ROLE OF THERMAL IONS IN THE PENETRATION OF INTENSE ULF WAVE POWER TO LOW-L: ULF WAVE ACCELERATION IN THE SLOT REGION DURING THE “HALLOWEEN” 2003 STORMS

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ABSTRACT

ULF wave fields have been suggested as drivers of enhanced radial diffusion leading to flux enhancements in the outer electron radiation belt. Using a case study from the 29th October 2003 during the ICME driven \"Halloween\" storms interval, we show how during storm times very significantly enhanced ULF wave power penetrated to the L-shells spanning the outer radiation belt. We demonstrate how mid-latitude L-shells were flooded with ULF power, clear and discrete driven field line resonances being observed with peak amplitudes at L=4. ULF wave power of several hundred nT p-p was observed on the ground down to L=3 and below, at the same time as the formation of a new slot-located electron radiation belt. This is consistent with ULF waves being responsible for the inwards transport of the usual outer belt to create the new slot radiation belt. Interestingly, cross-phase diagnosis of the Alfven continuum shows that following the SSC at around 06:10 UT, the local eigenfrequencies decrease significantly at all L-shells within ~ 2 hours. At L~3, the eigenfrequencies decrease by a factor of ~4-5, reaching ~3-4 mHz by 1430 UT. We believe that heavy ion injection from the ionosphere reduces the local Alfven eigenfrequency, moves the turning point for mHz ULF waveguide modes to very low-L, and consequently allows the penetration of Pc5 ULF power and the excitation of large amplitude mHz FLRs at much lower L-shells than is usually possible. Interestingly, this suggests that low energy ion populations may have an important role in determining ULF wave power penetration to the local outer radiation belt, and hence have an important indirect role in controlling ULF wave enhanced MeV electron radial diffusion in the outer radiation belt.