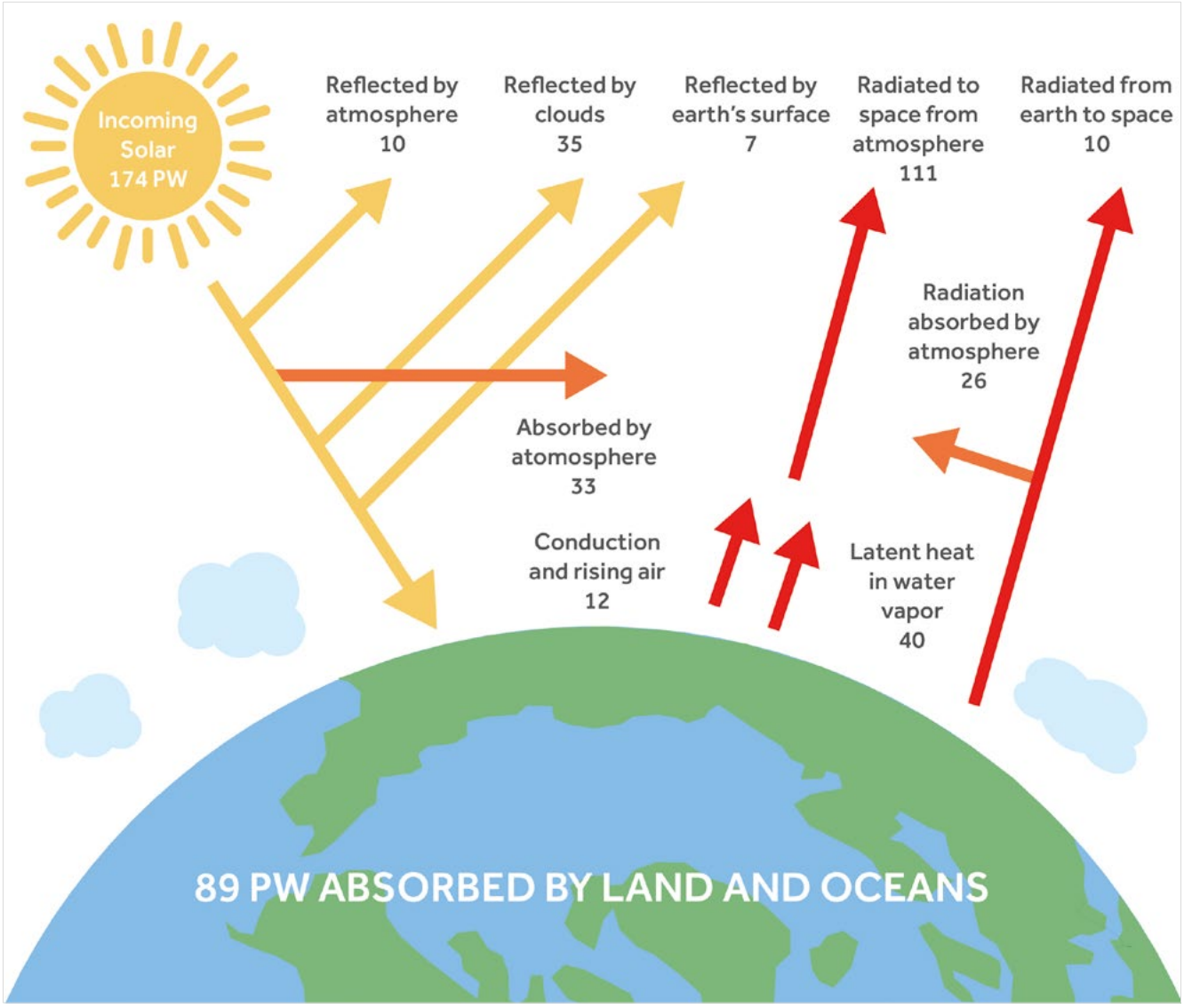

Figure 1-10. Solar energy and the greenhouse effect

the atmosphere at a much higher rate than they would naturally be produced. Some of these gases include [5]:

Carbon dioxide (CO2): This is a colorless gas that is one of the byproducts of the combustion of fossil fuels. Most of the CO2 currently in the atmosphere was put there from volcanic eruptions millions of years ago. We have been helping to increase carbon dioxide concentration for many years. Carbon dioxide is the primary contributor to global warming because it absorbs infrared radiation. Global CO2 emissions have increased from 1 billion tons in 1900 to 8 billion tons in 2000.

