ABSTRACT

TITLE:	Three-Channel Design Electric Field Change Sensor
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ABSTRACT: An electric field change sensor is an electronic device that detects charge build up on a metal plate that occurs as a result of charge development within thunderstorm systems. Typical atmospheric electrical properties are quantified by electric field mills that, with a rotating shield, expose a sensor plate to atmosphere in increments as short as one-tenth of a second to measure the amount of charge build up on the plate. Since the average lighting strike occurs over a time frame less than twenty microseconds, electric field mills are unable to measure the changes in the atmospheric electric field as a result of a lightning strike. Field change sensors, however, are designed to measure a sensor plate charge at a rate of tens of kilo-samples per second. This measurement rate allows the field change sensor to gather detailed information during a lightning strike that explains field changes as a result of lightning strikes during a thunderstorm. The intent of this project is to design, build and test a three-channel electric field change sensor that will be modeled after a previously built array of electric field change sensors. Due to the physical simplicities of field change sensors, lightning strikes can be detected and measured over a greater range of distances than field mills by using multiple channels. The channels used in a field change sensor are denoted as sensitive, medium, and insensitive. The sensitivity of each channel is determined by the size of the antenna and the gains associated with each channel. The sensitive channel is used to measure lightning strikes that occur up to 150 kilometers away from the sensor whereas the insensitive channel is used to measure lightning strikes that occur directly overhead the sensor that would saturate the other two channels. Using an electric field change sensor to quantify the electric field changes that occur during and immediately after a lightning strike can then be used to contribute to the research of upper atmospheric discharges that occur during a thunderstorm, called sprites. The discovery and research of sprites has been a topic of interest for researchers in recent years because our understanding of their formation and contribution to the atmospheric electrical circuit is largely unknown. By collecting data on lower atmospheric discharges, lightning, with a three-channel design electric field change sensor we hope that in the future we will be able to better understand sprites and the necessity they fulfill in the atmospheric global electric circuit.