high heat and pressure cause the crust to melt and rise as magma.
 3. A final way that magma rises is over hot spots. Hot spots are exactly what they sound like--hot areas inside of Earth. These areas heat up magma. The magma becomes less dense. When it is less dense it rises.



Check-out these resources!

- [How Do Volcanoes Erupt?](#)
- [Do-it-yourself science projects: Make a volcano!](#)
- [Why Deadly Japan Volcano Erupted Without Warning](#)
- [When Volcanoes Erupt](#)
- [What Is a Volcano?](#)
- [Japan volcano shoots rock & ash on Mount Ontake](#)

How Do Natural Disasters Impact People's Lives in Japan?

- How Does Prepares for Natural Disasters.?

Worksheet 5

Task 2: Research the Ways That Japan Prepares for Natural Disasters

1. Same group as Task1
2. Research How the Natural Disaster (from Task 1) Impacts on people's lives?
3. Research the ways that Japan prepares for natural disasters.

The importance of investment in Disaster Risk Reduction, which the Japanese government has been supporting based on past disaster experience in Japan, was shared and adopted as one of the Priorities for Action in the Sendai Framework for Disaster Risk Reduction 2015-2030. Working on Disaster Risk Reduction (DRR) in advance reduces the level of damage caused by a disaster. This approach is also more cost-effective when compared with the cost required for post-disaster recovery and reconstruction. As a result, it also leads to sustainable economic growth. The values and outcomes of the **Sendai Framework for Disaster Risk Reduction** have been incorporated into "Transforming our World: the 2030 Agenda for Sustainable Development (SDGs)." This agenda emphasizes the importance of DRR activities in achieving the SDGs.

The Sendai Framework for Disaster Risk Reduction 2015-2030

Four Priorities for Action:

- (1) Understanding disaster risk
- (2) Strengthening disaster risk governance to manage disaster risk
- (3) Investing in disaster risk reduction for resilience
- (4) Enhancing disaster preparedness for effective response, and to "Build Back Better" in recovery, rehabilitation and reconstruction

Key Facts

Natural Disasters	Impact on People's Lives	Countermeasures against Disasters
Earthquake	destroying houses, disrupting lifelines, and paralyzing traffic systems	regular evacuation drill, earthquake-resistant construction, awareness of self-help and mutual-help, and Community Disaster Management Plans
Tsunami	sweeping over sea walls and engulfing people and buildings, disrupting lifelines, and smashed the coast	sea wall building, anti-flood measures, improving tsunami warning and alarm system, developing
Typhoon	levees collapsing, destroying hoses, landslides and mudflows, engulfing people and buildings by flood	Safety measures outside and inside the house, daily precautions, weather warning, Real-time Risk Map, Hazardous Wind Watch
Volcanic Eruption	damaging people by volcanic gas, explosion and ejected volcanic blocks, and burning forest and houses	Volcanic Warnings, Eruption Notice, Volcanic Ash Fall Forecasts, building walls to prevent volcanic mudflow and landslide

Check-out these resources!

- [How Japan is using Space Technology in Natural Disasters](#)
- [Predicting Earthquakes: How Japan Is Learning From The Past](#)
- [Lessons of the Great Hanshin-Awaji Earthquake used in the world](#)
- [Learning to 'Coexist with Risk:' The Essence of Japan's Technical Cooperation with Central American Countries](#)
- [Disaster Resilient Society for All](#)
- [Earthquake and Tsunami Countermeasures of Tokyo's Sewerage disaster?](#)
- [Incorporating Science and Technology for Disaster Reduction, the Japanese Experience](#)
- [JR to use seafloor sensors to provide swifter train-stopping alert in event of offshore temblors](#)

Examples

The Earthquake-Proof Technology of Temple Pagodas

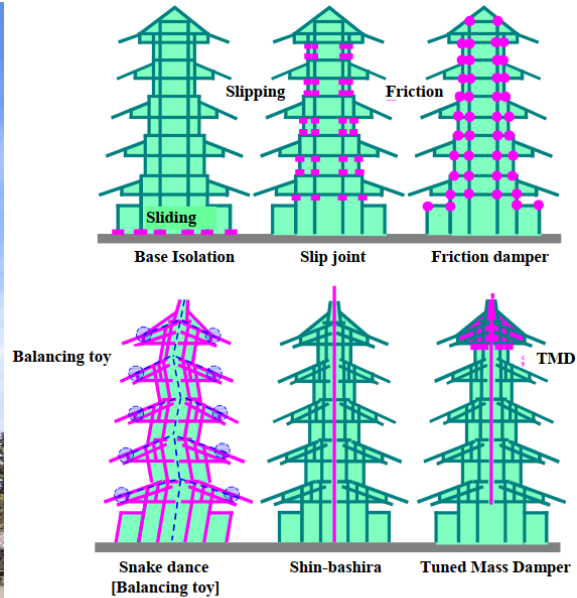


Figure . 3: Vibration control devices of the pagoda

([Nakahara, K. et al](#))

