

Latitude: 15S to 60S Longitude: 70W to 80W

Region 1

Two great oceans, the Atlantic and Pacific, are separated by the continents of North and South America. How do ships get from one ocean to the other? Today they use a canal in Panama. But long ago they had to go around South America. The route was around the tip of Chile. It held great danger. Terrible storms rage in the open ocean between the southern tip of Chile and Antarctica. In 1520, the Spanish explorer Ferdinand Magellan discovered a slightly safer route. His ship sailed a narrow passage that cuts through the southern tip of Chile. It is now called the Strait of Magellan. It is a twisty and foggy passage. But it is safer than the open ocean.

Magellan was not the only explorer in this region. A recent explorer was very unusual: it was a robot named Nomad. Nomad was made for space



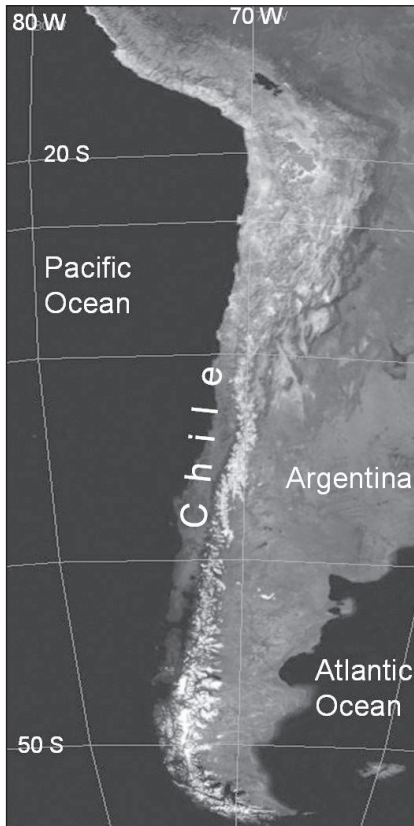
Nomad in the Atacama Desert, Chile. [Photo © 1997 Carnegie Mellon/NASA, used with permission.]



[Map adapted using ArcGIS/ArcMap software, ESRI World database.]

exploration. It explored the region in the north, called the Atacama Desert. This is one of the driest spots on Earth. Scientists put Nomad in the desert to test how it might work on another planet. Scientists chose this spot because it is so dry and rugged that it is like another planet. This desert is located on the northwest coast of Chile. You can see it in this satellite image.

Why is the land so dry on the west here in the Atacama Desert? The key is in the high mountains to the east. This long, north-south range is called the Andes Range. It lies along



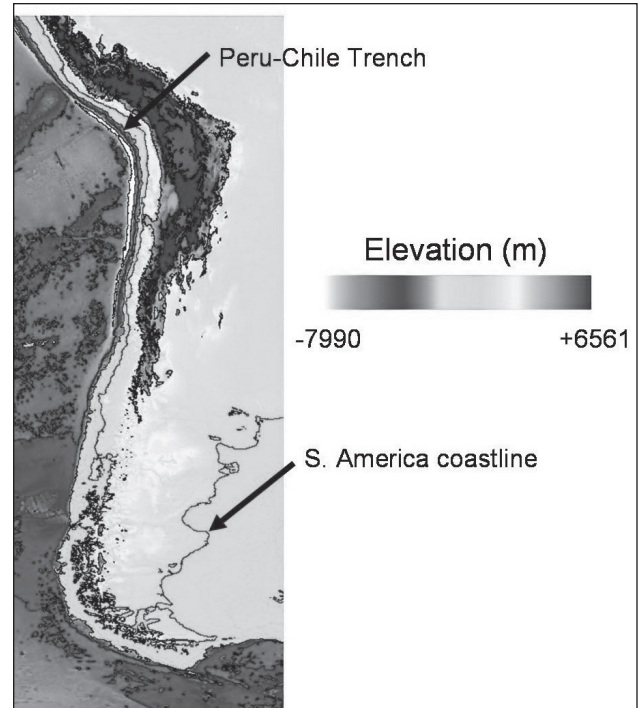
[Adapted using NASA World Wind software, NLT Landsat7 data.]



View of Aconcagua Peak in the Andes taken from an airplane. [Photo © Bill Caid, used with permission.]

the eastern border of Chile, running down the South American continent. The highest mountain in the Western Hemisphere is in Argentina, near the border with Chile. It is called Aconcagua. It is 6,960 meters tall. The Andes Range acts as a shield. It blocks wet air blown in from the Atlantic Ocean to the east. The wet air drops its water as rain in the area east of the mountains. The water does not make it over the mountains to the desert. Although the Atacama Desert is very dry, it is not hot. The high altitude makes it a cold desert.

In this region, there is also a very deep spot. It lies under the ocean 150 km west of Chile. Here the ocean is very deep. This is because of a deep gash in the ocean floor. This gash is called the Peru-Chile trench. It runs north-south following the line of the coast. It is 6 km deep! The image in the upper right shows this trench. It is a map of the height of the land and the depth of the sea compared to sea level (0 meters). The outline of South America is indicated on the image. The west coast of Chile has many small islands. In 1960, this was a very dangerous place to be. The biggest earthquake ever recorded happened here. It was a M9.5 quake. Many buildings were destroyed when the ground shook. There were huge landslides. And there was a huge wave called a tsunami. In some places, the tsunami was over 24 meters tall! That is taller than many buildings! Imagine living on an island off the coast of Chile during the



[Map adapted from NOAA/GEODAS ETOPO2 data using ArcGIS/ArcMap software.]

earthquake and tsunami. Here is a picture of what happened to houses in the coastal city of Valdivia.



[NOAA/NGDC photo by Pierre St. Amand]

Many people were saved because they knew to run up to the hills when the water began to pull out to sea as the tsunami started. The tsunami that followed the 1960 earthquake raced across the Pacific Ocean. It damaged things far away in Hawaii and Japan. On land in Chile, the earthquake ripped the ground along a north-south line (called a fault) almost 1000 km long!

