Surge Protection:
Measured Lightning Stroke Data

INTRODUCTION

Curiosity about lightning has been exceeded only by speculation and rumors on the same subject. Questions regarding “how” lightning occurs and the “magnitude” of a lightning stroke have led various scientific communities to conduct significant investigative programs to improve our understanding of the frequency, magnitude, and exposure to lightning events.

One area where significant data on lightning has been collected is around the Tampa, Florida area due to the high frequency of lightning events. Since 1990, Progress Energy (formerly Florida Power) has been collecting data on the total number and magnitudes of actual “cloud-to-earth” lightning strokes, which have occurred in their service area, from the National Lightning Detection Network. Such data is collected for the purpose of anticipating lightning activity that may affect customers, local transmission, and power distribution systems.

On July 15, 2000 a rare event occurred that provided an opportunity to capture and measure an unprecedented number of lightning strokes and supplied sufficient data to statistically document the magnitude and composition of a lightning event. This data provides supporting evidence regarding expected current magnitudes of lightning events in North America.

DETAILS

On July 15, 2000 between the hours of 0500 and 1900 two different storm fronts passed over the Tampa Bay area from different directions and subsequently collided. The resulting lightning storms generated 33,863 separate “cloud-to-earth” lightning strokes that were recorded by the National Lightning Detection Network. The shear number of individual “cloud-to-earth” strokes in such a relatively short period of time is unprecedented. The data collected by the National Lightning Detection Network measured the time, current magnitude of each positive stroke, and the current magnitude of each negative stroke. A summary of the data is represented in Appendix “A”. The magnitudes of current levels are arranged in 5kA increments. This spreadsheet indicates the count by increment of current magnitudes and their percentage of the total. Figure 1 shows the area in Florida covered by the study and Figure 2 shows the distribution of the lightning strokes.

Chart 1 displays the distribution of current magnitudes in 5kA increments for 2,597 positive lightning strokes. A summary of this data is given below:

95% were less than 30 kA
98% were less than 60 kA

Also during this same period there were 31,266 negative strokes with the measured current values shown in Chart 2 and summarized below:

82% were less than 30 kA
98% were less than 60 kA

SUMMARY

This data of 33,863 separate “cloud-to-earth” lightning strokes recorded by the National Lightning Detection Network provides supportable evidence of realistic magnitudes of lightning events that actually occur in North America. The data also reveals that less than 2% of the total of either the positive strokes or the negative strokes had a current magnitude greater than 60kA and the vast majority are less than 30 kA.

