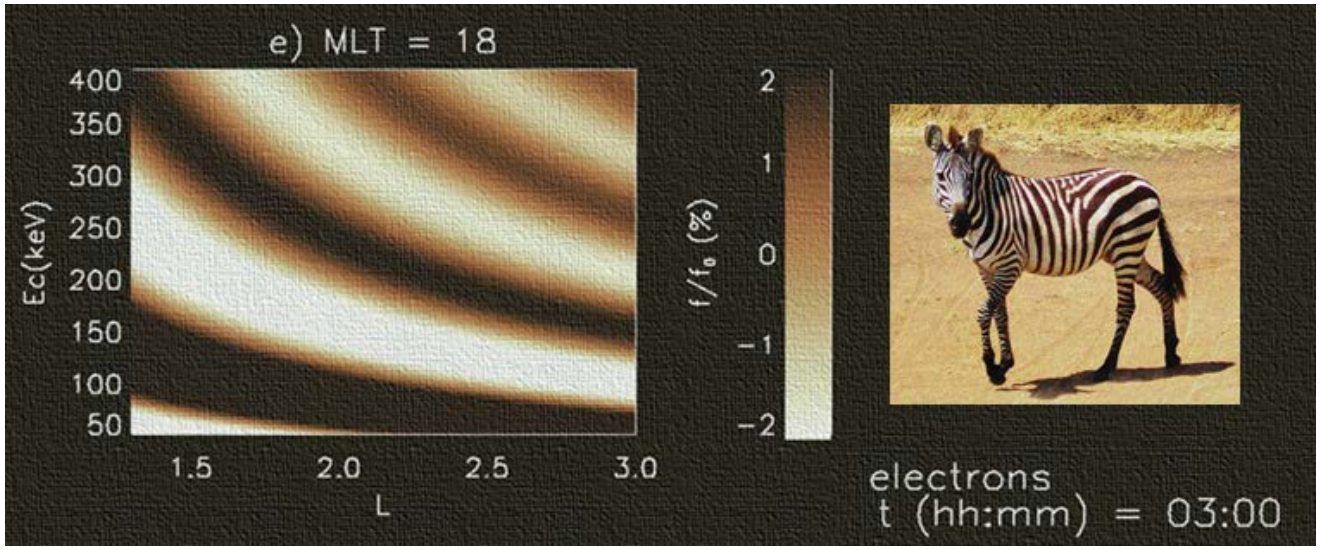
This is not a talk about the zebra stripes

This is not a zebra stripe.



Here are some zebra stripes.

The **"zebra stripes"** are structured peaks and valleys that have been reported in the spectrograms of energetic electrons [*Imhof and Smith*, 1965] and ions [*Williams and Frank*, 1984] trapped in the inner belt below L~3.

Different theories for the generation of the zebra stripes rely on **different *ad hoc* DC electric field models**.

In particular, [*Lejosne and Roederer*, 2016] introduced the idea **that high-altitude ionosphere winds** modulate the electric drift ExB/B^2 and ultimately affect the azimuthal distribution of radiation belt intensity.

About the quiet-time ionosphere dynamo

Because thermospheric neutral winds interact with the electrically conducting ionosphere, some electric fields and currents are generated (by **dynamo mechanism**).