Nitrous oxide (NO2): The nitrous oxide levels that have been released are less than the CO2 levels, but the amount of energy that NO2 absorbs is about 270 times as much [5]. NO2 is another byproduct of the combustion of fossil fuels.

Methane (CH4): Methane is the main component of natural gas. It is created from the burning of coal, the decomposition of garbage, and from large herds of livestock. It absorbs about 20 times more energy than CO2, and therefore also heats up the earth.

Water Vapor: The greenhouse effect is also exacerbated by water vapor but it is usually a result of climate change rather than man-made emissions. When the earth heats up, water vapor forms and rises, and the temperature of the lower air decreases. Eventually, the water vapor cools enough that it converts

back into liquid water, and it falls again. As water vapor rises, more of it will condense into the clouds which will help to reflect incoming solar radiation, allowing less energy to enter the earth's atmosphere. *Figure 1-12* illustrates the water cycle of evaporation, condensation, and precipitation. Scientists are uncertain of the exact effect of the increased amounts of water vapor on the earth, but they believe that the concentration of water vapor is correlated with increased amounts of carbon dioxide.

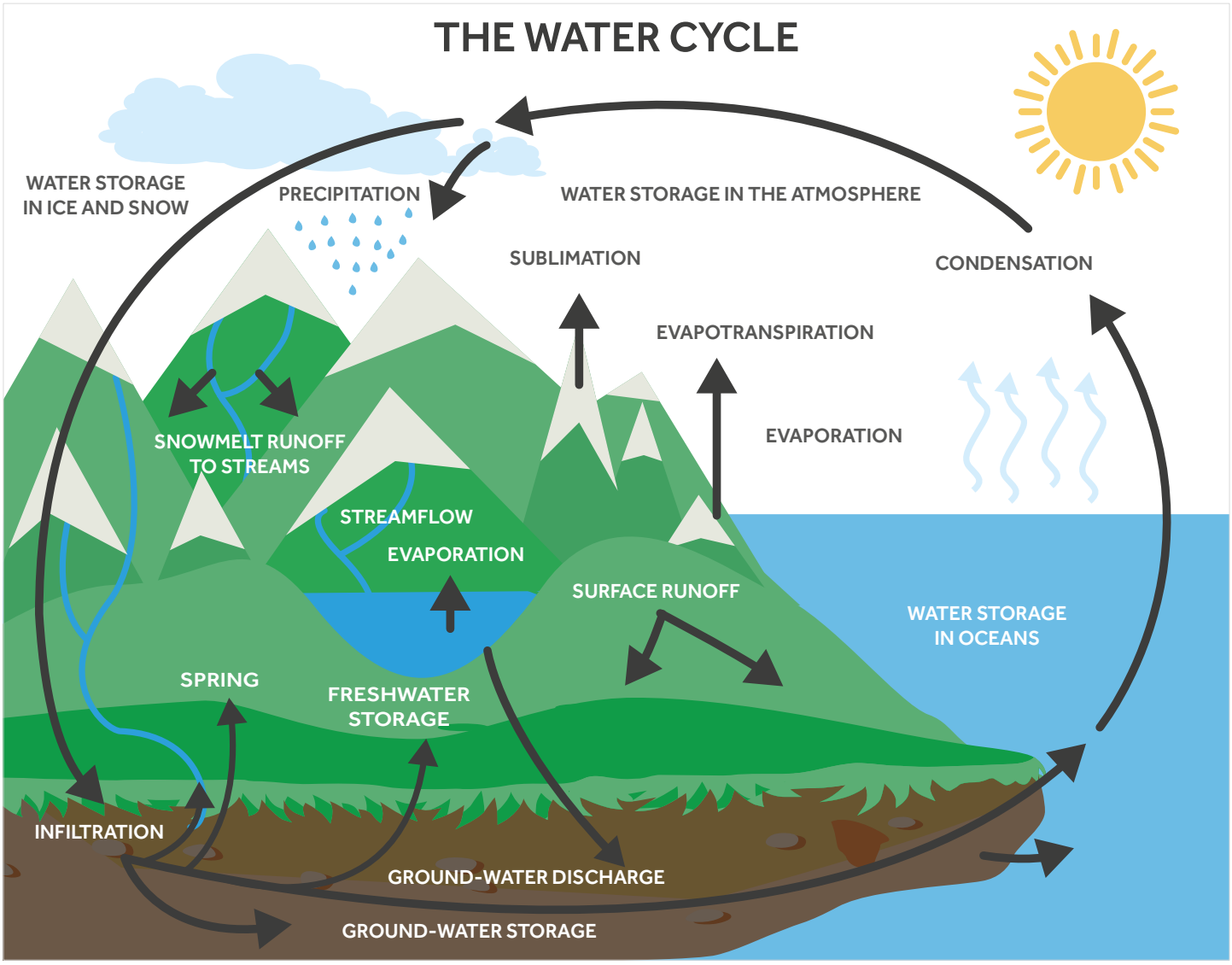

Figure 1-12. Water cycle

1.3.2 Sea Levels

Every summer, as local temperatures increase, ice melts as part of the natural cycle of freeze and thaw illustrated in *Figure 1-13*. But due to the increase in global temperature over recent years, glaciers and sea ice are melting much more than they can accumulate thanks to precipitation in the winter. The loss of large ice masses accelerates global warming since white