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Electromagnetic harmonic ELF emissions close to the geomagnetic equator observed by a low-altitude satellite

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Electromagnetic harmonic ELF emissions are electromagnetic waves observed by the low altitude DEMETER spacecraft (altitude about 700 km) close to the geomagnetic equator. When represented as a frequency-time spectrogram, they take form of nearly parallel and almost horizontal clearly defined lines. They propagate in whistler mode, with the polarization of magnetic field fluctuations being linear at the geomagnetic equator; this – as well as their structure – corresponds to the "equatorial noise" emissions or "fast magnetosonic waves" routinely observed at larger radial distances. We present a detailed study of 24 such events, demonstrating both their general properties and propagation characteristics. We show that the frequency of these events is most likely between about 300 and 700 Hz, with the total bandwidth being below 300 Hz in most of the cases. The events occur primarily at the geomagnetic equator, but they may extend as far as up to 15 degrees of geomagnetic latitude. Detailed analysis of the propagation characteristics reveals that the component of the Poynting flux parallel to the ambient magnetic field is oriented along the magnetic field lines in the Northern hemisphere and opposite the magnetic field lines in the Southern hemisphere, suggesting that the generation region of the waves is located close to the equatorial plane. The waves are coming towards the spacecraft from larger radial distances.