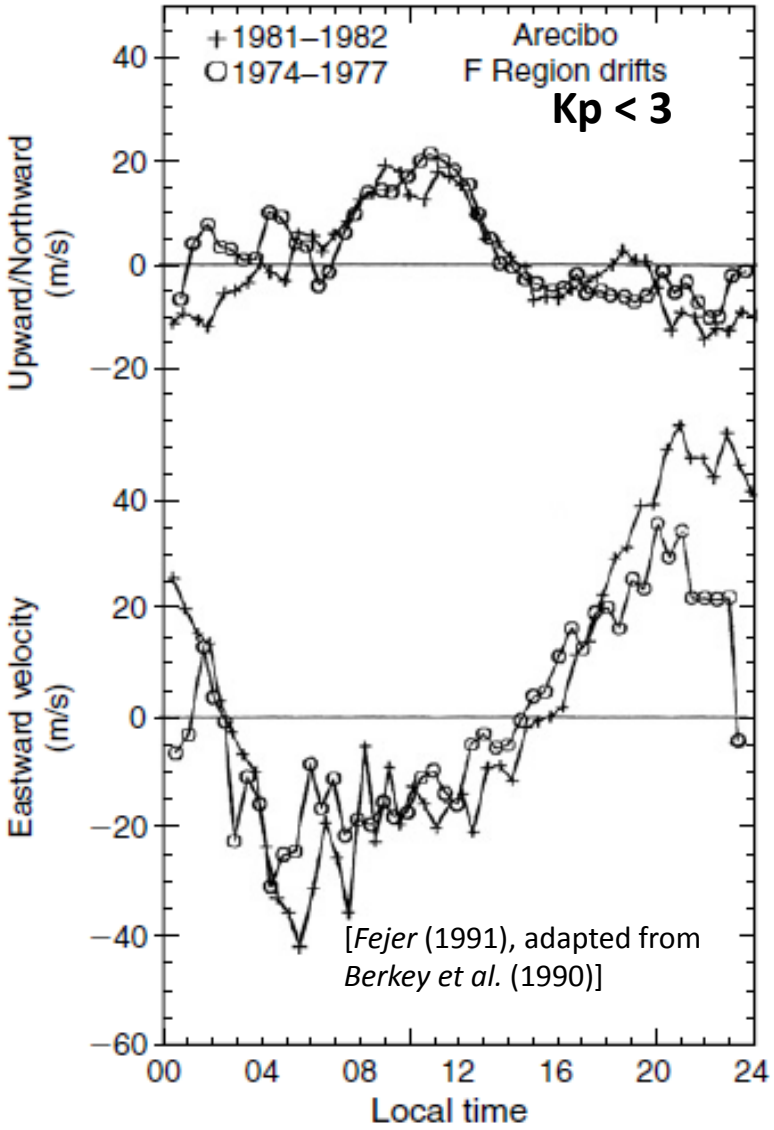
The corotational electric field model assumes:

1. Bfield = **Earth-centered** **rotation-aligned** magnetic dipole
   (ie no ~11° tilt - no offset - no multipoles)

2. an ionosphere being pushed into **corotation** with the Earth
   (ie no ionosphere dynamo)

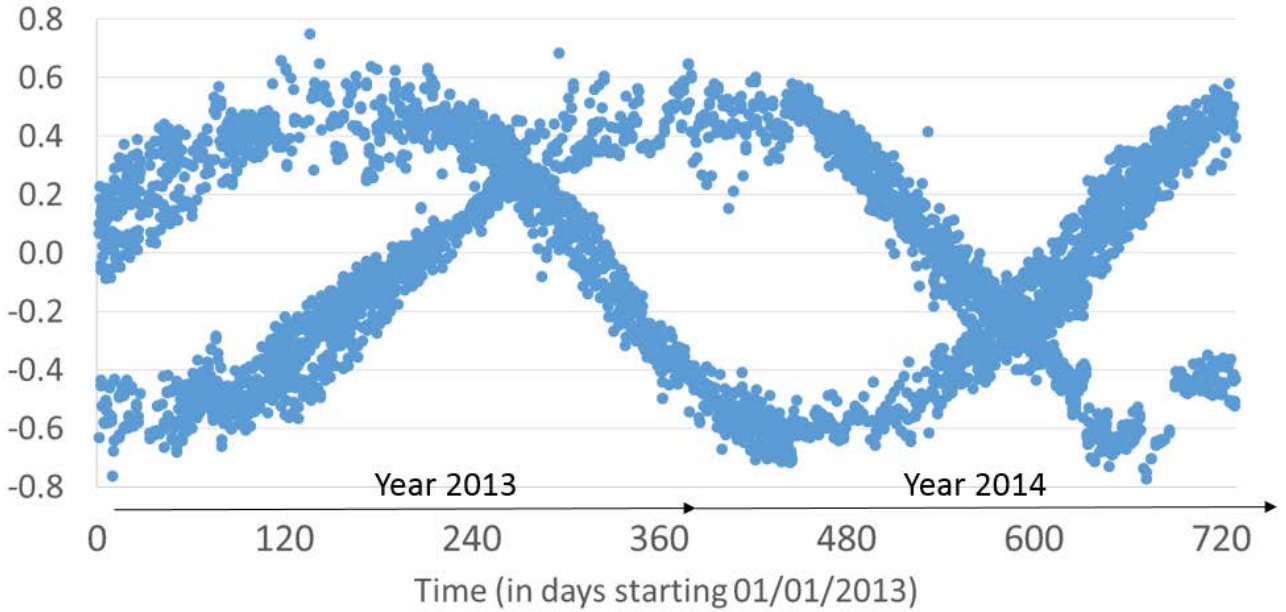
3. equipotential magnetic field lines
   (so that the electric field is transmitted to space).