ice and snow is very good at reflecting sunlight while darker colored water and land is not. Additionally, the melting of large amounts of land-based ice will cause global sea levels to rise. The initial rise would only be an inch or two, but even that small amount can cause flooding for some low-lying coastal areas. If the West Antarctic Ice Sheet, the largest ice sheet on Earth, melted and collapsed into the sea, the sea levels would rise about 10 meters (~32 feet). Cities like New York and London and even whole countries like Micronesia or the Maldives would be underwater.

The continent of **Antarctica** holds about 90% of the world's ice. At its thickest, the Antarctic ice is 2,133 meters (7,000 feet) thick. If all of this ice melted, the oceans would rise approximately 61 meters (200 ft), enough to flood the Bahamas completely and leave all but the tallest hills in Florida underwater. Luckily for those who still want to vacation in Miami, even the recent increase in global temperature has left the average temperature in Antarctica at -37°C, so it won't be melting very soon.

At the **North Pole**, the ice is not as thick as in Antarctica and it floats on top of the seawater. If this ice melted, the sea levels would not be affected, the same way melting ice in a glass doesn't affect the level of your drink. However, Greenland also has a large ice covering, and since that ice is on land it would add about 7 meters

North Pole

(20 feet) to the sea level if it melted, enough to put parts of Miami, New York, Los Angeles, Washington, and other cities underwater. Since parts of Greenland are much farther south than the North Pole, it regularly gets above freezing there. Of all the world's major ice sheets, Greenland is likeliest to melt first.

