

# One-two hour scale evolution of the inner magnetospheric plasma

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# Analyses

**Where?** Inner Magnetosphere at 4~6  $R_E$  (Cluster perigee)

**Species?**  $H^+$  of 0.05 ~ 5 keV (CIS/CODIF energy range)

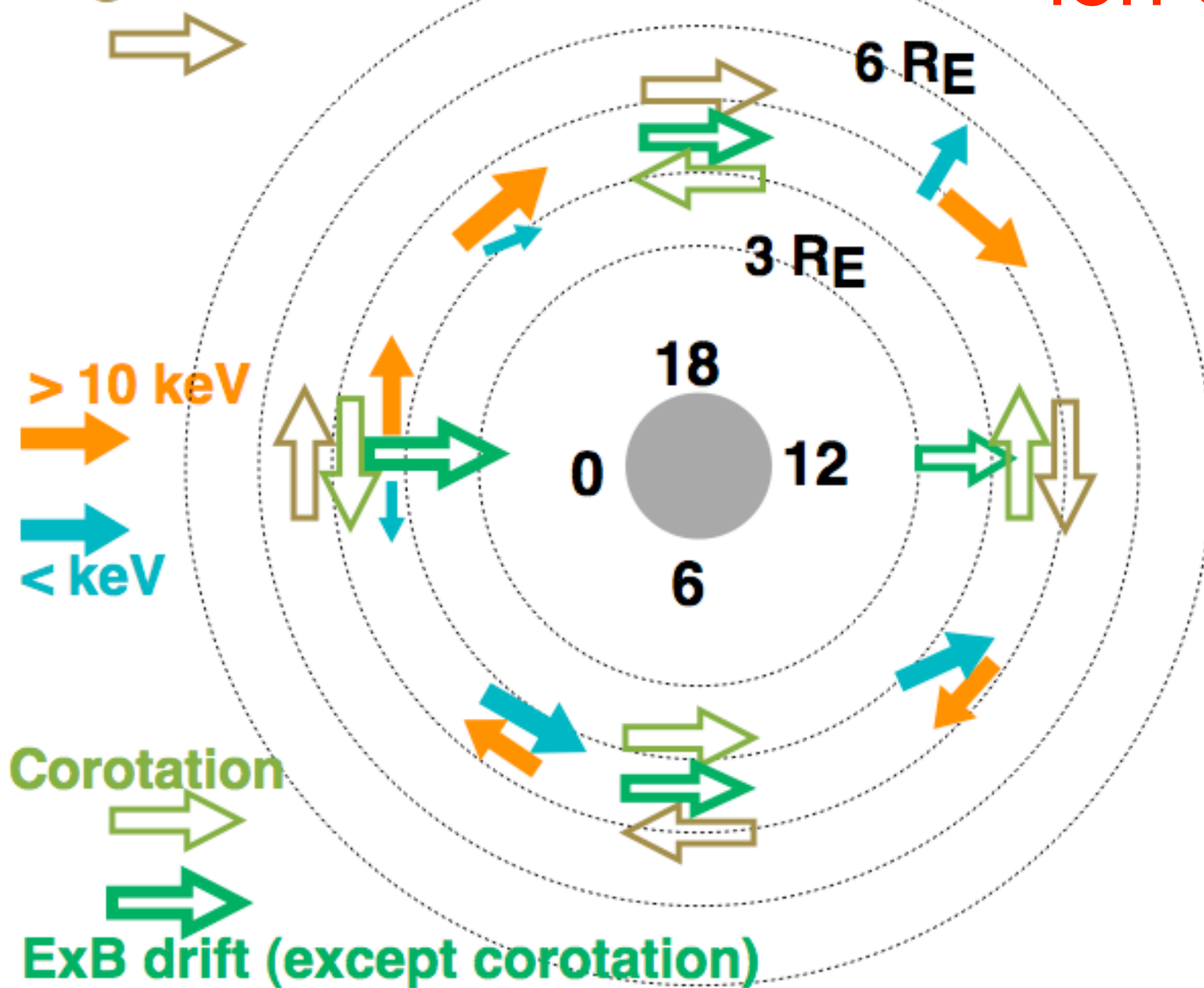
**Distribution?** **Stripes or burst structures** in E-T spectrogram

**In this work:** Inbound-outbound asymmetry as indication of **1-2 hour scale evolution/decay** (because trapped ions are normally north-south symmetric except seasonal effect due to bouncing, and Cluster traverses nearly along the same LT) that reflects “event” such as substorms.

