

Global lightning characteristics deduced from ELF/VLF electromagnetic emissions observed by the DEMETER spacecraft

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The global distributions of the ELF/VLF electromagnetic waves originated from world-wide thunderstorm activities are derived based on six-year record of the low altitude spacecraft data. The lightning electromagnetic pulses in the troposphere are observed as lightning whistlers by both electric and magnetic instruments onboard the low Earth orbit DEMETER satellite. The location and source intensity of each lightning event is determined by calculating approximate Poynting flux based on the survey frequency spectrum at the satellite orbit together considering transmission loss of the ionosphere. As a result three major thunderstorm active regions are clearly identified by enhanced Poynting flux values both for ELF and VLF frequency ranges. The region of high lightning activities in ELF frequency range representing the proxy of lightning discharges with a large charge moment change are differ from those in the VLF frequency range indicating a large peak current. Spatial distribution of the global lightning with a different time scale such as day-night asymmetry, seasonal migration and yearly dependence are presented as well. Finally, the source locating accuracy and magnetic conjugate effect of the VLF propagation are examined by the aid of the World Wide Lightning Location Network (WWLLN) data.