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The effect of interactive ozone chemistry on weak and strong stratospheric polar vortex events

Jessica Oehrlein et al.

Correspondence to: Jessica Oehrlein (jessica.oehrlein@columbia.edu)

In this supplementary section, we show the seasonality of the shortwave heating anomalies induced by the CHEM (interactive chemistry) simulation compared to NOCHEM (specified chemistry) in the occurrence of SSWs (Fig. S1). Given that March SSWs behave differently from those occurring in midwinter, we show the evolution of these events separately from that of the DJF SSWs. In particular, here we show the NAM evolution (Fig. S2), evolution of temperature and the individual heating terms (Fig. S3), and the wave forcing (Fig. S4). (These figures are parallel to Figures 4, 5, and 6 for midwinter SSWs in the main text). Finally, we show the same sequence (NAM, temperature and heating terms) for SPVs in midwinter in Figs. S5-S6.

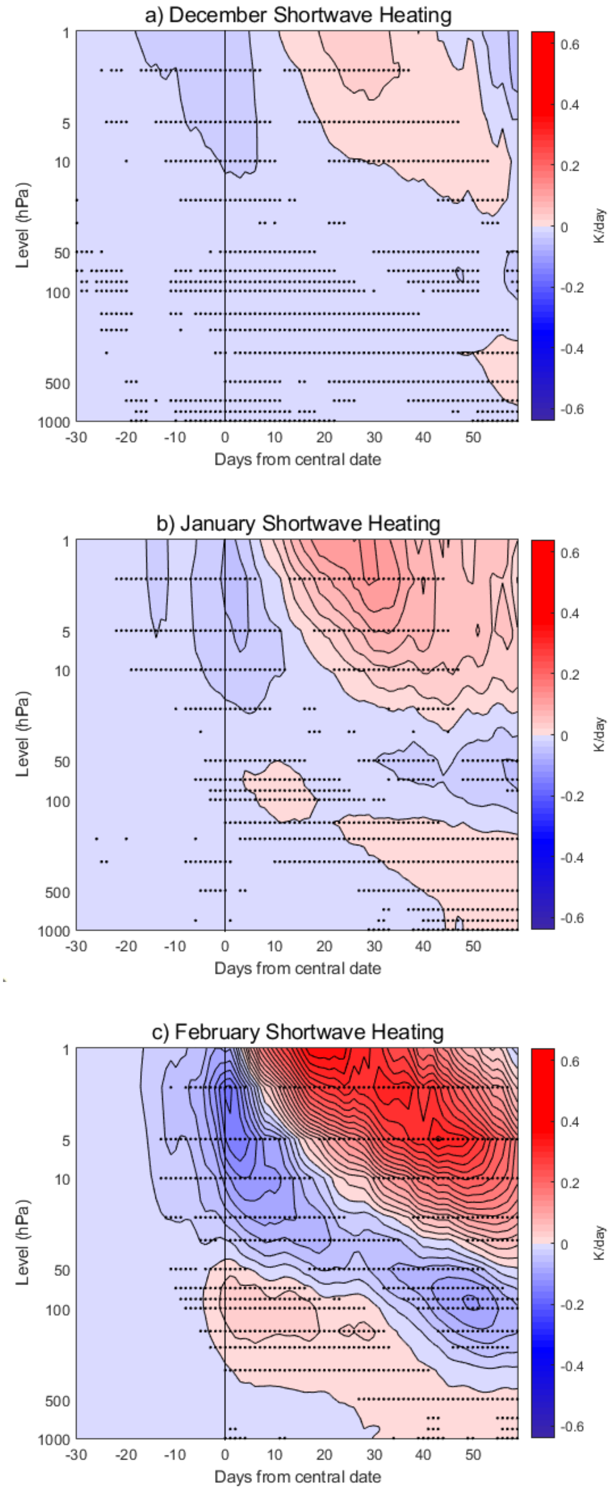

Figure S1. CHEM-NOCHEM difference in shortwave heating anomalies from -30 to +60 days around the SSW central dates in December (a), January (b), and February (c).