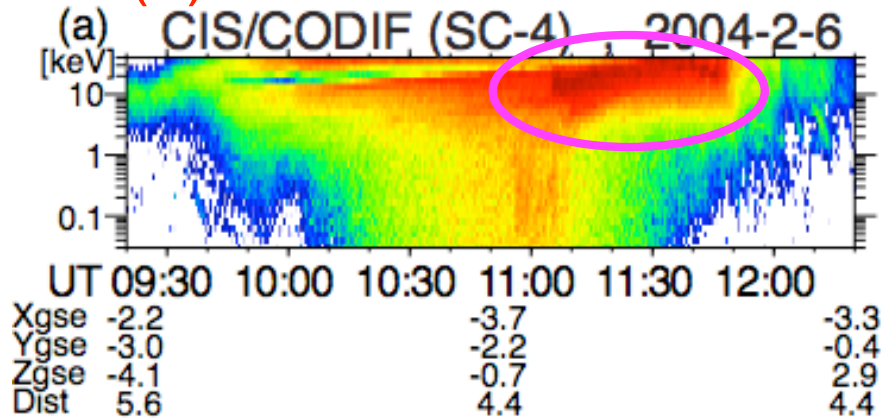
We examined all SC-4 perigee pass during 2001-2006 (about 670 traversals, with clean data of 460 traversals).

