



New observations of electromagnetic harmonic ELF emissions in the ionosphere by the DEMETER satellite during large magnetic storms

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DEMETER is an ionospheric micro-satellite launched on a polar orbit at an altitude of 710 km. Its scientific payload allows to measure electromagnetic waves and plasma parameters. During the strong magnetic storm from November 8 to November 10 2004, intense electromagnetic harmonic emissions between 500 and 2000 Hz have been detected at mid-latitudes and similar emissions were also observed on January 21-22, 2005 and on May 15, 2005 during two magnetic storms of lower intensity. They can be observed on consecutive orbits, either in one hemisphere or in both hemispheres at the same L values. On the dynamic energy/time spectrograms that are available in the DEMETER survey modes these emissions appear most often as patches of intensified signals lasting a few tens to hundreds of seconds with a frequency structure showing nearly equally spaced frequency bands. Such a frequency structure could be explained if the waves originate from the generation of electromagnetic ion cyclotron waves at proton cyclotron harmonics. When waveforms are available during burst modes, allowing a fine resolution frequency analysis, these emissions appear in one orbit be composed of a set of lines slowly drifting in frequency with time. During periods with a high magnetically activity, the ionosphere and the magnetosphere are severely disturbed and these waves could be generated at relatively low L-values and propagate from their equatorial source region along density gradients down to the

altitude of the satellite. Energetic electron data obtained onboard DEMETER indicate that these waves interact with the energetic electron populations.