Substorm influences on plasma properties distributions in the inner magnetosphere

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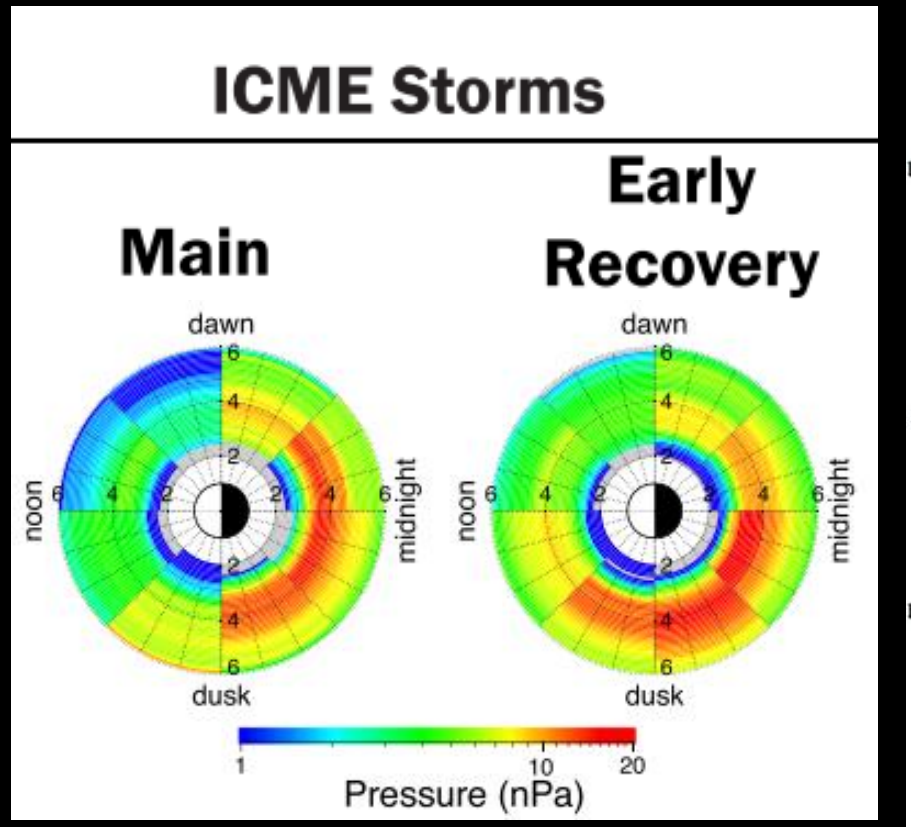
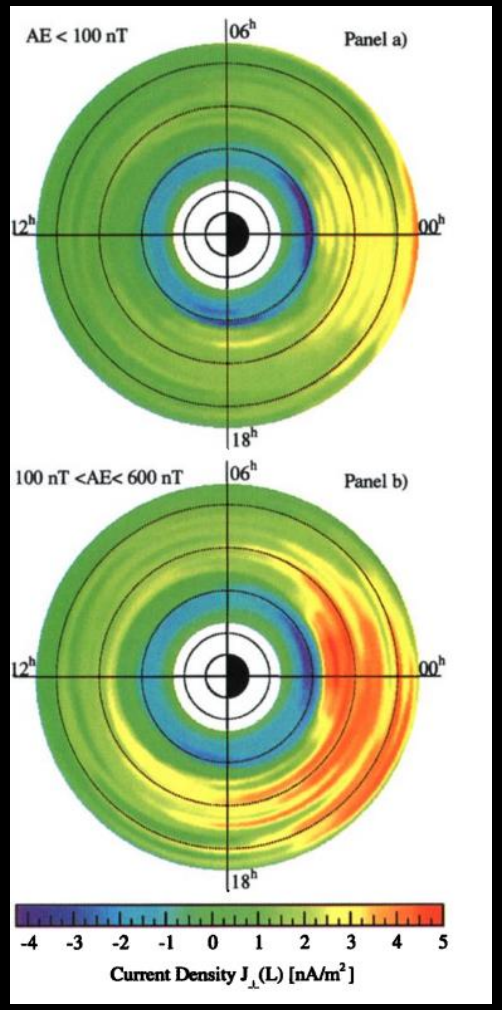
Introductions