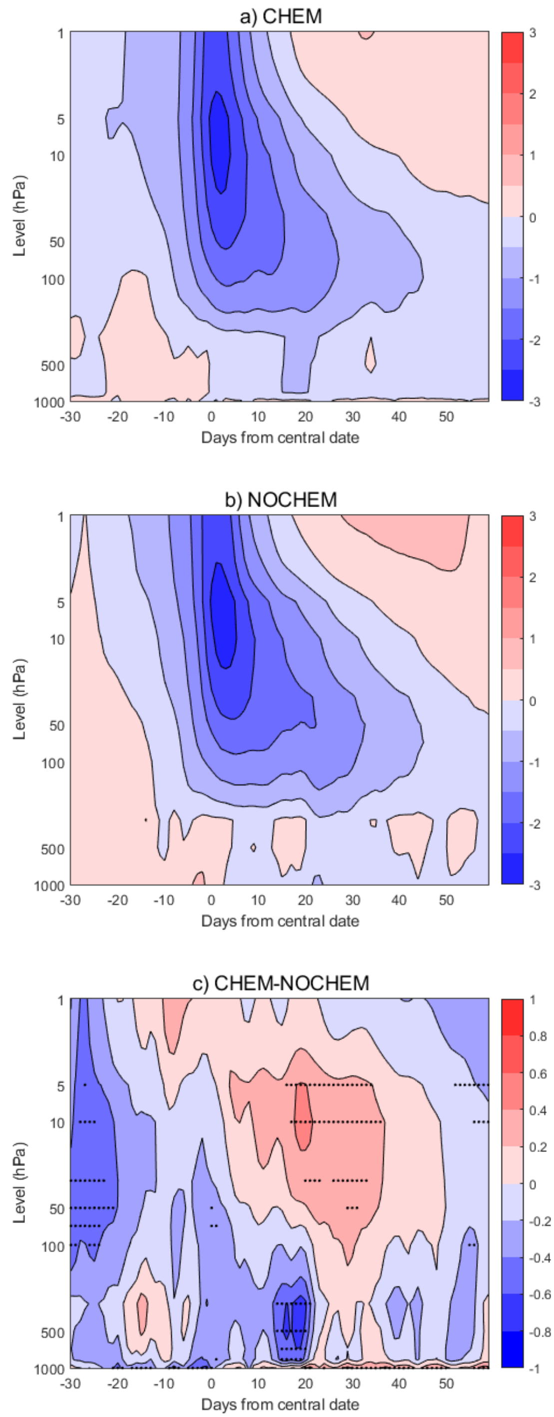

Figure S2. NAM anomaly composites around March SSW central dates in CHEM (a), NOCHEM (b), CHEM-NOCHEM (c). Stippling shows significance at the 95% level (with a Monte Carlo test for CHEM and NOCHEM and a two-tailed t-test for CHEM-NOCHEM). Contours are every 0.5 standard units for CHEM and NOCHEM and every 0.2 standard units for CHEM-NOCHEM.

