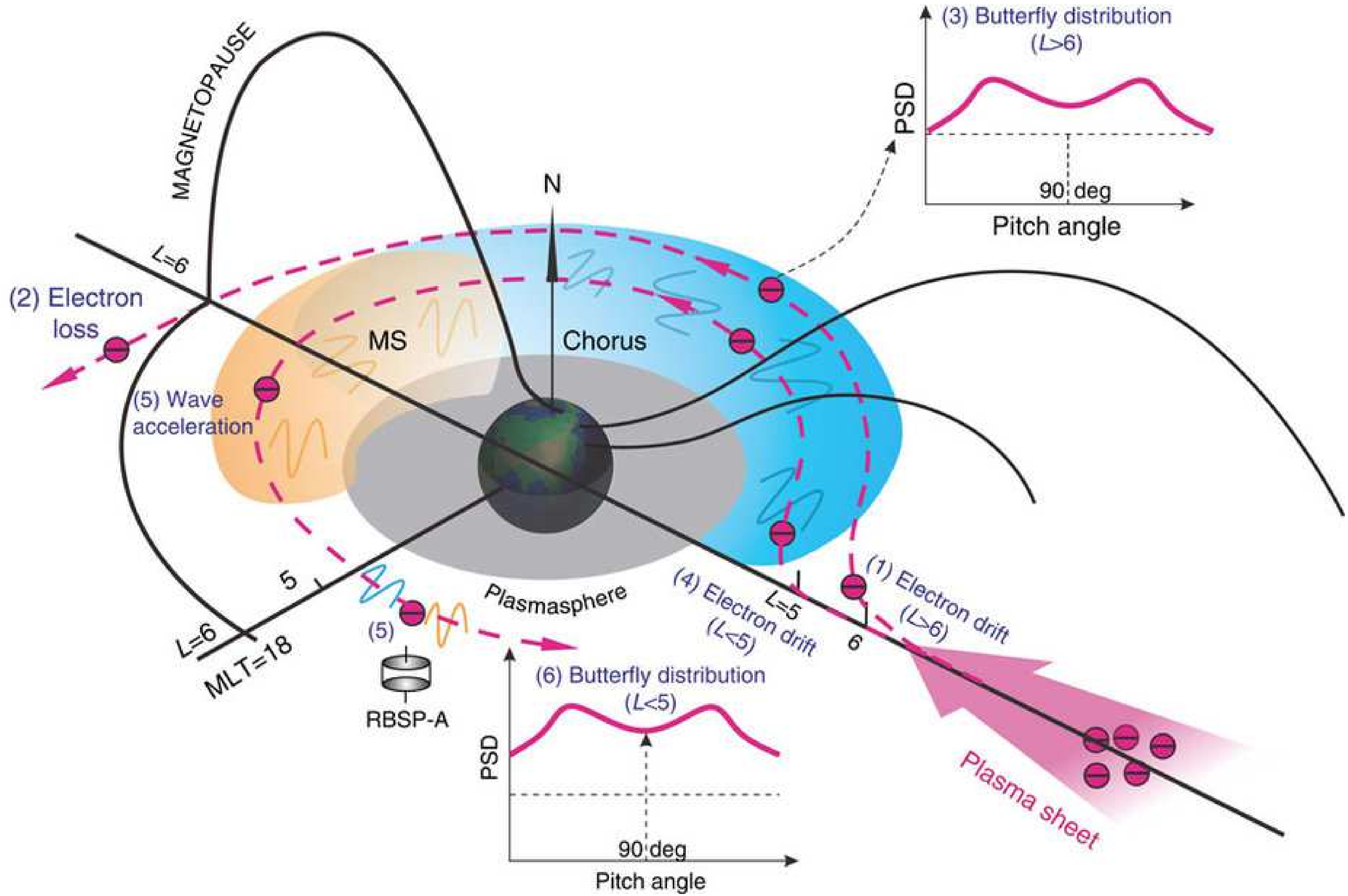
