



High predictability of the winter Euro-Atlantic climate from cryospheric variability

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The predictability of the winter North Atlantic Oscillation (NAO), the mode that largely dominates regional atmospheric and climate variability, remains a major hurdle for current dynamical prediction systems. Statistical forecasts have also been largely elusive, but October Eurasian snow cover has been recently shown to be a robust source of regional predictability. Here we use maximum covariance analysis upon observational data to show that Arctic sea-ice variability represents another good predictor of the winter Euro-Atlantic climate at as much as three months lead-time. Cross-validated hindcasts of the winter NAO index using September sea-ice yield a correlation skill of 0.64 over 1979/80-2010/11, suggesting that 40% 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 additional predictor. Skilful predictions of winter European surface air-temperature and precipitation are also obtained with September sea-ice as predictor. The mechanism by which September Arctic sea-ice anomalies, particularly over the Barents-Kara region, influence the winter NAO appears to involve the stratosphere.