Statistical results and models of Alfvèn wave related energy exchange processes during substorms: dot-AKR emission and Alfvèn Resonosphere

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We consider two separate processes that both occur during substorms. They are related to electron acceleration and transient Alfvèn wave activity arriving from the magnetosphere. The first process is the so-called dot-AKR emission which is a particular type of low frequency (30-50 MHz) Auroral Kilometric Radiation emission that occurs exclusively only in substorm onsets. Judging from the frequency, the source region for this AKR emission is much higher than for normal AKR, at about 2-3 R_E geocentric distance. We suggest that the dot-AKR emission is due to a strong incoming Alfvèn wave accelerating electrons inside a pre-existing auroral cavity. The second process is seen in plasma density and electric field statistics as an ``island'' of smaller plasma density and higher electric fields at 4-5 R_E geocentric distance. This feature occurs only for disturbed conditions (Kp>2) and mainly in the midnight (22-02) MLT sector only. We propose that this feature corresponds to a region where the local Alfvèn speed is nearly the same as the thermal speed of electrons, bringing the two in a Landau resonance. We call the region the Alfvèn Resonosphere (ARS). The ARS is a surprisingly well defined region with relatively sharp boundaries. We present a simple unified theoretical treatment for both processes.