magnetic drift

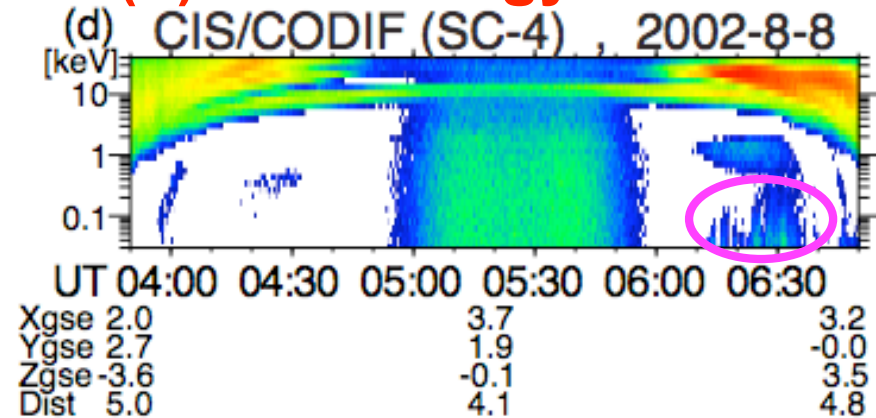
ion drift<sup>3</sup>



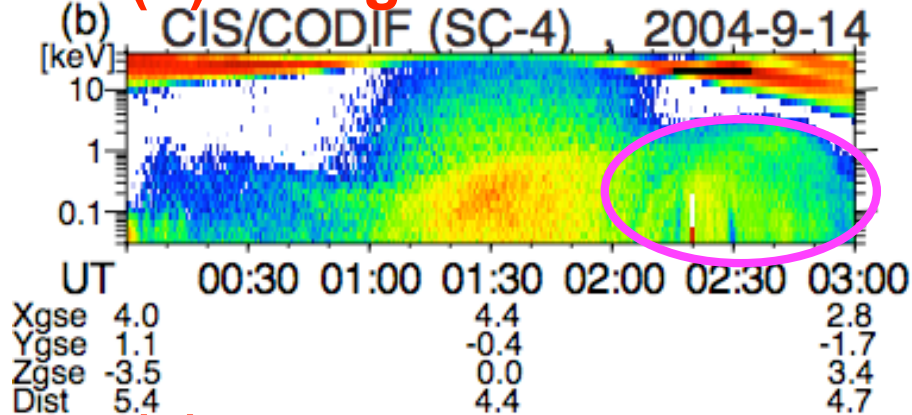
(a) Plasma sheet-like ions



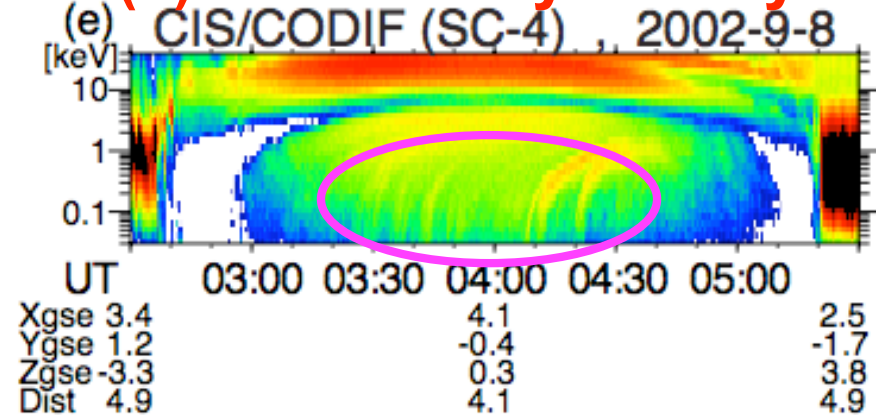
(d) Low-energy ion burst



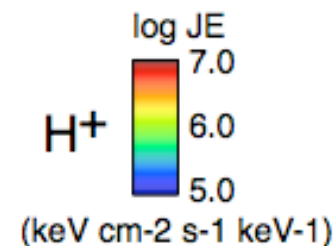
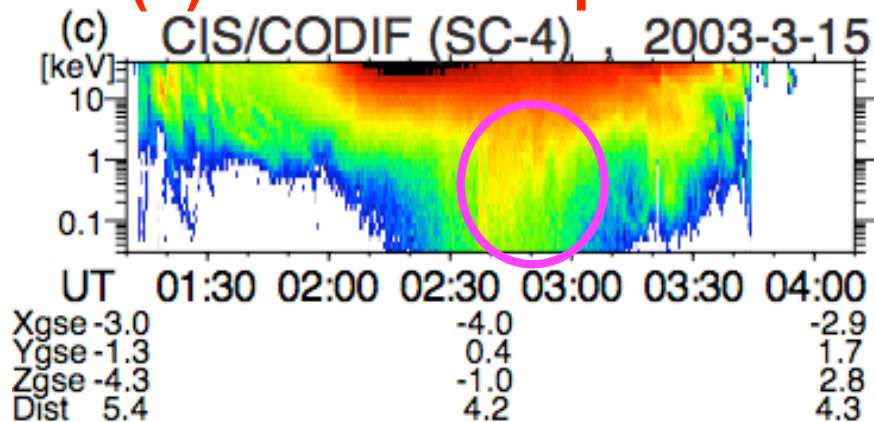
(b) Wedge-like structure



(e) Internal asymmetry of (b)



