High winds affect ocean circulation in North Atlantic, says study

December 20 2012

(Phys.org)—Gale-force winds that whip around the Greenland coast are driving ocean circulation, confirms a new study on the cover of the Nov. 30 issue of *Geophysical Research Letters.*

The study, led by U of T Mississauga professor Kent Moore, shows that a new diagnostic tool reveals the formation of high-speed winds in the northern Atlantic and their effect on ocean waters, deep sea currents and sea ice behaviour.

"We now have a more complete understanding of the complexity of the climate system," says Moore, a professor in the Department of Chemical and Physical Sciences. "This new diagnostic shows us how the shape of coastline can impact winds, and how the winds in turn drive oceanic events."

Moore began with an examination of Cape Farewell, on the southernmost tip of Greenland. The windiest oceanic site in the world, Cape Farewell experiences gale force winds called "tip jets" for one-sixth of the time during the winter.

With the new diagnostic, a statistical tool, Moore separated out gale force wind observations by wind direction and re-analyzed wind patterns from 1979 to 2012. It confirmed previous hypotheses that tip jets are caused by the sudden and steep elevation of Greenland's coast. Winds hitting the coast are forced to go around the land instead of over, causing wind acceleration (known as the Bernoulli effect, which also results in lift on an airplane wing).

"The diagnostic is quite simple but provides a more comprehensive view of how these winds develop and makes a real difference in how we study these winds," says Moore. He discovered three additional regions where strong winds are driven by the steep coastal topography – along the northeastern and southwestern coasts of Greenland and on Iceland's southeast coast.

Once these areas were identified, Moore realized these very strong, cold winds also affected the ocean over which they blew. The Cape Farewell area is one of the few places in the ocean where sinking occurs, Moore says. Warm water brought up from the Gulf Stream is stripped of its heat by the tip jets, causing it to sink as it becomes colder and more dense.

"These winds play a vital role in the thermohaline, or large-scale ocean, circulation which is a very important part of the climate system," says Moore. "The winds are what cause the return flow for the Gulf Stream, and are an example of how the atmosphere drives ocean circulations."

Moore then used the diagnostic to examine three other oceanic phenomena: the North East polynya, an area of open water surrounded by sea ice in northern Greenland, necessary for the survival of sea animals such as seals; the melting of glacial ice shelves in fjords along the southeast coast of Greenland; and the creation of eddies, or ocean storms, over the Labrador Sea. In each instance, he found the cause to be strong winds resulting from the acceleration around a topographic obstacle.

"We showed these tip jets form in several areas around Greenland, and in all these regions they play a crucial role in oceanic events," says Moore. "The diagnostic allows us to unify many questions relating to the land, the atmosphere and the ocean."

Provided by University of Toronto Mississauga

Citation: High winds affect ocean circulation in North Atlantic, says study (2012, December 20) retrieved 27 April 2024 from
https://phys.org/news/2012-12-high-affect-ocean-circulation-north.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.