TLE observing in Finland

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Overview of TLE observing efforts in Finland are presented. The observing network is two-fold. The cameras operated by the members of Finnish astronomical association Ursa working group on fireballs are dedicated to record potential meteorite yielding meteors with fixed camera orientations. The other half of the network consists of Ursa storm chasers who have cameras dedicated for TLE observations that can be manually oriented towards promising thunderstorms. Attempts to capture the TLE are also made with conventional digital cameras when possible. So far all of the TLE events recorded in Finland have been captured by the meteor cameras. These events are also the northernmost verified observations in the world.

1. Introduction

The first observation of upper-atmosphere lightning, or transient luminous event (TLE), in Finland [1, 2] was made on October 9, 2009 at 03:53 am local time by meteor camera operated by Timo Kantola of the Ursa working group on fireballs from Pieksämäki, Finland. The elve-type TLE was located above the Baltic sea at latitude 59.27° N. Two hours later also three sprites were recorded from the same thunderstorm. Being the first ever recorded from Finland, these were also the northernmost TLE events in the world at the time.

To date, the northern-most recorded TLE event (August 23, 2010) was captured by the meteor camera of Aki Taavitsainen and Jani Lauanne from Mikkeli, Finland. The column sprite was located over western Finland at 62.28° N latitude [3].

These observations initiated interest in the storm chasing section of Ursa, and the Finsprite project was started. Due to delays in equipment acquisition and deployment, the first full-length observation season will be the summer of 2012.

So far 21 TLE events recorded from Finland have been verified [4].

2. Observation networks

2.1. Ursa working group on fireballs

Ursa working group on fireballs is a network of 17 camera stations around Finland. Aim of the working group is to record bright meteors with video surveillance cameras, analyse the flight paths and try to recover the potential meteorites for scientific research.

The working group has been working closely with FMI with the TLE data, and so far all of the observed TLEs in Finland have been found from the images recorded by these meteor cameras.

2.2. Storm chasing section of Ursa

Ursa storm chasing section has long-standing co-operation with FMI. The chasers have provided FMI with observations of occurrence/absence of hail (verification of radar-based hail probabilities), strong winds (downbursts, funnel clouds, waterspouts, tornadoes), excessive precipitation and storm related damage in exchange of access to weather radar products.

FinSprite strengthens the collaboration by including TLE to the list of directly reported observations. FMI in turn offers participants access to lightning data so that it is easier to prepare for active observing, and to make preliminary verification of the images.

3. Equipment, software and observation methodologies

3.1 Equipment

The cameras used for continuous routine observations are high-sensitivity CCTV surveillance cameras with analogue video output attached to a computer for processing (peak-hold images, motion detection) and storing the images. Conventional digital SLR and compact cameras can also be used for high resolution colour photography.

3.2 Software

Variety of software are used with the CCTV cameras. Commercial UFOCapture [5] is probably the most widespread software, with good capabilities for motion detection, video saving and data analysis. VideoAnalyzer is another common

software amongst meteor hunters, but it is not maintained anymore. The corresponding author is developing a simple software for Linux systems with stacking and motion detection features. This software has not been named yet, but it will be published as Open Source Software under GPL license.

3.3 Observation methodologies

Majority of the time the observing will be passive, meaning that CCTV cameras are collecting data unattended, and the images can be previewed at a later time. These data are mainly peak-hold images of 1 – 2 minutes long, where the brightest value for each pixel location is stored. Some of the software available for this kind of observations allow the possibility of motion detection, making it possible to save individual frames and/or video of the actual event. In this way, the precise time can be obtained

Upon a forecast of potential thunderstorm, or observed lightning at feasible distance, more active observing mode can be used:

- adjust camera imaging direction and use narrower field-of-view for better detail
- switch motion detection on, if continuous application of motion detection would result in infeasibly large amount of data
- use of digital SLR cameras and short to medium length telephoto lenses for colour photography

4. Conclusions

TLE observations are becoming more and more organized in Finland. With the combined efforts of the Ursa storm chasing section, Ursa working group on fireballs and FMI, the FinSprite project aims to collect more information on the occurrence of TLEs at high latitudes. With the two camera networks spatial coverage in southern Finland is quite good, and there is a possibility to actively orient the cameras towards potential thunderstorms.

So far 25 TLE events have been recorded in Finland.

5. References

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