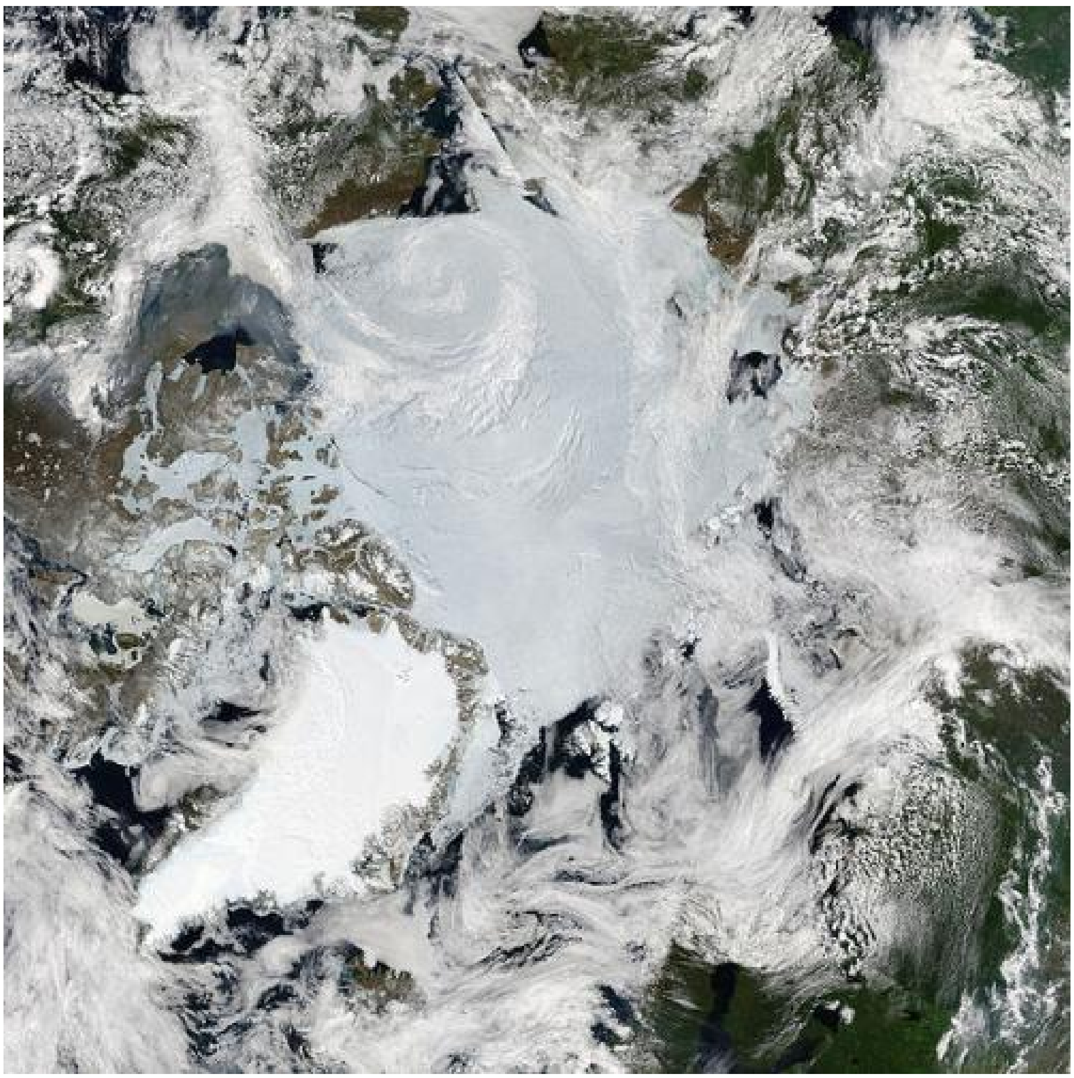
Researchers find temperature feedback magnifying climate warming in Arctic

February 3 2014, by Bob Yirka



Mosaic of images of the Arctic by MODIS. Credit: NASA

(Phys.org) —A team of researchers with the Max Planck Institute in Germany, has found that temperature feedback in the Arctic is causing more warming in that region than sea ice albedo. In their paper published in the journal *Nature Geoscience*, the team describes how plugging data into a computer simulation revealed a "layered cake" atmosphere that traps heat over the polar cap.

Scientists have known for several years that temperatures in the Arctic are rising faster (due to global warming) than for the rest of the planet—for the most part, most climatologists have attributed this to sea ice albedo—a feedback system where a small rise in temperature leads to melting of ice and snow. Less ice and snow means less heat is reflected back into space, which means more warming occurs, and so on. In this new effort, the researchers suggest that while sea ice albedo is causing temperatures to rise, it's second to temperature feedback in overall impact.

To gain a better perspective on why Arctic temperatures are increasing so much, the researchers turned to highly sophisticated and data intensive climate computer models. Their model showed a cap of cold layered air hovering over the Arctic, holding in the heat. The researchers believe their simulation accurately portrays what actually exists in the real Arctic.

Normally, they explain, changing weather patterns (such as thunderstorms) in other parts of the world keep atmospheric air churning, which in turn allows heat closer to the ground to be moved higher, allowing some of it to escape into space. Things are very different in the Arctic—there is very little churning, which means that warm air close to ground (just one to two kilometers thick) remains where it is, trapped by a heavy layered atmosphere.

The simulation also helps to explain why Arctic warming is more pronounced in the winter than during other seasons—even less mixing of the air in the atmosphere occurs because the air is so cold.

The team reports that their simulations show that the temperature feedback that occurs in the Arctic is causing more average temperature increase than sea ice albedo, the second most critical factor in causing warming. They have not used their findings to try to predict what sort of overall impact increasing Arctic temperatures might have on the rest of the planet, however, if the polar cap will melt completely, or if it does, when it might occur.

More information: Arctic amplification dominated by temperature feedbacks in contemporary climate models, *Nature Geoscience* (2014) DOI: 10.1038/ngeo2071

Abstract
Climate change is amplified in the Arctic region. Arctic amplification has been found in past warm and glacial periods, as well as in historical observations and climate model experiments. Feedback effects associated with temperature, water vapour and clouds have been suggested to contribute to amplified warming in the Arctic, but the surface albedo feedback—the increase in surface absorption of solar radiation when snow and ice retreat—is often cited as the main contributor. However, Arctic amplification is also found in models without changes in snow and ice cover. Here we analyse climate model simulations from the Coupled Model Intercomparison Project Phase 5 archive to quantify the contributions of the various feedbacks. We find that in the simulations, the largest contribution to Arctic amplification comes from a temperature feedbacks: as the surface warms, more energy is radiated back to space in low latitudes, compared with the Arctic. This effect can be attributed to both the different vertical structure of the warming in high and low latitudes, and a smaller increase in emitted blackbody radiation per unit warming at colder temperatures. We find

that the surface albedo feedback is the second main contributor to Arctic amplification and that other contributions are substantially smaller or even opposeArctic amplification.

© 2014 Phys.org

Citation: Researchers find temperature feedback magnifying climate warming in Arctic (2014, February 3) retrieved 24 April 2024 from https://phys.org/news/2014-02-temperature-feedback-magnifying-climate-arctic.html

This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.