(c) Vertical stripes



Examples of  
“asymmetric”  
traversals

# We examine ion signatures of

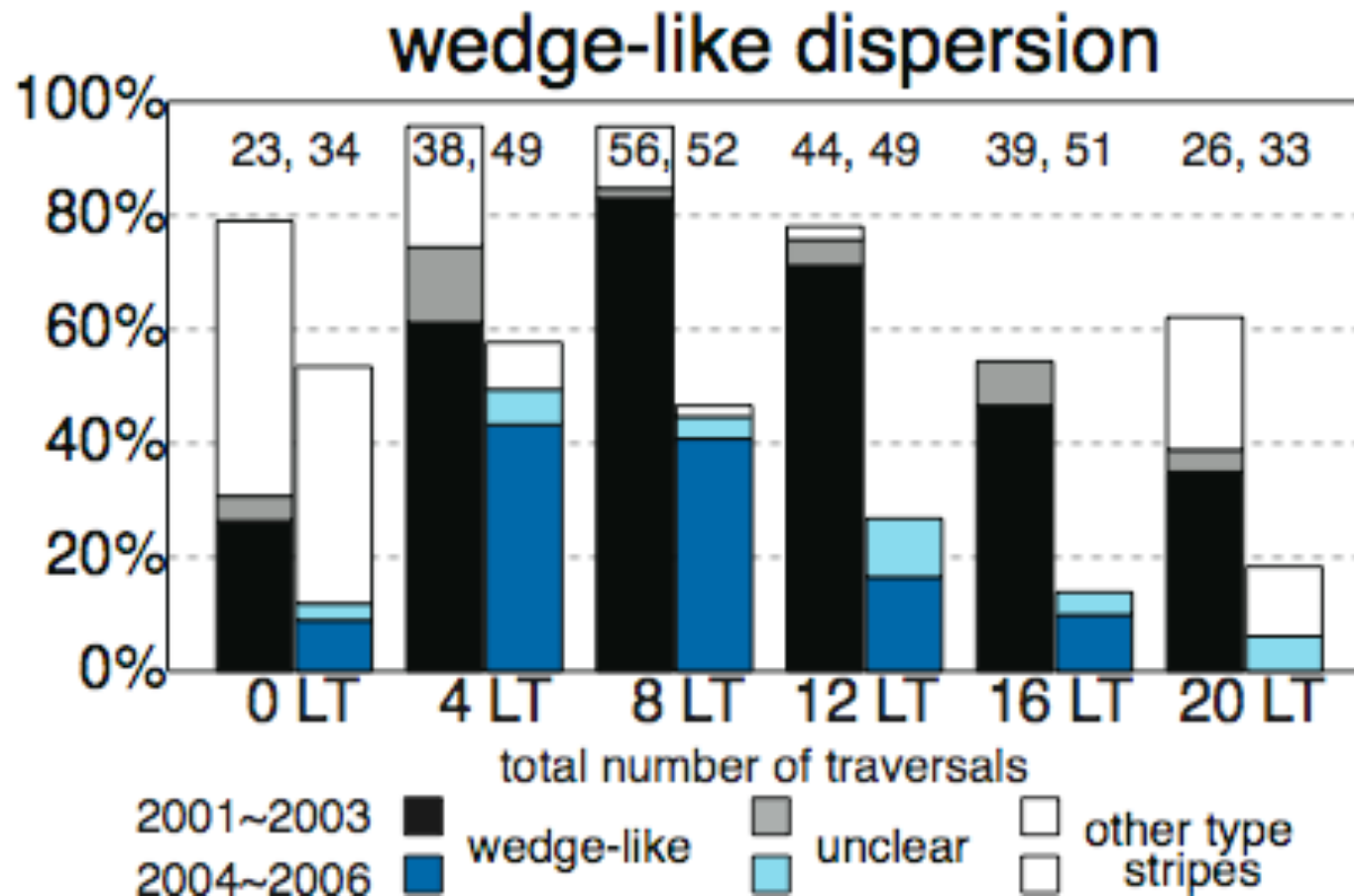
**(b) Wedge-like energy-latitude structure at sub-keV range. The energy of the source population is much lower plasma sheet, predominantly found in the morning sector some hours after a substorm.**

**(c) Vertical stripes that is similar to the wedge-like structure but dispersion is weak (nearly vertical in the spectrogram). The energy extends from the about 10 keV to sub-keV.**