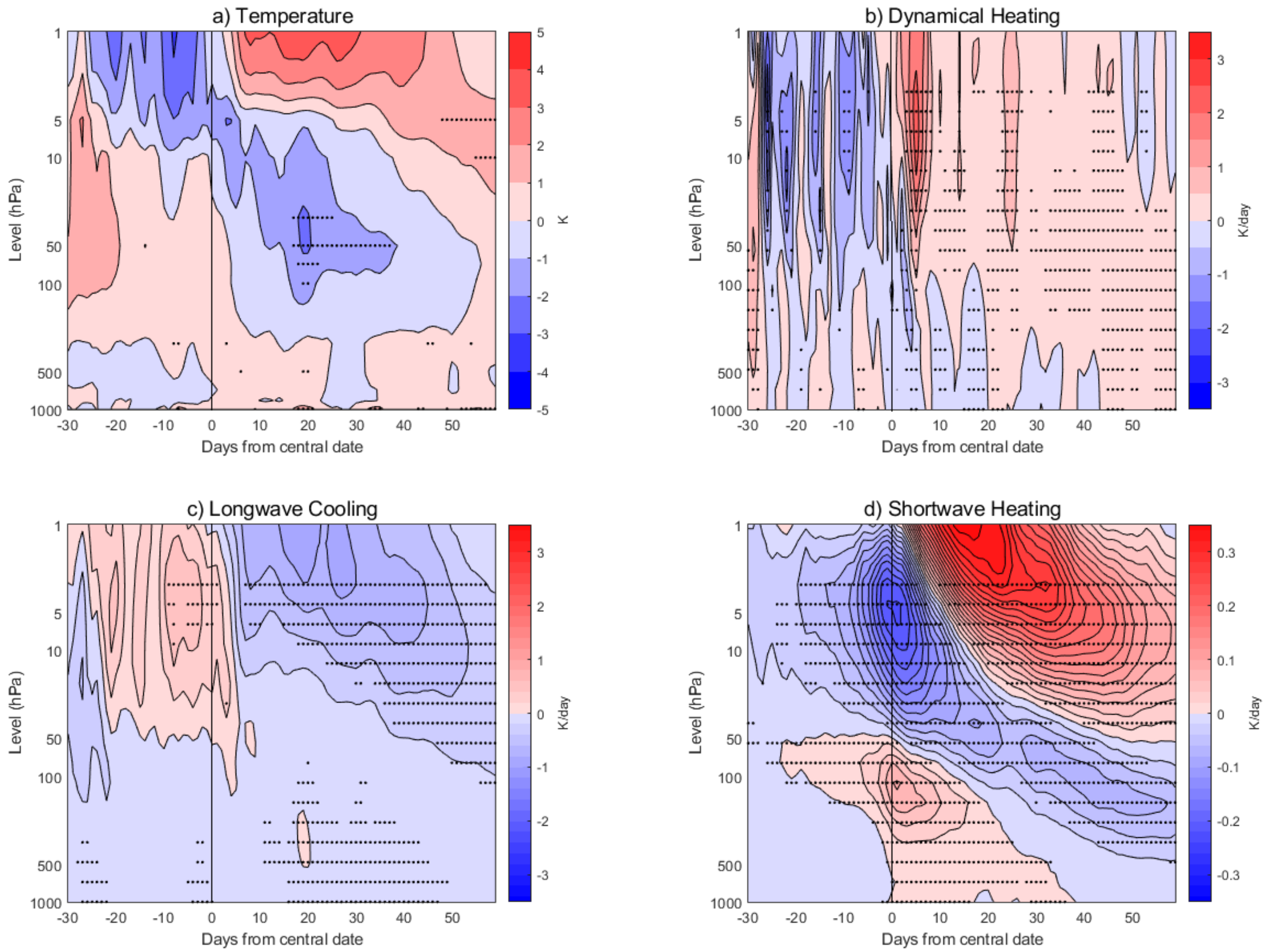

Figure S3. CHEM-NOCHEM differences in the temperature and heating anomalies over 60-90° N from -30 to +60 days around the SSW March central dates. (a): Temperature anomalies. Contours are every 1 K. (b): Dynamical heating anomalies. Contours are every 0.5 K/day. (c): Longwave heating anomalies. Contours are every 0.25 K/day. (d): Shortwave heating anomalies. Contours are every 0.02 K/day. Stippling shows significance at the 95% level under a two-tailed t-test.