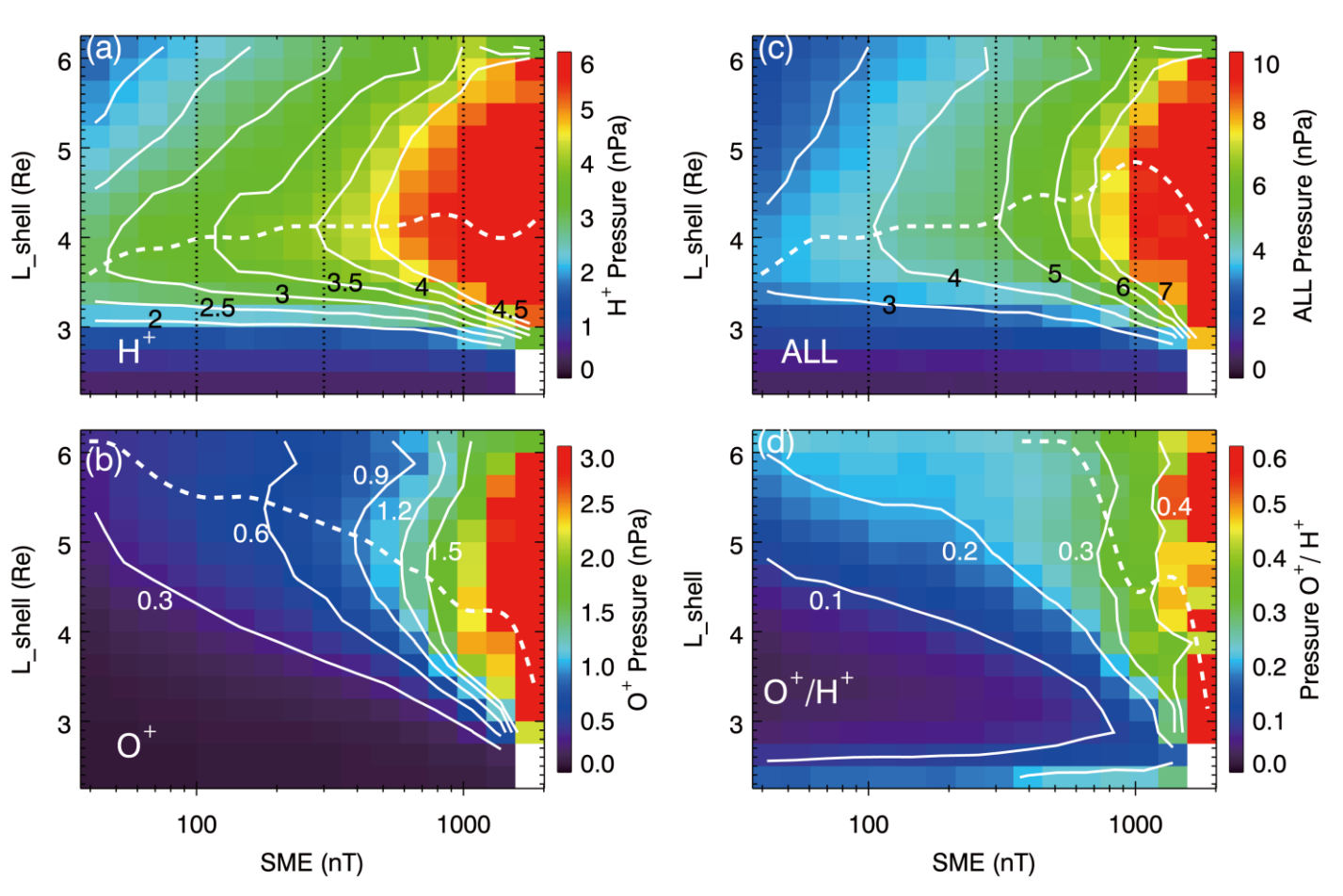
Mouikis et al. (2019)



De Mechelis et al. (1999)

- Previous studies have shown the distributions of pressure and ring current densities during quiet times and storms.
- We use the 6.5-year RBSP observations to study the plasma properties during substorms, especially intense substorms.

