

Nadir observation of lightning and TLEs by JEM-GLIMS: Comparison with ISUAL limb observation

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The present study analyzes the optical data of lightning and TLEs obtained by JEM-GLIMS on the International Space Station. In contrast to former studies based on the ISUAL limb observation, JEM-GLIMS is pointed toward nadir and, thereby, provides an innovative way to clarify the horizontal structures of lightning and TLEs, which are one of the most crucial issues to improve our understanding of atmospheric discharge physics and electrodynamic coupling between the troposphere and the ionosphere. A difficult point, however, is that careful analyses are required to separate the optical emissions of lightning and TLEs which spatially overlap in the field-of-view in the case of nadir-looking geometry.

The main data analyzed here are those obtained by GLIMS dual-color imager (LSI) and six-color spectrophotometer (PH). One LSI channel is equipped with a 762-nm filter to selectively detect high-altitude TLE emissions by minimizing contamination from low-altitude lightning emissions by deep O₂ atmospheric absorption while the other LSI channel has a broadband red filter to equally measure both phenomena. PH detects time-resolved emission intensity at a sampling rate of 20 kHz with six channels measuring at 150-280, 337, 762, 600-900, 316 and 392 nm, respectively. These spatiotemporally- and spectrally-resolved optical data are analyzed in comparison with well-calibrated results obtained by the ISUAL limb observation of lightning and TLEs.

The goal of this study is to separately identify the signatures of lightning and TLEs from GLIMS data and precisely clarify their spectral and spatiotemporal characteristics.

Keywords: lightning, sprites, atmospheric electricity, GLIMS, ISS, Spacecraft