

Characterizing influences of the Arctic sea ice loss on weak stratospheric polar vortex events

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We examined details of weak polar vortex (WPV) events including SSWs for the 1979–2015 period using the Japanese 55-year Reanalysis (JRA-55) data, in particular to see if there were any systematic differences in associated stratospheric wave propagation characteristics between heavy- and light-sea-ice conditions of the Barents–Kara Sea. In contrast to the heavy-ice year WPV events, upward wave propagation in the light-ice year WPV events was characterized by stronger stratospheric wavenumber-2 propagation, which also showed a close link with a tropospheric wavenumber-2 response to the Barents–Kara sea ice reduction. We further analyzed results of the high-top Atmospheric General Circulation Model (AGCM) time-slice experiments, prescribed with both the heavy (1979–1983) and the light (2005–2009) sea ice conditions while other forcing being fixed. Analysis reveals highly consistent results in regard to a more active role of the wavenumber-2 component for the low-ice case. The results thus suggest that the Arctic sea-ice is yet another possible factor to modulate wave propagation during the WPV events in addition to other factors such as ENSO, QBO and the solar cycles.

Key words: stratospheric sudden warming, weak polar vortex events, Arctic sea ice loss, Barents-Kara Sea, planetary wave