Earth's Energy Budget

Reflection of Incoming Solar Radiation

MODULE 3.3

3.3 Reflection of Incoming Solar Radiation

Lesson Goals:

» Predict how particular changes in the reflective properties of Earth's surface or atmosphere would likely affect Earth's temperature.

» Construct feedback loops involving reflectivity.

Changing reflectivity

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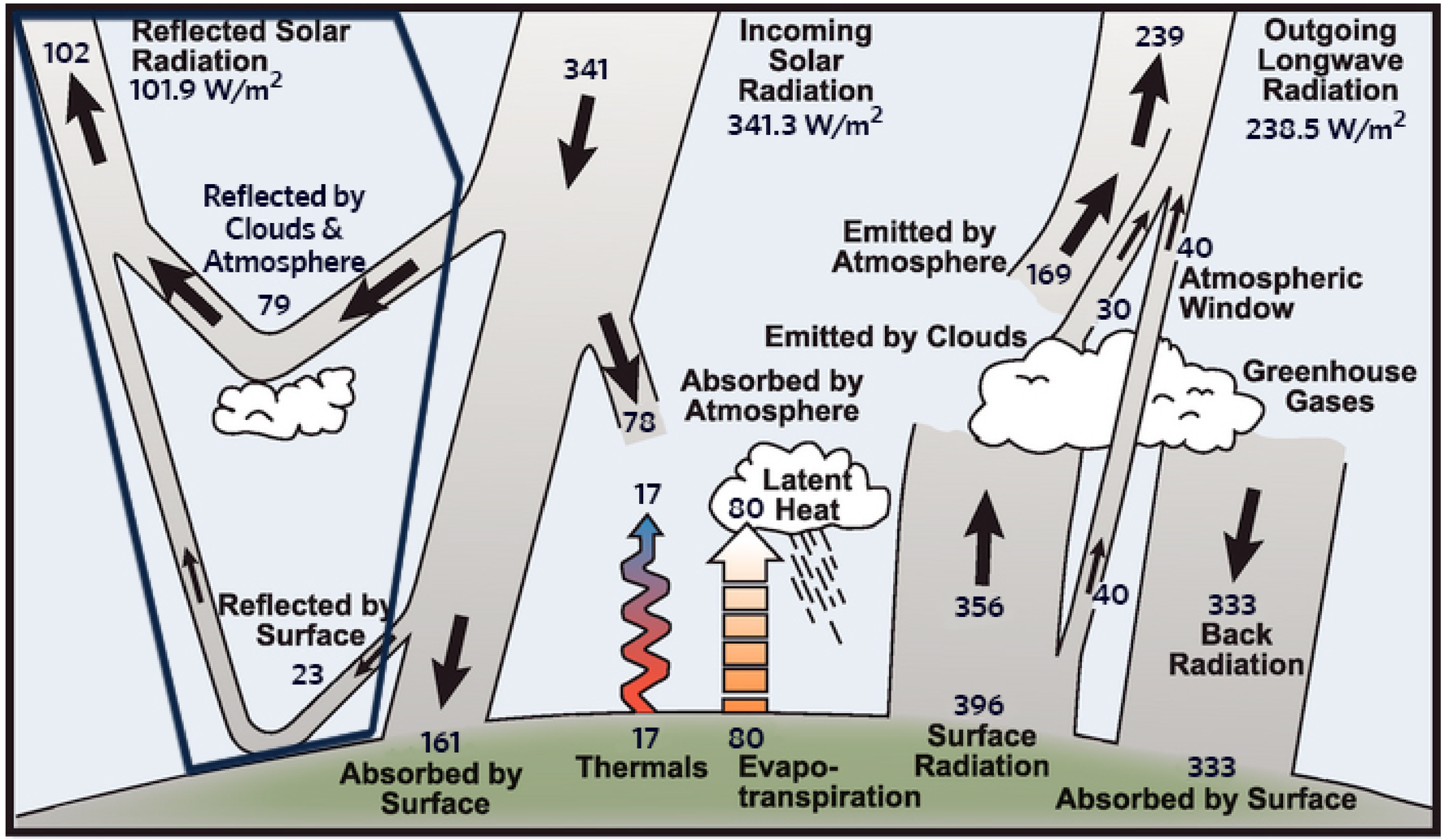
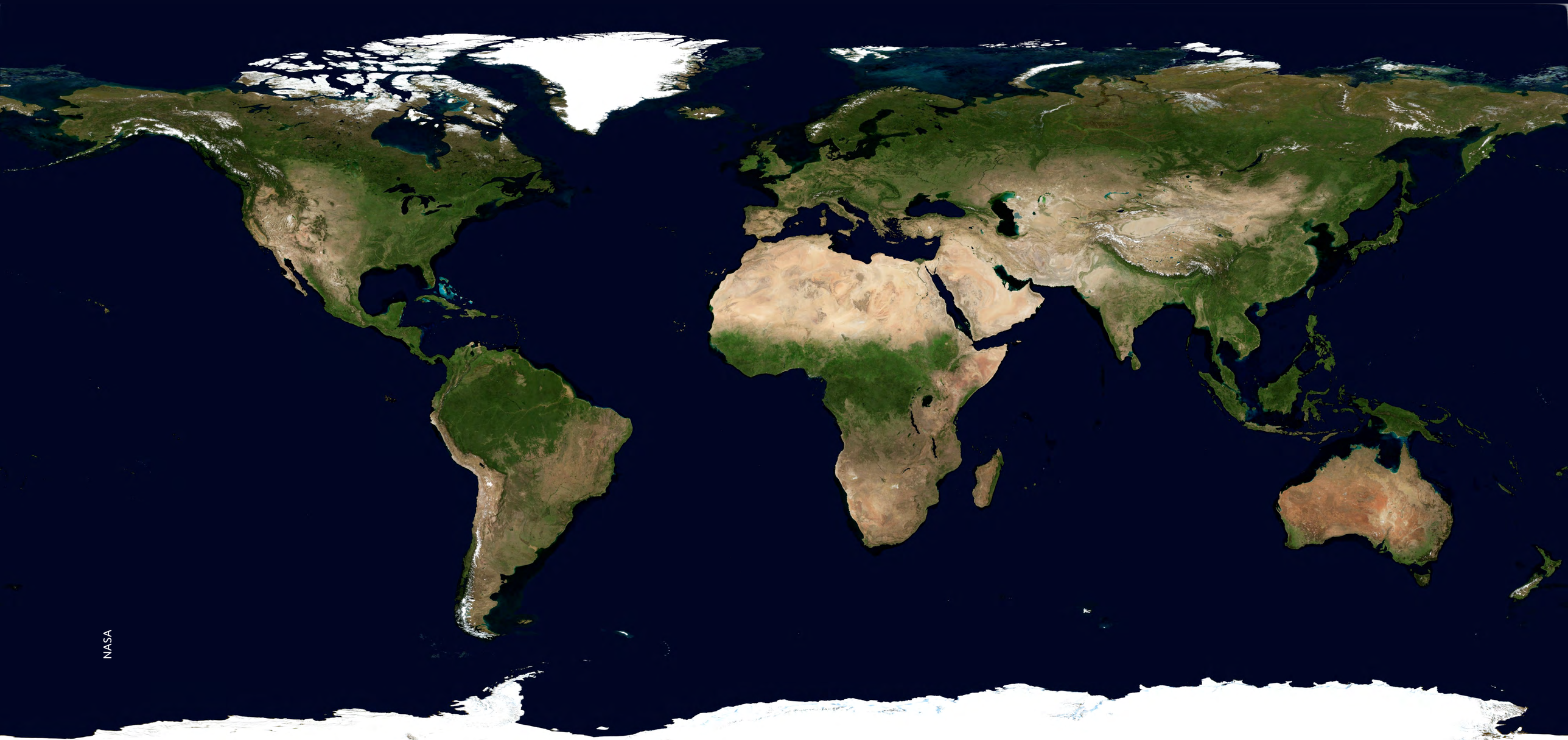
Earth's Annual Energy Budget



IPCC, 2007, UPDATED WITH TRENBERTH ET AL., 2009

Cloud-free Earth



NASA

What if the forest expanded into the desert area? Reflectivity would _____.

