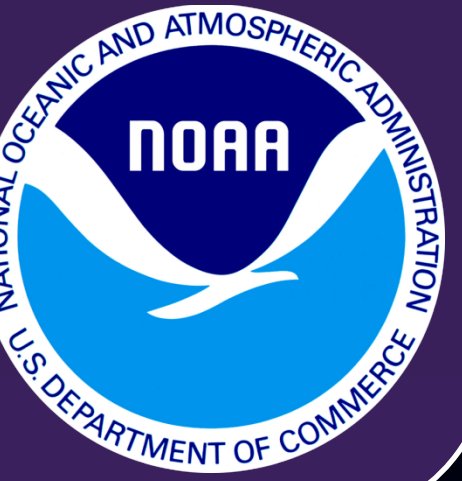


# Derivation of Composite Soundings for Severe Weather and Special Weather Statement (SPS) Conditions to Improve the Wind Gust Potential at WFO Miami

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## Objective

1. Improve forecasting of severe wind gust events in South Florida
2. Identify which parameters signal probability of a wind gust event
3. Transfer research into operations

## Data

1. Sounding Data: 2010 – 2013 (NCDC)
2. Sounding Time: 12 UTC
3. Total Soundings: 111
  - i. SPS Warm Season: 58
  - ii. SPS Cold Season: 27
  - iii. Severe Warm Season: 16
  - iv. Severe Cold Season: 10

## Motivation

Strong wind gusts generated from a severe thunderstorm pose a risk to life and property. The purpose of this research is to improve the prediction of days with severe wind gusts in South Florida, enhancing WFO Miami warning operations.

