Determining Favorable Atmospheric Conditions for Waterspout Development in South Florida

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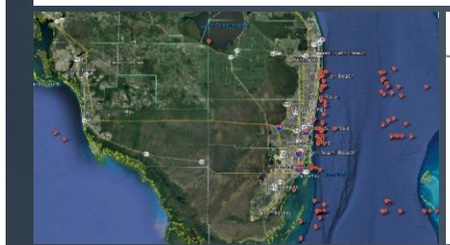
Background

- Waterspouts frequently occur in South Florida waters within 60 nm of the coast, sometimes making landfall
- Lack of identifiable radar signatures combined with rapid genesis presents challenges from a warning perspective
- Climatologically, low-level light easterly winds typically most favorable for waterspouts across South Florida waters



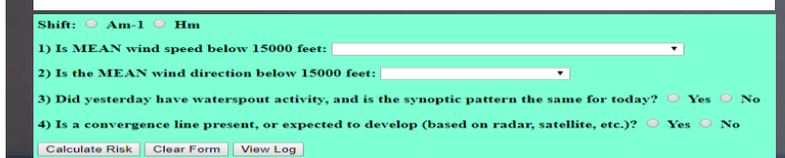
Location* (areal coverage)	Total spouts
1. Florida Keys** (22809 km²)	>1000
2. Greater Miami, Fla. (10 138 km²)	335 (++)
3. Tampa Bay, Fla. (6970 km²)	235 (++++)
4. Palm Beach, Fla. (5069 km²)	234
5. Corpus Christi, Tex. (6246 km²)	211 (+++++++++)
6. Ft. Lauderdale-Del Rey Beach, Fla. (5069 km²)	180 (++)

Golden 1977

a) Map of waterspout locations used in study; b) Top 6 most favorable locations for waterspouts in United States

Objectives

- Develop a predictive equation that improves upon the current NWS Miami waterspout calculator (below)
- Assess the importance of various thermodynamic and kinematic parameters conducive for waterspouts



Acknowledgments

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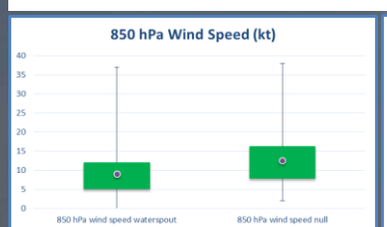
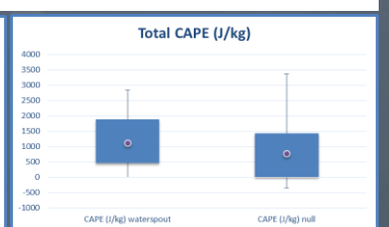
Data Collection and Analysis

- 130 days analyzed (78 waterspout, 52 null) from 2003-2007
- Collected data utilizing RAOB software for over 40 thermodynamic and kinematic variables using 1200 UTC KMFL observed soundings
- Box and whisker plots created to identify trends for waterspout days vs. null days
- Correlations performed to identify possible predictive variables
- Multiple linear regression analysis run from correlation findings to create a predictive equation for waterspout potential

Results

- Regression analysis shown to be statistically significant
- Box and whisker plots revealed several variables with little difference between waterspout vs. null days

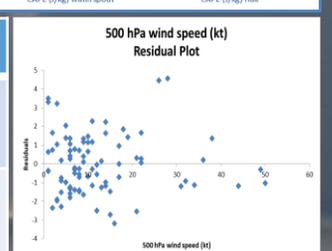




Multiple Linear Regression Results

R^2 ~ 0.87 Multiple R^2 ~ 0.93 Adjusted R^2 ~ 0.83	Significance and Bias F-Test: 9.33E-26 (p value < 0.05)

*Treated Sfc – 700 hPa mean wind as independent variable as proxy for observed waterspouts (light winds most conducive)

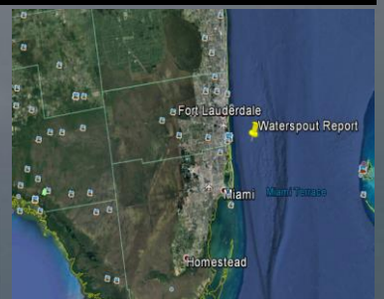


Sfc-700 hPa mean wind (Waterspout Potential) = -2.66 + 0.44(VGP) + 0.42(0-3 km shear) + 0.04(0-3 mean T-T_d) + 0.48(0-1 mean T-T_d) + 0.3(500 hPa wind speed) + 0.13(sfc-700 mean T-T_d) – 0.04(Bulk rich shear) – 0.86(0-3 km EHI) + 0.000868(LCL height) + 0.0019(LI) + 0.02(0-3 km SRH) – 0.26(0-6 km shear) + 0.34(0-1 km shear) + 0.03(0-500 m shear)

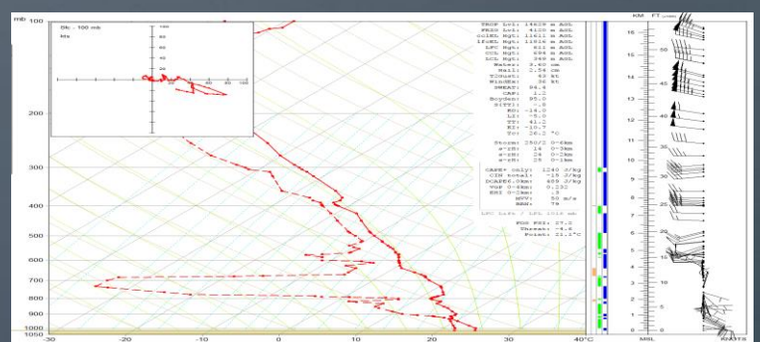
Case Study – 14 May 2012

- Waterspout reported east of Hollywood Beach, FL
- Predictive equation accurate to within 1 kt
- Also had favorable low-level SE wind direction

Sfc – 700 hPa mean wind (kt)	
Predicted	4.97
Observed	4.75



Map of observed waterspout report



14 May 2012 1200 UTC KMFL observed sounding; sounding created using RAOB software

Conclusions

- Based on results, NWS Miami will be adapting its local waterspout calculator to include predictive equation
- **Future Work:** Further data collection (2008-present); additional verification of predictive equation; Principle Component Analysis to further bolster results