LASP
Laboratory for Atmospheric and Space Physics
University of Colorado **Boulder**

Applied Mathematics
UNIVERSITY OF COLORADO **BOULDER**

From Van Allen Probes E & B Measurements to Radial Diffusion Coefficients

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RBSP Data

- RBSP EMFISIS B-field Data
  - Level 3 CDF files
  - 4 second resolution (decreased to 12 second)
- RBSP EFW E-field Data
  - Level 2 Spinfit CDF files
  - mGSE coordinates
  - 12 second resolution
- RBSP Ephemeris from LANL
  - 5 minute resolution
  - Interpolated to the desired higher resolution
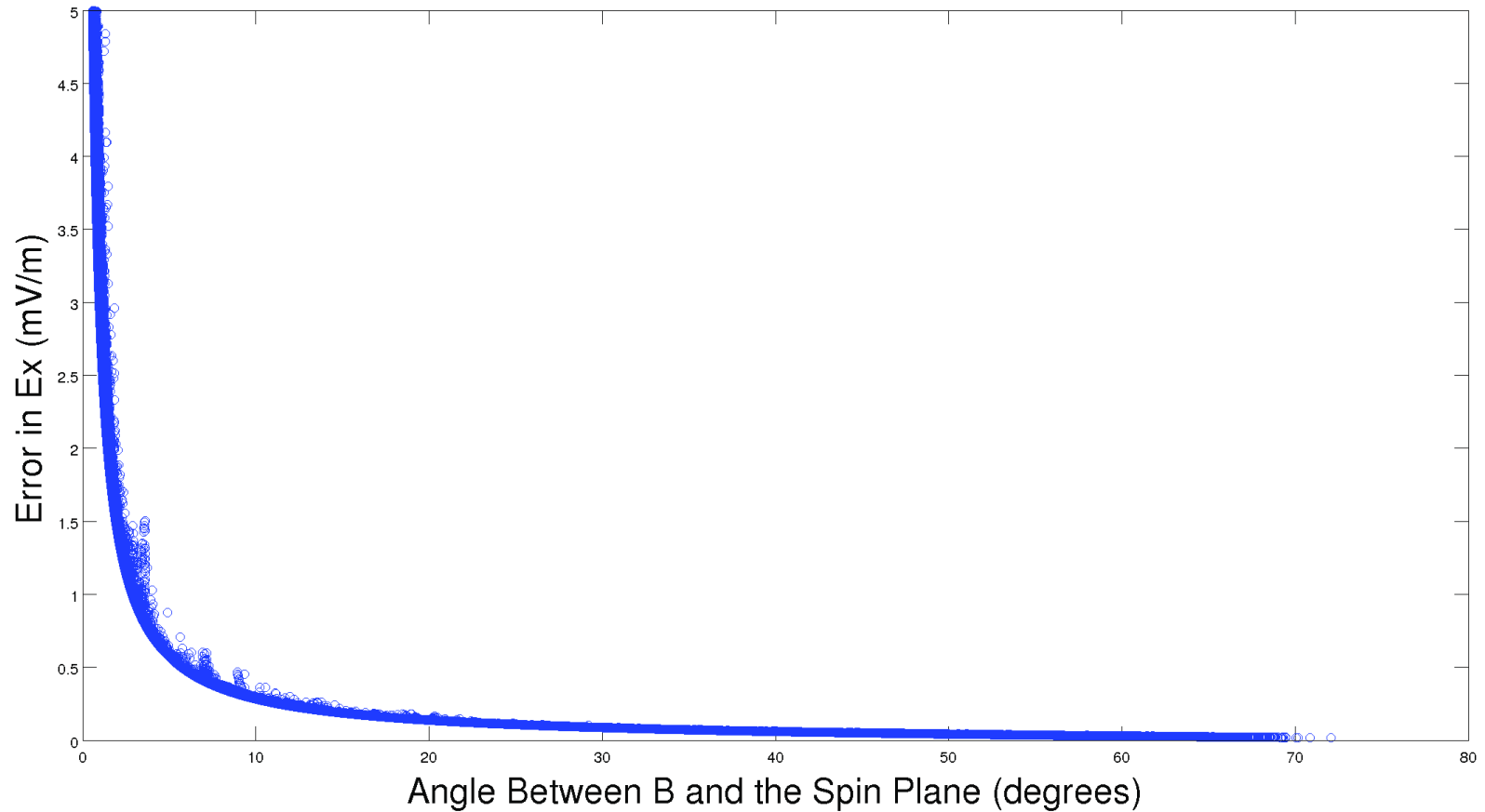- September 2012 to November 2014