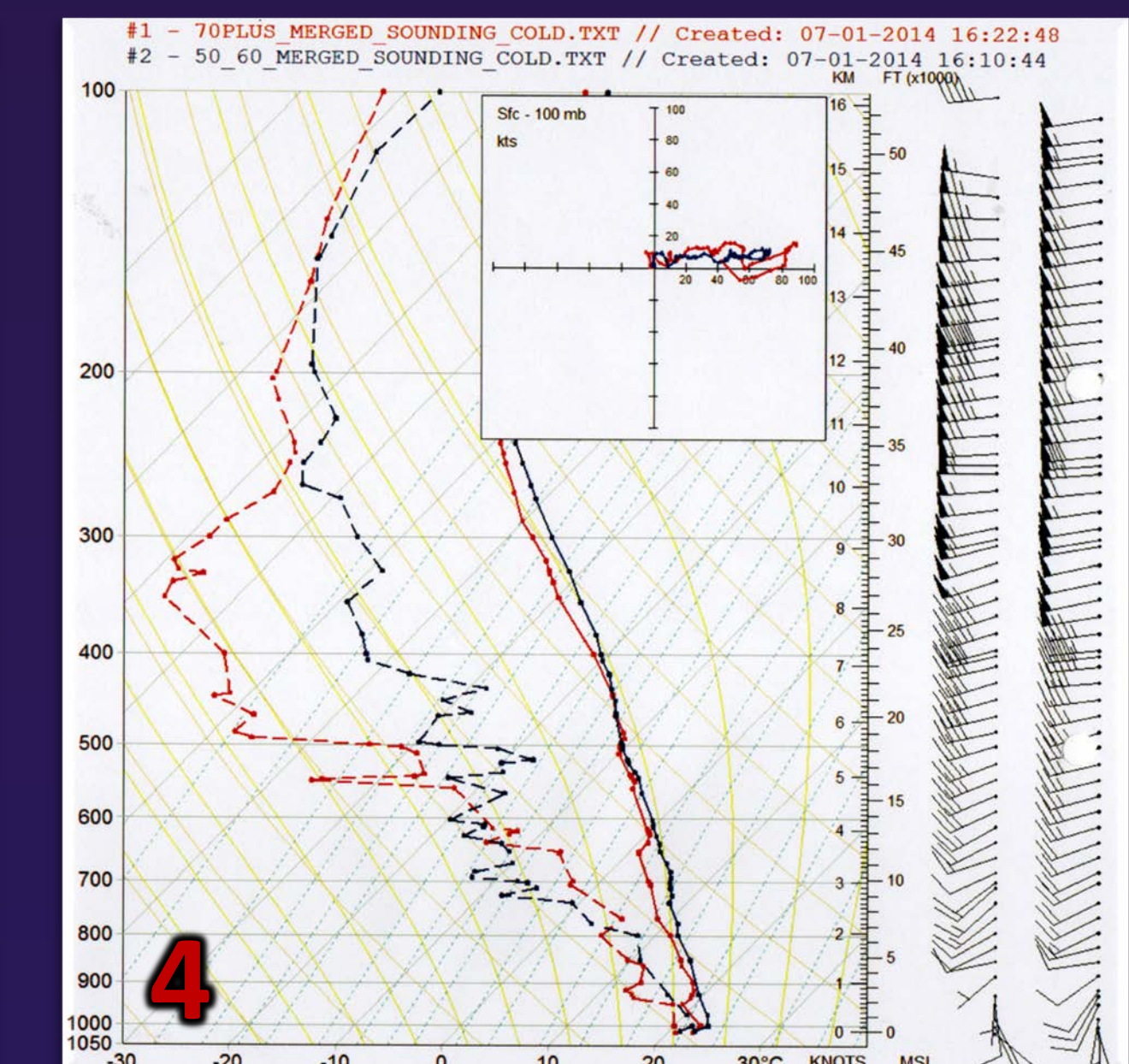
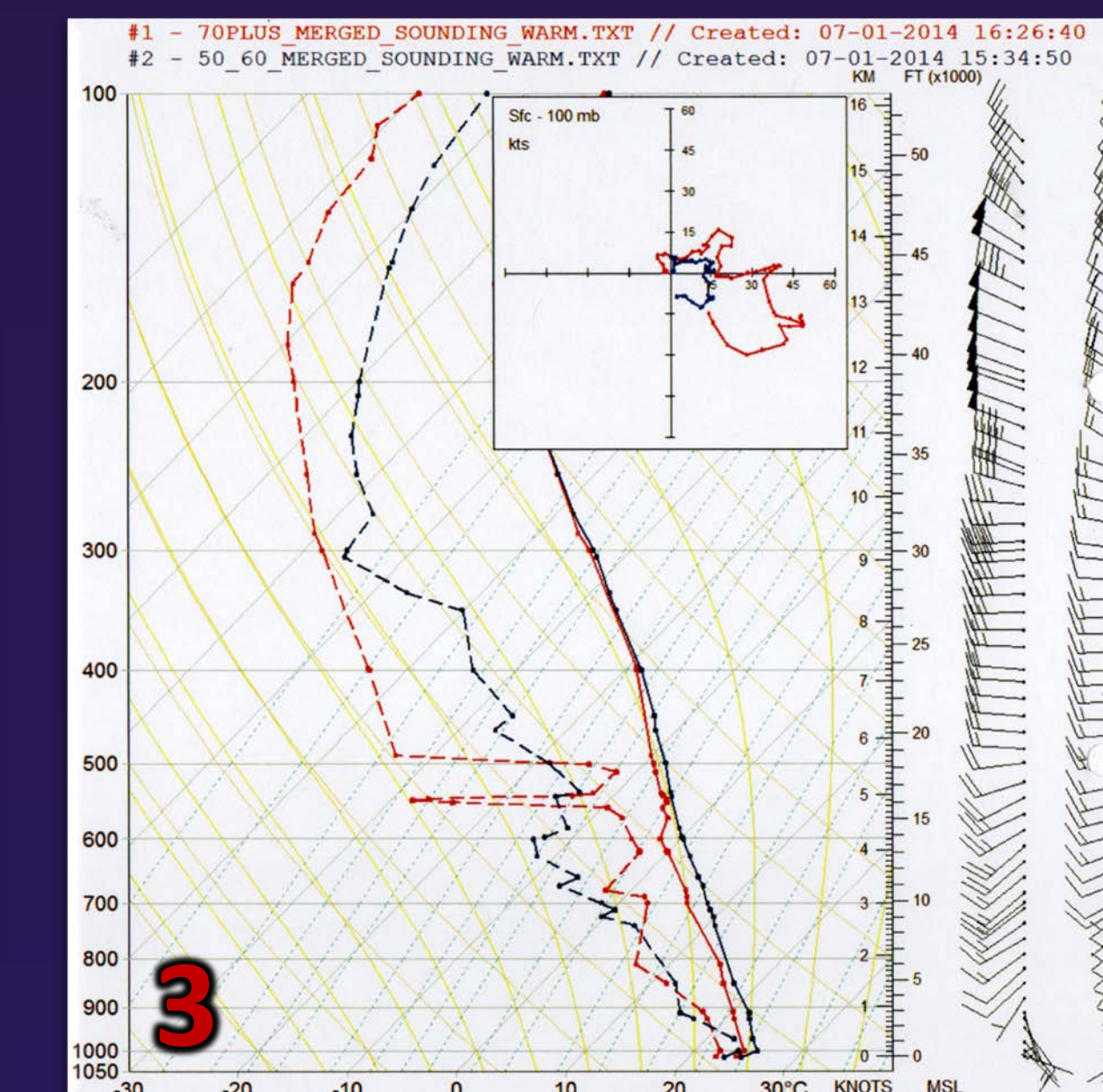
