

11/16/00

POLAR Polar Cap Boundary Layer Waves: An Auroral Zone Phenomenon

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The global properties of PCBL waves (local time dependences, interplanetary control, field-aligned current dependences, etc.) as well as specific wave modes will be discussed. Electromagnetic whistler mode waves at ~200 Hz, ~1-2 kHz and ~5 kHz have been identified. Three types of “electric waves” found are: solitary bipolar pulses (electron holes), “broadband” waves at $\sim 4 \times 10^2$ to 6×10^3 Hz and narrowband waves at ~10 kHz. It will be shown that all of these modes can be generated by instabilities associated with electron or ion beams with energies in the range of 50 eV to 10 keV. Thus, it appears as if the solar wind-magnetospheric interaction drives the electron and ion beams which, in turn, generates the nonlinear turbulence through a variety of specific instabilities. It is speculated that similar nonlinear turbulence will be detected at the magnetopause of all planetary and astrophysical magnetospheres.