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Implications of solar wind forcing on the Venus polar ionosphere and thermosphere

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ASPERA-ion data from Venus Express reveals new interesting aspects of the solar wind interaction with Venus. First of all, the solar wind and ionospheric flow display an XY-asymmetry, the flow vectors pointing consistently in the +Y direction near the planet, opposite to the planet's orbital motion. The +Y flow component is most pronounced near the Pole and in the tail/nightside region. Secondly, there is a clear connection between ionospheric O+ acceleration and solar wind H+ deceleration. The acceleration of O+ give velocities generally less than 20 km/s below 10 000 km altitude, below 6 000 km velocities generally less than 10 km/s. The latter implies that a large fraction of O+ is gravitationally trapped. An overall mass flux balance exists between solar wind H+ and ionospheric O+ in the altitude range 2 500 - 10 000 km. Below 2 500 km the O+ mass flux is enhanced at the expense of the H+ mass flux, implying a delivery of solar wind momentum to ionospheric ions. Finally, we find a strong O+ mass flux drop below 400 km altitude. At ≈200 km altitude (pericenter) the ion mass flux is reduced to ≈15% of the 400 km value. The ion momentum loss is most likely the result of a momentum transfer to thermospheric neutrals. Conservation of mass flux therefore requires that a neutral wind along the direction of the external ion flow is set up in the polar thermosphere. The long-term consequences of such an externally driven wind will be discussed.