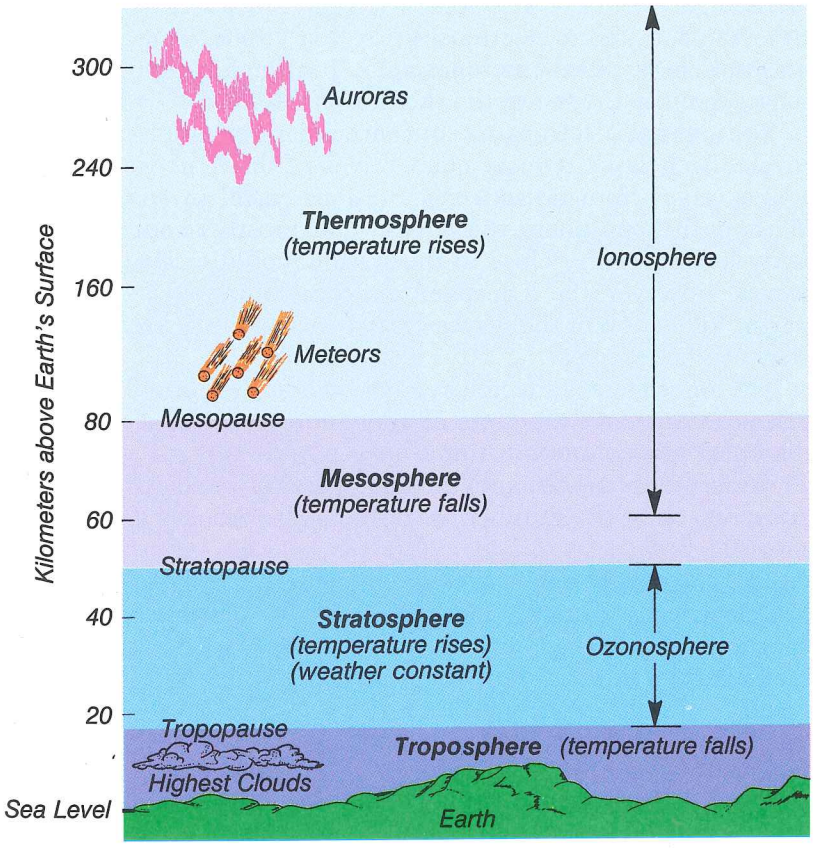
the isolated climate and extremely cold winters and early springs. The cold allows clouds to form in the atmosphere containing the ozone layer. Ice particles in these clouds provide places for ozone destruction. The ozone hole is filled when warmer winds from the north mix in ozone-rich air.

A similar hole occurs over the Arctic. Winter and spring ozone values over the northern middle latitudes decreased 6 to 8 percent from 1979 to 1990. Smaller decreases have occurred at lower latitudes.

Dust, another part of air, includes tiny grains of rock, dirt, pollen, salt crystals from sea spray, soot from fires, chemicals from factories, and bacteria. Dust helps form fog and rain. Water vapor condenses around some dust grains, forming tiny water droplets.

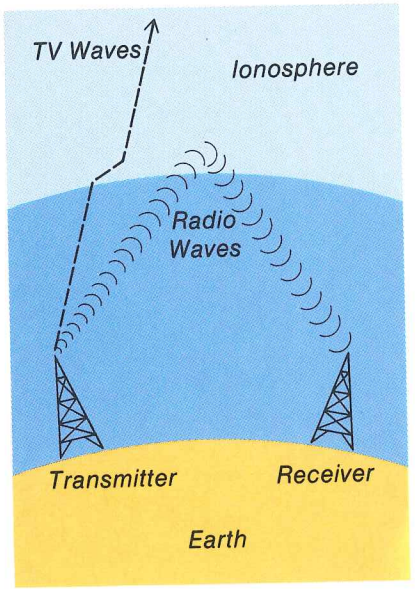
Topic 5 Structure of the Atmosphere

Scientists divide the atmosphere into four layers that are based on temperature changes. The lowest layer is called the **troposphere**. The troposphere starts at Earth's surface. Its thickness depends on the latitude. At the equator the troposphere is about 18 kilometers thick; at the poles it is only about 8 kilometers thick. The gases of the troposphere are essential to life on Earth. Earth's weather occurs in the troposphere.



26.3 This diagram shows the temperature layers of the atmosphere. It also shows where auroras form and meteors flare up.

26.4 Reflection of radio waves by the ionosphere extends the range of radio reception.



Temperatures gradually decrease with altitude in the troposphere. The top of the troposphere is called the *tropopause*. There the decrease in temperature stops. At the poles the tropopause temperature is about −55°C.

The second layer is the **stratosphere**. It reaches from the tropopause to a height of about 50 kilometers from Earth. The stratosphere is clear and dry. It has strong, steady winds and few weather changes. Because of its steady weather conditions, jet aircraft fly in the stratosphere.

The lower part of the stratosphere is as cold as the tropopause. Then it warms up steadily to its top, or *stratopause*. The absorbing or *absorption* of sunlight by ozone is what makes the stratosphere's temperatures increase with height.

The third and fourth layers are the **mesosphere**, in which temperatures drop again, and the **thermosphere**, in which temperatures rise again. The top of the thermosphere is around 500 kilometers from Earth. In the thermosphere, nitrogen and oxygen atoms absorb solar energy, causing the temperature to rise.

Topic 6 The Ionosphere

At heights between about 65 and 500 kilometers above Earth, the air is highly ionized. The ions are formed when ultraviolet rays from the sun knock electrons off oxygen atoms. This part of the atmosphere is called the **ionosphere.** It stretches from the lower mesosphere to the top of the thermosphere.

The ions and electrons are concentrated in layers at four different levels. Each layer reflects radio waves of different wavelengths. Radio waves from broadcasting stations travel in straight lines. Without the ionosphere, the waves would mostly go out into space. Only locations very close to the station would receive any radio waves. However, the ionosphere reflects the radio waves back to Earth. Reflection of the waves greatly increases the area in which they can be received.

The ionosphere is affected by solar events. Huge eruptions on the sun send out large amounts of very short-wave radiation, which disrupts radio communications. Solar eruptions reach a peak each 11 years. Scientists see a relationship between solar eruptions and sunspots, since the number of sunspots also reaches a maximum every 11 years.

The solar eruptions also send out ionized particles. Since they are electrically charged, these particles are deflected by Earth's magnetic field to the North and South Poles. At the poles, the ionized particles interact with air molecules to form *auroras*, colored displays of light in the nighttime sky.

The ionosphere does not reflect the waves used to transmit television. These waves, however, can be picked up and rebroadcast by special satellites orbiting high above Earth. Some radio signals are also relayed by satellite.

26.5 An aurora seen from Alaska