Latitude: 45N to 50N Longitude: 120W to 130W

Region 2

In the early morning of May 18, 1980, a mountain exploded. It was Mount St. Helens in the state of Washington. The massive explosion blasted a shock wave of heat that traveled at 300 miles per hour. Ash and rock were thrown out of the mountain.



*Mt. St. Helens during the eruption.
[USGS photo by Austin Post]*



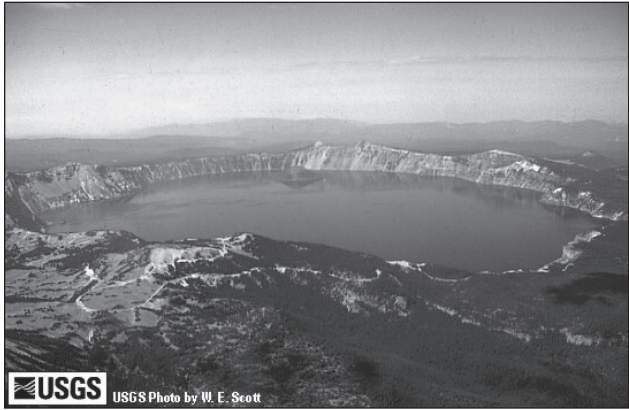
[USGS photo, Jan 14, 2005. Circle is where an instrument package (inset) was dropped to measure the volcanic activity. The package lasted 36 hours until it was destroyed in an explosion.]

The 1980 eruption started with a M5.1 earthquake. When it was over, the mountain was 400 meters shorter than the day before. Fifty-seven people died. Before the 1980 eruption, Mt. St. Helens was quiet for about 140 years. Recently, nearly 25 years after the 1980 explosion, Mt. St. Helens began a new kind of eruption. In September 2004, a swarm of tiny earthquakes announced an eruption. A giant lump of rock was pushed up from within the volcano. It is called a whaleback because it looks like a whale's back.



Mt. St. Helens after the eruption. [USGS photo by Lyn Topinka]

An eruption on another volcano in this region happened about 7000 years ago. What was left inside the mountain was a crater. It filled with water. This lake is now called Crater Lake. It is at the southern end of a range of volcanic mountains. They are called the Cascade Range. They contain 700 glaciers. This range stretches in a north-south line across Washington, Oregon and northern California. Some volcanic peaks in the Cascade Range are very close to large cities. Mount Rainier is very close to the city of Seattle, Washington. Over 1.5 million people live in Seattle. Mount



[Crater Lake, Oregon. USGS photo by W.E. Scott]



Olympic National Forest. [USGS photo]

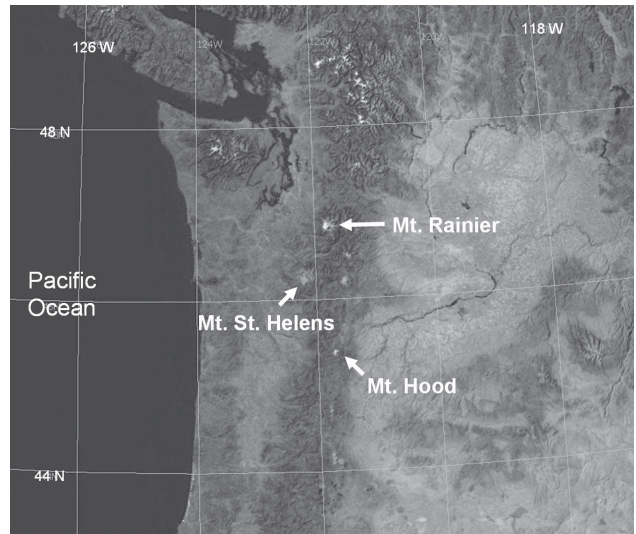


Mt. Hood and Portland, Oregon. [USGS photo by David E. Wieprecht]

Hood is near the city of Portland, Oregon. Mt. Hood last erupted in 1865. Compare it to Mt. St. Helens. Could Mt. Hood violently erupt during your lifetime?

In the Pacific Northwest, not all interesting features are volcanoes. For example, directly west of Seattle is a very wet area. It includes the Olympic National Forest and the Olympic Mountains. In contrast, east of the Cascade Range in Washington, the land is dry. Seattle is a port city. It is located on a very large bay called Puget Sound. Many ocean-going ships come to this harbor from a long waterway that leads to the Pacific Ocean. This waterway is called the Strait of Juan de Fuca.

This image of the Pacific Northwest is made from data collected by a satellite. Compare it to the map at the right. Can you see the Olympic Mountains, Puget Sound and some of the Cascade Range volcanoes?



[Image adapted using NASA World Wind software.]



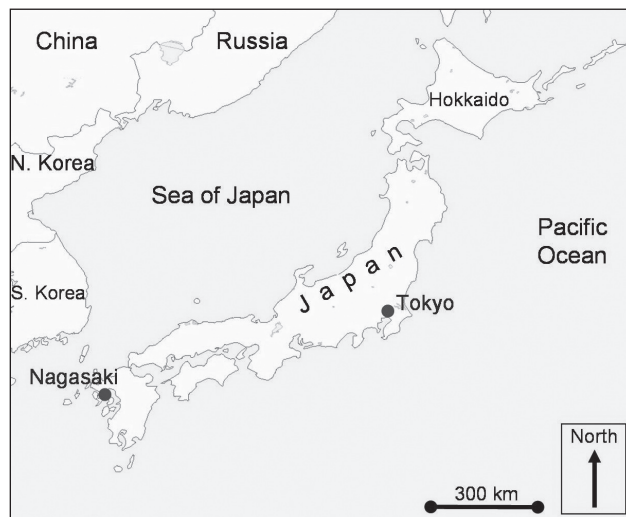
[Map adapted using ArcGIS/ArcMap software.]

Latitude: 30N to 48N Longitude: 125E to 148E

Region 3

Japan is a country made of many islands. No matter where you are in Japan, you are never far from the ocean. Japan is a country that has many contrasts. It has many miles of coastline but also has high mountain peaks. It is about the same size as California, but almost four times as many people live there. Even with so many people, forests cover most of the land in Japan. Half of the population lives in the three cities of Tokyo, Osaka, and Nagoya. Tokyo is the largest city in Japan, but is also one of the largest cities in the world!

