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 $E_x$
  – Only if the angle between $B$ and spacecraft spin plane was greater than 10 degrees.
• Compute $E_{phi}$
• Use the multitaper method to estimate the power spectral density
Uncertainty in $E_x$ vs. Spin Plane Angle

$\theta = \arctan \left( \frac{B_x}{\sqrt{B_y^2 + B_y^2}} \right) > 10^\circ$
$L^* = 3, 3.5, 4, 4.5, 5, 5.5$

$K_p = 0, 1, 2, 3, 4, 5$

$MLT = 0000, 0600, 1200, 1800$
\[ D_{LL}^E \text{ [RBSP]} \text{ for } M = 1000 \text{ MeV/G (days}^{-1}) \]

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

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

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

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

\[ D_{LL} = D_{LL}^E + D_{LL}^B \]