Study suggests autumn Arctic sea ice can be used to predict European winter weather

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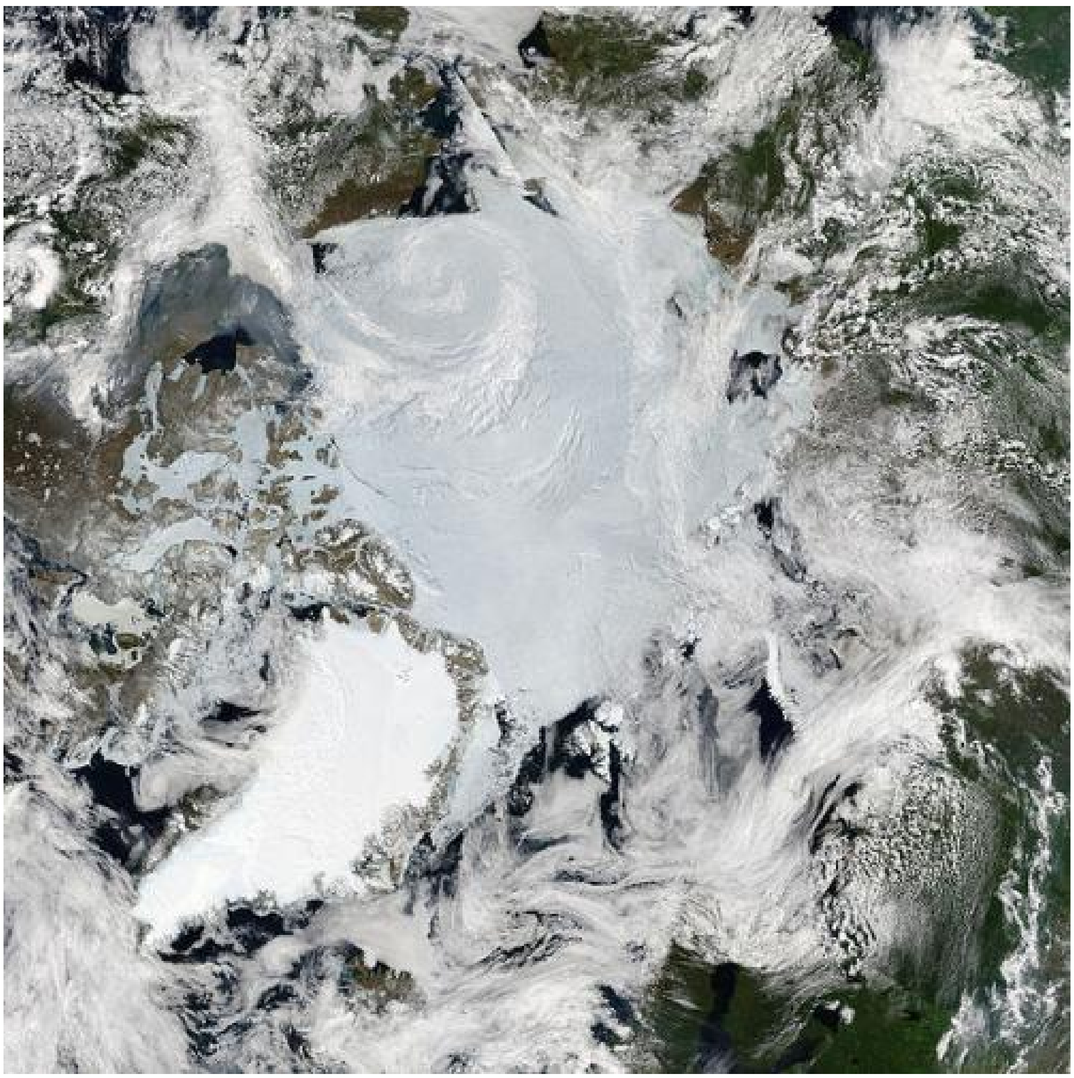

Mosaic of images of the Arctic by MODIS. Credit: NASA

(Phys.org) —A pair of researchers with L'Ocean IPSL Université Pierre et Marie Curie in Paris has published a paper in the journal *Nature Geoscience* describing research they've been conducting regarding the amount of Arctic sea ice in September and how it can be used to help predict how severe the following winter will be in Europe. Using maximum covariance analysis on data from 1979/1980–2012/2013, researchers Claude Frankignoul and Javier García-Serrano found that a correlation skill of .59 could be achieved in forecasting the harshness of the following European winter.

Scientists have been trying to forecast winter weather in Europe for hundreds of years, but it's been a daunting task. The North Atlantic Oscillation (NAO)—a climatic phenomenon in the North Atlantic Ocean with no defined periodicity, has made it a major challenge. In recent years, however, some progress has been made. The amount of Eurasian snow cover in October, for example, has been shown to offer some suggestion of how much cold and snow the continent is likely to get as the winter progresses. Wanting more, the research pair wondered if the amount of sea ice present in the Arctic in the fall might offer clues to winter weather patterns.

To find out, they pulled weather data for Europe for the winters over the year's 1979/1980 through 2012/2013 and compared what they found with sea ice concentrations in the Arctic for the same period. In so doing they found what they describe as a new tool for providing skillful predictions of European winter weather. They note that combining Arctic ice concentrations (particularly in the Barents-Kara Sea) as measured in September, with Eurasian snow cover, can provide a reasonably high degree of predictability.

The NAO was first discovered by Sir Gilbert Walker in the 1920's—he observed fluctuations in atmospheric pressure between Iceland and the Azores which appeared to control the westerly direction of winds and storms in the North Atlantic and thus weather patterns in Europe.

Predicting changes in the NAO has proved next to impossible, however. Thus, researchers have looked to other climate phenomena to help improve long-range weather forecasting for Europe. In their paper, García-Serranoand and Frankignoul suggest that it's important that any future weather forecasts for seasonal winter predictions for Europe include measurements of ice in the Arctic in September.

More information: High predictability of the winter Euro–Atlantic climate from cryospheric variability, *Nature Geoscience* (2014) DOI: 10.1038/ngeo2118

Abstract
Seasonal prediction skill for surface winter climate in the Euro–Atlantic sector has been limited so far. In particular, the predictability of the winter North Atlantic Oscillation, the mode that largely dominates regional atmospheric and climate variability, remains a hurdle for present dynamical prediction systems. Statistical forecasts have also been largely elusive, but October Eurasian snow cover has been shown to be a robust source of regional predictability. Here we use maximum covariance analysis to show that Arctic sea-ice variability represents another good predictor of the winter Euro–Atlantic climate at lead times of as much as three months. Cross-validated hindcasts of the winter North Atlantic Oscillation index using September sea-ice anomalies yield a correlation skill of 0.59 for the period 1979/1980–2012/2013, suggesting that 35% of its variance could be predicted three months in advance. This skill can be further enhanced, at the expense of a shorter lead time, by using October Eurasian snow cover as an additional predictor. Skilful predictions of winter European surface air temperature and precipitation are also obtained with September sea ice as the only predictor. We conclude that it is important to incorporate Arctic sea-ice variability in seasonal prediction systems.