A. Increase
B. Decrease
C. Stay the same

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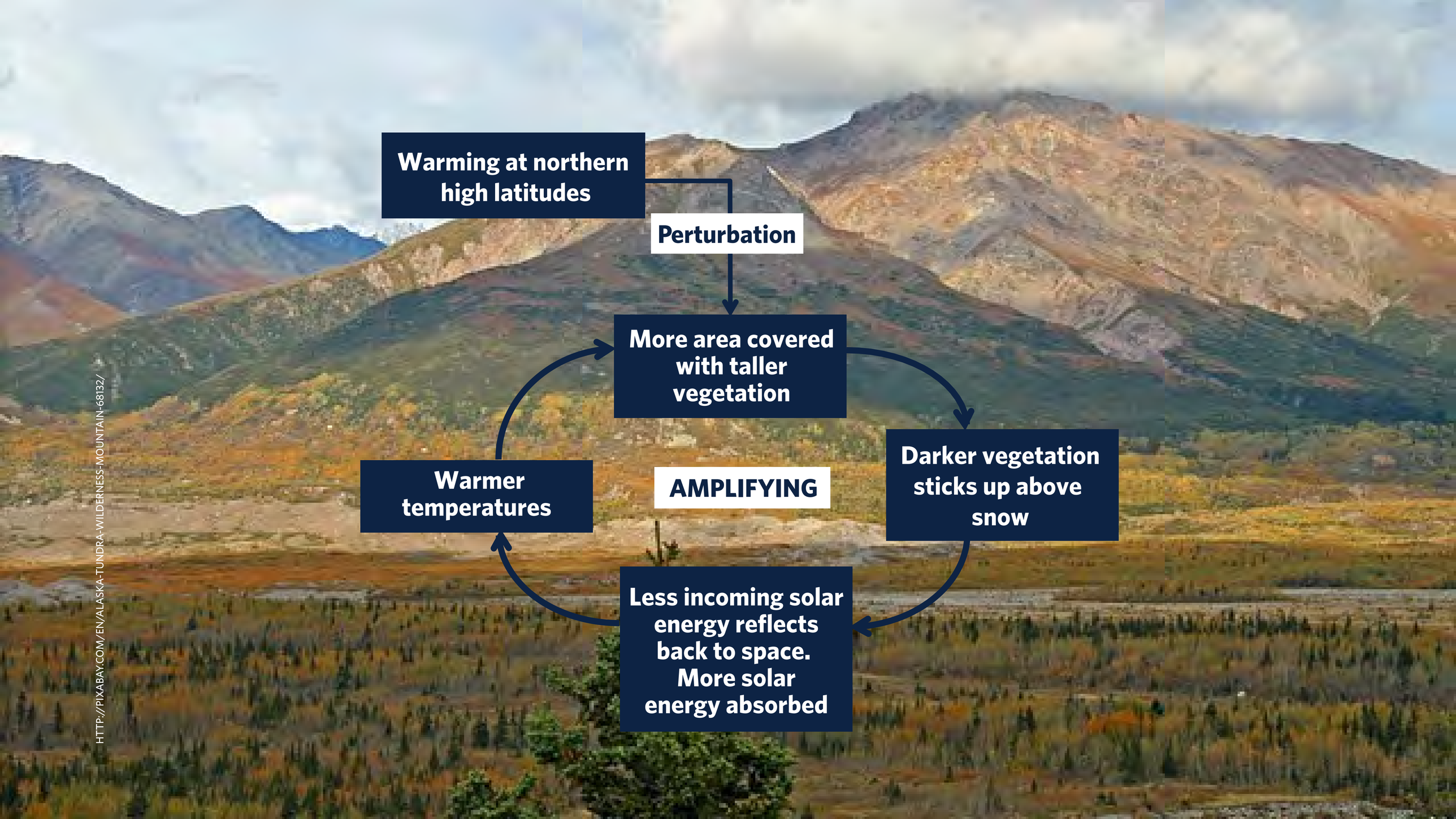

