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The effect of subauroral polarization streams on the mid-latitude thermospheric disturbance neutral winds: a universal time effect

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The temporal and spatial variations in thermospheric neutral winds at an altitude of 400 km in response to subauroral polarization streams (SAPS) are investigated using global ionosphere and thermosphere model simulations under the southward interplanetary magnetic field (IMF) condition. During SAPS periods the westward neutral winds in the subauroral latitudes are greatly strengthened at dusk. This is due to the ion drag effect, through which SAPS can accelerate neutral winds in the westward direction. The new findings are that for SAPS commencing at different universal times, the strongest westward neutral winds exhibit large variations in amplitudes. The ion drag and Joule heating effects are dependent on the solar illumination, which exhibit UT variations due to the displacement of the geomagnetic and geographic poles.With more sunlight, stronger westward neutral winds can be generated, and the center of these neutral winds shifts to a later magnetic local time than neutral winds with less solar illumination. In the Northern Hemisphere and Southern Hemisphere, the disturbance neutral wind reaches a maximum at 18:00 and 04:00 UT, and a minimum at 04:00 and 16:00 UT, respectively. There is a good correlation between the neutral wind velocity and $\cos^{0.5}$SZA (solar zenith angle). The reduction in the electron density and enhancement in the air mass density at an altitude of 400 km are strongest when the maximum solar illumination collocates with the SAPS. The correlation between the neutral wind velocity and $\cos^{0.5}$SZA is also good during the northward IMF period. The effect of a sine-wave oscillation of SAPS on the neutral wind also exhibits UT variations in association with the solar illumination.