# GLIMS Mission: Optical and Electromagnetic Observation of Lightning and TLEs from International Space Station (ISS)

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In order to study the generation mechanism of TLEs, global occurrence rates and distributions of lightning and TLEs, and the relationship between lightning, TLEs and TGFs, we will carry out the lightning and TLE observation at Exposure Facility of Japanese Experiment Module (JEM-EF) of International Space Station (ISS). In this mission named GLIMS (Global Lightning and sprIte MeasurementS on JEM-EF) two kinds of optical instruments and two sets of radio receivers will be integrated into the common port module (MCE) and will be installed at JEM-EF finally. The optical instruments consist of two wide FOV CMOS cameras and six wide FOV photometers, and all these optical instruments look the nadir direction. CMOS cameras use the STAR-250 device as a detector, which has 512x512 pixels and 25x25 um pixel size, and have 28.3x28.3 deg. FOV. One CMOS camera with a wideband filter (730-830 nm) mainly measures lightning emission, while another camera with a narrowband filter (766+/-6 nm) mainly measures TLE emission. Using these cameras, we can measure spatial distribution of sprites and the displacement between the sprite position and the parent lightning discharges. Five of six photometers have 40 deg. conical FOV and use photomultiplier tube (PMT) as a photon detector. They equip band-pass filters (150-280 nm, 316+/-5 nm, 337+/-5 nm, 391+/-5 nm, and 762+/-5 nm) for the absolute intensity measurement of the TLE emission. One of six photometers equips a wide-band filter (600-900 nm) to detect lightning occurring within 87 deg. conical FOV. These output signals will be recorded with the sampling frequency of 20 kHz. These data will be analyzed to estimate the electron temperature and vibration temperature of $N_2$. Two kinds of radio receivers are also employed. VLF receiver consists of 15 cm monopole antenna and a analog-to-digital converting electronics. VLF receiver will measure whistler waves in the frequency range of 1-40 kHz, and will record the waveform with 13-bit resolution and with 100 kHz sampling frequency. At the bottom panel of MCE two VHF antennas will be installed to detect VHF pulses emitted by lightning currents. These antennas have a capability to detect VHF pulses in the frequency range of 70-100 MHz. These VHF pulses will be digitally sampled with 8-bit resolution and 200 MHz sampling frequency. From these electromagnetic measurement data, we can deduce the characteristics and the micro physics of lightning discharges which excite TLEs.

GLIMS will be launched in 2011 by H-II Transfer Vehicle (HTV). We have passed the Preliminary Design Review (PDR) in July, and we have started the development of the pre-flight model. We will report the development status of the GLIMS instruments and discuss the possibility of the cooperative observation with other missions such as TARANIS and ASIM.