Pressure Distributions

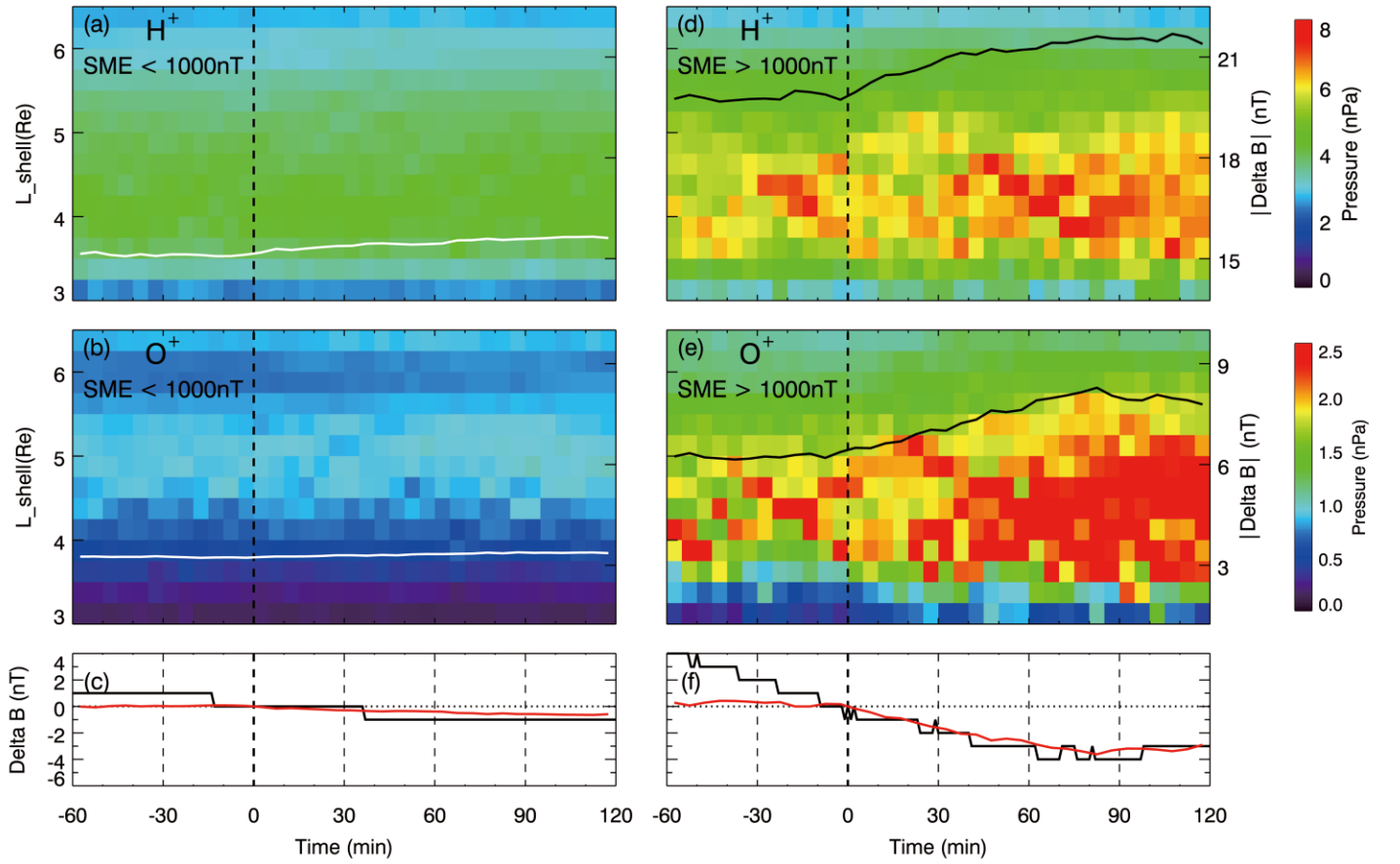


The pressure of H^+ and O^+ ions increases significantly for larger SME indexes.

