



**CALIFORNIA STATE SCIENCE FAIR
2003 PROJECT SUMMARY**

Name(s) Scott M. Elder	Project Number J0607
Project Title Tracking Storms in the Ionosphere	
Objectives/Goals The objective of my experiment is to find a way to track storms in the Ionosphere and then measure storm intensity. If I can measure Radio Frequency signal delay through the Ionosphere, then I can track storms and measure storm intensity.	
Abstract Methods/Materials When Radio Frequency (RF) travels through the Ionosphere, the signal transmission time is delayed due to storms in the ionosphere. The amount of signal delay directly corresponds to the intensity of the storm in the Ionosphere. The Global Positioning System (GPS) is a constellation of 24 satellites which transmit RF signals used for navigation through the Ionosphere to earth. I collected GPS altitude measurement data with my GPS receiver over a one month period. Time of measurements was adjusted 4 minutes each day to always have the same GPS satellite configuration.	
Results I compared my GPS altitude measurement data with the Space Environment Center (SEC) Ionosphere storm data to build a chart I could use to determine ionosphere storm presence and intensity. This chart compared my altitude error measurements with the SEC data for Ionosphere storm intensity. The result was a linear comparison matching my altitude error data to the SEC Ionosphere storm data.	
Conclusions/Discussion During the next few days I made some random measurements to determine if I could now track a storm in the Ionosphere and determine storm intensity. During one of my sample measurements, I determined from the amount of error in the altitude measurement that there was a storm in progress in the ionosphere. I took several readings over the next five hours and analyzed the data to determine the storm intensity. The next day when the SEC data was available, I compared my analyzed reading with the SEC ionosphere storm readings. The results were comparable which meant that I did track a storm in the Ionosphere and was able to measure the storm intensity.	
Summary Statement I tracked storms in the ionosphere and determined storm intensity by measuring Global Positioning System altitude measurement errors.	
Help Received Father helped with the display.	