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Are blocking events precursors to stratospheric sudden warmings?

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The stratospheric circulation is fundamentally disrupted during stratospheric sudden warming events (SSWs): the polar vortex is either shifted away from the pole towards the Atlantic basin (displacement events) or breaks-up into two separate parts (splitting events). While many features of the dynamics involved in SSW are well understood, their onset remains mysterious. It is well established that SSWs are preceded by anomalous fluxes of planetary scale waves: what is not known is why such bursts in wave fluxes occur.

In order to shed some light on this matter, we here examine the tropospheric circulation prior to SSWs, for both displacement and splitting types. We find significant differences in the flow both in the Atlantic and the Pacific basin. Preceding splitting events, the frequency of atmospheric blocking exceeds the climatological distribution in the eastern Pacific basin, whereas the frequency of blocks is severely reduced (to almost zero) in the same area prior to displacement events. This is accompanied by an eastward extension of the Pacific jet prior to displacement events compared to the flow preceding splitting events. Over the Atlantic basin, blocks are essentially confined to the Greenland area prior to and during splitting events. Prior to displacement events they occur further downstream over the central Atlantic and Scandinavia.

These changes in the flow structure associated with the changes in the blocking frequencies are mirrored in the location and amplitude of planetary scale waves that

propagate upwards from the tropopause region into the middle atmosphere.