Energy Transfer in the Climate System

Earth's climate is a *system* → a group of interdependent parts that work together to form a single functioning whole

Open System:	A system in which energy and matter cross the system's boundaries
Closed System:	A system that allows energy but not matter to cross the system's boundaries

Earth is a closed system → it maintains a temperature balance by radiating as much energy into space as it takes in from the Sun

Effects of Feedback Loops on the Earth System

Feedback Loop:	A process in which part of a system's output is returned, or fed back, to the input

In Earth's system, many feedback loops affect the conditions of the atmosphere, ocean, and land

Positive Feedback Loops

Acts to increase the effects of interacting Parts

Small initial changes in climate can lead to large and larger changes

Example:	Decrease in albedo ↓
	Increase in global warming ↓
	Increase rate of melting ice ↓
	Decrease in albedo ↓

Negative Feedback Loop

Acts to decrease the effects of the interacting parts and helps to maintain a system's equilibrium

The processes in a negative feedback loop act as checks and balances to prevent, slow, or reverse change in a system

Example:	Increase in global warming ↓

Effects of Feedback Loops on the Earth System (cont)

	Increase in evaporation of water ↓
	Increase in cloud cover ↓
	Increase in albedo ↓
	Decrease in global warming

Heating the Planet

Sunlight is responsible for feedback loops in Earth's climate system

Thermal energy is the energy that an object has because of the motion of its molecules

Three main processes transfer energy through Earth's climate system	**I. Radiation:** The transfer of energy, including thermal energy, as electromagnetic radiation. All matter radiates some thermal energy. This form of energy can travel through the vacuum of space. When radiation encounters matter, the matter may absorb the radiation, reflect it, or refract it.
	II. Conduction: The transfer of thermal energy between two objects or substances in direct physical contact. The thermal energy always moves from a region of higher temperature to a region of lower temperature.

Effects of Feedback Loops on the Earth System (cont)

III. Convection:* The transfer of thermal energy by highly energized molecules moving from one place to another. Can occur in liquids and gases, but not solids. A convection current is a pattern of circulation.

Energy Transfer in the Atmosphere

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