The peak of proton pressure is always near L~4, and the peak of oxygen pressure moves inward during intense substorms.

The pressure ratio of O^+/H^+ increased from <0.1 during quiet periods to > 0.4 during intense substorms.

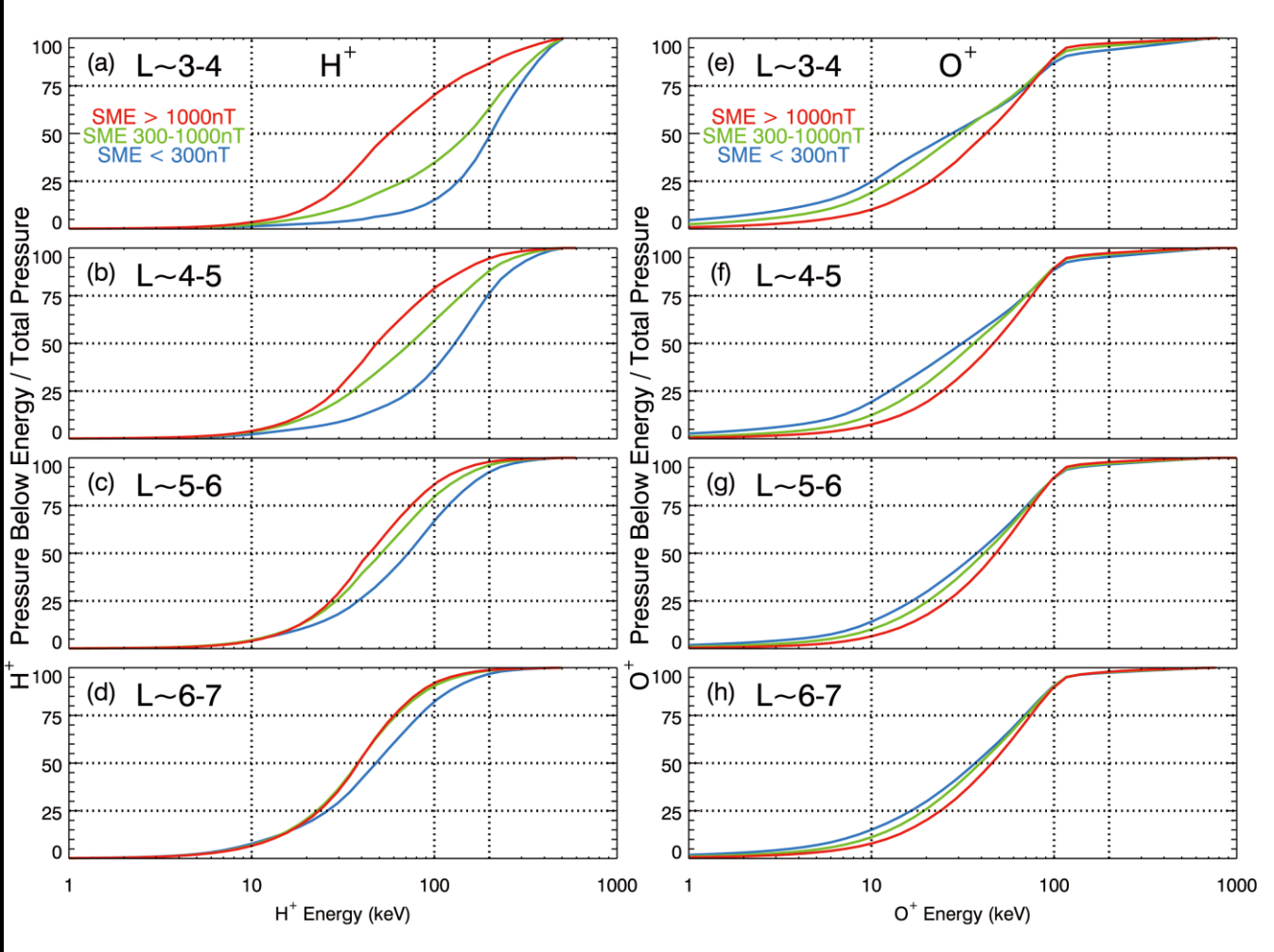
Magnetic Disturbance



The pressure of both H^+ and O^+ ions rises rapidly during the intense substorms.

