



## Climate Feedback Loops: Atmosphere

### Key Points and Guiding Questions

#### SUMMARY

Global warming is altering Earth's weather patterns dramatically. A warmer atmosphere absorbs more water vapor, which in turn traps more heat and warms the planet further in an amplifying feedback loop. Climate change is also disrupting the jet stream, triggering a feedback loop that brings warm air northward and cold air southward, further warming the Arctic and causing weather patterns to stall in place for longer.

Tip # 1: Get familiar with the content.

Tip # 2: Create connections between what viewers say in the discussion and key concepts from the film. Use your knowledge of the presentation to make these connections.

Tip #3: Practice empathy. This content may be hard to understand for some viewers.

## ATMOSPHERE FEEDBACK LOOPS

- **Water Vapor** is a naturally occurring gas formed by the evaporation of water, mostly from lakes and oceans. It is the most abundant heat-trapping gas, accounting for 60% of all warming caused by atmospheric greenhouse gases. With both the climate and the oceans warming, increased evaporation adds even more water vapor to the atmosphere.
- **Water Vapor Feedback Loop** – As heat-trapping gases like carbon dioxide warm the atmosphere, the warmer air holds more water vapor, which traps more heat, amplifying the initial warming:

Fossil fuel emissions → warming climate → warmer atmosphere holds more water vapor → water vapor traps more heat → more warming.

- **Clouds** – Some water vapor cools and condenses, forming clouds. By reflecting sunlight away from the planet, clouds can cool the Earth, and by trapping heat below them, they can warm it. Scientists conclude that, on balance, clouds raise Earth's temperature.
- **Warming Ocean Feedback Loop**  
As the climate warms, oceans are also warming:  
Fossil fuel emissions → warming climate → oceans heat up → increased evaporation → more water vapor into atmosphere → more heat trapped → warming climate.
- **Stronger Hurricanes** – The combination of increased water vapor and ocean warming is driving hurricanes, making the stronger storms more frequent.
- **Jet Stream** – a west to east flow of wind that encircles the Northern Hemisphere and is responsible for creating the weather in this area. When the Arctic is cold, the jet stream winds blow strong and fast. But with the Arctic warming at two to three times the rate as the rest of the globe, the jet stream has weakened, resulting in larger north-south swings.
- **Jet Stream Feedback Loop** – The larger north-south swings bring warm air to the Arctic in a feedback loop: Fossil fuel emissions → warming Arctic → jet stream weakens → larger north-south swings → more heat moves from south to north → more Arctic warming.
- **Extreme Weather Events** – The larger swings of the weakened jet stream result in weather stalling in one place for a long time, so the wet places become even wetter and the dry places become warmer and drier. The multi-year drought in the western U.S. and the increase in wildfires are connected to this larger north-south swing in the jet stream.

# Discussion Questions:

## Feedback Loops

What is a positive feedback loop? What is a negative feedback loop?

A positive feedback loop enhances or amplifies the effects of change, producing instability, such as warming creating more warming. A negative feedback loop reduces and or dampens the effect of change, helping maintain balance.

Have you heard of feedback loops before? If so, where?

Can you think of examples of positive and negative feedback loops from your everyday experience?

What is warming the Earth and setting off feedback loops?

Why are feedback loops so important in understanding climate change?

Is it possible to slow, halt, or reverse feedback loops?

## Atmosphere

What is water vapor and how is it formed?

Why is water vapor important in the climate? How much does it amplify global warming?

What is the water vapor feedback loop?

How do clouds heat and cool the planet? On balance, do clouds raise or lower Earth's temperature?

What is the feedback loop triggered by warming oceans? How is it affecting hurricanes?

What is the jet stream?

How is the jet stream being impacted by the warming Arctic?

What is the feedback loop involving the jet stream, and how is it affecting our weather?

What is an example of an atmospheric feedback loop?

How do particular images impact your reaction and reception of the messages in the film? What images had the biggest impact on you?

Have you heard anything in the news lately that affirms or contradicts any of the issues presented in this film?

## General

Should we focus on reducing emissions of carbon or focus on finding ways to store it? Or both?

Do you think we can continue living the way we have been while also reducing global warming?

How can we manage Earth in ways that help us mitigate climate change? What are some possible positive steps humans can initiate?

*What do you feel motivated to do?* The film ends with a message of the need to act. While feedback loops mean that one problem can cause many more, they also imply that one solution can trigger many others. What are some possible action steps humans can take?

Why is the content of this film important for the world to know?

Do you think we can continue living the way we have been while also reducing global warming?

How can we manage Earth in ways that help us mitigate climate change? What are some possible positive steps humans can initiate?

## Resources:

[Water Vapor Feedback and Global Warming](#)

[It's Water Vapor, Not the CO<sub>2</sub>](#)

[What is the Net Feedback from Clouds?](#)

[Jet Stream: Is Climate Change Causing More Blocking Weather Events?](#)

[Why Does Weather Stall? New Theories Explain Enigmatic Blocks in the Jet Stream](#)

[Drawdown - Solutions to decrease your carbon footprint](#)

[How You Can Stop Global Warming](#)