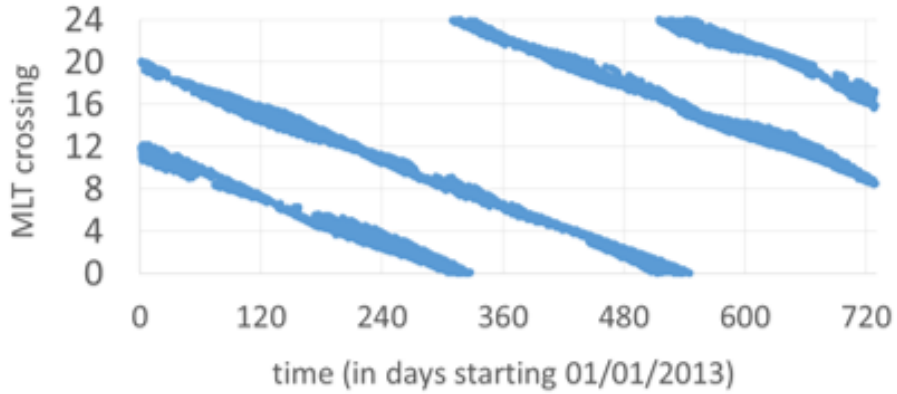
But the ionospheric plasma does NOT exactly corotate with the Earth.



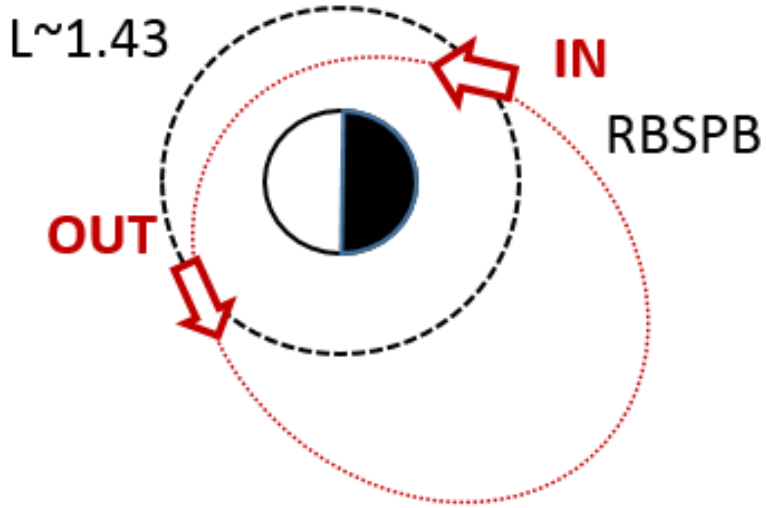
F-region average plasma drifts over Arecibo (L~1.4)

