

## **LIGHTNING EFFECTS IN THE LOWER IONOSPHERE AND RADIATION BELTS**

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Lightning discharges are potent sources of electromagnetic radiation, which propagate through the lower ionosphere and up to the overlying radiation belts, producing profound effects in these regions. While many manifestations of lightning-induced disturbances have long been observed, in the form of ELF/VLF signatures, electron precipitation, or optical flashes (elves), the quantification of the global extent of these phenomena is not yet complete. Recent ground- and satellite-based data has only recently begun to provide statistical information which may be used to determine effects of individual lightning discharges in terms of the recordable properties of causative lightning (e.g., peak current, duration, multiplicity, charge removal). In this paper, we provide a review of recent results, with the point of view of attempting to quantify per-lightning and per-storm effects, which ultimately must form the basis for global extent estimates.

Lightning, electron precipitation, elves

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