

TITLE: Coincident observation of lightning using spaceborne spectrophotometer and ground-level electromagnetic sensors

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ABSTRACT: The present study aims at assessing a possible new way to reveal the properties of lightning flash, using spectrophotometric data obtained by FORMOSAT-2/ISUAL which is the first spaceborne multicolor lightning detector. The ISUAL data was analyzed in conjunction with ground-based electromagnetic data obtained by Duke magnetic field sensors, NLDN, North Alabama Lightning Mapping Array (LMA), and Kennedy Space Center (KSC) electric field antennas. We first classified the observed events into cloud-to-ground (CG) and intra-cloud (IC) lightning based on the Duke and NLDN measurements and analyzed ISUAL data to clarify their optical characteristics. It was found that the ISUAL optical waveform of CG lightning was strongly correlated with the current moment waveform, suggesting that it is possible to evaluate the electrical properties of lightning from satellite optical measurement to some extent. The ISUAL data also indicated that the color of CG lightning turned to red at the time of return stroke while the color of IC pulses remained unchanged. Furthermore, in one CG event which was simultaneously detected by ISUAL and LMA, the observed optical emissions slowly turned red as the altitude of optical source gradually decreased. All of these results indicate that the color of lightning flash depends on the source altitude and suggest that spaceborne optical measurement could be a new tool to discriminate CG and IC lightning. In the presentation, we will also show results on the comparison between the ISUAL and KSC electric field data to clarify characteristics of each lightning process such as preliminary breakdown, return stroke, and subsequent upward illumination.

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