Japan Geoscience Union Meeting 2012
(May 20-25 2012 at Makuhari, Chiba, Japan)

PEM12-P01 Room:Convention Hall Time:May 21 15:30-17:00

Operation Plan and Data Processing System of JEM-GLIMS Mission

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In order to study the occurrence conditions and generation mechanisms of Transient Luminous Events (TLEs), lightning and TLE observations named JEM-GLIMS (Global Lightning and sprIte MeasurementS on JEM-EF) will start this year. JEM-GLIMS instruments will be launched by H-IIB rocket with HTV carrier and installed at Exposed Facility of Japanese Experiment Module (JEM-EF) of International Space Station (ISS). In this mission two kinds of optical instruments and two sets of radio receivers are employed. After the installation, JEM-GLIMS instruments will be checked their health during the initial operation phase, which is planned to take a few months. After the initial operation, nominal operation phase will start. In this nominal operation, JEM-GLIMS instruments will be operated by TLE mode mainly, which is the observation mode of lightning and TLEs when ISS located night-side. All science data acquired by optical and electromagnetic instruments are continuously transmitted to the ground with a 5.8 kbps telemetry speed, which enables to obtain 53 optically transient events. All these level-0 data are stored in JAXA data server and transmitted to ISAS/JAXA data processing system. After these level-0 data are converted into level-1 data, they will be distributed to the JEM-GLIMS mission members. We will present the mission schedule, operation mode and data processing system more in detail at the presentation.

Keywords: lightning, sprite, JEM-GLIMS, ISS, Operation, Data Processing

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Three-dimensional Structure of Sprite Streamers by Aircraft observation

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The spatial distributions and the three-dimensional structures of sprite streamers are the key parameters to reveal the occurrence conditions and the development mechanisms of them. However the three-dimensional structures of sprite streamers have never been identified, because it is difficult to capture images from multiple ground-based observation sites simultaneously. Moreover, since the time constant of sprite emissions is about a few milliseconds, it is difficult to capture detailed spatial and time evolution of sprite streamer without using high- speed cameras.

In this study, we study the characteristic of the spatial and time evolution of sprite streamers, especially three-dimensional structures which have never been revealed, by analyzing the data of sprite images observed by high-speed cameras from jet aircraft.

On November 28 and December 3, 2010 in winter Japan, we have carried out optical observations using a high-speed camera and a high-vision CCD camera from a jet aircraft under collaboration between Japan Broadcasting Corporation (NHK) and Hokkaido University. Using the high-speed camera, it is possible to capture images with a sampling rate of 8,300 frames per second (fps). Using the high-vision CCD camera, it is possible to capture true color images of sprites with a sampling rate of 30 fps. During the two observation flights, we have succeeded to capture 28 sprite events. We have analyzed a columniform sprite observed at 13:12:35UT on November 28, 2010 and revealed the spatial and time evolution of the sprite streamers. This sprite consists of 4 distinct sprite elements. Each element begins as a bead between 66 and 78 km altitude and moved downward with a speed of $0.8x10^7$-$1.1x10^7$ m/s and a remnant emission stayed at the region where the bead passed through. The altitudes of upper and lower edge of columns are estimated to be 85-90 km and 65-70 km, respectively. It is found that these results are comparable with previous results derived from the sprite observations in North America.

On the other hand, we have carried out simultaneous optical observations using the high-speed cameras and high-vision cameras and WATEC CCD cameras from two jet aircrafts in summer US. In the period of June 27-July 10, 2011, aircraft observations were conducted in 8 nights totally, and succeeded to capture sprite images for over 40 events by the high-speed cameras in each aircraft simultaneously. Using these images, we have performed triangulation analysis for two sprite events observed at 05:20:49UT on July 3, 2011 and at 08:54:13UT on July 5, 2011, and estimated the spatial distributions. It was found that sprites were occurred with a horizontal shift from the location of the parent CG discharge with distance from 60 to 80 km. This result may suggest that there are certain occurrence conditions produced by not only a vertical current of the parent CG discharge but also other factors such as horizontal lightning currents, atmospheric gravity waves and micro meteors. We also studied a columniform sprite with upward streamers observed at 05:20:49UT from July 3, 2011 and performed triangulated analysis to identify the three-dimensional structures. It was found that upward streamers grew radially from a bottom part of the downward streamer. It was also found that the altitudes of upper and lower edge of upward streamers are 76-78 km and 72-73 km, respectively, and that diameter and the velocity of the upward streamers are about 0.3 km and $5.5x10^6$ -$5.6x10^6$ m/s. On the other hand, the altitude of upper and lower edge of downward streamer is estimated to be 81 km and 71 km, respectively. The diameter and the velocity of downward streamer were estimated to be about 0.7 km and $4.7x10^6$ m/s, respectively.

At the presentation, we will show the characteristic of the spatial and time evolution of sprite streamers observed in winter Japan and in summer US more in detail.

Keywords: sprite, Three-dimensional structure of sprite streamers, spatial distributions of sprite