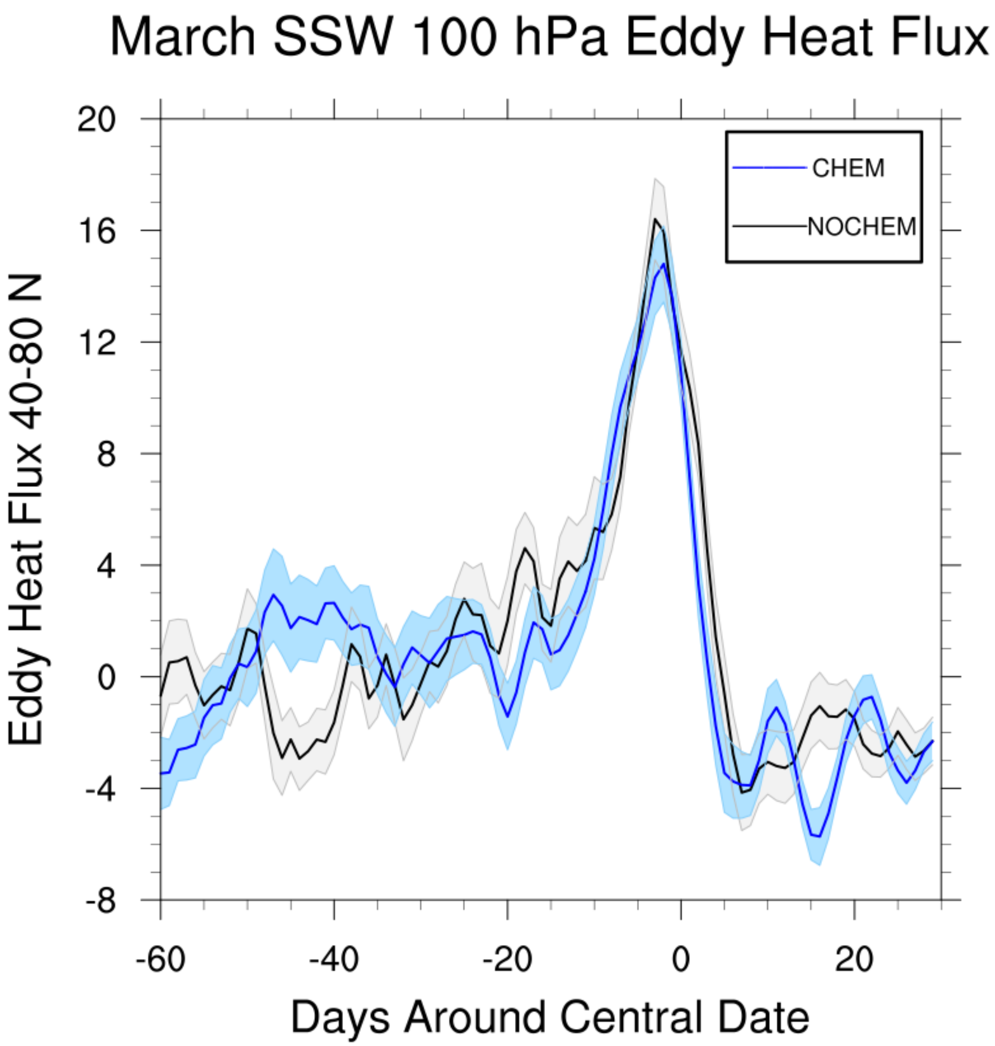

Figure S4. Eddy heat flux in mK/s over 40-80° N from -60 to +30 days around the SSW March central dates. The CHEM average is in blue, with confidence intervals shown in pale blue. The NOCHEM average is in black, with confidence intervals shown in gray.

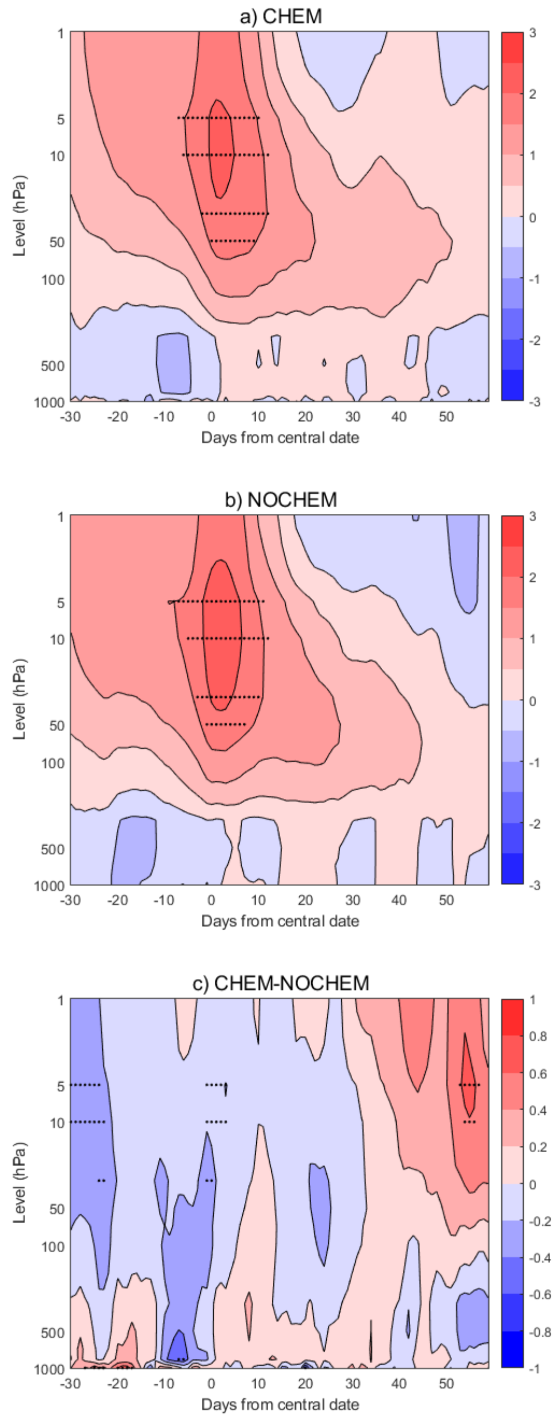

Figure S5. NAM anomaly composites around DJF SPV central dates in CHEM (a), NOCHEM (b), CHEM-NOCHEM (c). Stippling shows significance at the 95% level (with a Monte Carlo test for CHEM and NOCHEM and a two-tailed t-test for CHEM-NOCHEM). Contours are every 0.5 standard units for CHEM and NOCHEM and every 0.2 standard units for CHEM-NOCHEM.

