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Changes in stratospheric transport and mixing during sudden stratospheric warmings in reanalysis and model

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The extreme disruptions of the wintertime stratospheric circulation during sudden stratospheric warmings (SSW) have important effects on tracer concentrations through alterations in transport properties. The goal of this study is to provide a quantitative analysis of those changes examining the anomalies of the advective Brewer-Dobson circulation and the effective diffusivity as a measure of isentropic mixing. We composite data around the central day of SSWs from thirty-six years of reanalysis data (ERA-Interim), and from five ensemble members (60 years each) of the Whole Atmospheric Community Climate Model version 4 (WACCM4) performed for the Chemistry Climate Model Initiative (CCMI).
Our main findings include: i) A weakened residual circulation and intensified isentropic mixing after the onset of SSWs that persist for more than two months in the lower stratosphere; ii) sufficiently deep SSWs (i.e. those followed by Polar-night Jet Oscillation events) have a stronger and more persistent response in the meridional circulation and isentropic mixing; and iii) long after the strong wave forcing that drives the SSWs has declined, diffusive fluxes of potential vorticity in equivalent latitude remain anomalously high in the lower stratosphere delaying the recovery of the vortex.