Arctic sea ice loss and La Niña as precursors of extreme East Asian cold winters

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Despite current global warming due to increasing greenhouse gases, severe cold winters have devastated the East Asia in recent decades. Efforts are being made to predict cold events using dynamic models and physically-based statistical models. In this study, we explore the potential predictability of the East Asian winter surface temperature by establishing a multiple linear regression model based on three precursors of time-evolved preconditions: 1) autumn Arctic sea-ice loss, 2) northern Eurasian sea level pressure pattern, and 3) the El Niño-Southern Oscillation (ENSO). Reduced autumn Arctic sea-ice was favorable for extreme cold events in the East Asia. Furthermore, the autumn Arctic sea-ice loss was accompanied by cyclonic circulations over northern Eurasia in November, which could have led to cold anomalies over the East Asia in the late winter. The preconditioning deep convection in La Niña events is a well-known indicator of exerted atmospheric wave propagation, resulting in cold winters over the East Asia. We suggested here that by combining Arctic sea-ice, atmospheric circulations, and ENSO, the predictability of East Asian winter surface temperature variability could be improved.