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Thunderstorm activity observed by the low-altitude satellite DEMETER

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DEMETER is an ionospheric micro-satellite launched on a polar orbit in June 2004. Its main scientific objectives are to study the ionospheric perturbations in relation with seismic and anthropogenic activities. Therefore, its scientific payload allows to measure electromagnetic waves and plasma parameters all around the Earth except in the auroral zones. At its altitude (~ 700 km), the phenomena observed on the E-field spectrograms recorded during night time by the satellite are mainly dominated by whistlers. The paper is a review of various emissions recorded during thunderstorm activities. V-shaped emissions have been observed at the time of powerful thunderstorms during night time. When the power of the parent lightning is high enough a corresponding MF pulse is observed and their occurrence is discussed. Global maps of the Earth reveal a persistent wave activity at MF frequencies above the location of ground-based VLF transmitters. It is shown that it is due to the perturbation of the ionosphere by these transmitters which produce ionospheric irregularities. Whistler waves generated by lightning strokes can therefore penetrate through the ionosphere at MF frequencies at the location of these VLF transmitters. Global maps at VLF frequencies also show the influence of the thunderstorm activity on the electromagnetic environment of the Earth. Effects of the lightning strokes on the particle precipitation are revealed. At the end, the paper will show electromagnetic waves recorded at the time of sprites which are associated to powerful lightning strokes.