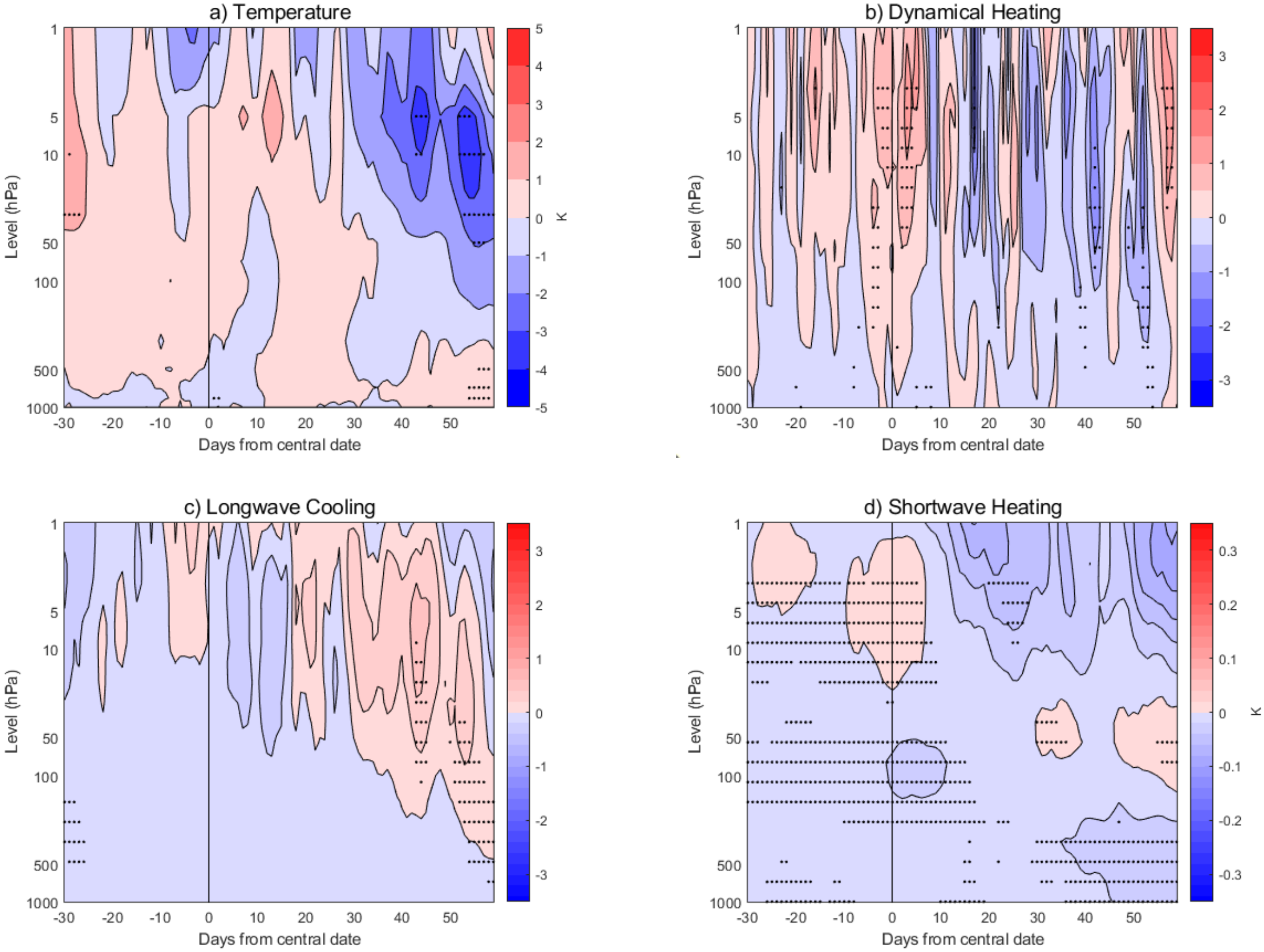

Figure S6. CHEM-NOCHEM differences in the temperature and heating anomalies over 60-90° N from -30 to +60 days around the SPV DJF central dates. (a): Temperature anomalies. Contours are every 1 K. (b): Dynamical heating anomalies. Contours are every 0.5 K/day. (c): Longwave heating anomalies. Contours are every 0.25 K/day. (d): Shortwave heating anomalies. Contours are every 0.02 K/day. Stippling shows significance at the 95% level under a two-tailed t-test.