

Relationship between four giant jets in the past and meteorological phenomena in the troposphere

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“Transient Luminous Events” is a discharge light emission phenomenon that occurs from the stratosphere to the lower thermosphere at about 20km to 100km above the sky. Giant jets are also a kind of this type. It is inverted cone-shaped luminous phenomenon .its lower end is at about 20km above the sky and upper end is at about 70km to 90km above the sky. Our school has been observing high-altitude luminous phenomena using three high-sensitivity CCD cameras every night since 2007. There are few observation examples, and the unexplained portion occupies most of the occurrence mechanism.

In past studies, there were some problems in its process. One is that although there were four observation records, only one giant jet was investigated. The other is that the cause of the rise in seawater temperature and the decrease in temperature above the sky has not been verified other than those mentioned above.

In this study, a total of five giant jets were studied, all four giant jets observed at our school and those that occurred off southern Kanto in September 2019 and we did a survey on them in the way we did in the past. Then, we found that the value of direct solar radiation energy and downward infrared radiation was not so large at the observation points nearest the points which giant jets occurred in the day which giant jets occurred compared with other days in the same month. In addition, only two out of five cases the cold front passed , which was attributed to a decrease in the temperature above the sky. From these results, it was verified using the seawater temperature map and radiosonde upper temperature data to confirm whether the seawater temperature rise and the temperature decrease in the sky actually occurred. Then, the seawater temperature was higher than the average value during the days around the giant jet occurred, and when the temperature of the sky was compared with the average of the week before and after the day when the giant jet occurred, there were places in the troposphere where the day when the giant jet occurred was lower. From the above, it was found that the situation described in the previous research was correct. From the fact that seawater was not warmed by solar radiation, we first expected the warm seawater flowed in from other waters. Therefore, we used the figure showing the velocity of the ocean current. Then, it was found that the two giant jets for which data were obtained were near the end of the area where the current of the Japan Current, which is a warm current, was fast. This suggests that warm seawater from the tropics was rapidly transported and reached the vicinity of the giant jet occurrence site at a high temperature, where it stayed there. Next, the cause of the lowering of the temperature in the sky could be read again from the weather map. We found that of the five days which giant jet occurred, on all three days when the cold front did not pass, there was a low pressure near the point where the giant jet occurred, a high pressure on the east coast of mainland China, and a north-south high-low pressure arrangement. This suggests that cold air was flowing from Siberia.

Based on the above, the occurrence mechanism common to these five giant jets was considered. As a result, the giant jets were caused by a rise in seawater temperature due to warm currents, and a strong ascending current caused by the temperature difference caused by the passage of the cold front or the inflow of cold air into the sky due to the north-south high-low pressure arrangement. The ice crystals intensely collided with each other, resulting in the separation of enormous amounts of charge, which led

to the conclusion that a discharge occurred from a cumulonimbus cloud containing a large amount of charge, resulting in a giant jet. In addition, the giant jets are considered to occur easily sea areas where the seawater temperature tends to be high like off Shikoku and south of Kanto and off Chiba and Ibaraki Prefecture.

Keywords: Transient Luminous Events, Giant jets