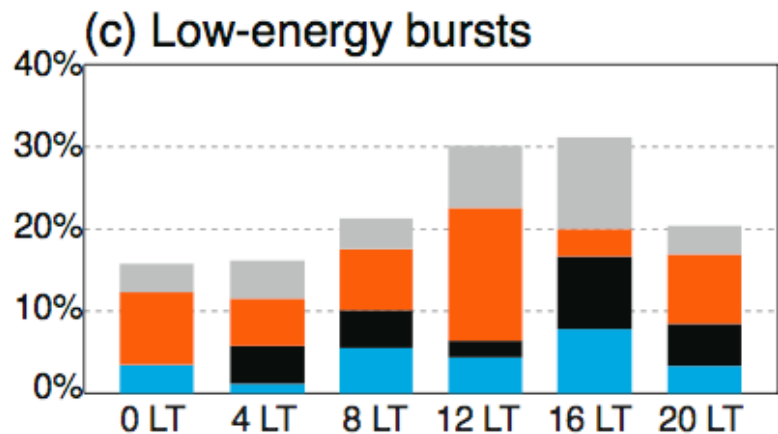
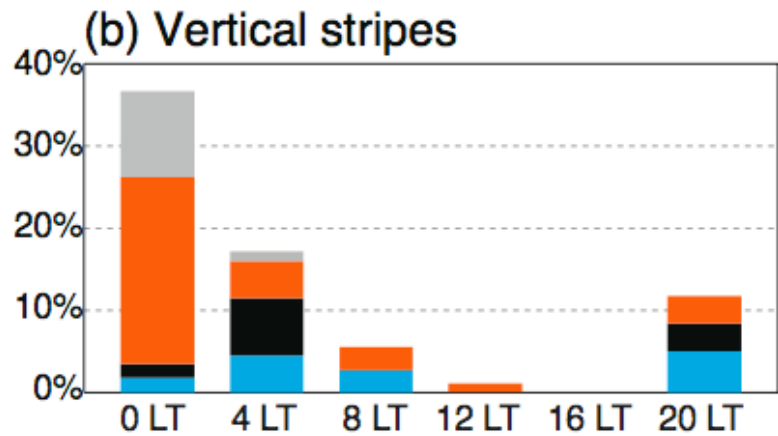
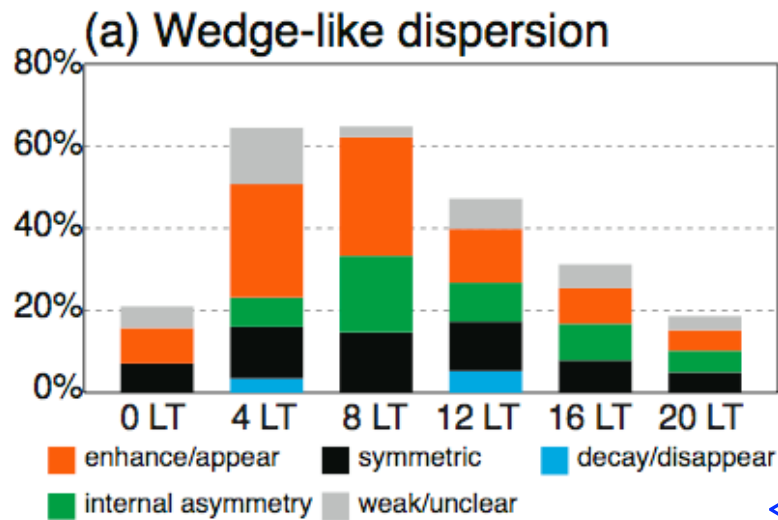
**(d) Short bursts of low-energy ions isolated from the above structures, with a peak energy flux less than 100 eV but not thermal.**