Another interesting contrast is that Japan has very old things and very new things. Some of the oldest pottery in the world was made in Japan 12,000 years ago. Japan also has very advanced industries. Sony, Sega, and Nintendo are large electronics companies based in Japan. There are many coastlines in Japan. Because of this, many people make a living by fishing. This map shows that Japan is made of a long chain of islands.



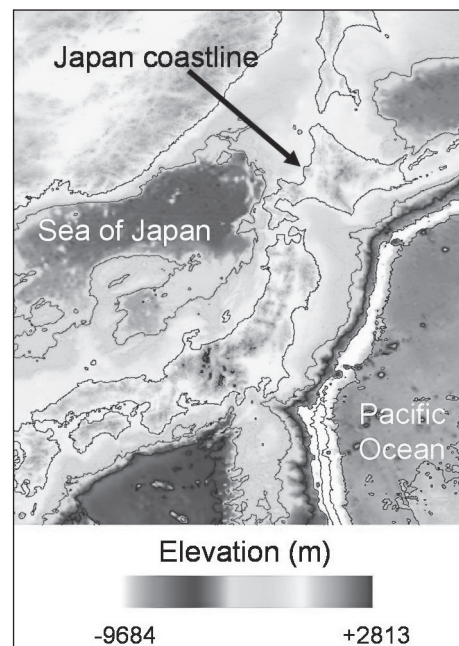
[Map adapted using ArcGIS/ArcMap software.]

The weather in southern Japan is warm and rainy. The northern part of Japan is much cooler. The temperature also is very different along the coast or up on a mountain. Typhoon is the Asian name for storms like hurricanes. Southern Japan often has typhoons that bring very heavy rain and high winds.



Mount Fuji. Japan's tallest volcano. (from volcano world—permission pending)

There are many earthquakes in Japan. Earthquakes cause problems because the shaking can destroy buildings. Earthquakes can also cause very large waves, called tsunamis. These waves are sometimes very destructive. Japan has very advanced warning systems for tsunamis. The warnings let people know when the tsunami is coming so they can get out of the way. The ocean to the east of Japan is very deep. On the west, it is very shallow. The map below shows this. It represents the height of the land and depth of the sea. The coastline of Japan is shown on the map. Interestingly, earthquakes occur more on the east side of Japan than on the west.



[Map adapted from NOAA/GEODAS ETOPO2 data using ArcGIS/ArcMap software.]

Besides storms and earthquakes, Japan has the most explosive volcanic eruptions in the world. Some volcanic peaks rise up from the ocean floor but not high enough to reach above the surface of the water. They are called submarine volcanoes.

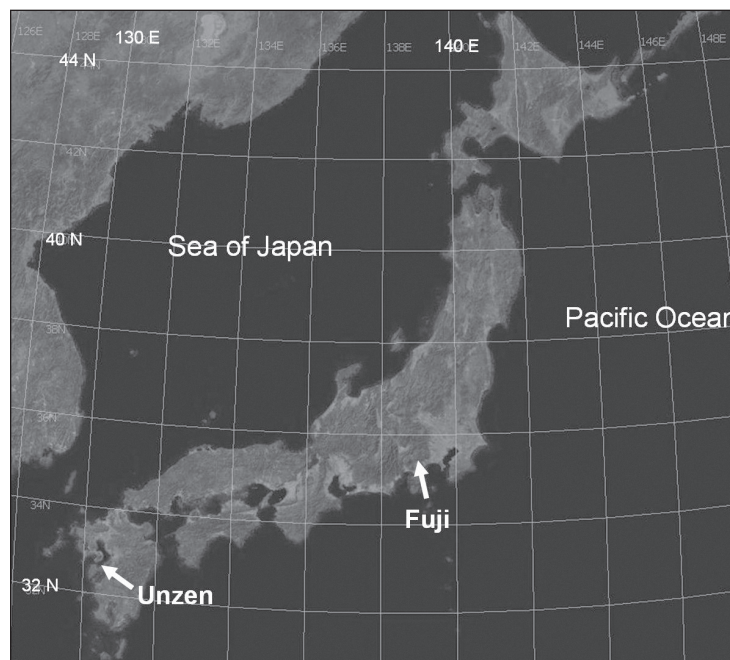
One of the most dangerous volcanoes in Japan is named Unzen. It is on the island at the southern tip of Japan. Unzen is near the city of Nagasaki. In 1792, part of Unzen collapsed and caused a landslide and tsunami that killed 15,000 people!

After “sleeping” for many years, Unzen erupted in 1991. It continued erupting for four years. The Unzen eruption was similar to the eruption of the U.S. volcano Mount St. Helens in 1980. Thousands of homes were destroyed and 43 people were killed in the 1991 Unzen eruption. There are over 75 active volcanoes in Japan. That is more than any other region in the world.

If you visited Japan, some things would seem familiar. The roads, trains, and cities look a lot like they do in the U.S. Other things might seem different. Some of the animals are very different from those in the U.S. There are monkeys throughout all of Japan except for the northern island of Hokkaido. There are also deer foxes and an animal called a raccoon dog. Raccoon dogs are related to dogs, but they look a lot like raccoons.



Raccoon dog. [Image used with permission by Wendy Baker and Michigan Science Art.]



[Image adapted using NASA World Wind software.]

Latitude: 10N to 25N Longitude: 140E to 150E

Flying over this region, a scientist took a picture of an island. It is called Farallon de Pajaros. This island is a volcano. It is about 2 km wide. No one lives there. Farallon de Pajaros has erupted about 16 times in the last 150 years. Most of the eruptions form lava flows. Can you see the result in this picture?