Magnetic Field Data

- Data with L* < 2.5 is deleted

- Despiked and cleaned

- Remove thruster firing events

- Use a low-pass digital filter to estimate the background trend

- Compute the compressional component

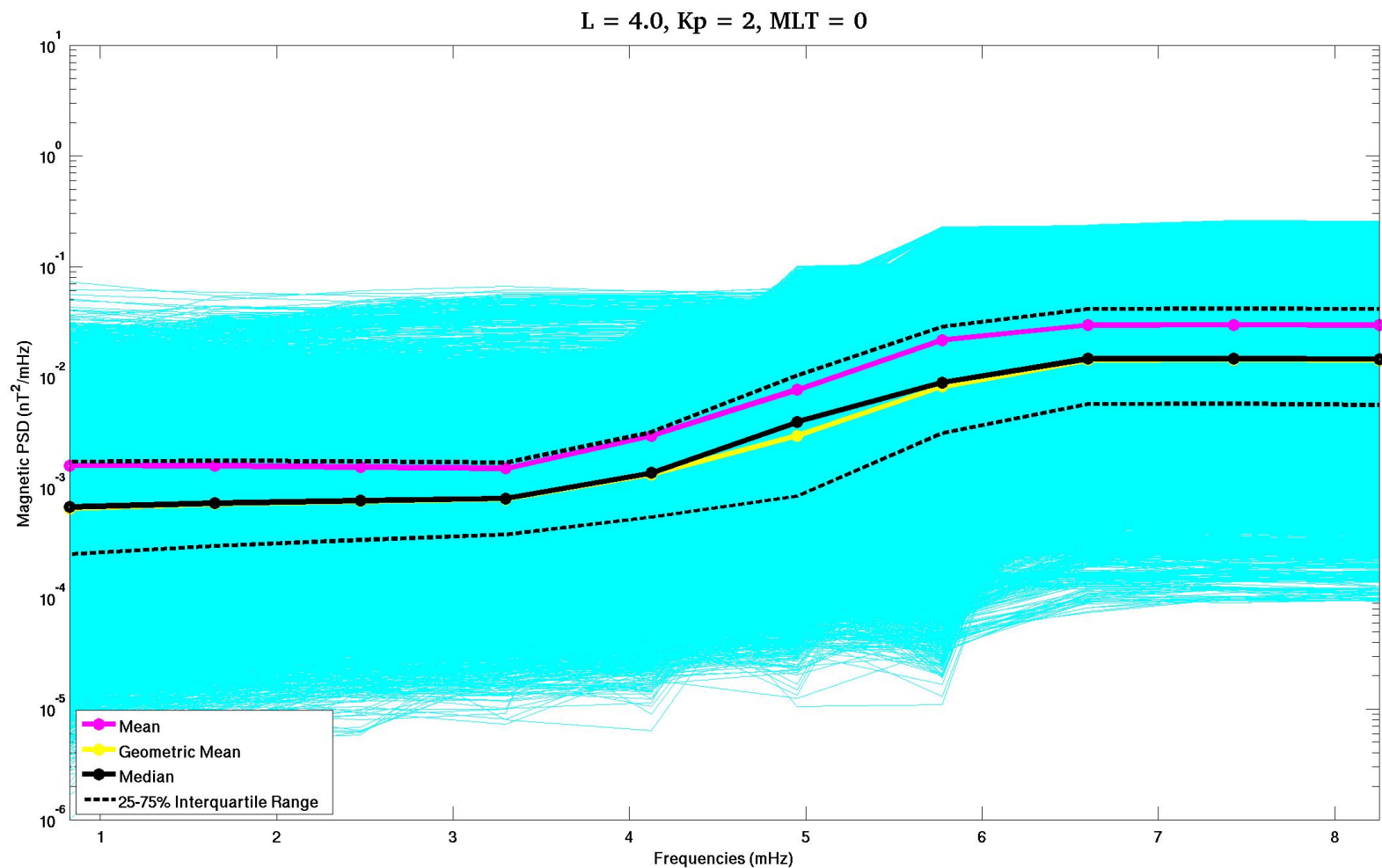- Use the multitaper method to estimate the power spectral density

Electric Field Data

- Data with L* < 2.5 is deleted

- Despiked and cleaned

- Remove thruster firing, eclipsing, and charging events

- Use E.B = 0 to estimate Ex
  - Only if the angle between B and spacecraft spin plane was greater than 10 degrees.