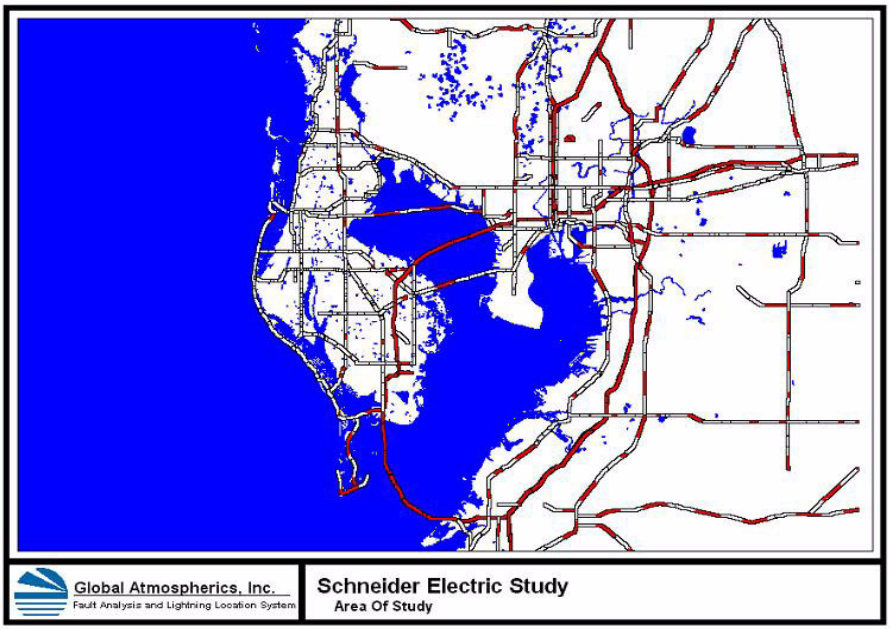

Figure 1: Area of Study

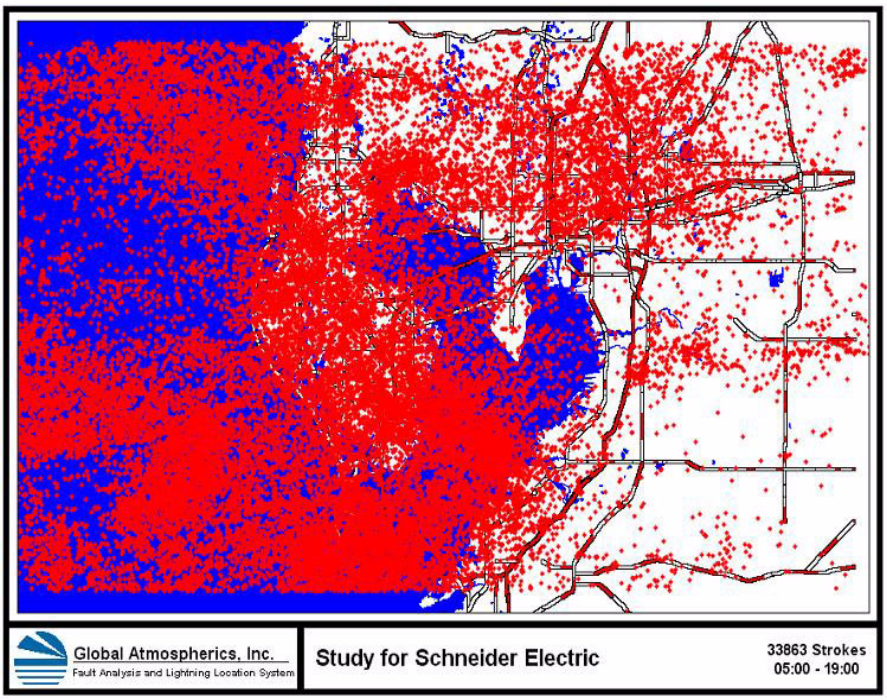

Figure 2: Distribution of Lightning Strokes

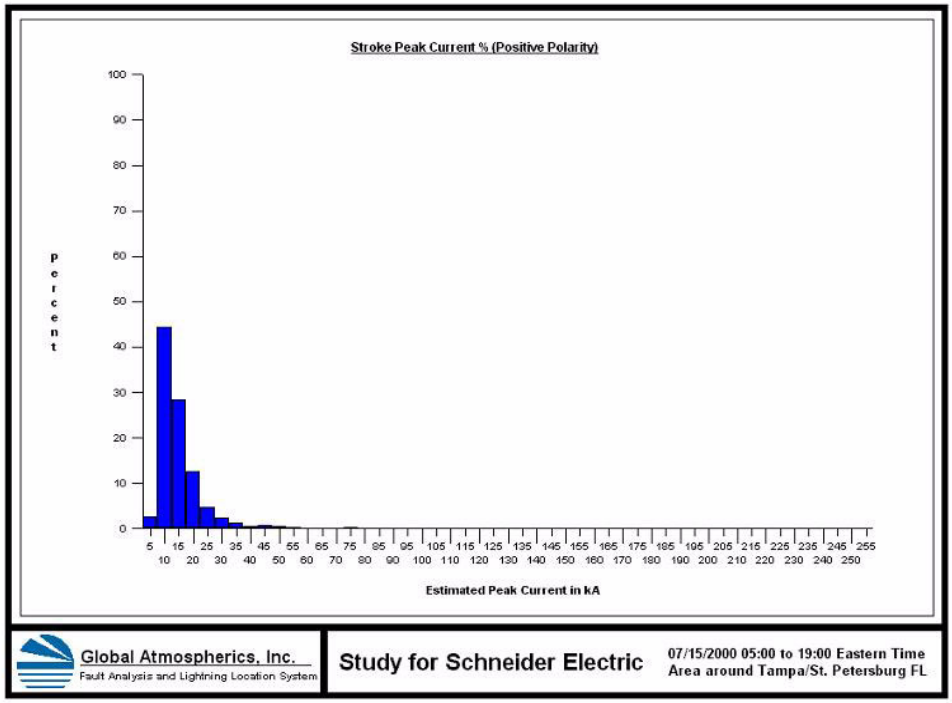

Chart 1: Positive Lightning Strokes

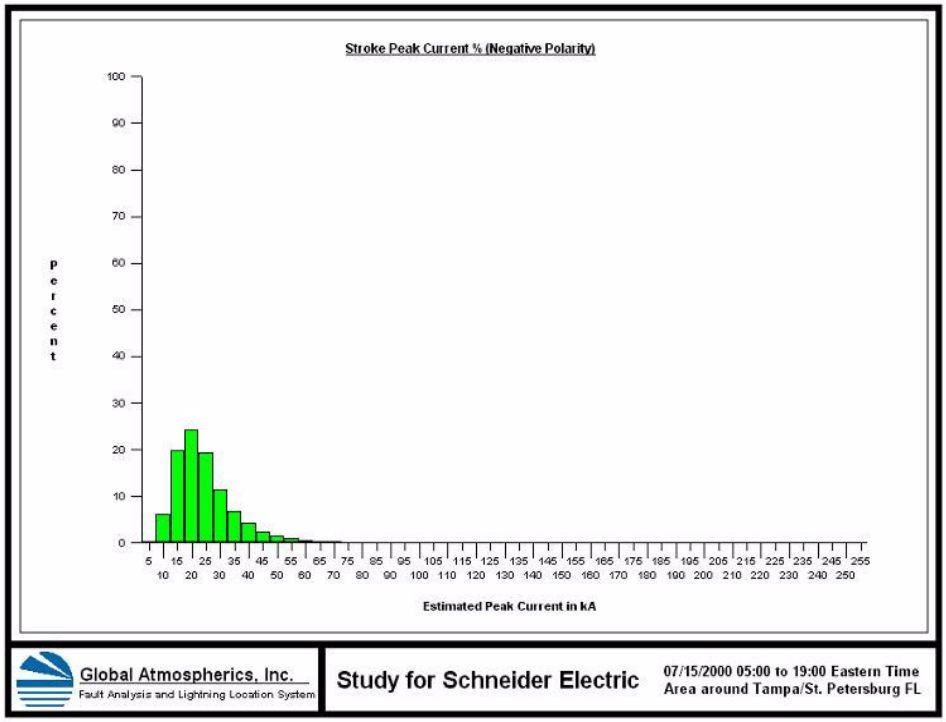

Chart 2: Negative Lightning Strokes

Appendix A: Lightning Stroke Data

Study for Schneider Electric											
Positive Lightning						Negative Lightning					
Lo KA	Hi KA	Count	% of Pos	Cumm %	% of Total	Lo KA	Hi KA	Count	% of Neg	Cumm %	% of Total
0	5	70	2.70%	2.70%	0.21%	0	-5	115	0.37%	0.37%	0.34%
5	10	1,152	44.36%	47.05%	3.40%	-5	-10	1,919	6.14%	6.51%	5.67%
10	15	737	28.38%	75.43%	2.18%	-10	-15	6,201	19.83%	26.34%	18.31%
15	20	327	12.59%	88.02%	0.97%	-15	-20	7,601	24.31%	50.65%	22.45%
20	25	123	4.74%	92.76%	0.36%	-20	-25	6,067	19.40%	70.05%	17.92%
25	30	60	2.31%	95.07%	0.18%	-25	-30	3,617	11.57%	81.62%	10.68%
30	35	31	1.19%	96.26%	0.09%	-30	-35	2,142	6.85%	88.47%	6.33%
35	40	16	0.62%	96.88%	0.05%	-35	-40	1,310	4.19%	92.66%	3.87%
40	45	18	0.69%	97.57%	0.05%	-40	-45	766	2.45%	95.11%	2.26%
