WINDMI PARAMETERS

V^{sw} Solar wind input voltage from interplanetary electric field $V_x^{\text{sw}} B_s$ and effective magnetopause interaction length L_y^{eff}. $V^{\text{sw}} = V_x^{\text{sw}} B_s L_y^{\text{eff}}$ in volts.

L Inductance of the lobe cavity surrounded by the geotail current $I(t)$. The nominal value is $L = \mu_0 A_\ell / L_x^{\text{eff}}$ in Henries where A_ℓ is lobe area and L_x^{eff} the effective length of the geotail solenoidal. Computation of L as function of the IMF from Tsyganenko are in Horton, Pekker, Doxas (GRL, 1998).

C Capacitance of the central plasma sheet in Farads. The nominal value is $C = \rho_m L_x L_z / B^2 L_y$ where ρ_m is the mass density in $kg/m^3, L_x L_z$ is the meridional area of the plasma sheet, L_y the dawn-to-dusk width of the CPS and B the magnetic field on the equatorial plane. Computations of C are given in Horton and Doxas (1996).

Σ Large gyroradius ρ_i plasma sheet conductance from the quasineutral layer of height $(L_z \rho_i)^{1/2}$ about the equatorial sheet. The nominal value of $\Sigma = 0.1(n_e/B_n)(\rho_i/L_z)^{1/2}$. Computation of Σ is given in Horton and Tajima (JGR, 1992).

Ω Volume of the central plasma sheet that supports mean pressure $p(t)$. In some works $\Omega = \Omega_{\text{cps}}$.

u_0 Heat flux limit parameter for parallel thermal flux on open magnetic field lines $q_\parallel = u_0 (K_\parallel/\rho_m)^{1/2}$ where $(K_\parallel/\rho_m)^{1/2}$ is the mean parallel flow velocity and p is the mean pressure.

τ_p Energy confinement time for the central plasma sheet with closed magnetic field lines. Total plasma energy is $W_p = \frac{3}{2}P\Omega_{\rm cps}$.

$\tau_\|$ Confinement time for the parallel flow kinetic energy K in the central plasma sheet.

$I(p)$ The geotail current driven by the plasma pressure p confined in the central plasma sheet. Pressure blance between the lobe and the central plasma sheet gives $B_\ell^2/2\mu_0 = p$ with $2L_xB_\ell = \mu_0 I_p$. This defines the coefficient α in $I_p = \alpha(p)^{1/2}$ to be approximately $\alpha = 2.8L_x/\mu_0^{1/2}$.

L_1 The self-inductance of the wedge current or the nightside region 1 current loop $I_1(t)$

M The mutual inductance between the nightside region 1 current loop I_1 and the geotail current loop I.

$L_{\rm RC}$ The inductance of the ring current.

C_1 The capacitance of the nightside region 1 plasma current loop.

Σ_1 The ionospheric Pedersen conductance of the westwrd electrojet current closing the I_1 current loop in the auroral ($\sim 100\,$km, 68°) ionosphere.

$\Sigma_1^{n\ell}$ The enhancement of the Pedersen confuctivity from precipitating electrons. From the Robinson *et al.* formula the total conductance is $\Sigma = \Sigma_1 + \Sigma_1^{n\ell}(I_iV_i)^{1/2}$. Turbulence enhancements of Σ for $V_i/\Delta L_y > 20$mV/m may also be applied.

Σ_2 The ionospheric Pedersen conductance for the region 2 shielding current.

WINDMI DYNAMICAL VARIABLES

$\Delta V_{\|}$ Parallel potential drop from Knight or Lemaire-Scher formulas $j_{\|} = \pm k(\Delta V_{\|} - T_{\text{eff}}/e)$ with $k = ne^2/m_e v_e$ for the Lyons-Evans conductance.

I Cross-field geotail plasma current in Ampéres. The magnetic lobe energy is $W_g t = \frac{1}{2}LI^2$, $W_{gt} = \frac{1}{2}LI^2$.