Farallon de Pajaros, as seen from an airplane in 1992. [USGS Image by Frank Trusdell]

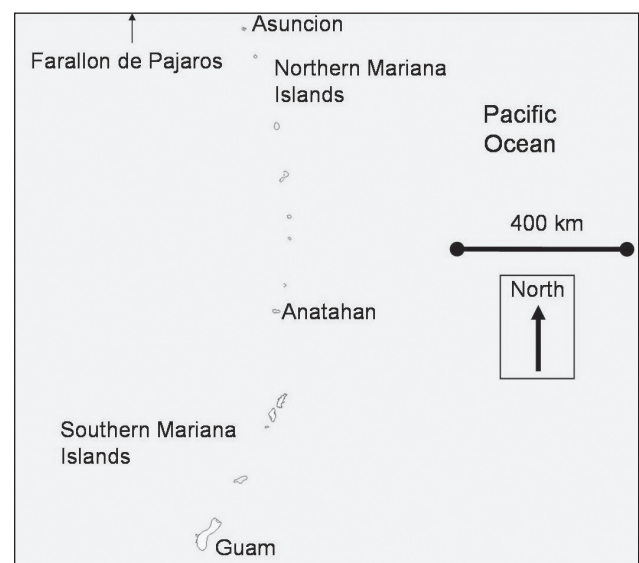
Farallon de Pajaros is at the northern end of a chain of volcanic islands in this region. They are called the Mariana Islands. These islands form an arc or crescent shape. They are very old. In fact, the islands are about 40 million years old! Flying south from Farallon de Pajaros along the line of islands, you would see the small island of Asuncion. It rises 857 meters above the ocean. Like the other Mariana Islands, it is a volcanic peak. The volcano does not start at the water's surface. Instead, it rises up from the ocean floor. The peak you see is the top of a volcanic mountain. The point is so tall it sticks out of the water. The top of Asuncion volcano is covered with clouds. The sides are very green and covered with palm trees. The shore is rough and rocky. But if you were flying near another of the Mariana Islands, Anatahan Volcano, you would have to be very careful. Anatahan erupts frequently. It throws ash as much as 10 km into the sky. This can be dangerous for airplanes. The first time in recent history that people observed Anatahan

Region 4



The small island of Asuncion. [USGS image by Frank Trusdell.]

erupt was on May 10, 2003. Days before the volcano erupted, the number of small earthquakes increased nearby. There were more than 100 small earthquakes per hour! Then at 5 PM an explosion sent ash high into the air. Many explosions happened in the next three weeks. South of Anatahan is the largest of the Mariana Islands, Guam. It is formed from two volcanoes. It is the shape of a foot. Almost all year long, the weather is hot and wet. The drier time is from January to June. From July to December, Guam gets a lot of rain. About 25% of the land in Guam is farmed. More than 168,000 people live there.



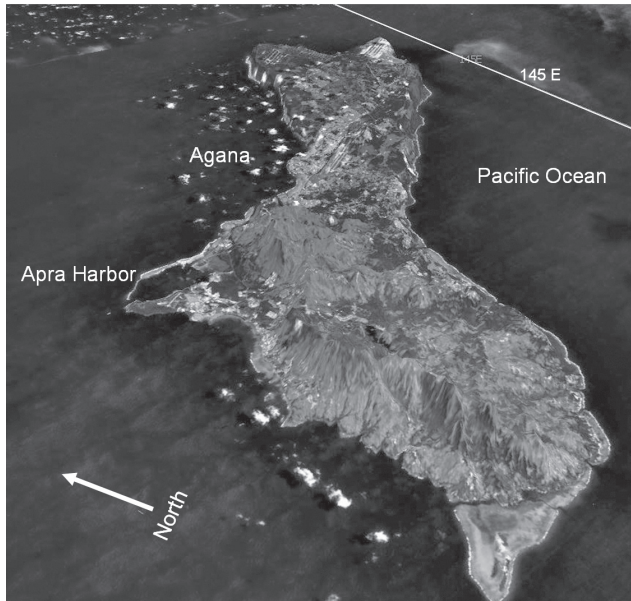
[Map adapted using ArcGIS/ArcMap software.]

The capital of Guam is Agana. There is a good harbor called Apra Harbor. There are many palm trees in Guam. In some places they grow as a forest. Here a geologist looks down at a palm tree

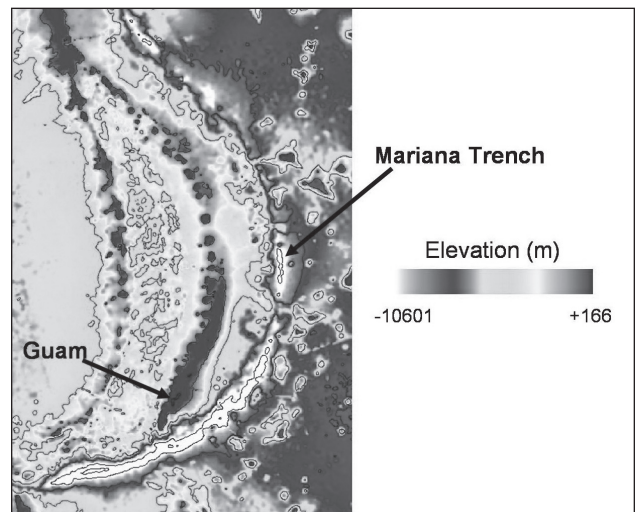


[Photo used with permission by Dr. John Keyantash, California State University, Dominguez Hills.]

forest. The north end of Guam is fairly flat. The middle area has low hills. Mountains are found in the southern part of Guam. The highest point is Mount Lamlam. It rises 406 meters above sea level. But this is just the tip. The entire mountain rises from a deep cut in the ocean floor that is east of Guam and all the Mariana Islands. This cut is called the Mariana Trench. It is 11 km deep! The highest mountain in the world, Mt. Everest, could sit in this trench and still have water above its peak! The Mariana Trench runs north-south following the line of the ridge that makes up the Mariana Islands. The trench can be seen in the image below. It shows the depth of the ocean below sea level. The outlines of Guam and some other islands are shown. West of the Mariana Islands is a second, slightly lower ridge, but it lies underwater. Compare how deep the ocean is on each side of the Mariana arc of islands.



[Image adapted using NASA World Wind software.]

