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The Modern Day Space Elevator as a Permanent Transportation Infrastructure (3)

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CANDIDATE LOCATIONS FOR THE INSTALLATION OF EARTH PORTS ON SPACE ELEVATORS TO MINIMIZE LIGHTNING DAMAGE AS CONSIDERED FROM THE GLOBAL LIGHTNING ACTIVITY DATA

Abstract

The space elevator is composed of a 96,000 km tether that extends from the Earth port to the counterweight, and carries climbers in the direction of the center of the Earth. Due to the long tether and the equipment it carries, the mechanical strength of the tether was the main issue to be addressed during construction. The discovery of carbon nanotubes (CNTs) has raised the possibility of solving the problem of tether material, which requires sufficient mechanical strength. However, since CNTs are electrically conductive, the electromagnetic modulation in the atmosphere and outer space could affect the natural environment and damage the space elevator, so this issue also needs to be considered. Although it is generally thought that equatorial regions are suitable for the installation of Earth port for space elevator, these equatorial regions are generally active lightning areas. Therefore, in order to avoid lightning strikes on the tether as much as possible, it is necessary to propose candidate locations for the installation of earth ports, taking into account the global distribution of lightning activity. In this study, we examine these issues using lightning activity distribution data. The two main methods for determining the location of lightning discharges are: one is to use a ground-based radio wave reception observation network to measure the radio waves (sferics) generated during lightning discharges to determine the location of the discharge, and the other is to determine the location optically from a satellite. In this study, we investigated global lightning activity using these methods and selected locations with low lightning strike rates on the tether and low occurrence probabilities of superbolts, which are lightning discharges with huge energy. As a result of the survey, it was found that the Pacific Ocean on the west side of South America would reduce the frequency of lightning strikes and also reduce the impact of superbolts.