We have analyzed 2 years of ExB/B^2 measurements by RBSP B at Arecibo's L = 1.4





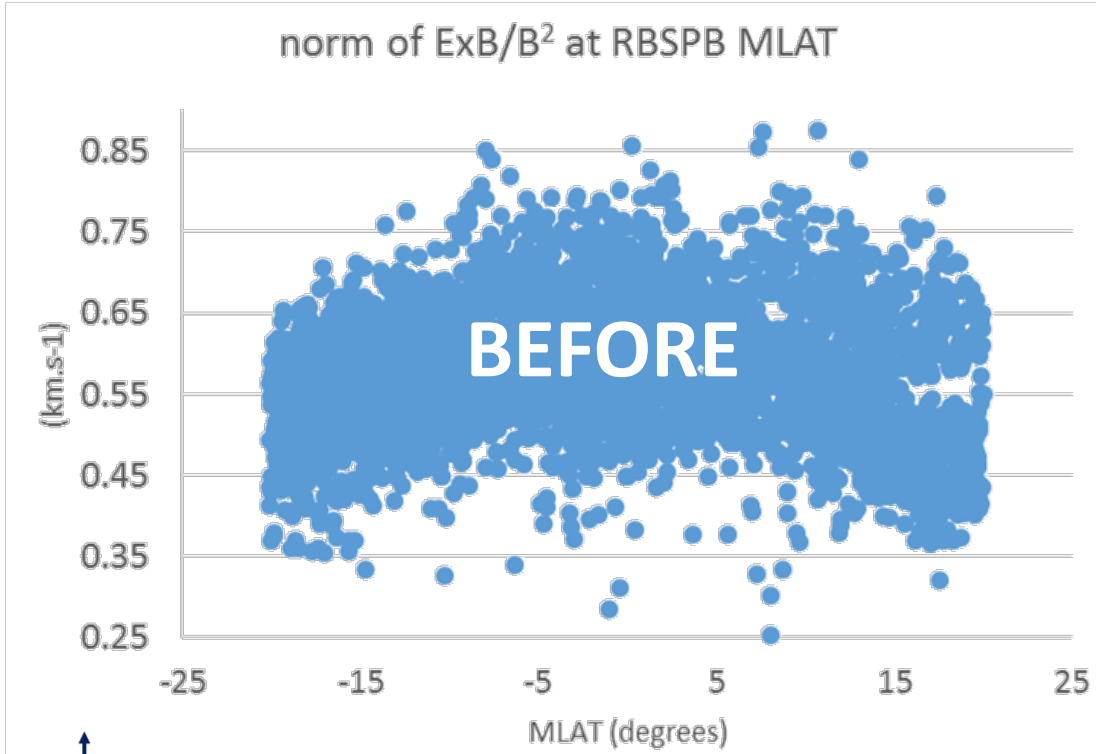
2 years of ExB / B^2 by Van Allen Probe B (GSE X component – Earth/Sun Line). The inbound and outbound crossings are slowly drifting in MLT.