HTTP://PIXABAY.COM/EN/ALASKA-TUNDRA-WILDERNESS-MOUNTAIN-68132/

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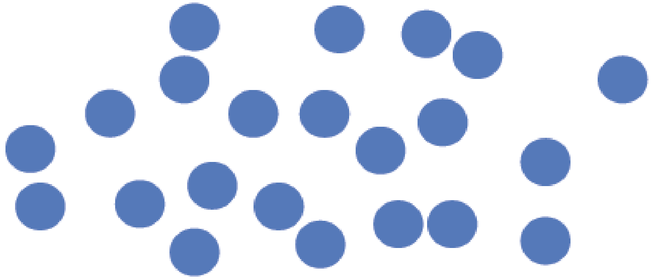
MORE reflective

Small droplets

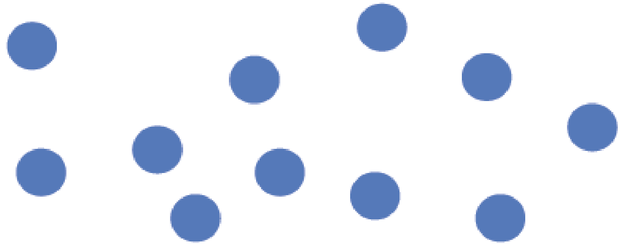
LESS reflective

Large droplets

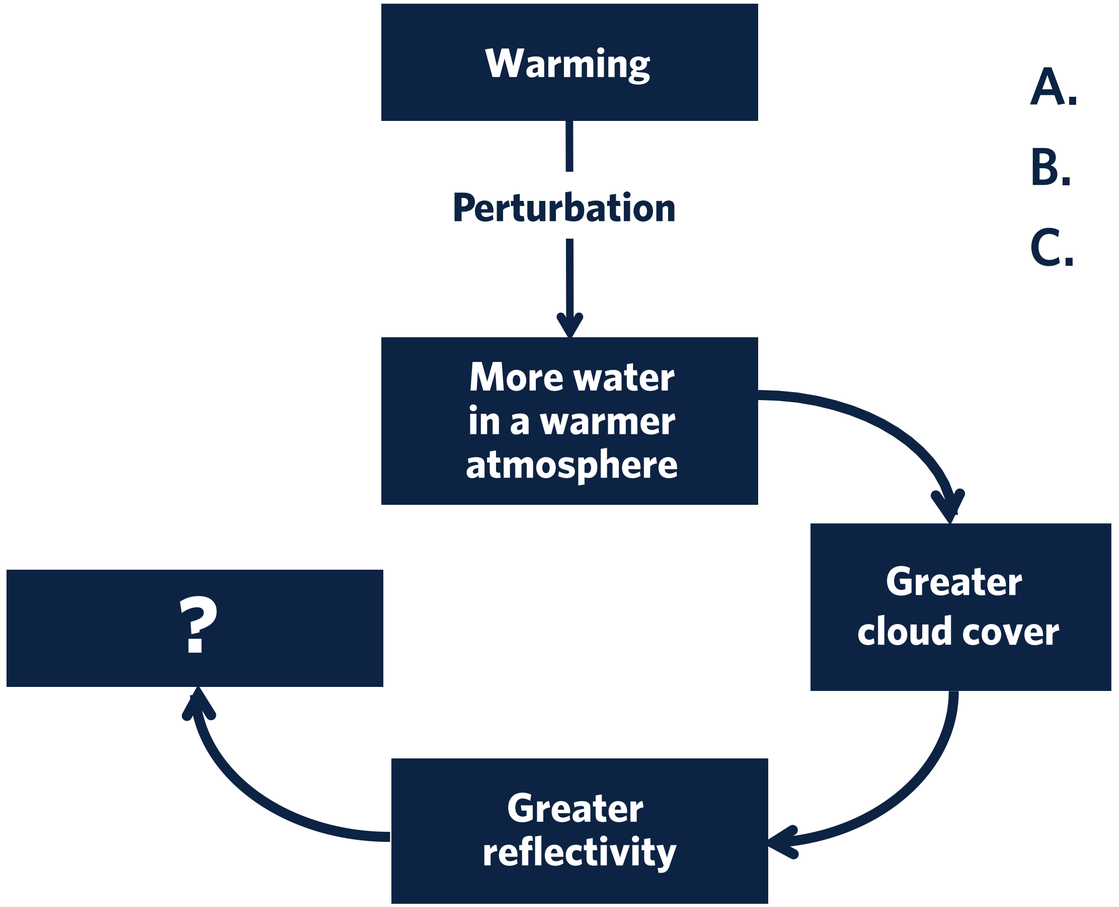
Higher concentration



Lower concentration

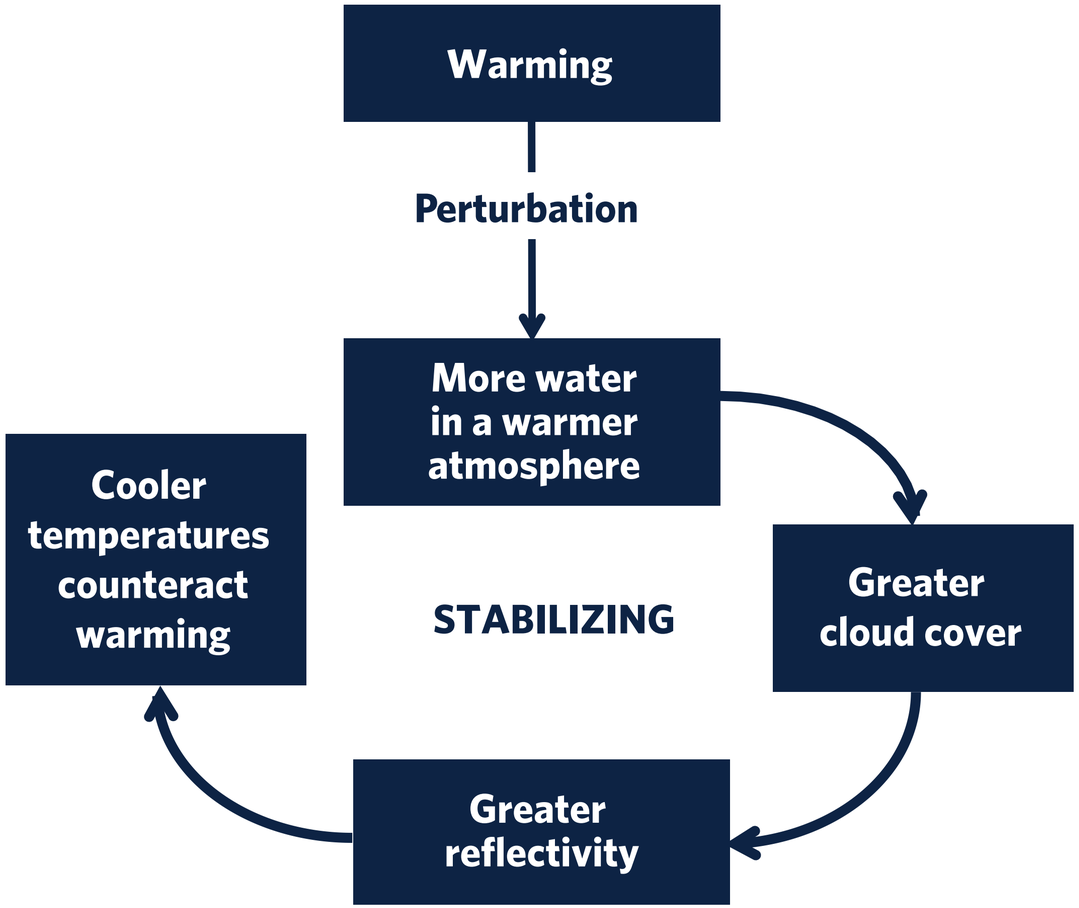


