

10.1

ATMOSPHERE AND CLIMATE

0:08–1:03

MILANKOVITCH CYCLES

The Earth has always experienced climate change. Variations in the planet's tilt and its orbit around the sun produce climate patterns called Milankovitch cycles. In the last few million years, the cycle has alternated between cold periods called Ice Ages and warmer periods called Interglacials.

Scientists use a number of techniques to study climate. Pollen grains preserved in lake and bog sediments tell us about flora that thrived in the past. The rings of trees, thicker in warm wet years and thinner during cold dry ones, record the climate. Ice core samples, containing bubbles of ancient air, store data that goes back about one million years. And the chemistry of ocean sediments can provide an estimate of water temperatures going back 65 million years to the time of the dinosaurs.

At the peak of the last Ice Age, about 21,000 years ago, an ice sheet covered most of Europe and North America. Our current geologic epoch, the Holocene, is an interglacial period that began 12,000 years ago. When the ice melted, numerous species of plants and animals prospered in the warmer climate. The stable temperatures of the Holocene enabled humans to develop agriculture.

1:03–1:59

THE HOLOCENE

Eventually, humans began to impact the environment by clearing timber and depleting soil resources. Still, the atmosphere largely stayed the same throughout the agrarian era. Subtle natural climate changes had been normal but even changes of only a few degrees in average regional temperature can affect the biosphere, opening and closing waterways and influencing migrations.

Human impact on the global climate increased sharply after the Industrial Revolution. Average temperatures began to rise in the early 20th century. This was largely caused by carbon dioxide emissions from the burning of fossil fuels such as coal, oil and natural gas. Carbon dioxide is a greenhouse gas. It absorbs invisible heat radiation from the Earth, emitting much of it back down.

1:59–3:10

INDUSTRIAL REVOLUTION

Consequently, the Earth's surface is heated by both visible sunlight and infrared radiation from the atmosphere in what is called the greenhouse effect. Scientists project that average global temperatures will increase by several degrees this century if nothing is done, perhaps even exceeding the five-degree temperature fluctuations typical between an ice age and

an interglacial period. This will cause changes in weather patterns and sea levels will rise as the ice sheets on Greenland and Antarctica melt.

3:10–3:28 Global warming threatens forest and ocean habitats, especially coral reefs, which live in a narrow range of temperature. To fight global warming, we'll need a global commitment to conserve energy, develop sustainable energy sources and preserve our forests.

GLOBAL WARMING