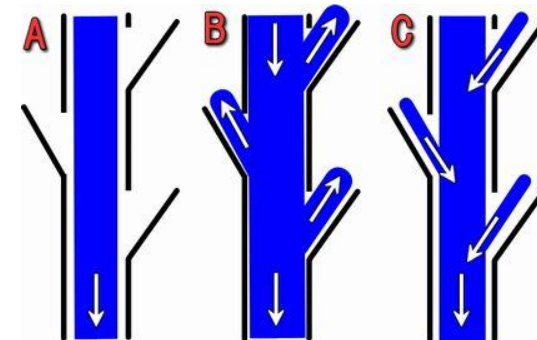
The Hōryū-ji:

Temple Pagoda (in Nara Prefecture) built by Prince Shōtoku in 607 is one of the oldest existing wooden buildings in the world. The unique architectural structure of this five-story pagoda is earthquake-proof.



Prince Shōtoku

The Flood Control System of the Kofu Basin



([Edahiro, J. 2016](#))



Shingen Takeda

Kasumi-tei (open levee) Design:

Shingen Takeda, a wartime warrior, is said to have started a flood control project on rivers in Japan in 16 century. Kasumi-tei was built along the river to prevent inundation water from entering into the central area of the basin by Shingen. Normal flow (A), at the time of flooding (B), and after flooding (C)

Who is Vulnerable When Natural Disasters Occur?

-How Can Technology and Scientific Development Protect Vulnerable Populations?

Demographic Data for Katrina-Related Deaths: Louisiana, 2005

All Victims (N = 971)*	
Characteristic	No. (%)
Sex	
Male	512 (53)
Female	455 (47)
Race/ethnicity	
Black	498 (51)
White	403 (42)
Hispanic/Latino	18 (2)
Age, years	
<18¶	20 (2)
Black	10
White	0
18-29	18 (2)
Black	13
White	5
30-44	47 (5)
Black	31
White	15
45-54	119 (12)
Black	78
White	38
55-64	137 (14)
Black	80
White	54
65-74	136 (14)
Black	85
White	43
≥75	472 (49)
Black	198 (42)
Male	96
Female	102
White	247 (52)
Male	90
Female	157

The tsunami's impact on gender balance in Aceh

Aceh Besar District

Village	Population pre-tsunami	Survivors	Surviving females	Surviving males
Gampong Baru	242	123	39	84
Meunasah Masjid	1,110	159	45	114
Lamsenia	220	124	26	98
Dayeuh Mapplam	4,500	270	79	191

North Aceh District

Village	Population pre-tsunami	Total dead	Fatalities: female	Fatalities: male
Sawang	Not available	93	70	23
Kuala Keureutou	Not available	85	68	17
Kuala Cangkoy	Not available	146	117	29
Matang Baroh	Not available	42	29	13



Mortality Rate of Disabled Population of The Great East Japan Earthquake

Area	Population	Disabled Population	Mortality Rate	Disabled Population's Mortality Rate
Miyako-City (Iwate Prefecture)	59,636	3,371	525(0.9%)	36(1.1%)
Miyagi Prefecture	2,346,853	107,150	9,471(0.4%)	1,028(1.7%)

Worksheet 6

Final Task: As A Scientist, How Can You Help Protect Vulnerable Populations?

1. Pair Up
2. Research A Case of Natural Disaster and Identify the Vulnerable Group/Population of the Natural Disaster
3. How Do You Develop Technology and/or Scientific System to Protect Vulnerable Population?

Check-out these resources!

- [Left Behind -Persons with Disabilities from 3.11](#)
- [The Great East Japan Earthquake and Disabled Persons](#)
- [Socio-economic impacts of natural disasters: a gender analysis](#)
- [Women, the elderly,& the disabled are disproportionately hit by natural disasters – planning & preparedness](#)
- [How natural disasters affect women](#)
- [Four times as many women died in tsunami](#)
- [Column: Women, the elderly, and the disabled are disproportionately hit by natural disasters](#)
- [Disaster and gender statistics](#)

What kind of tool or system would you invent??



[Southern, Thailand - January 9, 2017: a volunteer helps a man with a disability get through the flood in his wheelchair. Photo: issara anujun / Shutterstock.com](#)

Lesson plan created by **Aika Okishige**,
Curriculum Developer at East Asia National Resource Center
The George Washington University