The calculated geomagnetic depression using the DPS relation is about ~3nT/h during intense substorms. Its curve is consistent with the superposed epoch of the SYM-H index.

Energy Distributions

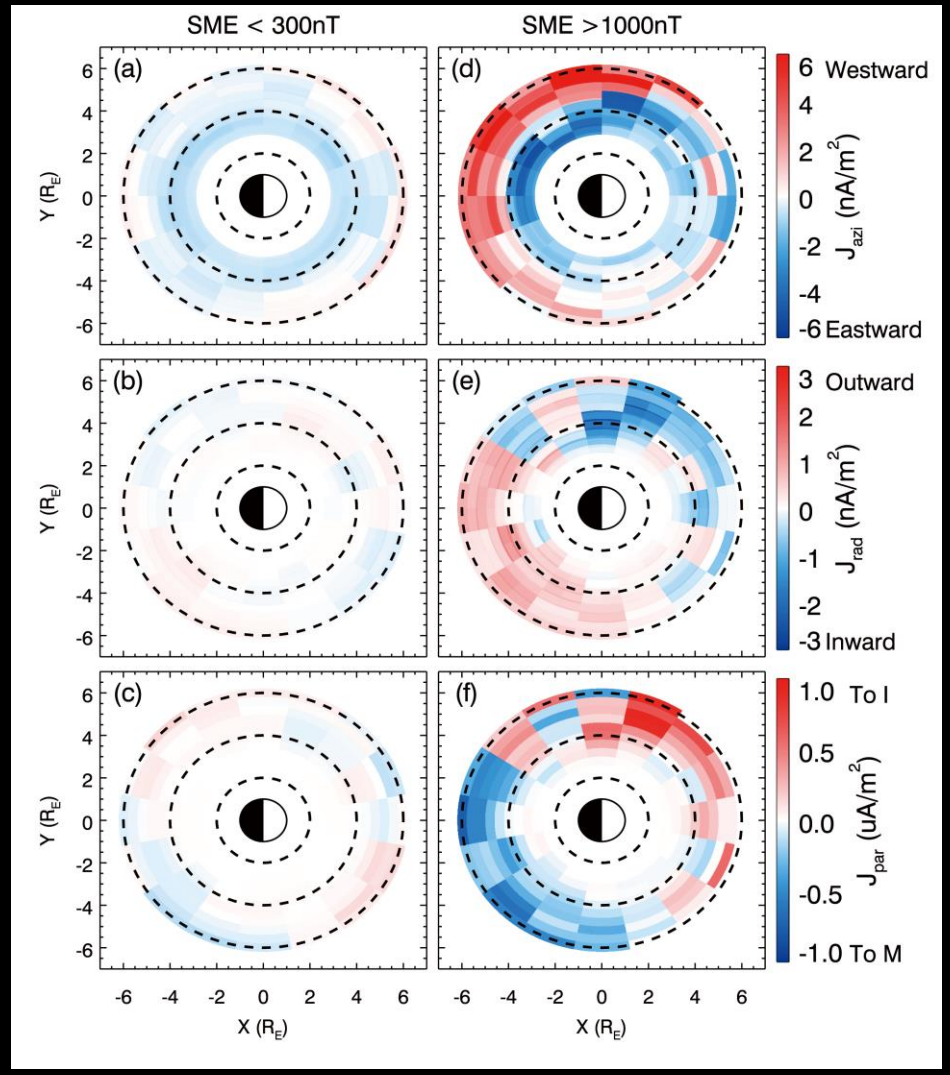


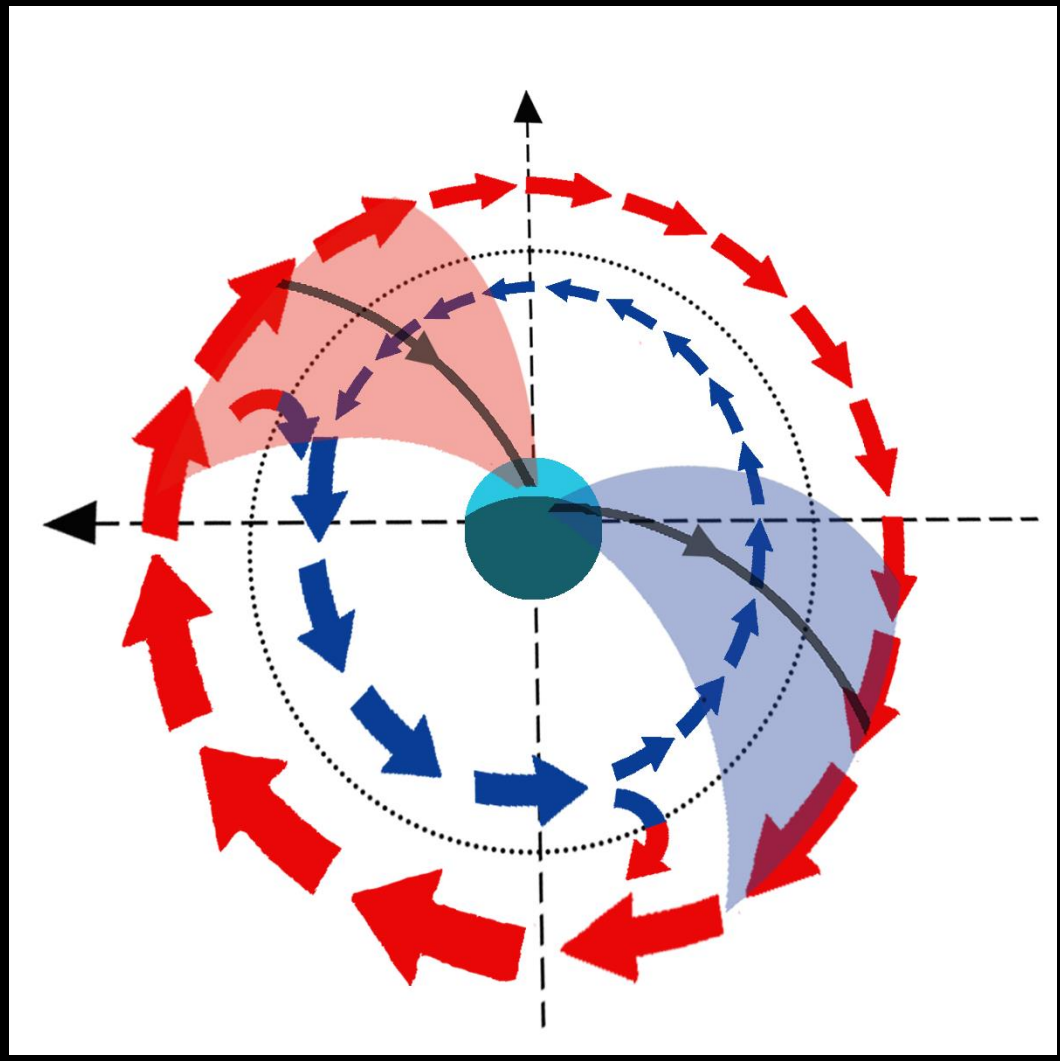
The ion pressure is mainly contributed by protons of 10-300keV, and oxygen ions of 3-100keV.

The energy distribution of hydrogen ions is greatly affected by the L-shell, while oxygen ions are hardly affected.

Compared with the quiet periods, the proportion of <100keV H^+ and >10keV O^+ ions during intense substorm increase respectively, more significant at a lower L.

Current Densities





Conclusions

- The pressure peak of O^+ ions moves inward during intense substorms, while that of protons remains L~4.
- The pressure increase caused by intense substorms can lead to ~3nT/h magnetic field depression, consistent with the time variations of the SYM-H index.
- The pressure contribution of both <100keV H^+ and >10 keV O^+ increase during intense substorms.
- The current densities of the ring current from dusk to midnight and Region II FACs increase dramatically during intense substorms.