

TLEs aircraft observation campaign in United States

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Transient Luminous Events (TLEs), kinds of optical phenomena induced by electrical activity of thunderstorm, were discovered about 20 years ago and have been investigated observationally by various methods. However, the details of development of TLEs structure have not been clarified yet. To capture the real spatial structure of TLEs without influence of atmospheric absorption, spacecraft would be the best solution. However, since the imaging observation from space is mostly made for TLEs appeared above the horizon, the range from spacecraft to TLEs becomes large, such as few thousand km, resulting in low spatial resolution imagery. Also the limited amount of downlinked data, high-speed and/or high spatial resolution imaging is quite difficult. On the other hand, aircraft can approach thunderstorm up to a few hundred km or less and can carry heavy high-speed cameras with huge size data memories.

In the time period of June 25th - July 10th, 2011, TLEs observation campaign with two jet airplanes was carried out in United States, under collaboration between NHK and universities, including Hokkaido University and University of Alaska, Fairbanks. On 8 out of 16 nights standing-by, the jets took off from the airport near Denver, Colorado, and captured about 80 TLE events/night at maximum. The two jets flew along the same track but separately in time by about 10 min, and from both airplanes the cameras were looking at a same location where TLEs appear repeatedly to make a stereo imaging. Two types of camera were installed at both airplanes, namely, a high-speed camera with a frame rate of >8000 frames/sec, which enables catching the motion of TLEs, and a color EM-CCD camera. Adding to the imaging observation from airplane, ground-based measurements with high-sensitivity cameras, a high-speed camera and radio wave receivers were organized at two observation sites, that is, Yucca Ridge Field Station in Colorado and Langmuir Laboratory in New Mexico. Not a few numbers of unknown time development of TLEs with fine structures were captured by the high-speed camera. In this presentation, preliminary results of analysis about such new findings will be introduced as well as outline of the campaign.