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The zonally-asymmetric response to stratospheric forcing in the Atlantic and Pacific storm tracks

The stratosphere can have a substantial impact on surface weather in winter, in particular during stratospheric extreme events, so-called sudden stratospheric warming (SSW) events. The tropospheric response tends to dominate in the Atlantic basin and is characterized by a significant equatorward shift of the tropospheric jet stream over the North Atlantic, leading to a change in weather patterns over Europe. A significantly weaker and opposite response is observed over the North Pacific. Although several mechanisms have been suggested to explain the downward influence of SSW events, including sensitivity to the SSW type and the magnitude of the tropospheric background flow, their role and relative importance for determining the zonal asymmetry of the response remains unclear.

Through eddy - mean flow interaction, synoptic-scale eddy feedback may affect the variability of the downward influence of the stratosphere, and play a significant role in maintaining the observed response. Using composites of reanalysis data, we identify two types of tropospheric responses to SSWs: (1) a zonally-symmetric response associated with an equatorward shift of the jet and the storm track in the Atlantic, and (2) a zonally-asymmetric response associated with a poleward shift. The anomalies in storm track intensity and the anomalous position of the storm track in the East Pacific are suggested to control the persistence of the response to SSW events in the Atlantic.

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