

Figure 3.60 Global average temperatures since 1860, compared to the average temperature over the 30-year period from 1961 to 1990. Notice the clear global warming trend of the past few decades. *Source:* National Center for Atmospheric Research.

in the atmospheric concentration of carbon dioxide (CO₂) and other *greenhouse gases*. Therefore, if we wish to predict how much the temperature will rise in the future, we need data on the recent rise in the atmospheric CO₂ concentration, as well as past data concerning how the CO₂ concentration is linked to global temperature changes.

For the recent rise in the CO₂ concentration, we have an extraordinary data set collected since 1958 by scientists working at a station on Mauna Loa (Hawaii). These data, shown on the right side of Figure 3.61, represent direct measurements of the changing CO₂ concentration. Notice that the units of the concentration are *parts per million* (ppm); for example, 320 ppm means that there are 320 carbon dioxide molecules in every million molecules of air. The yearly wiggles on the graph show that the carbon dioxide concentration varies with the seasons. Despite these wiggles, the trend is clearly upward.

To learn how much we might expect the temperature to rise, we would like to have data showing the correlation between carbon dioxide concentration and temperature in the past.

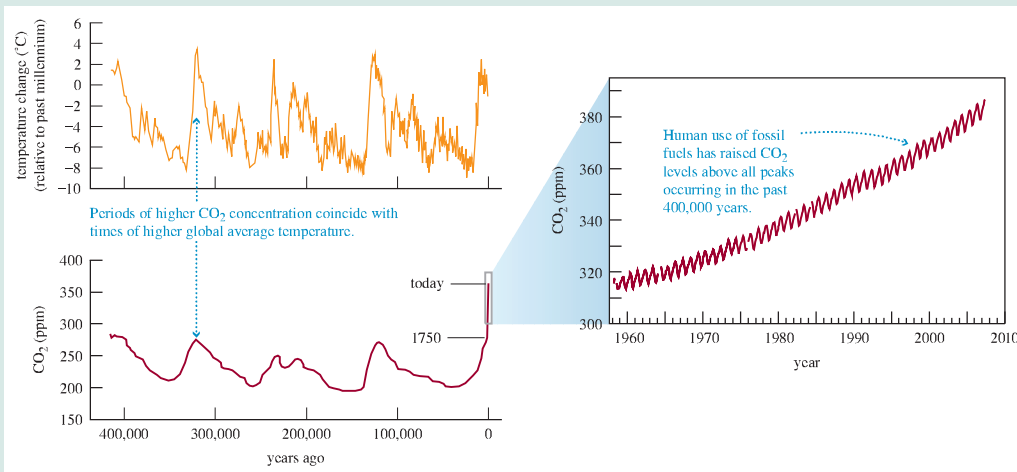


Figure 3.61 The atmospheric concentration of carbon dioxide and global average temperature reconstructed from ice cores and other data for the past 400,000 years. The recent CO₂ data (right) represent direct measurements taken at Mauna Loa (Hawaii).