45	50	14	0.54%	98.11%	0.04%	-45	-50	497	1.59%	96.70%	1.47%
50	55	9	0.35%	98.46%	0.03%	-50	-55	307	0.98%	97.68%	0.91%
55	60	5	0.19%	98.65%	0.01%	-55	-60	194	0.62%	98.30%	0.57%
60	65	5	0.19%	98.84%	0.01%	-60	-65	121	0.39%	98.69%	0.36%
65	70	2	0.08%	98.92%	0.01%	-65	-70	99	0.32%	99.01%	0.29%
70	75	6	0.23%	99.15%	0.02%	-70	-75	46	0.15%	99.16%	0.14%
75	80	3	0.12%	99.27%	0.01%	-75	-80	53	0.17%	99.33%	0.16%
80	85	5	0.19%	99.46%	0.01%	-80	-85	47	0.15%	99.48%	0.14%
85	90	2	0.08%	99.54%	0.01%	-85	-90	27	0.09%	99.56%	0.08%
90	95	3	0.12%	99.65%	0.01%	-90	-95	23	0.07%	99.64%	0.07%
95	100	1	0.04%	99.69%	0.00%	-95	-100	22	0.07%	99.71%	0.06%
100	105	1	0.04%	99.73%	0.00%	-100	-105	20	0.06%	99.77%	0.06%
105	110	1	0.04%	99.77%	0.00%	-105	-110	17	0.05%	99.82%	0.05%
110	115	1	0.04%	99.81%	0.00%	-110	-115	15	0.05%	99.87%	0.04%
115	120	1	0.04%	99.85%	0.00%	-115	-120	10	0.03%	99.90%	0.03%
120	125	1	0.04%	99.88%	0.00%	-120	-125	11	0.04%	99.94%	0.03%
125	130	1	0.04%	99.92%	0.00%	-125	-130	6	0.02%	99.96%	0.02%
