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Influence of the solar cycle on the Polar-night Jet Oscillation

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The Polar-night Jet Oscillation (PJO) is the dominant mode of stratospheric variability in the Southern Hemisphere (SH), and persists from mid-winter to spring. The influence of the 11-year solar cycle on modulation of the PJO from late winter to spring is examined using observations and three 42-year simulations from a chemistry-climate model. The only variation applied to model boundary conditions was the strength of ultraviolet radiation (UV). This is set at two times larger than observations to enhance the strength of the solar signal. Simulations show a downward propagation of the stratospheric signal into the troposphere from late winter to spring, which tends to be enhanced as UV strength increases. This result is similar to observations, but with a 1–2 month lag. The behavior of the PJO with respect to wave-mean flow interactions is examined using a newly developed momentum budget analysis as well as wave-energy analysis. We suggest that UV modulation of the interactions between planetary waves and zonal-mean flow in the stratosphere, rather than direct diabatic processes as suggested in a previous study, is the source of solar cycle modulation of the PJO.