Correlation of magnetospheric energy input in the upper atmosphere to the solar wind velocity

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A strong correlation between solar wind velocity and thermosphere density at a 9-day period has been found and it is suggested that this periodic oscillation is produced by the high-speed streams in the solar wind. However, the energy transfer process through the solar wind, magnetosphere and ionosphere is still not clear. It is very important to confirm if the periodic oscillations exist in the Joule heating and vary in the same manner as neutral density. However, no periodic oscillation in the Joule heating has ever been reported due to the measurement difficulty of the total Joule heating in both hemispheres. The assimilative mapping of ionospheric electrodynamics (AMIE) technique [Richmond, 1992] provides a method to estimate the global energy deposition rate into the ionosphere. In this study, a yearly run of AMIE in 2005 is used to investigate the 9-day periodic variation of Joule heating. The Lomb-Scargle spectral amplitudes are examined to prove the existence of the periodic oscillation in the Joule heating and other variables. The yearly variations in the specific period window (6-12 days) are then investigated using a band-pass filter centered at 9 days and the phase shift between neutral density, Joule heating and solar wind velocity is also studied. These results will strongly advance our understanding of the solar wind/magnetosphere/ionosphere coupling in observed periodic oscillations.