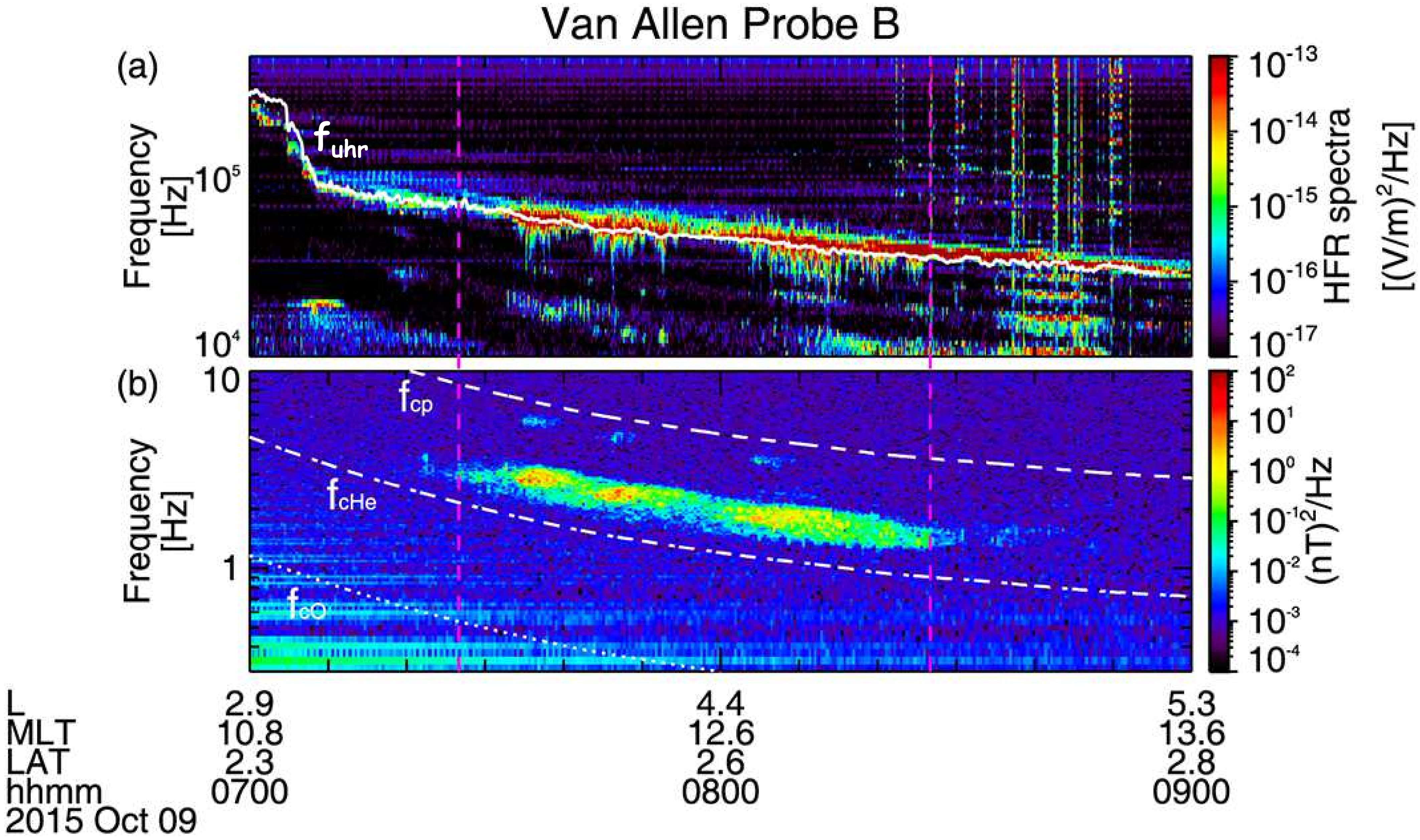