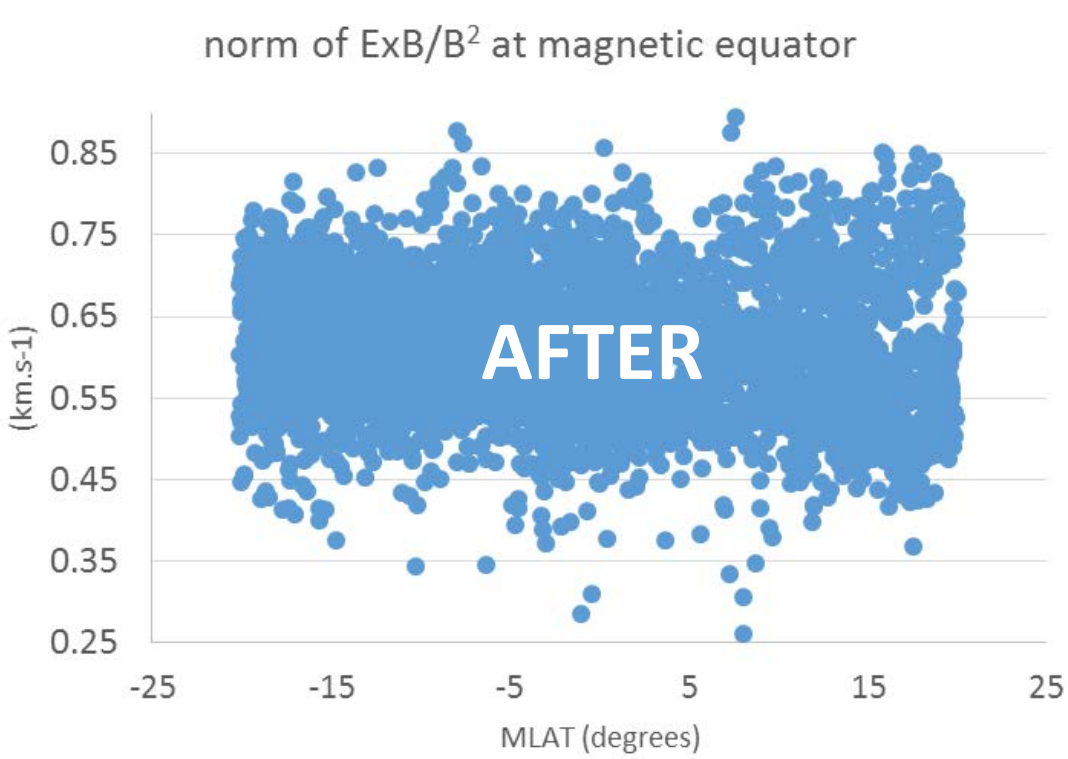


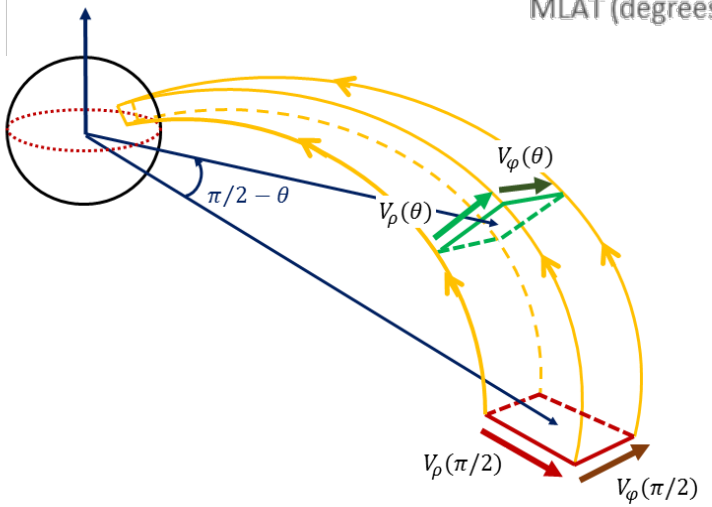
DATA Processing:

- **Shorting factor set to 1** (high density thus short Debye length)
- **E// = 0**
- **Angular corrections** for the magnetometer axes ($\Delta u = -0.035^0$, $\Delta v = 0.08^0$ and $\Delta w = 0.8^0$, where w is the axial component)

