

OBSERVATION OF TRANSIENT LUMINOUS EVENTS (TLEs) IN PEKAN

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ABSTRACT

Transient Luminous Events (TLEs) are classified as a type of lightning events that occurs above a thunderstorm. It is a very fast event that is hardly seen by the naked eyes and happened in a very short period of time. So, a high frame rate capturing device is required in order to capture the scenes of TLEs. This paper reveals a study to verify the occurrences possibility of TLEs in Malaysia by selecting a simple and suitable device to detect and capture the event. There are various types of TLEs such as Elves, Sprites, Halos, Blue Jets, and Gigantic Jets that differs in height within atmosphere. Experimental studies are made to observe Elves and Sprites in Malaysia partially in Pekan, Pahang. The event is being traced using amplified antenna with noise filter and a data acquisition (DAQ) module used to interface between antennas and personal computer (PC) aided with online data logging device to perform a live characteristic recording through PC software. Verification of the obtained TLEs data will be carried out by comparing them with data recorded by Department of Meteorology Malaysia.

Keywords: Lightning, Transient Luminous Events, Sprites, Elves, data acquisition

INTRODUCTION

Lightning is one of the phenomena that occur above the atmosphere area. It occurs during thunderstorm and generally have three types of lightning when electrical breakdown among the cloud such as cloud to cloud (CC) lightning, cloud to ground (CG) lightning, and intra-cloud (IC) lightning. Lightning not only occurs on the lower atmosphere, but also in the upper atmosphere which is 40 km until 100 km above the earth's surface area, which is called transient luminous events (TLEs). TLEs are described as short lived electrical breakdown phenomena and the flashes of light occur at lower ionosphere (D region). It occurs when gas molecules are excited and results in electrical breakdown. During the process light is emitted for a few milliseconds when the ionised gas returns to their normal state. The process called return stroke [1].

Some of the TLEs occur at lower places which is located 80 km away from earth's surface while some of them located approximately 100 km away from the ground. The types of TLEs included Sprites, Elves, Gigantic Jets, Blue Jets, and Halos. Differences between luminous transient produced with different height as shown in Figure-1. The Figure explains that transient flashes produced in different altitudes were classified so that for every distance of altitude, the characteristics of the flashes can be identified.

A Sprite, which is one kind of TLEs, was first documented by Franz and his partners in year 1989. The Sprite was captured by using a low light level television camera. The event was recorded on the night of 22 and 23 September 1989 during a hurricane Hugo storm at the eastern coast of United States [2]. Since then, other types of TLEs were found and discussed by scientists around the world.

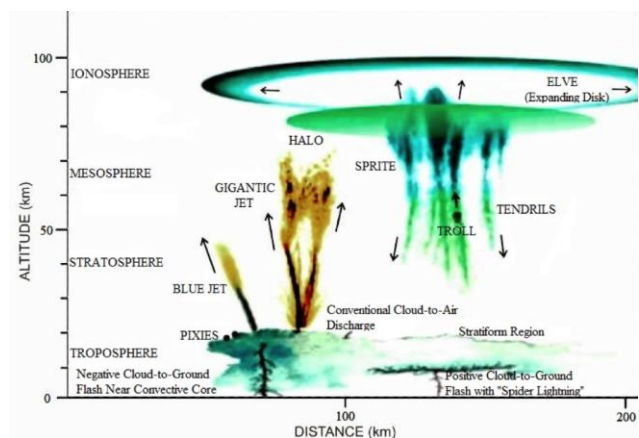


Figure-1. Different TLEs occur below ionosphere [3].

The research is aimed to identify the possibility of occurrences for different transient luminous with a height limit 80 km. The events will be traced using a Lightning Detector System (LD-250). Daily and monthly lightning for the past six month (October 2014 until March 2015) was observed and recorded. Furthermore, the location of frequent lightning event was traced as well and concluded at the end of the paper. Lastly, the direction of camera capture process will decided to capture TLEs.

The productions of TLEs reveal their own characteristics such as process, colour, shape, duration, frequency, and feature. The characteristics are shown in Table-1.

METHODOLOGY

The research was divided into two sections which were signal detection and image observation. These two methods were used to categories the types of TLEs by figuring out their unique signal, size, and shape. The function flow diagram of the research project is shown in the Figure-2.