Relativistic electrons originating from the plasma sheet azimuthally drift eastward around Earth. (1) Higher pitch angle electrons at L>6 drift to larger radial distance beyond the dayside magnetopause and are consequently lost due to the day-night magnetic field asymmetry (2), yielding the regular butterfly distribution (3). (4) Electrons at L<5 drift inside the magnetosphere without loss to the dayside magnetopause because of a very small day-night magnetic field asymmetry, continuously resonating with chorus and MS waves. (5) Wave acceleration can enhance electron PSD primarily within the medium pitch angles, leading to the formation of the unusual butterfly distribution (6).

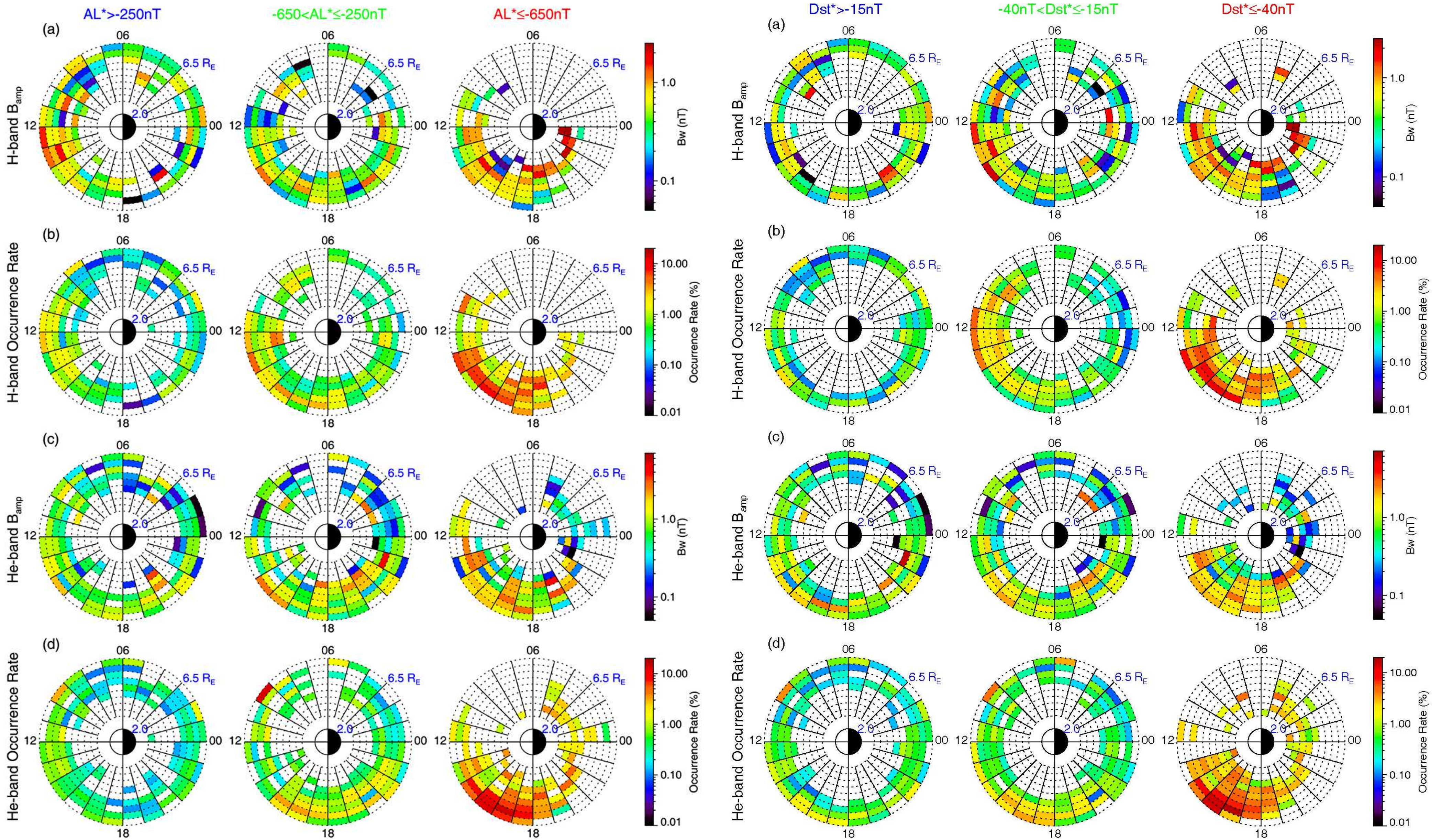
http://www.nature.com/articles/ncomms9590

Electromagnetic Ion Cyclotron Waves (EMIC, <1–2 Hz) are discrete electromagnetic emissions, which occur in distinct frequency bands separated by multiple ion gyrofrequencies. The EMIC source region is typically confined within ≈10 degrees of the geomagnetic equatorial plane. EMIC waves are enhanced during magnetic storms, as anisotropic energetic ring current ions are injected into the inner magnetosphere. EMIC waves can cause rapid scattering and loss for ring current ions and relativistic electrons above 0.5 MeV. Favored regions for EMIC excitation include the overlap between the ring current and the plasmasphere, dayside drainage plumes, and the outer dayside magnetosphere in association with solar wind pressure fluctuations. Resonant pitch-angle scattering and ultimate precipitation of ring current protons by EMIC waves in dayside plasmaspheric plumes has been directly associated with observations of detached sub-auroral proton arcs. EMIC waves can also cause the resonant scattering of relativistic electrons leading potentially to rapid loss during the main phase of a storm. However, such scattering only occurs at geophysically interesting energies (~MeV) when EMIC waves are excited in regions of high plasma density and have significant power at frequencies just below the He+ gyrofrequency.