130	135	-	0.00%	99.92%	0.00%	-130	-135	4	0.01%	99.97%	0.01%
135	140	-	0.00%	99.92%	0.00%	-135	-140	2	0.01%	99.98%	0.01%
140	145	-	0.00%	99.92%	0.00%	-140	-145	2	0.01%	99.98%	0.01%
145	150	-	0.00%	99.92%	0.00%	-145	-150	3	0.01%	99.99%	0.01%
150	155	-	0.00%	99.92%	0.00%	-150	-155	2	0.01%	100.00%	0.01%
155	160	-	0.00%	99.92%	0.00%	-155	-160	-	0.00%	100.00%	0.00%
160	165	-	0.00%	99.92%	0.00%	-160	-165	-	0.00%	100.00%	0.00%
165	170	-	0.00%	99.92%	0.00%	-165	-170	-	0.00%	100.00%	0.00%
170	175	1	0.04%	99.96%	0.00%	-170	-175	-	0.00%	100.00%	0.00%
175	180	-	0.00%	99.96%	0.00%	-175	-180	-	0.00%	100.00%	0.00%
180	185	1	0.04%	100.00%	0.00%	-180	-185	-	0.00%	100.00%	0.00%
185	190	-	0.00%	100.00%	0.00%	-185	-190	-	0.00%	100.00%	0.00%
190	195	-	0.00%	100.00%	0.00%	-190	-195	-	0.00%	100.00%	0.00%
195	200	-	0.00%	100.00%	0.00%	-195	-200	-	0.00%	100.00%	0.00%
200	205	-	0.00%	100.00%	0.00%	-200	-205	-	0.00%	100.00%	0.00%
Total Positive		**2,597**			**Total Negative**			**31,266**			
					Total Strikes			**33,863**			

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