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Geographical dependence observed in blocking-high influence on the stratospheric variability through enhancement and suppression of upward planetary-wave propagation

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Many previous studies have suggested the importance of blocking high development for the occurrence of stratospheric sudden warming (SSW), while there is a recent study that failed to identify their statistical linkage. Through composite analysis applied to high-amplitude anticyclonic anomaly events observed around every grid point over the extratropical Northern Hemisphere, the present study reveals distinct geographical dependence of blocking-high influence on upward propagation of planetary waves into the stratosphere. Tropospheric blocking highs that develop over the Euro-Atlantic sector tend to enhance upward planetary-wave propagation, leading to the warming in the polar stratosphere. In contrast, the corresponding upward propagation tends to be suppressed by blocking highs developing over the western Pacific and the Far East, resulting in the polar stratospheric cooling. This dependence is found to arise mainly from the sensitivity of the interference between the climatological planetary waves and Rossby wave packets emanating upward from blocking highs to their geographical locations. An event of SSW tends to follow blocking high development over the climatological planetary-wave ridge over the Euro-Atlantic sector, whereas a polar stratospheric cooling event tends to be preceded by blocking high development over a climatological planetary-wave trough. Our results suggest that blocking highs that induce the stratospheric cooling can weaken statistical relationship between blocking highs and SSW events.