Model provides successful seasonal forecast for the fate of Arctic sea ice

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Relatively accurate predictions for the extent of Arctic sea ice in a given summer can be made by assessing conditions the previous autumn, but forecasting conditions more than five years into the future depend on understanding the impact of climate trends on the ice pack, new research shows.

Current conditions form an important starting point that governs how the ice responds to weather in the course of a few years, University of Washington-led research shows. But eventually climate trends overtake that starting point as the primary influence on the overall predictability of sea ice conditions.

"The Arctic is one of the places where conditions are changing the fastest of any climate system in the world," said Edward Blanchard-Wrigglesworth, a UW doctoral student in atmospheric sciences. "Current trends are so strong that it takes five years to establish a new mean."

Blanchard-Wrigglesworth is lead author of a paper explaining the research published Wednesday (Sept. 21) in Geophysical Research Letters. Co-authors are Cecilia Bitz, a UW atmospheric sciences professor, and Marika Holland of the National Center for Atmospheric Research in Colorado.

Research from the National Snow and Ice Data Center indicates the low point of this summer's Arctic sea ice cover was 36 percent less than the average minimum from 1979 through 2000, and was just a fraction

above the record low in 2007.

In the new study, the scientists used the Community Climate System Model version 4, one of only a few models that have successfully simulated the rate of Arctic sea ice decline that has occurred so far.

They found that measurements of ice thickness and area in September could provide a good gauge for what the ice expanse would be like at its low ebb the following summer, July through September.

Such predictions are important for shipping – knowing whether the Northeast and Northwest passages might be ice-free in summer, for example – or for natural resource interests such as oil exploration. They also are important for native populations who depend on the sea ice for their livelihoods and to conservationists trying to preserve species such as polar bears.

Measuring the area of Arctic sea ice is relatively simple for satellites, Blanchard-Wrigglesworth said, but determining the thickness – and thus the volume – is much trickier and something for which satellites have only produced reasonable estimates in the last 10 years or so.

"The key thing about assessing the model is comparing the model's trend and variability to real-world conditions," he said. "With a successful comparison, we believe the predictive results we see in the model are relevant to the real world."

Since the current sea ice conditions are instrumental in forecasting conditions only a few years in the future, they don't tell scientists what lies in store for the icepack at the top of the world in the coming decades. Many scientists believe the Arctic could be completely free of sea ice in summer by the middle of this century.

Based on the model's results using projections for increases in atmospheric greenhouse gases such as carbon dioxide, Blanchard-Wrigglesworth agrees.

"It's reasonable to think the planet will follow the model fairly closely if the forcing conditions evolve as they are predicted to," he said.

More information: The paper is available at www.agu.org/pubs/crossref/2011/2011GL048807.shtml

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