

Principle 3: Grades 9-12

**Principle 3:
The ocean has a major influence on weather and climate.**

The interaction of oceanic and atmospheric processes control weather and climate by dominating Earth's energy system.

Global Climate Change

B.
Changes in the ocean/atmosphere system can result in changes to the climate.

B.1.
Carbon-containing gases (e.g., carbon dioxide and methane) are exchanged between the ocean and the atmosphere. These gases are called greenhouse gases. The exchange of carbon is part of the carbon cycle.

B.9.
Changes in climate can cause changes in ocean circulation patterns, which can cause further changes in climate.

B.2.
Greenhouse gases in the atmosphere create a greenhouse effect by trapping longwave radiation and preventing it from leaving Earth, thus contributing to the warming of the atmosphere. The ocean removes and stores atmospheric carbon dioxide through biological and chemical activity that mediates the global greenhouse effect.

B.5.
The ocean and atmosphere are in a dynamic equilibrium related to carbon fluctuation. Excess carbon input into the atmosphere, including that from human activity, changes this equilibrium.

B.10.
Feedback loops can amplify the effects of a change in one component of the climate system, influencing the equilibrium of the entire Earth system. These complex interactions may result in climate change that is more rapid and on a larger scale than projected by current climate models.

B.3.
Carbon dioxide is taken up by phytoplankton through photosynthesis.

B.4.
Ocean absorption of carbon dioxide may produce carbonic acid, which increases the acidity of the ocean.

B.6.
An increase in greenhouse gases contributes to excessive warming of the atmosphere.

B.7.
A primary source of excess carbon dioxide is burning fossil fuels.

B.8.
Deforestation reduces the amount of photosynthesis, increasing the amount of carbon dioxide in the atmosphere.

B.11.
Changes in ocean circulation have produced large, abrupt changes in climate during the last 50,000 years.

See Principle 2: B3

See Principle 6: D2

See Principle 1: C1