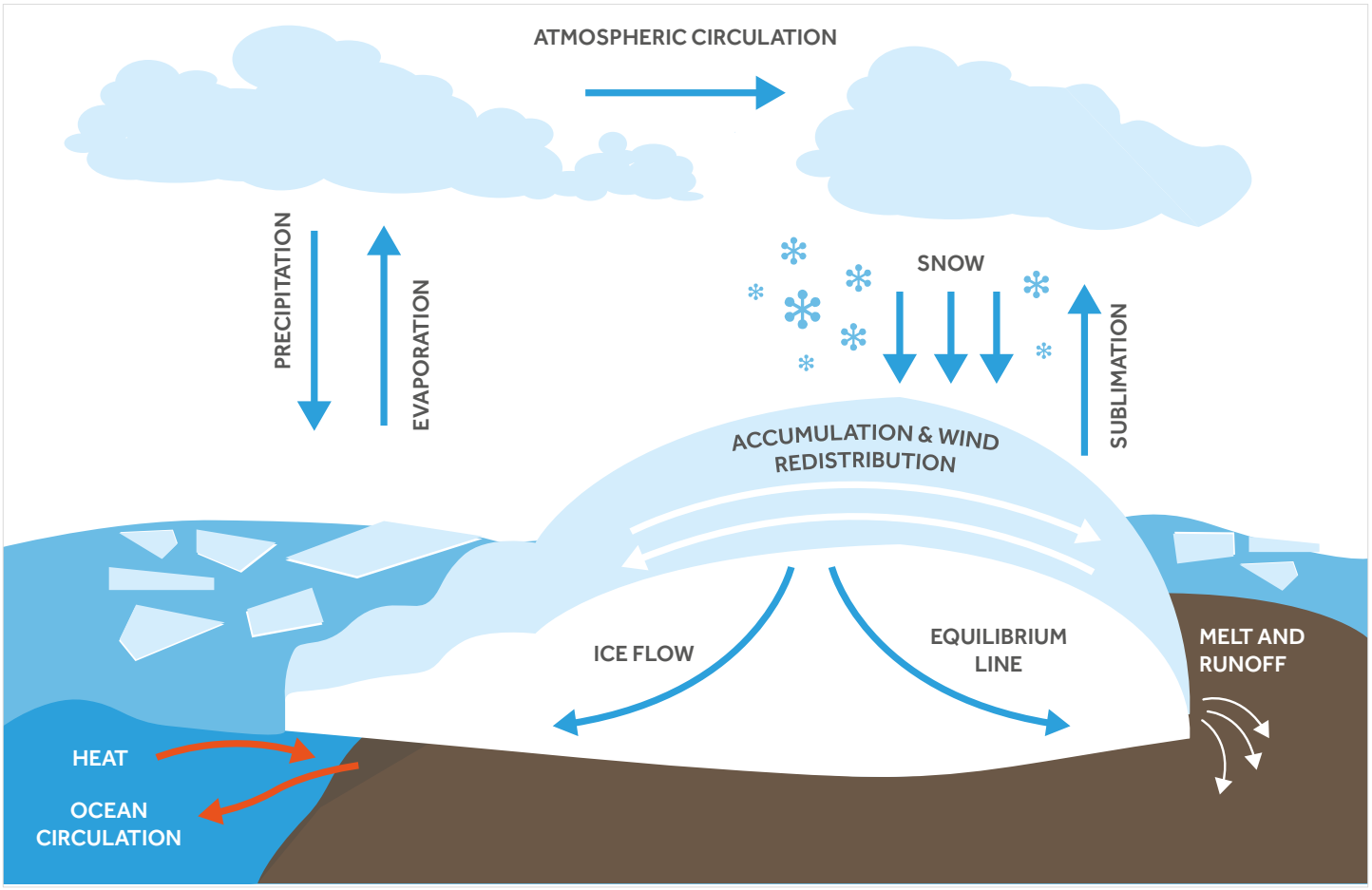

Figure-1-13.-Water-cycle between ocean,atmosphere,and glaciers.

1.3.3 Ecosystem Effects of Global Warming

It is hard to predict the effect of global warming on the ecosystem. Ecosystems are very delicate, and small changes can drastically alter them. Earth's ecosystems are also interconnected; changes to one ecosystem will always affect other ecosystems. An increase in temperature or rain in different areas affects crop growth. It's estimated that approximately $5 billion in crops are lost each year due to ecosystem changes brought on by global warming. For every degree of increase in temperature, there is a 3–5% decrease in crop yields.

Ecosystem

An area that consists of all of the living (plants, animals and micro-organisms) and non-living physical factors of the environment functioning in harmony with one another.

1.3.4 Can We Stop Global Warming?

In addition to raising the global temperature, greenhouse gas emissions contribute directly to health problems, acid rain, and the formation of ozone. In many parts of China and India, air pollution remains a public health issue. Acid rain occurs when sulfur dioxide (SO_2), sulfur trioxide (SO_3) and nitrogen dioxide (NO_2) in the atmosphere undergo chemical reactions to form acidic compounds. These are absorbed by water droplets in the clouds, and then fall to the ground, increasing the acidity of the ecosystem. This can damage plant life, soil, and buildings. Most acidic compounds are deposited near the source of contamination, but they can also be carried in the atmosphere for hundreds or thousands of miles. This means pollution created in the U.S. can be carried to China and vice versa.

The current concentration of carbon dioxide in the atmosphere is 180 to 300 ppm. How does this compare to other times in Earth's history? Thanks to bubbles of air trapped in ice, we can get an idea of what the atmosphere was like in the past. Studies of these bubbles have found that our current concentration is far greater than the natural range found over the last 650,000 years. If the CO_2 concentration rises to 400–440 ppm, the eventual rise in temperature would be between 2.4 and 2.8 °C.

In order to stabilize the CO_2 level, it needs to peak, and then decline. The more quickly that this occurs, the lower the peak stabilization level. According to the IPCC, in order to stabilize the CO_2-equivalent concentrations around 445 to 490 ppm, CO_2 emissions would need to peak by 2015 (at the latest), and then fall to between 50–85% below the year 2000 levels by 2050. And no, they haven't slowed down enough to peak any time soon. So a later peak will lead to even larger increases