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Prolonged Effect of the Stratospheric Pathway in Linking Barents-Kara Sea Sea Ice Variability to the Midlatitude Circulation in a Simplified Model

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Observations show a delayed midlatitude circulation response during late winter following early winter Barents-Kara Sea (BKS) sea ice variability. To better understand the dynamical mechanism that accounts for the observed lead-lag correlation, a series of numerical experiments are conducted using a simplified atmospheric general circulation model (AGCM) with a prescribed idealized near-surface heating over the BKS region. A prolonged effect is found in the idealized experiments following the near-surface heating and can be explicitly attributed to the stratospheric pathway and the long time scale in the stratosphere. The analysis of the Eliassen-Palm (EP) flux shows that, as a result of the imposed heating and linear constructive interference, anomalous upward propagating planetary-scale waves are excited and weaken the stratospheric polar vortex. This stratospheric response persists for approximately 1-2 months accompanied by downward migration to the troposphere and the surface. This downward migration largely amplifies and extends the low-level jet deceleration in the midlatitudes and cold air advection over central Asia. The idealized model experiments also suggest that the BKS region is the most effective in affecting the midlatitude circulation than other regions over the Arctic.