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Response of Northern Hemisphere storm tracks to Indian-western Pacific Ocean warming in atmospheric general circulation models

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With 40 yr integration output of two atmospheric general circulation models (GAMIL/IAP and HadAM3/UKMO) forced with identical prescribed seasonally-varying sea surface temperature, this study examines the effect of the observed Indian-western Pacific Ocean (IWP) warming on the Northern Hemisphere storm tracks (NHSTs). Both models indicate that the observed IWP warming tends to cause both the North Pacific storm track (NPST) and the North Atlantic storm track (NAST) to move northward. Such a consistent effect on the two storm tracks is closely associated with the changes in the low-level atmospheric baroclinicity, high-level jet stream and upper-level geopotential height. The IWP warming can excite a wavelike circum-global teleconnection in the geopotential height that gives rise to an anticyclonic anomaly over the midlatitude North Pacific and a positive-phase NAO anomaly over the North Atlantic. These geopotential height anomalies tend to enhance upper-level zonal westerly winds north of the climatological jet axes and increase low-level baroclinicity and eddy growth rates, thus favoring transient eddy more active north of the climatological storm track axes, responsible for the northward shift of the both storm tracks. The IWP warming-induced northward shift of the NAST is quite similar to the observed, suggesting that the IWP warming can be one of key factors to cause decadal northward shift of the NAST since the 1980s. However, the IWP warming-induced northward shift of the NPST is completely opposite to the observed, implying that the observed southward shift of the NPST since the 1980s would be primarily attributed to other reasons, although the IWP warming can have a cancelling effect against those reasons.
Keywords: Northern Hemisphere storm tracks, Indian-western Pacific Ocean warming, baroclinicity, eddy growth rate