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## **Abrupt stratospheric vortex weakening associated with North Atlantic anticyclonic wave breaking**

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The sudden stratospheric warming (SSW) of 12 February 2018 was not forecast by any extended-range model beyond 12 days. From early February, all forecast models that comprise the subseasonal-to-seasonal (S2S) database abruptly transitioned from indicating a strong stratospheric polar vortex (SPV) to a high likelihood of a major SSW. We demonstrate that this forecast evolution was associated with the track and intensity of a cyclone in the north-east Atlantic, with an associated anticyclonic Rossby wave break, which was not well-forecast. The wave break played a pivotal role in building the Ural high, which existing literature has shown was a precursor of the 2018 SSW. The track of the cyclone built an anomalously strong sea-level pressure dipole between Scandinavia and Greenland (termed the S-G dipole) which we use as a diagnostic of the wave break. Forecasts which did not capture the magnitude of this event had the largest errors in the SPV strength and did not show enhanced vertical wave activity. A composite of 49 similarly strong wintertime (November–March) S-G dipoles in reanalysis shows associated anticyclonic wave breaking leading to significantly enhanced vertical wave activity and a weakened SPV in the following days, which occurred in 35% of the 15-day periods preceding observed major SSWs. Our results indicate a particular transient trigger for weakening the SPV, complementing existing results on the importance of tropospheric blocking for disruptions to the Northern Hemisphere extratropical stratospheric circulation.

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