http://onlinelibrary.wiley.com/doi/10.1029/2010GL044990/full http://link.springer.com/article/10.1007/s11214-013-9993-6

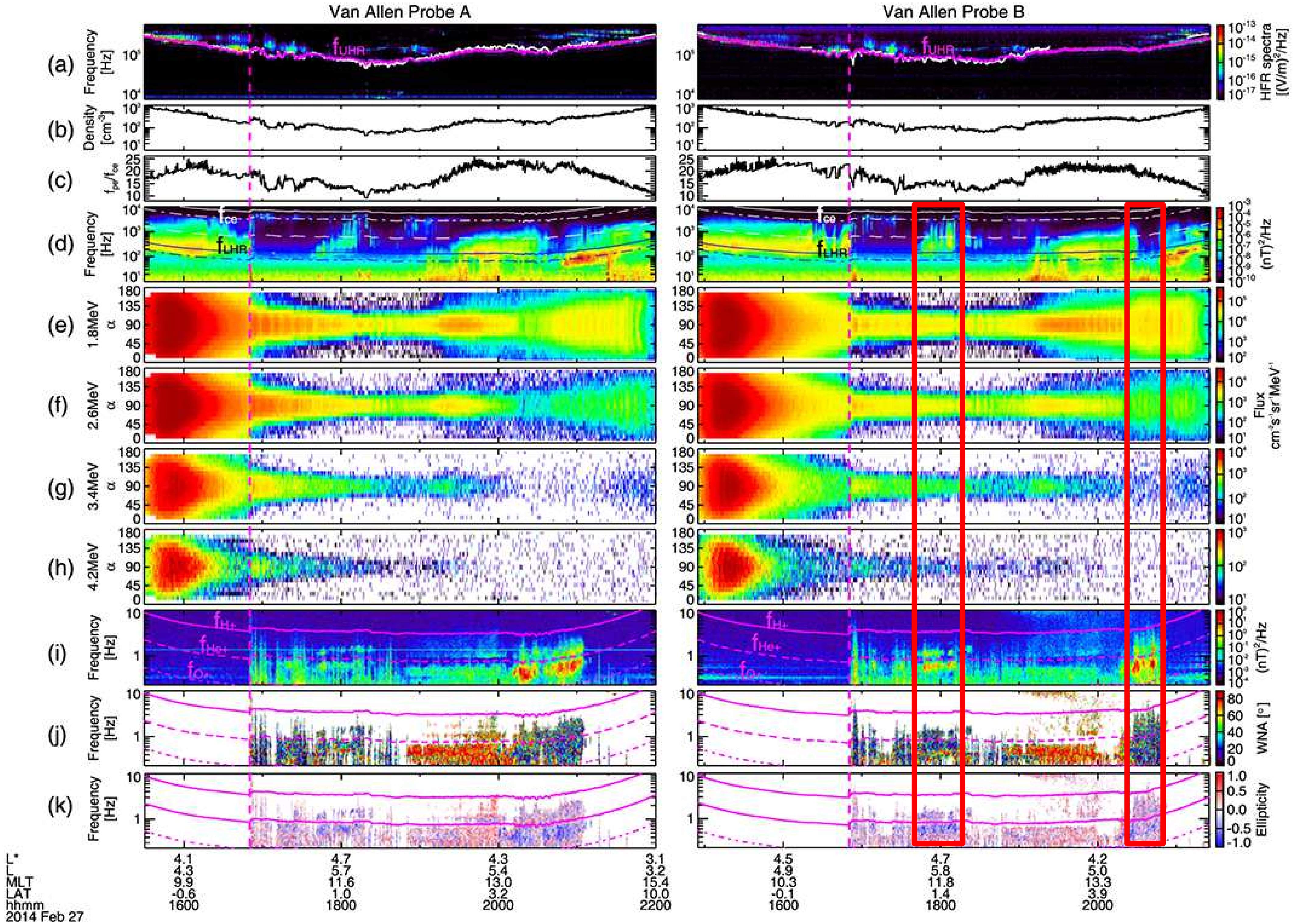


http://onlinelibrary.wiley.com/doi/10.1002/2016GL071158/full

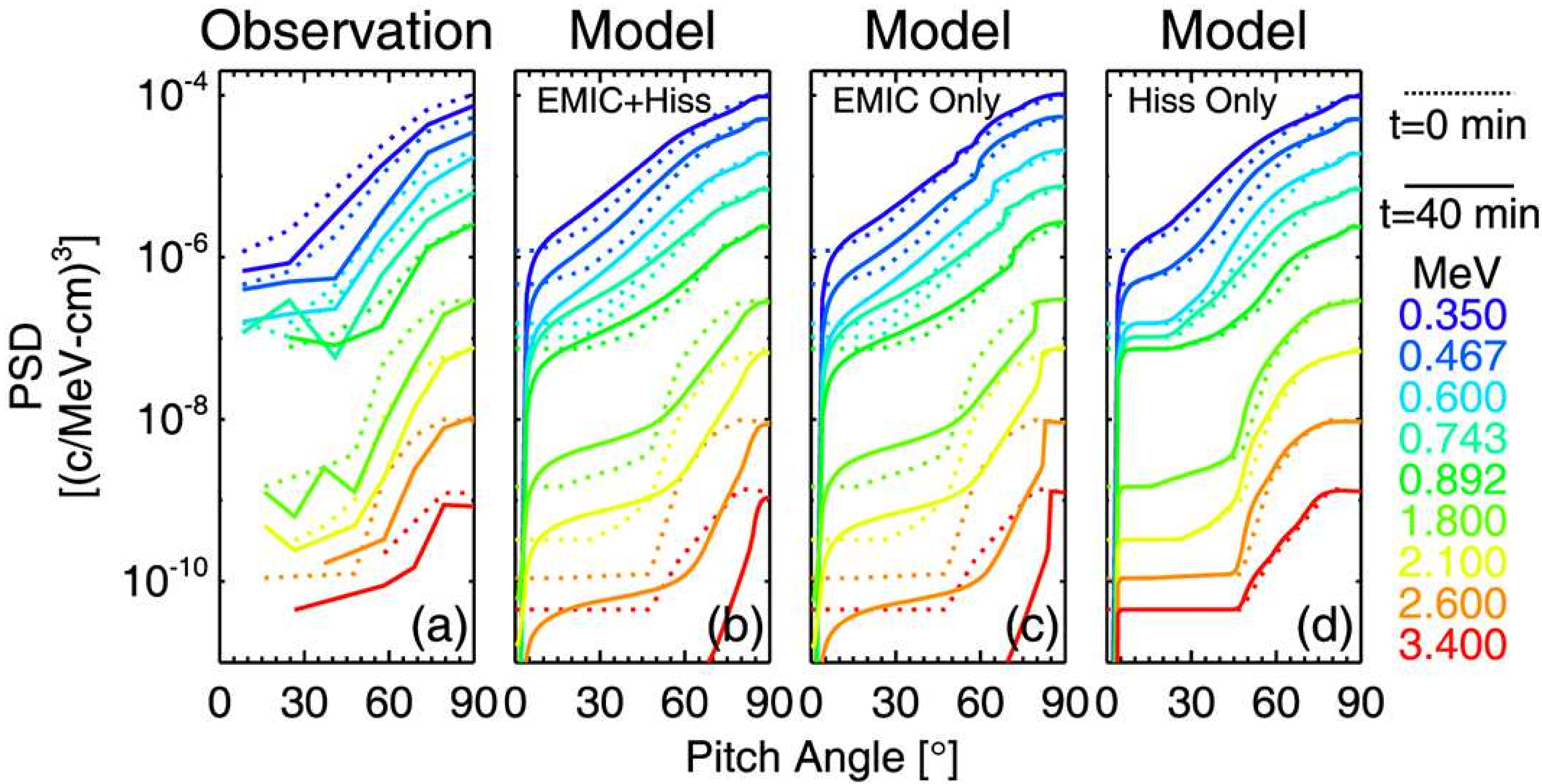


Stronger EMIC waves are captured with increasing substorm (AL*) or storm (Dst*) activity levels. In addition, the occurrence rate distribution exhibits a clear peak in the postnoon to dusk sector (1300<MLT<1900) during active times.