V Mean cross-tail convection potential in volts. The $\boldsymbol{E} \times \boldsymbol{B}$ flow kinetic energies are $W_E = \frac{1}{2}CV^2$.

P Mean plasma pressure in central plasma sheet (CPS) in nPa. The CPS energy is $W_p = \frac{3}{2}P\Omega_{\text{cps}}$.

$K_{\|}$ Total parallel flow kinetic energy in Joules.

I_1 Nightside region 1 current or mean wedge current during a substorm in Ampéres. Field-aligned current or FAC.

V_1 Polar cap potential difference between the footpoints of the region 1 current loop into the ionosphere. The Joule heating of the ionosphere is $P_1(t) = I_1(t)V_1(t)$ in Watts.

I_2 Nightside region 2 shielding current closing in the radiation belts. The current forms a partial ring current flowing parallel to the ring current $I_{\text{RC}}(t)$. Field-aligned current FAC.

V_2 Potential difference between the footpoints of the region 2 FAC I_2.

$I_{\rm RC}$ The ring current with peak density in the radiation belt and formed by the westward magnetic drifts of the trapped high-energy protons and oxygen ions.

$W_{\rm RC}$ The plasma energy stored in the ring current.

Σ Large gyroradius plasma sheet conductance from the quasineutral layer of height $(L_z \rho_i)^{1/2}$ about the equatorial plasma sheet. The nominal value of $\Sigma = 0.1(n_e/B_n)(\rho_i/L_z)^{1/2}$[mhos]. Computation of Σ is given in Horton and Tajima, JGR (1992).

Ω Volume of the central plasma sheet that supports mean pressure $p(t)$.

u_0 Heat flux limit parameter for parallel thermal flux on $q_{\parallel} = u_0 (K_{\parallel}/\rho_m)^{1/2} p$ where $(K_{\parallel}/\rho_m)^{1/2}$ is the mean parallel flow velocity and p the mean pressure.

τ_p Energy confinement time for the central plasma sheet with closed magnetic field lines.

$\tau_{\parallel}$ Confinement time for the parallel flow kinetic energy in the central plasma sheet.

$I(p)$ The geotail current driven by the plasma pressure p in the confined central plasma sheet. Pressure balance between the lobe and the central plasma sheet gives $B_\ell^2/2\mu_0 = P$ with $2L_x B_\ell = \mu_0 I_p$. This defines the coefficient α in $I_p = \alpha(p)^{1/2}$.

L_1 The self-inductance of the wedge current or the nightside region 1 current loop $I_1(t)$.

M The mutual inductance between the nightside region 1 current loop I_1 and the geotail current loop I.

C_1	The capacitance of the nightside region 1 plasma current loop.
Σ_1	The ionospheric Pedersen conductance for the westward electrojet current closing the I_1 current loop.
$\Sigma_1^{n\ell}$	The enhancement of the Pedersen conductivity from precipitating electrons. From the Robinson *et al.* formula the total conduction is $\Sigma = \Sigma_1 + \Sigma_1^{n\ell}(I_i V_i)^{1/2}$. Turbulence enhancement for $V_i/\Delta L_y > 20\,\mathrm{mV/m}$ may also be applied.
$\Delta V_\parallel$	Parallel potential drop from Knight or Lemaire-Scher formulas $j_\parallel = \pm k(\Delta V_\parallel - T_{\mathrm{eff}})$ with $k = ne^2/m_e v_e^2$ for the Lyons conductance.
Σ_2	Pedersen conductance for the region 2 FAC closing in the partial ring current.
A_{eff}	The effective apperture in m^2 of the cross-section of the Earth's dipole presented to the plasma sheet for corssing the Alfvén layer (separatrix).
τ_{rc}	Energy decay time for the ring current principally due to charge exchange on the neutral from the hole of upper atmosphere atoms.
P^{dyn}	Dynamic pressure of the solar wind.
E^{sw}	the solar wind dynamo electric field given by $v_x^{\mathrm{sw}} B_s$.
a, d_{st}^j, f, c	Empirically-derived parameters and functions in the literature used to model the D_{st} from interplanetary magnetic field and plasma data.

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