Cloud feedbacks: What if…

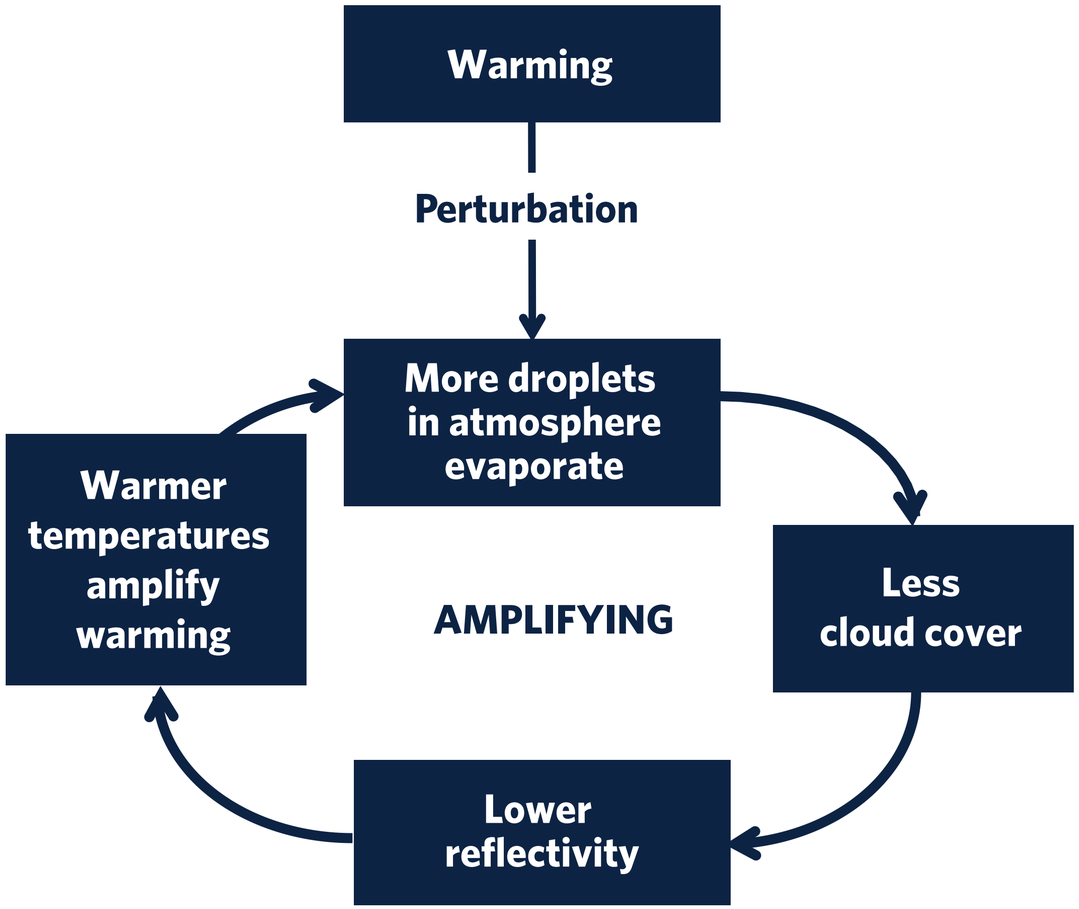


A. Amplifying
B. Stabilizing
C. Could be either

Cloud feedbacks: What if...



Cloud feedbacks: What if...



Key Points

» Changes in Earth's surface toward more reflective materials promote cooling; changes toward less reflective materials promote warming.

» On Earth's surface, changes in vegetation cover and land use can alter reflectivity.

» In the atmosphere, changes in cloud cover and the stock of reflective aerosols can change Earth's overall reflectivity.

» Reflection is involved in important feedback loops in the climate system.

» Feedbacks involving clouds are not well-constrained, but recent research suggests that cloud feedbacks in a warming world are likely to be net amplifying.