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Generation of Pc 1 pulsations in the regime of Backward Wave Oscillator

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Satellite data (Loto'aniu et al., 2005) show that EMIC Pc-1 waves demonstrate, in a wide range of L values, bidirectional energy flux propagation at low magnetic latitudes $|\mathrm{MLat}| < 11^\circ$ and unidirectional (downward) propagation for $|\mathrm{MLat}| < 11^\circ$. Loto'aniu et al. suggested that this fact can be due to generation of Pc-1 waves in the regime of Backward Wave Oscillator (BWO) suggested earlier for ELF/VLF chorus generation. We give a quantitative consideration of this idea. According to the BWO model, waves are generated in the vicinity of the equatorial cross-section of a magnetic flux tube, and the MLat width of the generation region is estimated as $|\mathrm{MLat}| = (R_0 k_A L)^{-1/3}$, where R_0 is the Earth radius and k_A is the wave number. In the case of Pc 1 waves, for reasonable values of $k_A \sim 0.01$ km^{-1}, $|\mathrm{MLat}| \simeq 9^\circ$ and depends only weakly on L. This is in close agreement with observations. We discuss the dynamical features of Pc 1 pulsations generated in the BWO regime and estimate the threshold energetic-ion flux for BWO generation.