- Compute Ephi

- Use the multitaper method to estimate the power spectral density
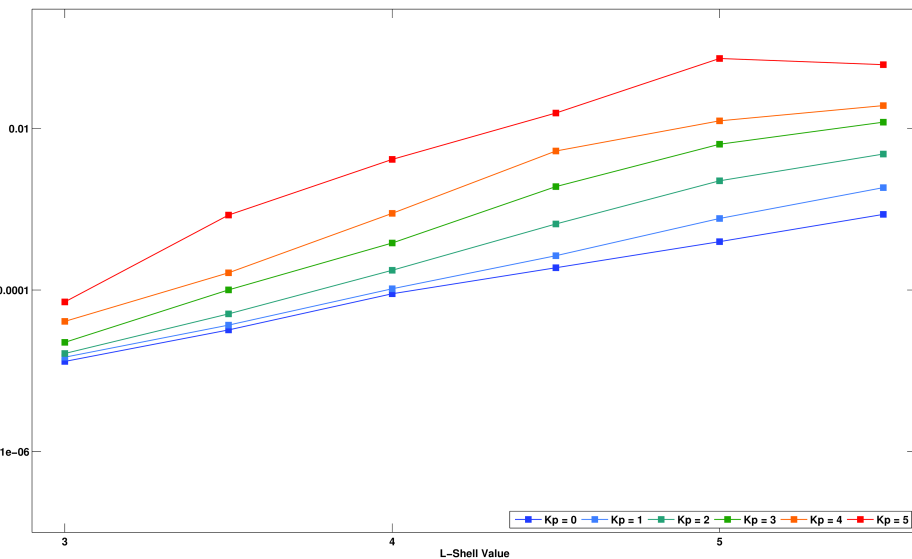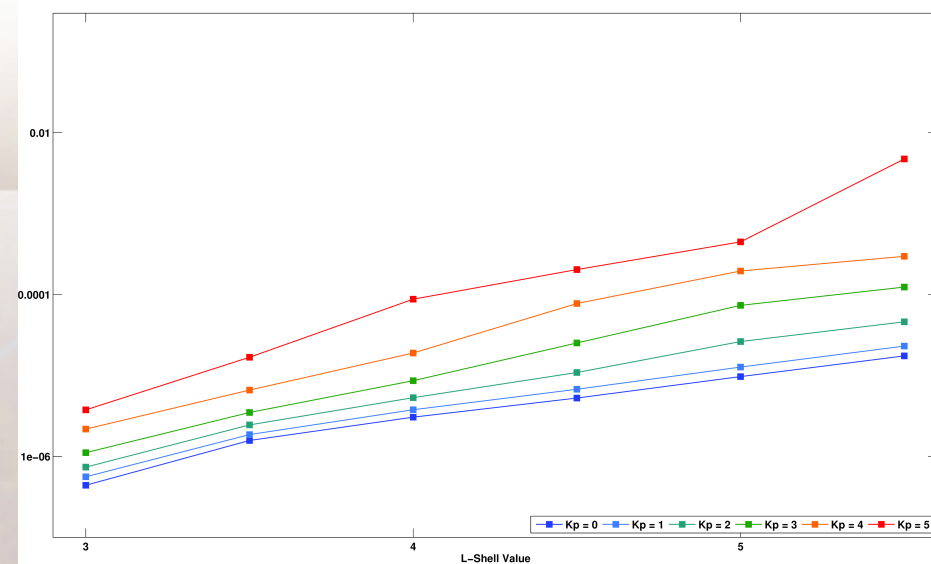
Uncertainty in Ex vs. Spin Plane Angle

Plot with y-axis labeled "Error in Ex (mV/m)" ranging from 0 to 5, and x-axis labeled "Angle Between B and the Spin Plane (degrees)" ranging from 0 to 80.