We projected the measurements at the magnetic equator



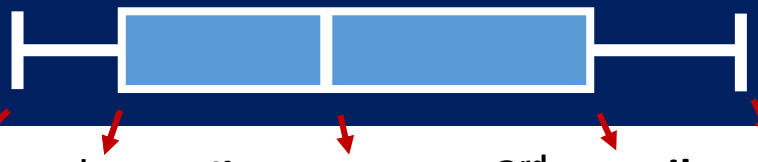


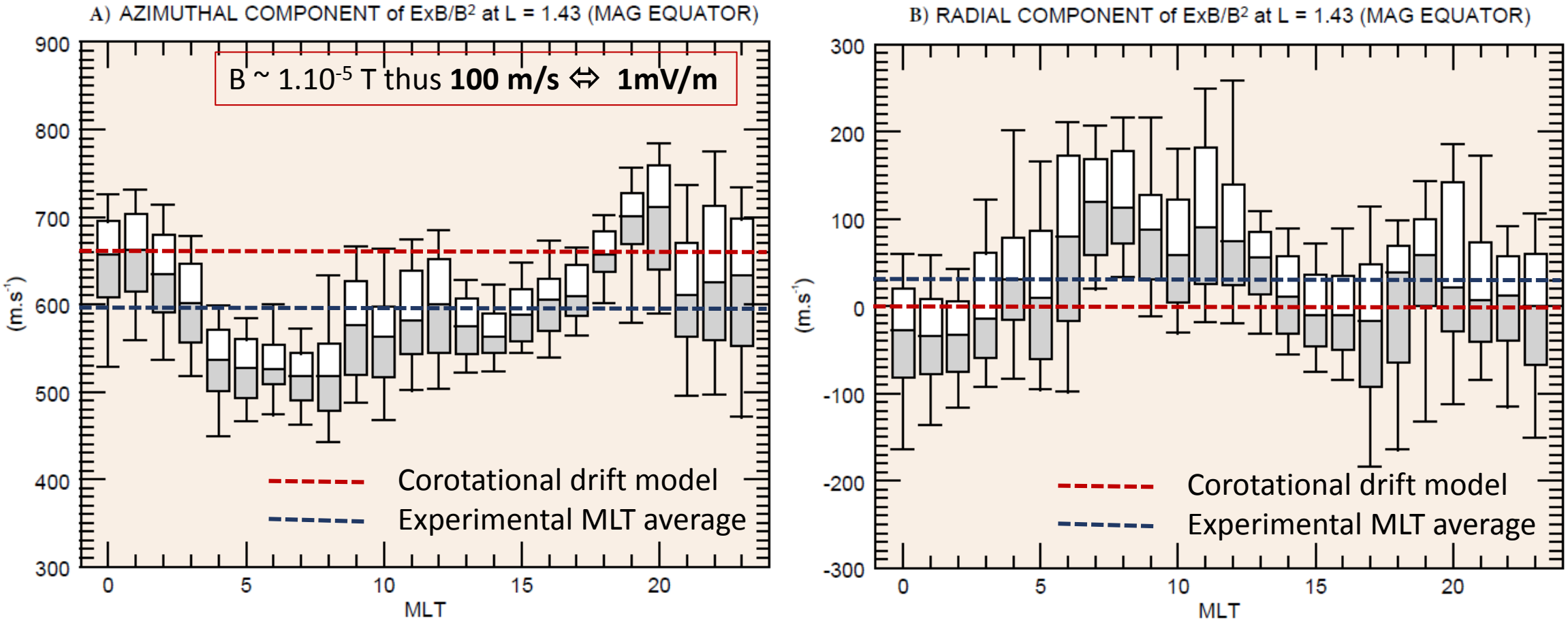


We applied amplification factors as a function of MLAT (derived assuming equipotential dipolar field lines).

$$V_\varphi(\pi/2) = \frac{V_\varphi(\theta)}{sin^3\theta} \qquad V_\rho(\pi/2) = \frac{\sqrt{1+3\cos^2\theta}}{\sin^3(\theta)} V_\rho(\theta)$$