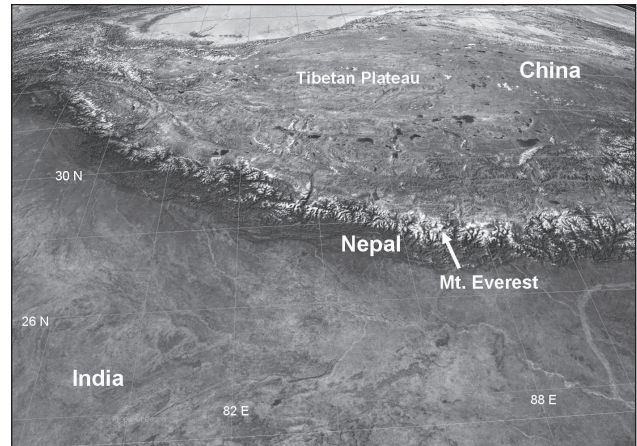


[Map adapted from NOAA/GEODAS ETOPO2 data using ArcGIS/ArcMap software.]

Latitude: 25N to 40N Longitude: 70E to 100E

Region 5

“Abode of Snow”—this is what the word “Himalaya” means in the language called Sanskrit. The Himalaya region is a world of amazingly tall mountain peaks. They lie in a broad east-west band that twists across the region of southern Asia. Among the peaks is Mt. Everest. This is the highest mountain in the world. Mt. Everest stands 8,850 meters above sea level. The north half of the mountain is in Tibet, a region in southwestern China. The south half of the mountain is in the country of Nepal. The Himalaya mountain range contains many mountains almost as tall as Mt. Everest.



Satellite photo of Himalaya region. [Adapted using NASA World Wind software.]



Kantega, a Himalayan peak near Mt. Everest, is 6,857 m above sea level. [Photo © Alan Arnette, used with permission.]

The valleys in the Himalaya mountain range are very deep. Some are over 3,000 meters deep. People live in the lower valleys. A few people live in the valleys that are part way up the mountains, but almost no one lives in the icy world at the highest areas. It is very cold there. The temperature is usually below -10°C . How far below freezing is that? At the tops of the peaks, it can be as cold as -38°C . Here winds blow almost all the time, sometimes at speeds of 150 km/hr. In April and May, the winds calm down a little. This is the time of year when some people try to climb

the high peaks. It is very dangerous. Storms can come very quickly. This view of the Himalayas is from the south looking toward the north. It is a photograph taken from a satellite in space. The brown area to the north is a very high plateau. A plateau is a high, flat area of land. This plateau is called the Tibetan Plateau. The climate is dry on the plateau. There are lakes on the plateau, but the water in many of them is salty. North of the plateau is a huge desert. Do you see it?

South of the plateau, the Himalaya Mountains form a very high ridge. The ridge appears white in this picture because it is covered with snow and ice. There are many mountain glaciers here. This mountain ridge lies between the dry plateau and the wetter area to the south. India and most of Nepal lie in this wetter southern region. The area south of the ridge is also fairly flat. This type of land is called a plain. Clouds bring rain across the plains during the summer months. It rains and rains and rains. These heavy rains are called monsoons. The clouds can rarely carry water over the ridge of mountains. Instead, the water falls as rain on the plains and on the southern side of the mountain range. The range is a divide between the dry areas to the north and the wet areas to the south.

This region is an area of great contrasts. The dry Tibetan Plateau and the desert to the north are very different from the wet plains and the wet southern slopes of the mountains. On the wet side of the Himalayas, plants called giant rhododendrons grow at very high altitudes. Animals called yaks live at very high altitudes on the other, dry side of the Himalayas. They are ridden by people or used to carry heavy loads. Lower on the slopes are forests of conifers, plants such as pine trees. The monsoon climate makes the south side of the mountains and the southern foothills very wet, with many different kinds of plants. Here is a map that shows the boundaries of countries and the location of the Himalaya Mountains and the desert in China. This map covers about the same area as the satellite photo.



[Map adapted using ArcGIS/ArcMap software.]

Latitude: 60N to 70N Longitude: 30W to 0

If you were flying over this region, in the middle of the North Atlantic Ocean, you would see an island. This island is the country of Iceland. It is east of Greenland and west of Norway. Iceland is near the Arctic Circle. From the name “Iceland”, what would you expect it to look like as you flew in close? If you guessed “icy” you would be partly correct. Iceland has more land covered by glaciers than in all the rest of Europe. Iceland has the largest glacier in Europe called Vatnajokull. This glacier is located in the southeast part of Iceland, on its highest mountain. The elevation is 2119 meters. There are volcanoes and hot springs in many parts of the country. In some places in the south, you could be swimming in a hot spring and looking at icy mountain peaks. If you flew low over the Vatnajokull glacier in 1991, you might have seen something like this:



[USGS photo by Magnús Tumi Guðmundsson]

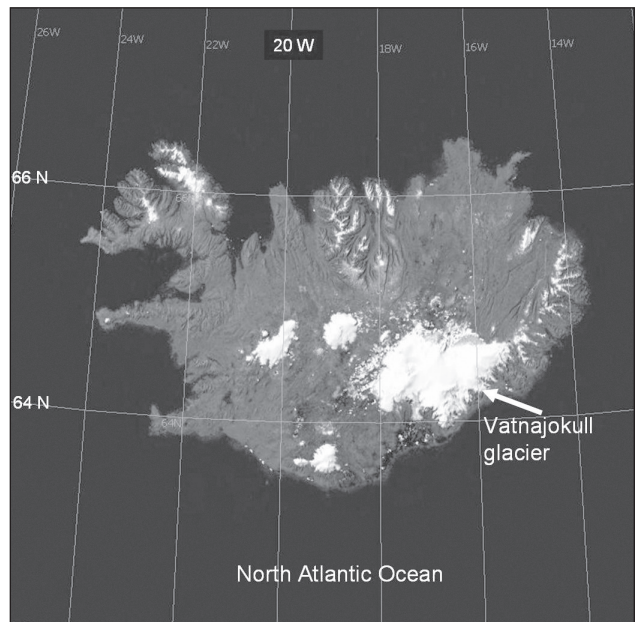
Less than two days later, the glacier looked like this:



