



Climate Feedback Loops: Albedo

Key Points and Guiding Questions

SUMMARY

The reflectivity of snow and ice at the poles, known as the albedo effect, is one of Earth's most important cooling mechanisms. But global warming has reduced this reflectivity drastically, setting off a dangerous warming loop: as more Arctic ice and snow melt, the albedo effect decreases, warming the Arctic further, and melting more ice and snow. The volume of Arctic ice has already shrunk 75% in the past 40 years, and scientists predict that the Arctic Ocean will be completely ice-free during the summer months by the end of the century.

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.

ALBEDO FEEDBACK LOOPS

- **What is the Albedo Effect?** At Earth's poles, snow and ice reflect up to 85% of the sun's rays away from the surface and back into space, helping to keep the planet cool. This reflectivity is called the albedo effect.
- **How is it at Risk?** In the Arctic, this natural mirror has begun to break down as warming temperatures melt snow and ice cover, reducing the planet's reflectivity. In summer, when the ocean snow melts, the open water absorbs 90% of the sunlight, warming the ocean, which in turn melts more sea ice, reducing reflectivity even more.
- **Albedo Feedback Loop** – Fossil fuel emissions → warming climate → Arctic snow and ice melt, ocean exposed → less reflectivity and more heat absorption → more warming.
- **Effect on Global Warming** – Approximately 25% of global warming can be attributed to the loss of Arctic sea ice.
- **Land Snow** – Snow on the surrounding land is also reflective and contributes to Earth's albedo, but that has been melting too. Together, the loss of sea ice and land snow account for an estimated 40% increase in global warming.
- **The "New Arctic"** – In the past 40 years ago, we've lost half of the area covered by the Arctic Sea ice during the summertime and the volume of ice has decreased by 75%. The ice is now mainly "first year ice," which is ice that forms in one winter and melts over the summer.
- **The Future of Arctic Sea Ice** – Climate models predict that summer sea ice will disappear by the end of the century and, eventually, the winter sea ice will disappear as well.
- **Refreeze the Arctic** – If we could lower the temperature at the poles, it would take a long time, but eventually sea ice would reform.

ANTARCTICA FEEDBACK LOOPS

- **Antarctica** – In the South Pole, the melting of land ice doesn't affect reflectivity because the ice sheets are miles thick; however, as ice melts and enters the ocean, it causes sea level to rise causing its own feedback

loops. If both Greenland and Antarctica's glacial ice shelves melt, sea levels could potentially rise by more than one hundred feet.

- **Antarctica Feedback Loop** – Higher, warmer water → land ice melts → sea level rises further → more land ice melts → higher, warmer water.

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?

Albedo

What is the albedo effect and why is it important?

If the Earth has a higher albedo, is it more reflective or less reflective?

How is reflectivity in the Arctic being threatened?

What is the albedo feedback loop in the Arctic?

Why is it called the "New Arctic"?

How much volume of Arctic sea ice has been lost in the past 40 years?

What percentage of global warming can be attributed to loss of Arctic sea ice?

What percentage of loss in the planet's reflectivity is caused by the melting of both land snow and sea ice in the Arctic?

When could we lose summer Arctic sea ice? When could we lose the winter sea ice?

How long has ice covered the Arctic Ocean?

How is warming affecting Antarctica?

Is the albedo effect being threatened in the South Pole? Why or why not?

What is the feedback loop in the South Pole?

How much has the loss of ice on the Greenland ice sheet increased in the past 30 years?

How much could the sea level rise if both the Greenland and Antarctica ice sheets melted?

Could the ice we've lost in both poles be recovered?

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:

[Ice-Albedo Feedback in the Arctic](#)

[Why is the Arctic So Sensitive to Climate Change and Why Do We Care?](#)

[Flooded Future: Global Vulnerability to Sea Level Rise Worse Than Previously Understood](#)

[Climate Change: Global Sea Level](#)

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

[How You Can Stop Global Warming](#)