Here are the results

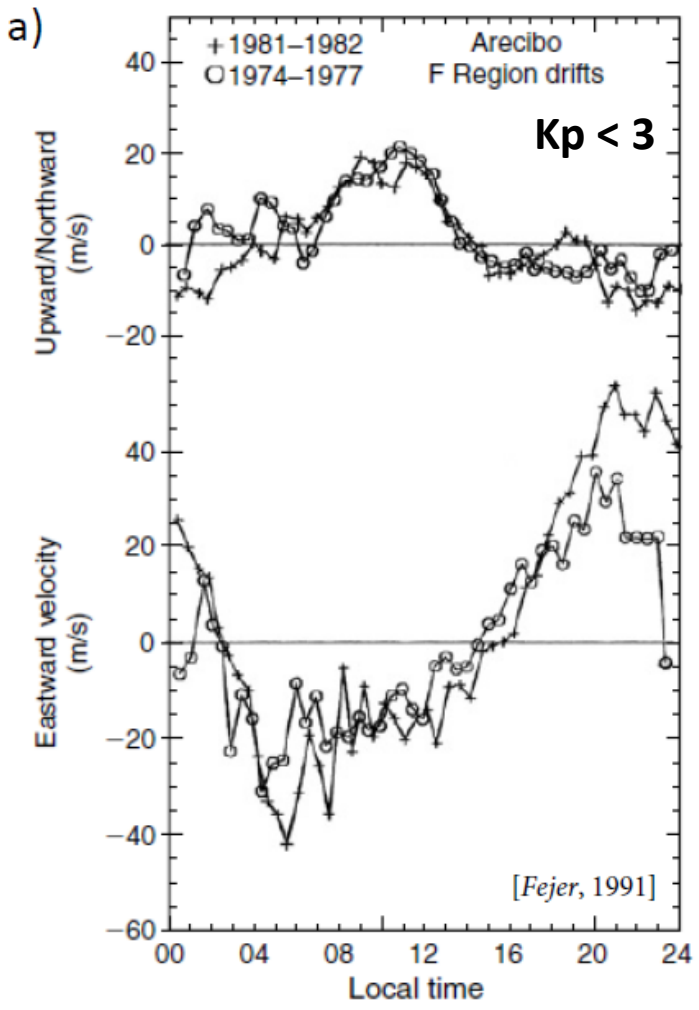


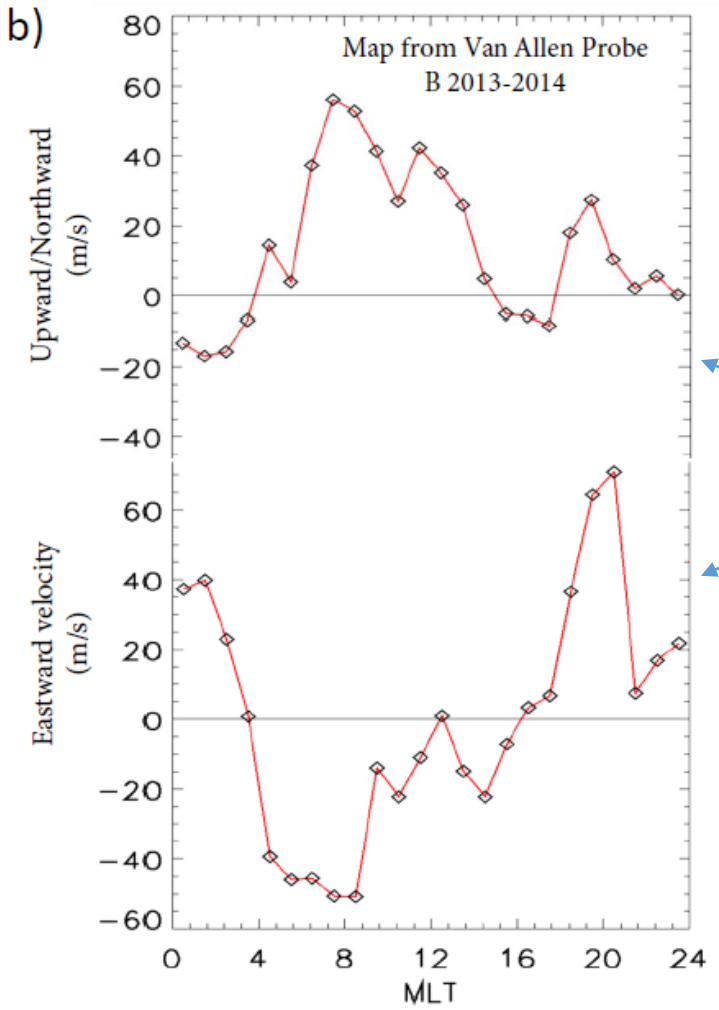


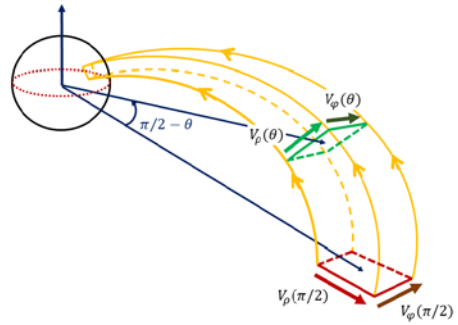
Amplitudes of the equatorial **ExB**/B² at Arecibo's L coordinate in the azimuthal (a) and radial (b) directions.

(adapted from [*Lejosne and Mozer*, Van Allen Probe measurements of the electric drift $\mathbf{E} \times \mathbf{B}/\mathrm{B}^2$ at Arecibo's L=1.4 field-line coordinate, under review GRL])

We compared the MLT trends with Arecibo's ISR measurements







80+% of the measurements were sampled during geomagnetically quiet times ($Kp \leq 2$)

A comparison of the average drifts over Arecibo during solar minimum and solar maximum from [*Fejer,* 1991] (a) with the average drifts mapped up to the ionosphere from Van Allen Probe measurements (b). (adapted from [*Lejosne and Mozer*, under review GRL])

Conclusions and perspectives

We report on departures from the traditional picture of corotational motion with the Earth in 2 ways:

(1) Rotational angular speed found = 10% smaller than the rotational angular speed of the Earth (in agreement with previous works on plasmaspheric notches…)

(2) the quiet-time equatorial electric drift displays a dependence in MLT, with a pattern consistent with the mapping of the Arecibo ionosphere dynamo electric fields along equipotential magnetic field lines.

The electric fields due to the ionosphere dynamo are therefore expected to play a significant role when discussing for instance the structure and dynamics of the plasmasphere or the transport of trapped particles in the inner belt.

It would for example explain why **radial diffusion coefficients** in the inner belt do not display the same ~ L^{10} dependence as the outer belt diffusion coefficients.

Future work:
Extend the analysis of ExB/B^2 measurements to the entire inner belt region (below L~3)
Perspectives:
DLLs, zebra stripes, plasmasphere models, you name it!

Acknowledgments: Jack Vernetti, UCB team, RBSP-EFW, RBSP-EMFISIS, THEMIS