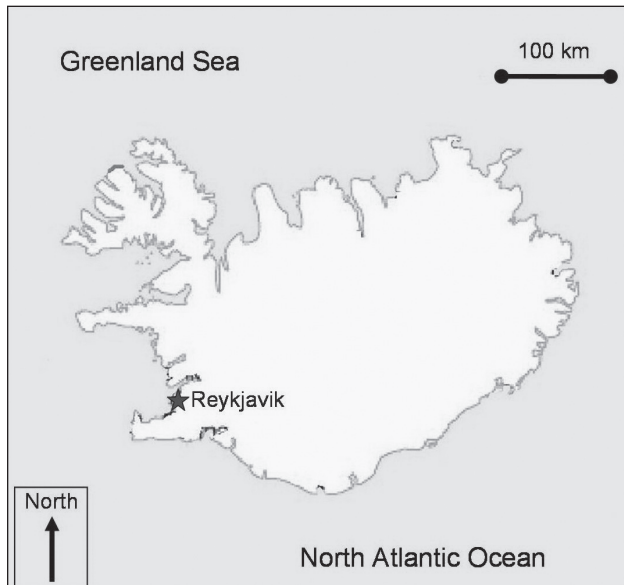
[USGS photo by Magnús Tumi Guðmundsson.]

What do you think could be causing the glacier to melt?

Most of Iceland is not covered with ice! The land is mostly high plains with some mountain peaks. There are lakes and some high waterfalls. The average elevation is 500 meters. There are deep cuts in the coastline here, called fjords, which are steep-sided inlets of the sea. Iceland’s climate is surprisingly mild for a place so far north. The



[Image adapted using NASA World Wind software.]

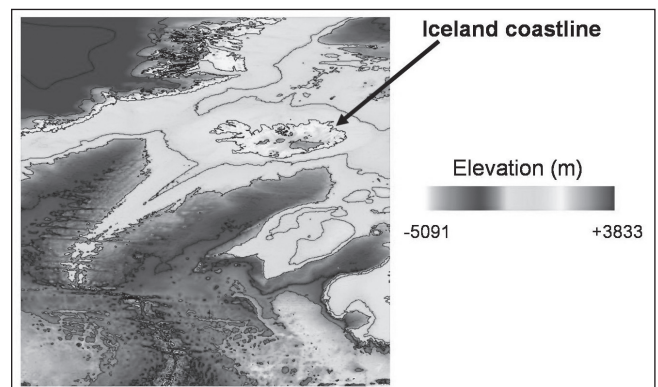


[Map adapted from CIA World Factbook.]

average temperature in July is 11°C. In the winter, the average temperature is about like that in New York City, around freezing. But in mid-winter in Iceland there are only about 4 hours of daylight. In mid-summer the light lasts almost all day!

About the same number of people live in Iceland as in the area around Madison, WI. The capital city is Reykjavik. This is the northernmost capital city in the world. There used to be trees in Iceland,

but most were cut down by the 1200s. Now, people are working hard to replant trees. Only a tiny portion of the land can be farmed. Fishing is an important source of food and income. Energy from Earth's internal heat, called geothermal energy, is also an industry in Iceland. Scientists have made measurements that show the shape of the ocean floor beneath the water. There are mountains and trenches in parts of the ocean floor around Iceland. This image shows what Earth's surface looks like near Iceland. The different colors represent different heights and depths above and below sea level. The coastline of Iceland is also shown.



[Map adapted from NOAA/GEODAS ETOPO2 data using ArcGIS/ArcMap software.]

Latitude: 15N to 10S Longitude: 90E to 120E

Region 7

As you fly over this region of the world, you look down on an arc of islands. The cones of many volcanoes can be seen along this arc. The volcanoes in this arc rise thousands of meters from the sea floor. The tallest ones are exposed above the surface of the water. One island, Anak Krakatau, is new! It has grown since 1927 from many small eruptions and some large, explosive ones. It is in the Sunda Strait, a water passage between Sumatra and Java. Anak Krakatau means “Child of Krakatau.” It has this name because it replaced a famous volcano called Krakatau. Krakatau was destroyed in one of the largest explosions on Earth. This was in 1883. A volcanic eruption destroyed most of the island. Not all the volcanic islands are small. Some fused into a huge island called Java.



[Anak Krakatau 1960 © Robert Decker, permission pending.]

Java is about the size of California. It is crowded with people. In fact, it is the most populated island on Earth. Over 114 million people live there. That is a little more than one third of the number of people that live in the United States. Over 12,000 of Java’s people live in the collapsed remainder of a huge volcano called Ijen. When a volcano explodes and leaves an open shell, it is called a caldera. The caldera of Ijen has rich soil. People grow coffee there. Have you ever heard of coffee referred to as “java”?

One part of Ijen is an active crater. Steam rises from it. The mineral called sulfur is mined in the crater. In the center is an acidic lake. This lake is 200 meters deep. Northwest of Java is the large island of Sumatra.



[Photo courtesy Volcano World, University of North Dakota. Used with permission.]

Mountains run the length of Sumatra, mainly on the western side. Some are over 2900 meters high. The eastern coast has been a busy stop for ships for hundreds of years. Nature preserves on the island protect interesting animals and plants. This includes the biggest flower in the world, called rafflesia. Parks also protect elephants, tigers, and many birds. The climate here is very wet. Rain falls almost all year, but it is much heavier from fall to spring. Thick forests grow here, especially in the north end of Sumatra. There also are fields where people grow rice. Water flows down from the mountains in many streams and waterfalls. There are also many sandy beaches on Sumatra.