http://onlinelibrary.wiley.com/doi/10.1002/2016GL071158/full



http://onlinelibrary.wiley.com/doi/10.1002/2016JA022521/full

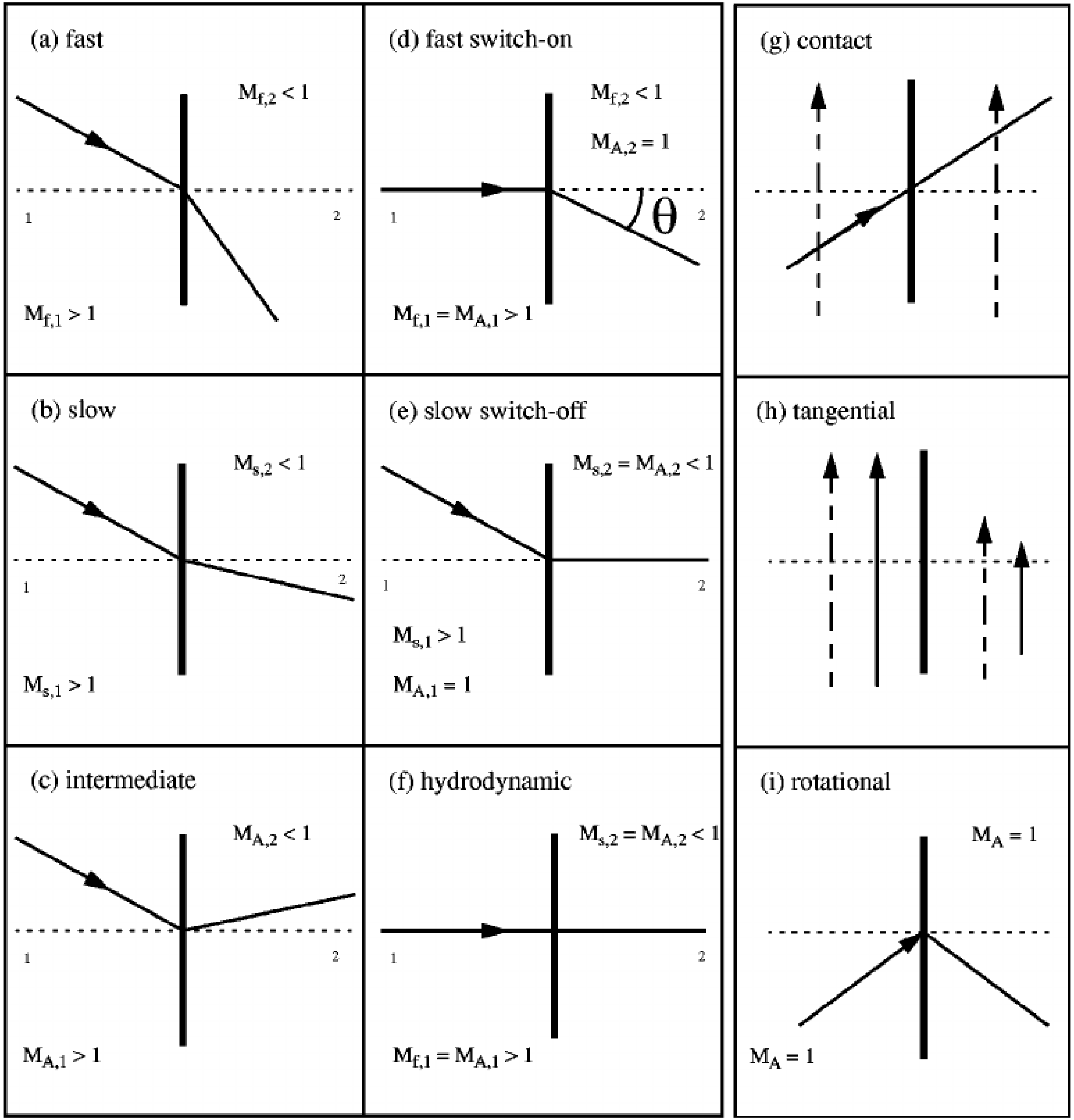


By comparing model results with local observations of pitch angle distributions, the results show direct, quantitative evidence of EMIC wave-driven relativistic electron losses in the Earth's outer radiation belt.

http://onlinelibrary.wiley.com/doi/10.1002/2016JA022521/full

$[u_n] \neq 0$, $[S] > 0$, $[u] < 0$, $[\rho] > 0$, $[P] > 0$

$[u_n] = 0$



De Sterck et al. (1998)

