Whistler-mode Chorus Wave-Normal Distribution and Electron Scattering in the Radiation Belts

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We performed a statistical study for VLF emissions using a whistler frequency range for ten years (2001-2010) of Cluster measurements. We utilized data from the STAFF-SA experiment, which spans the frequency range from 8.8 Hz to 3.56 kHz and present distributions of wave magnetic and electric field amplitude and wave-normals in dependence on MLat, MLT, L-shell and geomagnetic activity in a form of probability levels, which were directly applied for electrons diffusion coefficients estimation in the outer radiation belt. The propagation direction of chorus waves rapidly deflects from the magnetic field with the increase of latitude [1]. The width of the distribution increases also. Results were proved by use of numerical ray tracing simulation. Distributions for the diffusion coefficients for day and night sectors and for different geomagnetic activity regimes are obtained. The diffusion coefficients from these distributions are compared with coefficients calculated under assumption of whistler parallel propagation with constant value of variance and wave amplitude along magnetic field line (Fig. 1).

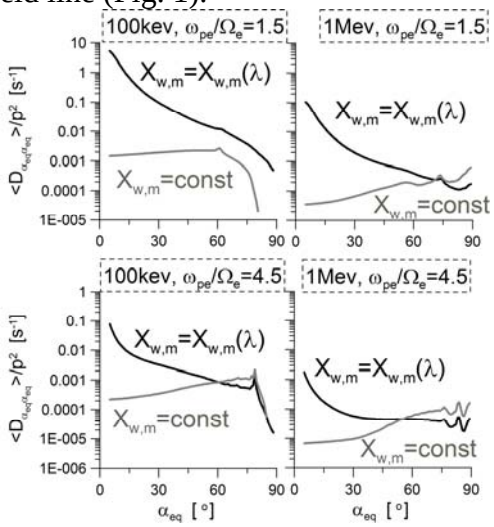

Figure 1: *Pitch-angle diffusion coefficients averaged over electron bounce oscillations are shown for constant parameters (X_w = 0.577, X_m = 0, gray color) and for parameters dependent on the magnetic latitude (black color).*

The increase of the mean value and the variance of the wave vector distribution with latitude results in significant growth of the pitch-angle diffusion rates due to significant increase of the contribution of higher order cyclotron resonances at large latitudes, which is most efficient for electrons with small equatorial pitch-angles.

Références

[1] Agapitov, O., V. Krasnoselskikh, Y. V. Khotyaintsev, and G. Rolland. GRL,38 (2011)
[2] Artemyev, A., O. Agapitov, H. Breuillard, V. Krasnoselskikh, G. Rolland GRL,40 (2012)