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ULF Waves Due to Lightning in the Venus Ionosphere

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Terrestrial lightning generates a broad spectrum of electromagnetic energy from near 1 Hz (ULF) to MHz (Radio Frequencies). Recently we have been able to clean the spacecraft noise from the Venus Express magnetometer and extend the bandwidth of signal detected down to below 1 Hz. We find that on Venus also, the noise spectrum of electrical activity extends down to the ULF range. The nature of the propagation of signals is a magnetized plasma that affects the access of the signals to the spacecraft in the ionosphere. Above the lower hybrid resonance, signals cannot propagate exactly across the magnetic field so that the magnetic field must be tilted to the horizontal to allow the signals to reach the spacecraft, since signals from the atmosphere are refracted vertically by the ionospheric density. We test this control by examining data obtained on passes with different magnetic field strengths. When the magnetic field is strong, say 50 nT, the signals characteristic of those that cross the magnetic field at right angles can extend over the full bandwidth of the magnetometer (64 Hz). When the magnetic field is weak (e.g. 8 nT), these perpendicularly propagating waves extend only to about 10 Hz. These ULF signals allow mapping the lightning occurrence on almost every orbit.