$u_n = 0$, $B_n \neq 0$

$[\rho] \neq 0$, $[T] \neq 0$

$u_n = 0$, $B_n = 0$

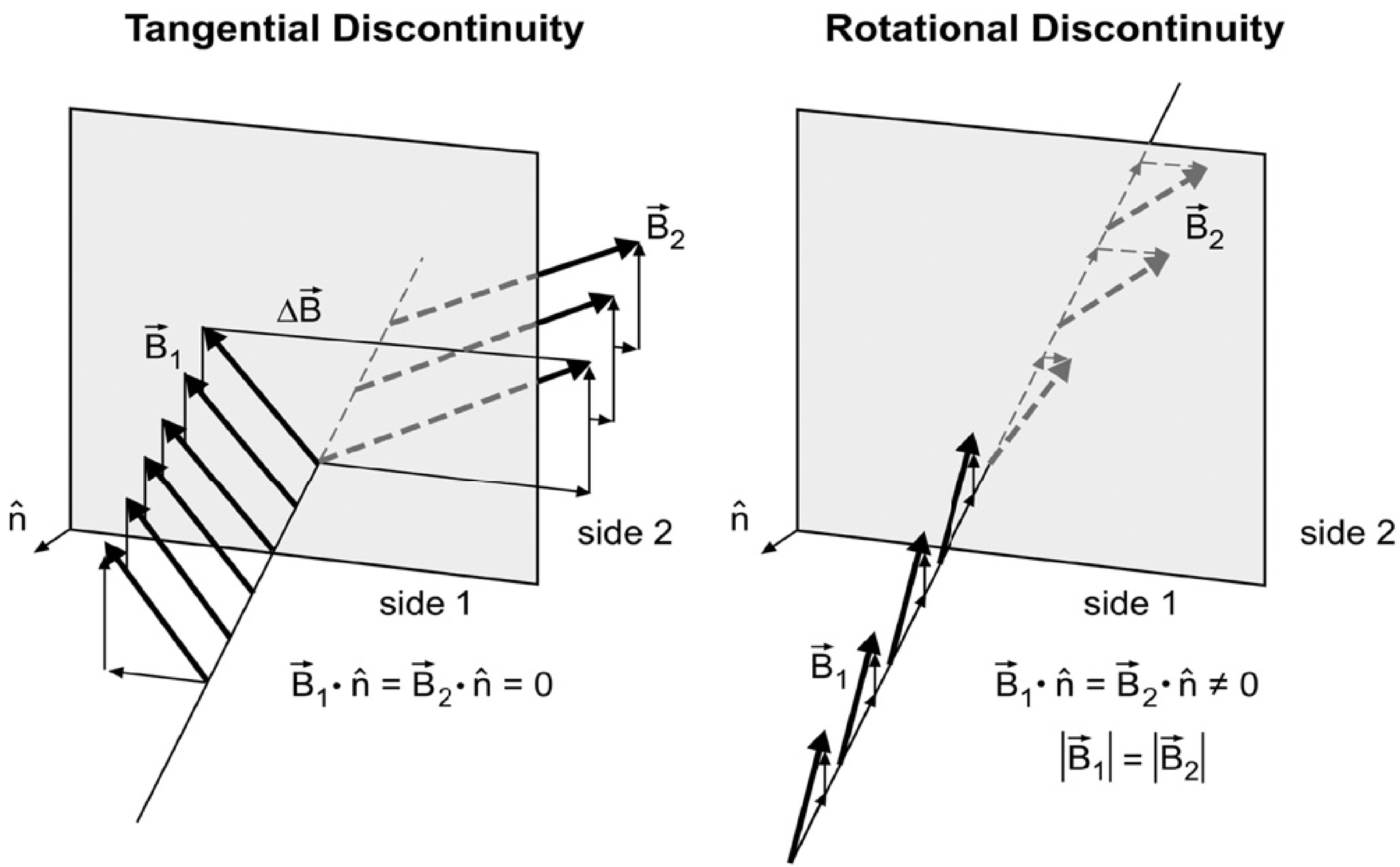
$$\left[P + \frac{B^2}{2\mu_0} \right] = 0$$

$u_n \neq 0$, $B_n \neq 0$

$$u_n = \frac{B_n}{\sqrt{\mu_0 \rho}}$$

$$\Delta \vec{u} = \pm \frac{\Delta \vec{B}}{\sqrt{\mu_0 \rho}}$$

Walén relation



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