SAM13/RCM SIMULATION STUDY OF THE MARCH 31, 2001 STORM

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\[ \nabla \cdot \Sigma \nabla \Phi = S(V_n, J_\parallel) \]

- penetration electric field
  - \( S(V_n, J_\parallel(t)) \)
  - time scale: mins
- stormtime dynamo electric field
  - \( S(V_n(t), J_\parallel) \)
  - time scale: hrs
PENETRATION ELECTRIC FIELD
stormtime impact on ionosphere (Mannucci et al., GRL, 2005)
\[ \nabla \cdot \sum_{\text{SAMi3}} \nabla \Phi = S \left( V_n, \left\{ \frac{J_{\parallel}}{\text{HWM}}, \frac{J_{\parallel}}{\text{RCM}} \right\} \right) \]
PLASMASPHERE DYNAMICS

stormtime response (Grebowsky, JGR, 1970)
H$^+$/He$^+$ CONTOURS

(Huba and Krall, GRL, 2013)
Electron Number Density (cm$^{-3}$)

$\log_{10} n_e = -0.66L + 4.89$
IONOSPHERE/PLASMASPHERE SIGNATURES


GPS TEC [10,150] TECu  19:30 UT  March 31, 2001

Equatorial Projection

**19:30 UT TEC > 50 TECu**
march 29, 2001 storm - impact on TEC and electron density profile
SUMMARY

- quiet time: plasmasphere just an extension of ionosphere (reasonably well-modeled by SAMI3/Weimer)
- stormtime: high latitude dynamics become important
  - penetration electric field
  - disturbance dynamo electric field
- effects
  - erosion of plasmasphere/plume development
  - stormtime enhanced density (SED) in mid- to high-latitude ionosphere
- some fundamental stormtime dynamics confirmed using SAMI3/RCM: relationship of SED and plume