Northwest of Sumatra, the island arc ends with a string of small islands called the Andaman Islands. They belong to the country of India. There are no very high mountains in the Andaman Islands. Instead, there are many hills cut by narrow valleys. There are no rivers and only a few streams. Yet, when the monsoon rains come, the islands get a lot of water. Thick jungles cover the hills. The

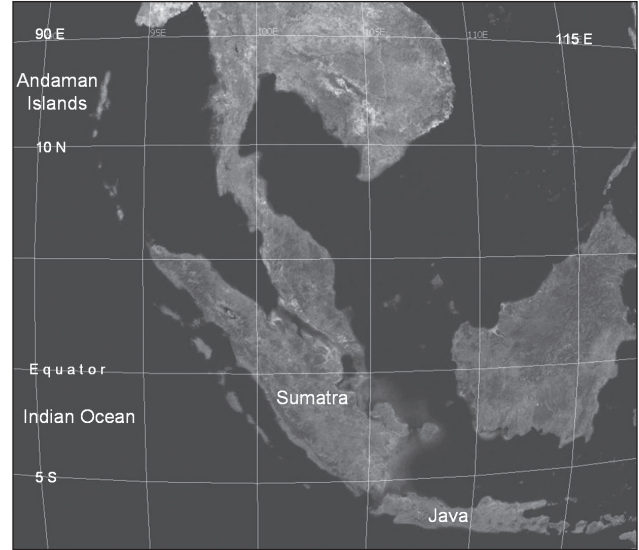
climate is always warm, with breezes from the ocean. It can be very hot in summer.

The main city of the Andaman Islands is Port Blair. In 2003, astronauts on the Space Shuttle were flying over the Andaman Islands. They saw steam

arising from a volcanic island 135 km northeast of Port Blair. This is Barren Island volcano. It has erupted many times. Only a few trees survived the 1991–1994 eruptions. A few animals live on Barren Island. The largest is a wild goat.



[Map adapted using ArcGIS/ArcMap software.]



[Image adapted using NASA World Wind software.]

Latitude: 50N to 70 N Longitude: 130W to 180W

Region 8

Think of Alaska. Is it cold or is it hot? When you think of Alaska, you may first think of snow and icy, high mountains. Alaska has all of those things. Alaska can be COLD. In fact, there are many glaciers in Alaska. Glaciers are rivers of ice. Here is a picture of a glacier where it flows into the sea.



[USGS photo by Bruce F. Molina.]

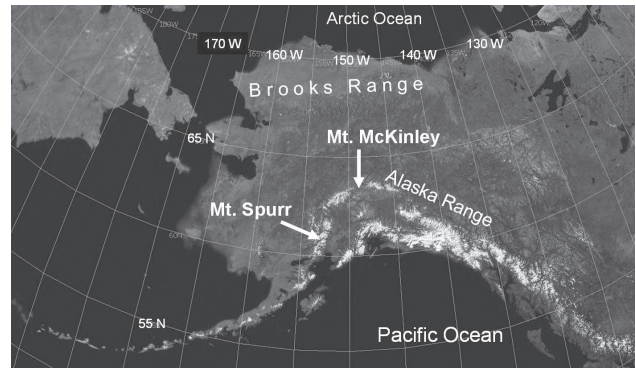
There are two main mountain ranges in Alaska. The northern one is called the Brooks Range. This mountain range continues into northern Canada. Another range is along the southern part of the state. It is called the Alaska Range. The tallest mountain in North America is found here. The Native American name for this mountain is Denali. It is sometimes referred to as Mount McKinley. This mountain is 6,194 meters tall.

Between these mountain ranges is an area of low rolling hills and valleys. There are lakes here, too. Some of the land is farmed. There are many trees growing on the lower mountain slopes. Alaska has many lakes and rivers. One of the largest rivers runs east-west across the state. It is called the Yukon River.

Despite the many mountains and ice, Alaska can also be HOT. During the summer months, the weather often is warm, but the place where Alaska is really hot is in its volcanoes. The ground, rock, and steam are very hot. Heat from deep in Earth's interior causes steam to rise and melt through snow and ice. Small steaming vents are



Mt. McKinley. [National Park Service photo by Karen Ward.]



[Satellite image adapted using NASA World Wind software.]

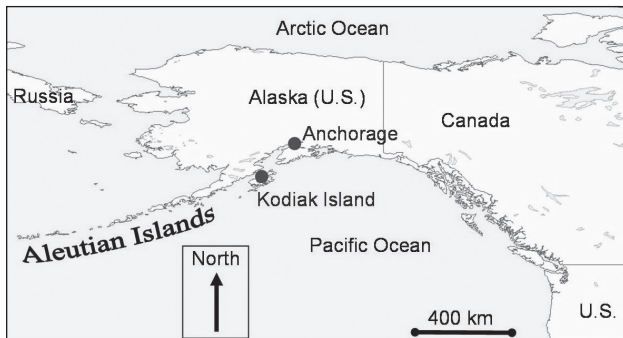


Mt. Spurr. [USGS image by C. A. Neal, Alaska Volcano Observatory]

called fumaroles. In one area, there are so many fumaroles that the place is called Valley of Ten Thousand Smokes.

One of the most famous of Alaska's volcanoes is called Mount Spurr. It is only 80 miles west of the

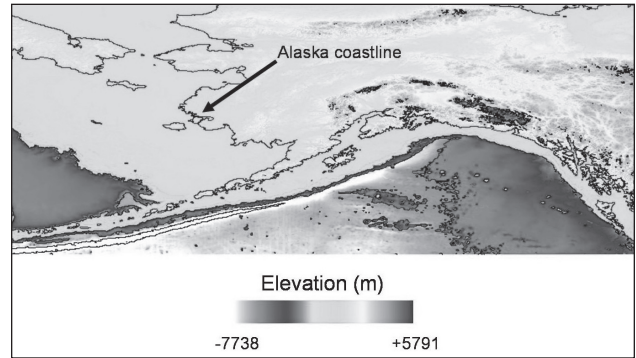
city of Anchorage, Alaska. Mount Spurr is one of 40 volcanoes in Alaska that are active. Scientists at the Alaska Volcano Observatory warned skiers and people flying planes to be careful of gases and huge areas of melting snow near the top of this peak in the spring of 2005. But these are just small events. A very large volcanic eruption in Alaska happened in 1912. This was the largest volcanic eruption on Earth in over 100 years. The volcano that erupted was southwest of Mount Spurr along the coast. Its name is Novarupta. The eruption lasted 3 days. So much ash came out of the eruption that it blew over North America in one day. Eight days after the eruption, ash from Novarupta blew all the way to Africa! Mount Spurr and Novarupta are just two in a long chain of volcanoes that stretch in a curve along the southern coast of Alaska. This line of volcanoes forms a set of islands called the Aleutian Islands. They stretch for 2500 km from Mount Spurr.