**(e) Internal asymmetry of the wedge-like structure**



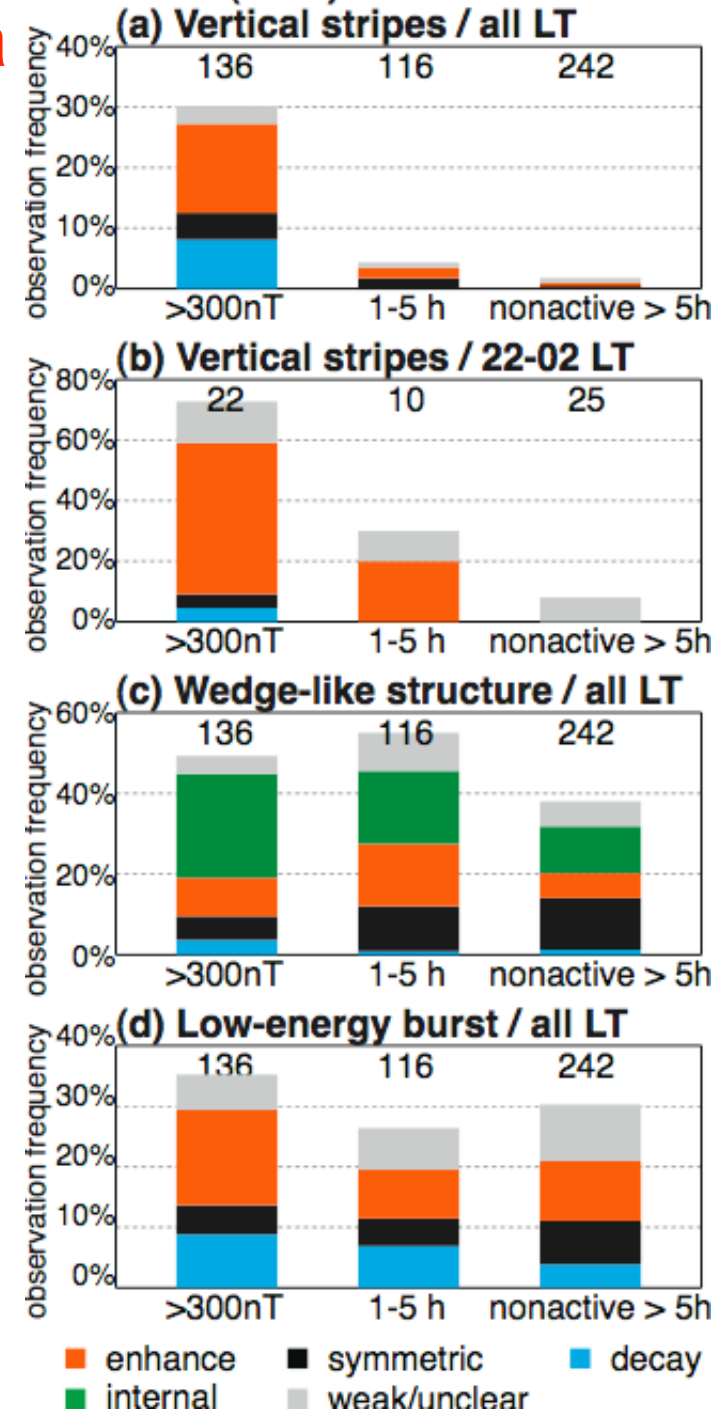


Local time distribution is not very much changed from 2001-2003 to 2004-2006 ⇒ **can safely use 2001-2006 data together.**  
 (note: there is a slight shift of the peak probability, which probably reflect the weaker E-field during substorm for 2004-2006 than 2001-2003)



# CIS/CODIF (SC-4) statistics 2001-2006

8



Relation to  
AE activities ⇒

# Summary

Three basic energy-latitude patterns of ions in the sub-keV range:

- (1) Wedge-like energy-latitude dispersed structure ( $< \text{a few keV}$ ),
- (2) Vertical stripes ( $< 10 \text{ keV}$ ),
- (3) Short-lived low-energy ion ( $< \text{few hundred eV}$ ).

- Asymmetric cases are found more often than symmetric cases at almost all LT for all three patterns.
- High rate of asymmetry at local midnight for (2).
- No LT preference of asymmetry for (1) and (3).
- Clear relation to AE (AL) for (2).

Significant changes within 1-2 hours in the inner magnetospheric ion populations, and short lifetime of the low-energy bursts of about 1 hour or less.

For (1) and (2), Relation with AE is the clearest when we set the threshold value of AL -300 nT instead of -200 nT or -400 nT