Forecasting Cloud To Ground Lightning Densities On The Florida Peninsula

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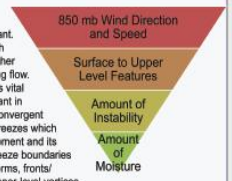
Introduction

Among the highest cloud to ground lightning densities in the United States annually occurs in Florida, and for energy companies these provide a major disruption to their operations. These lightning strikes are attributed to thunderstorms whose catalysts are from sea and lake breeze boundaries, fronts, mid and upper level disturbances and feeder bands from tropical cyclones. The low level steering flow located just above the boundary layer is a driver for these synoptic, mesoscale, and microscale features and is the basis for this study. Working in concert with the steering flow are the comparisons to it with precipitable water values, lifted indices, and the K index. In analyzing the impactful thunderstorms this study examines the thunderstorm intensities based on a lightning scale using a 4-year compilation of data (January 1, 2007 – December 31, 2011) as recorded by Schneider Electric meteorologists. The focus is on moderate or higher cloud to ground lightning strike densities that are most impactful for Schneider Electric energy clients in Florida. Using this data, the relationship with the steering flow is compared with the instability, temperature lapse rates, moisture depth and content indices for cloud to ground lightning densities in a 5 X 5 km grid over 1 hour of time using a minimum of 76 lightning strikes. This information is used to more accurately forecast the position and strength of thunderstorms to scale in Florida that give our energy clients the most issues for power interruptions and that assists in planning for mobilizing crews to where the highest lightning densities will occur.

Lightning Forecasting Methodology

Knowing 850 mb flow is important. 850 mb flow that converges with the coast typically produces higher lightning densities than opposing flow. Knowing the 850 mb direction is vital with 850 mb speed very important in determining the speed of any convergent boundaries, i.e. sea and lake breezes which will aid in thunderstorm development and its propagation. While sea/lake breeze boundaries can be a catalyst for thunderstorms, fronts/ troughs/tropical systems/mid/upper-level vortices produce more of the impactful lightning events.



Sufficient instability with lifted index values of at least -3 and K indices over 30 can help produce moderate to higher lightning densities as well as abundant moisture levels over 1.80". Southerly 850 mb flows account for most of Level 3 or higher lightning storms by region with Southwest winds having a plurality of the shares, except in the West Region where Southeast winds are highest.

Onshore 850 mb Steering Flows

Level 3's
850 mb Speeds: 7.7 to 12.6 knots
LI's: -3.1 to -5.5
PW's: 1.87" to 2.05"
K's: 30.3 to 32.4

Level 4's
850 mb Speeds: 4 to 9.3 knots
LI's: -3.7 to -5.4
PW's: 1.89" to 2.13"
K's: 31.2 to 35.2

Level 3 or Higher Percentages By Region
East 14% | South 10% | Brevard/Treasure Coast 9% | West 9% | North/Central 5%

Offshore 850 mb Steering Flows

Level 3's
850 mb Speeds: 8.7 to 14.4 knots
LI's: -4.1 to -5
PW's: 1.97" to 2.09"
K's: 31.6 to 35.4

Level 4's
850 mb Speeds: 9.2 to 10.6 knots
LI's: -3.7 to -4.6
PW's: 1.90" to 2.09"
K's: 31.7 to 34.9

Level 5's
850 mb Speeds: 9 to 12.3 knots
LI's: -5 to -5.7
PW's: 1.87" to 2.09"
K's: 34 to 37.8

*No Level 5's in South or West

Level 3 or Higher Percentages By Region
North/Central 31% | West 28% | Brevard/Treasure Coast 27% | East 17% | South 17%

Northerly 850 mb Steering Flows

Level 3's
850 mb Speeds: 6.3 to 8.8 knots
LI's: -3.5 to -5.1
PW's: 1.87" to 2.11"
K's: 32 to 34.9

Level 4's
850 mb Speeds: 7 to 9.4 knots
LI's: -4.1 to -4.7
PW's: 1.93" to 2.19"
K's: 30.7 to 36.7

Level 5's
850 mb Speeds: 6.3 to 8 knots
LI's: -2.3 to -5
PW's: 1.93" to 2.22"
K's: 34 to 36.1

*No Level 5's in North/Central or South

Level 3 or Higher Percentages By Region
South 21% | West 19% | North/Central 15% | Brevard/Treasure Coast 14% | East 14%

Southerly 850 mb Steering Flows

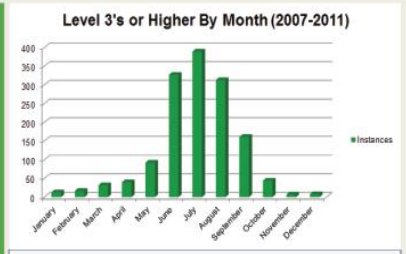
Level 3's
850 mb Speeds: 9.8 to 14.4 knots
LI's: -4.2 to -4.8
PW's: 1.93" to 2.02"
K's: 32.3 to 34.8

Level 4's
850 mb Speeds: 9.9 to 13.1 knots
LI's: -3.8 to -4.9
PW's: 1.94" to 1.99"
K's: 32.1 to 34.5

Level 5's
850 mb Speeds: 4 to 18 knots
LI's: -4 to -5.4
PW's: 1.60" to 2.04"
K's: 33 to 37

Level 6's
850 mb Speeds: 4 to 19 knots
LI's: -4.5 to -7.2
PW's: 2.03" to 2.36"
K's: 36.1 to 39.9

Level 3 or Higher Percentages By Region
East: 55% | South 51% | Brevard/Treasure Coast 50% | North/Central 48% | West 44%



60-70% of these storms occurred from June 10-August 20

Summary

Considering the low level steering flow depending on region and how it interacts with various atmospheric features, a reasonable forecast for cloud to ground lightning density can be achieved in the Florida Peninsula. Knowledge of these conducive factors can provide energy companies with the heads up to make preparations for lightning interruptions, especially for moderate and higher lightning storms.

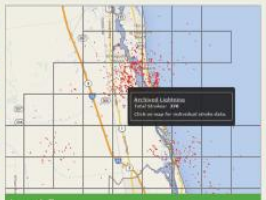
Schneider Electric's MxVision WeatherSentry Online software pinpoints cloud to ground lightning strikes instantaneously and provides lightning counts to assist in determining user-determined threshold levels. This technology combined with industry-leading expertise results in savings of valuable resources for our Florida energy clients daily.

Lightning Level	Lightning Strikes Per 5 X 5 km Grid Per Hour
1	0
2	1-75
3	76-150
4	151-300
5	301-450
6	451+

Level 2

Level 3

Level 4



Level 5

Level 6

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