[Map adapted using ArcGIS/ArcMap software.]

Off the coast, south of the Aleutian Islands, the ocean is unusually deep. The ocean is deeper here because there is a trench in the ocean floor. It is called the Aleutian Trench. It follows the curve of the line of islands. You can see the trench in the image below. The following image shows the depth of the ocean below sea level and the height of land above sea level. The coastline of Alaska is also shown.

Volcanic eruptions are not the only earth-shattering events in Alaska. This state also has earthquakes. The largest earthquake ever to hit Alaska was in 1964. It was an M9.2 quake. This was the second largest earthquake in the world in over 100 years. In fact, three of the 10 largest



[Map adapted from NOAA/GEODAS ETOPO2 data using ArcGIS/ArcMap software.]

earthquakes in the world have been in Alaska. The epicenter of the 1964 earthquake was only 120 km from the city of Anchorage. This area is called Prince William Sound. During the quake, land lifted up from Kodiak Island toward Anchorage. There were landslides and a great wave (tsunami). There was also a very large earthquake recently in 2002. It had a magnitude of 7.9. This earthquake was located inland, far from the Aleutian Islands.



Turnagain Arm, railroad torn during 1964 earthquake. [USGS photo by Joseph K. McGregor and Carl Abston.]

Many more people live in Alaska now than did in 1964. Even so, there are few compared with many other parts of the United States. People who live in Alaska may fish or cut timber. Many work for the oil industry. There is a large oil field under the ground in Alaska. Oil is piped for many miles across the large state and is shipped to other parts of the world.

Latitude: 32N to 42N Longitude: 114W to 125W

Region 9

Would it surprise you to know that the city of Los Angeles is further west than San Diego? These are two large cities in the state of California. California is a very large state. It shares its southern border with Mexico. Yet California reaches over half way to our neighbor to the north, Canada. The state is the third largest in the U.S. Its most famous boundary is to the west, the Pacific Ocean.



Part of the California shoreline and the Pacific Ocean, near Los Angeles. [Photo courtesy M. D'Amato, used with permission.]

California is well known for its mountains. Some of these mountains rise steeply from the ocean. These include coastal mountains near San Diego and Los Angeles. The Santa Monica mountains are near the city of Los Angeles. They rise over a thousand meters above sea level just a few kilometers from the shore. This range runs from east to west.

Further north, the Coastal Range mountains run from Santa Barbara north to another range called the Klamath Mountains. Unlike the Santa Monica range, these ranges stretch from north to south.

The highest point in the state is Mount Whitney. This is also the highest point in the United States outside of Alaska. Mt. Whitney is 4418 meters above sea level. Compare this to the lowest point in the state and the U.S.: Death Valley. The elevation there is 86 meters below sea level. These two points are within only about 240 km of each other!



[Map adapted using ArcGIS/ArcMap software.]

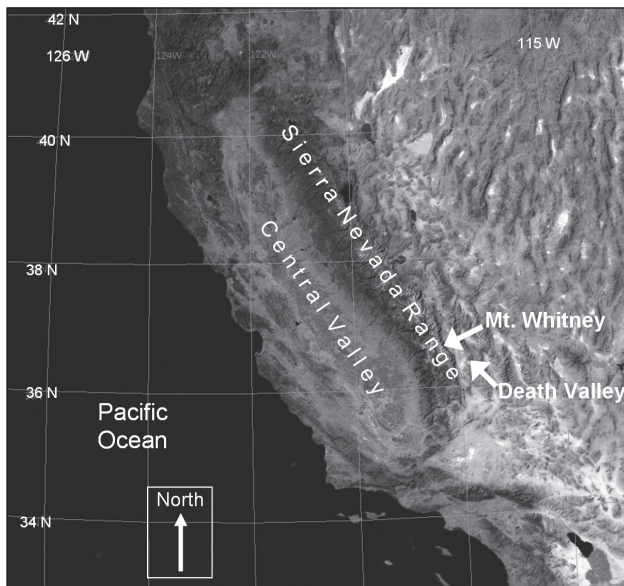
Mt. Whitney is part of the Sierra-Nevada Mountain range. This range runs from north to south. It lies along the eastern edge of California, near the border with Nevada. Glaciers have cut deep valleys into these mountains. The glaciers are now gone, but the valleys remain. Yosemite Valley and a famous rock formation called Half Dome are examples.



Half Dome, Yosemite National Park. [Image courtesy World ImageBank, © Dr. Roger Slatt, University of Oklahoma.]

Between the Coastal Ranges and the inland Sierra-Nevada range is a very large, flat area. It is called the Central Valley. When farmers add water through irrigation to this area, the Central Valley becomes a great place to grow food crops.

In the far north, a small part of the Cascade Mountains enters the state of California. This north-south range includes two famous mountain peaks. Mt. Shasta used to be an active volcano. Mt. Lassen is an active volcano now. It last erupted in 1921.



[Adapted using NASA World Wind software, NLT Landsat7 data.]



Lassen Peak. [Image courtesy World ImageBank, © Marli Miller, University of Oregon.]

Some people do not know that California has volcanoes. But many people think of earthquakes when they think of California. An earthquake of long ago in San Francisco is particularly famous. This earthquake had a magnitude of 6.7. Almost immediately after the earthquake, a huge fire burned the city. Many people and animals died. Many buildings were destroyed. The fire caused much of the damage. The earthquake caused gas lines to break and start the fire. Today, many earthquakes occur in California. Most of them are small but every once in a while there is a large one that causes damage.



Collapse of City Hall at Santa Rosa, near San Francisco, 1906. [Image courtesy NOAA/NGDC, University of California-Berkeley.]