$$\theta = \arctan\left(\frac{B_x}{\sqrt{B_y^2 + B_y^2}}\right) > 10°$$
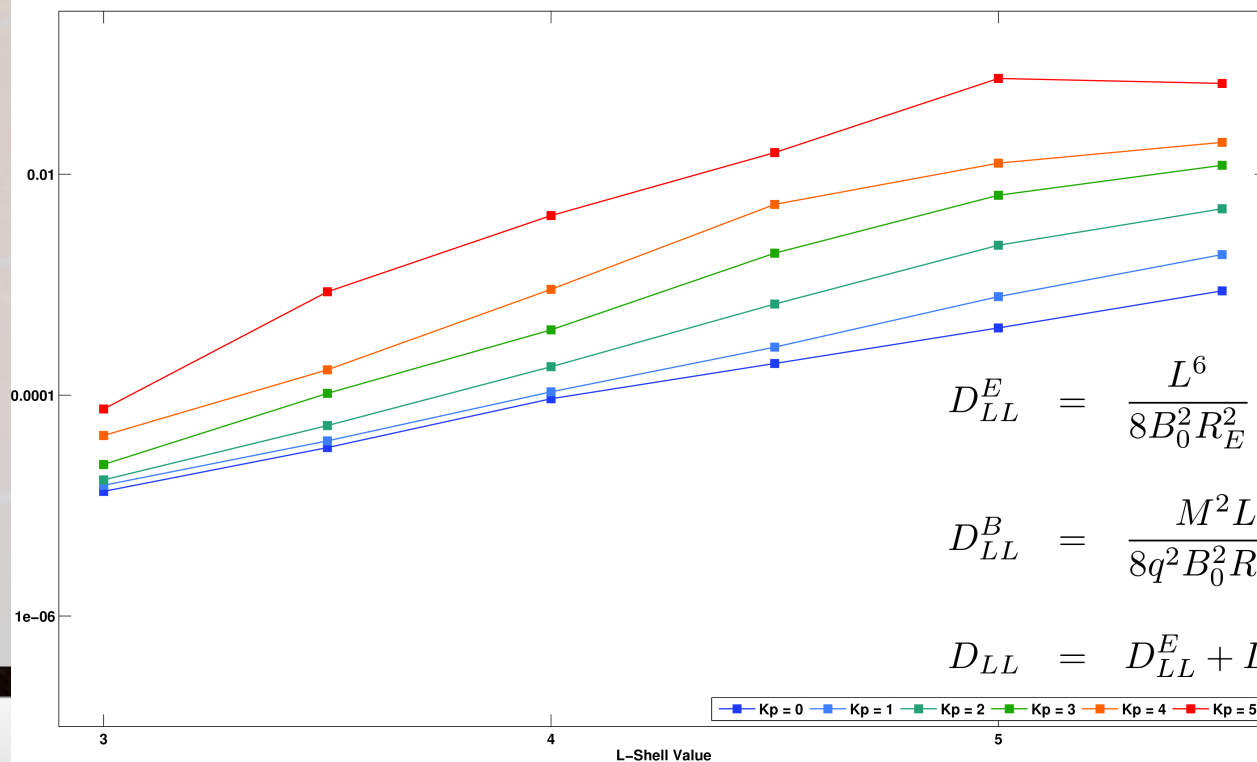
L = 4.0, Kp = 2, MLT = 0

L* = 3, 3.5, 4, 4.5, 5, 5.5
Kp = 0, 1, 2, 3, 4, 5
MLT = 0000, 0600, 1200, 1800

$D_{LL}^{E}[RBSP]$ for M = 1000 MeV/G (days^{-1})

$D_{LL}^{B}[RBSP]$ for M = 1000 MeV/G (days^{-1})

$D_{LL}^{Total}[RBSP]$ for M = 1000 MeV/G (days^{-1})

$$D_{LL}^{E} = \frac{L^6}{8B_0^2 R_E^2} \sum_{m=1}^{\infty} P_m^E(m\omega_d)$$

$$D_{LL}^{B} = \frac{M^2 L^4}{8q^2 B_0^2 R_E^4 \gamma^2} \sum_{m=1}^{\infty} m^2 P_m^B(m\omega_d)$$

$$D_{LL} = D_{LL}^{E} + D_{LL}^{B}$$