Classification of Polar-Night Jet Oscillations and Their Relationship to Fast and Slow Variations in a Global Mechanistic Circulation Model of the Stratosphere and Troposphere

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Polar-night jet oscillation (PJO), which is a low-frequency intraseasonal oscillatory variation in the winter stratosphere, is investigated with a 14,000-year long dataset obtained with an idealized global mechanistic circulation model of the stratosphere and troposphere. After performing an empirical orthogonal function analysis on the time series of the northern polar temperature, 10,647 PJO events are identified and classified into four groups. About 20% of them are two groups of cold events, while the rest are two groups of warm events. All of them show slow downward propagations of negative or positive temperature anomaly, with relatively short or long lifetime.

Composite analysis shows that each group has its own typical relationship to fast variations in the polar stratosphere known as stratospheric sudden warming and polar vortex intensification, and to slow variation in the troposphere known as arctic oscillation. A statistically significant evidence of downward dynamical influence of PJO to the surface is obtained for a group of warm events with longer lifetime.

Keywords: polar-night jet oscillation; stratospheric sudden warming; polar vortex intensification; arctic oscillation; global mechanistic circulation model; 14,000-year long time integrations