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Absorbing and reflecting sudden stratospheric warming events and their relationship with tropospheric circulation

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Sudden stratospheric warming (SSW) events have received increased attention since their impacts on the troposphere became evident recently. Studies of SSW usually focus on polar stratospheric conditions; however, understanding the global impact of these events requires studying them from a wider perspective. Case studies are used to clarify the characteristics of the stratosphere–troposphere dynamical coupling, and the meridional extent of the phenomena associated with SSW. Results show that differences in the recovery phase can be used to classify SSW events into two types. The first is the absorbing type of SSW, which has a longer timescale as well as a larger meridional extent due to the persistent incoming planetary waves from the troposphere. The absorbing type of SSW is related to the annular mode on the surface through poleward and downward migration of the deceleration region of the polar-night jet. The other is the reflecting type. This is characterized by a quick termination of the warming episode due to the reflection of planetary waves in the stratosphere, which leads to an amplification of tropospheric planetary waves inducing strong westerlies over the North Atlantic and blocking over the North Pacific sector. Differences in the tropospheric impact of the absorbing and reflecting SSWs are also confirmed with composite analysis of 22 major SSWs.