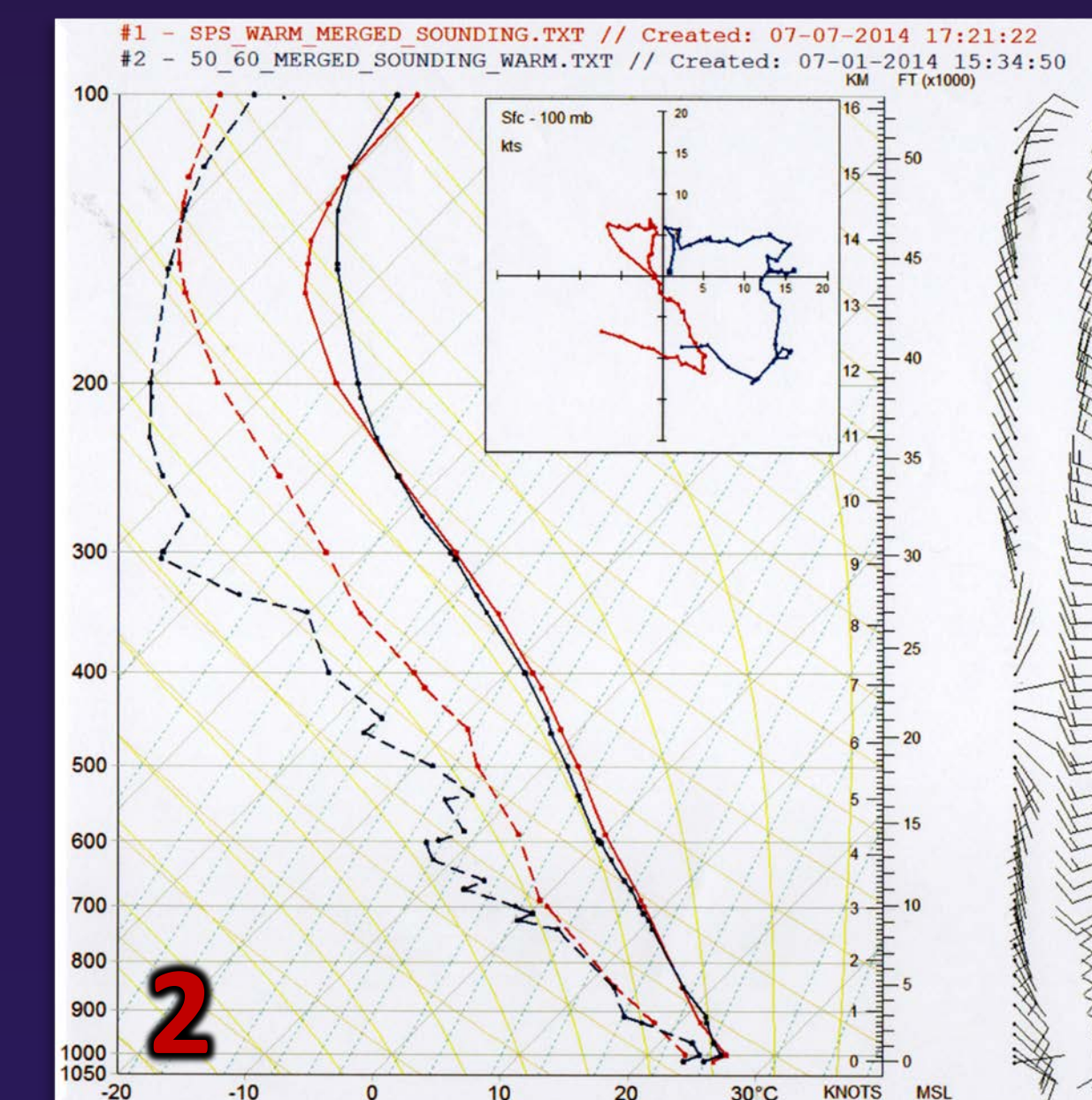
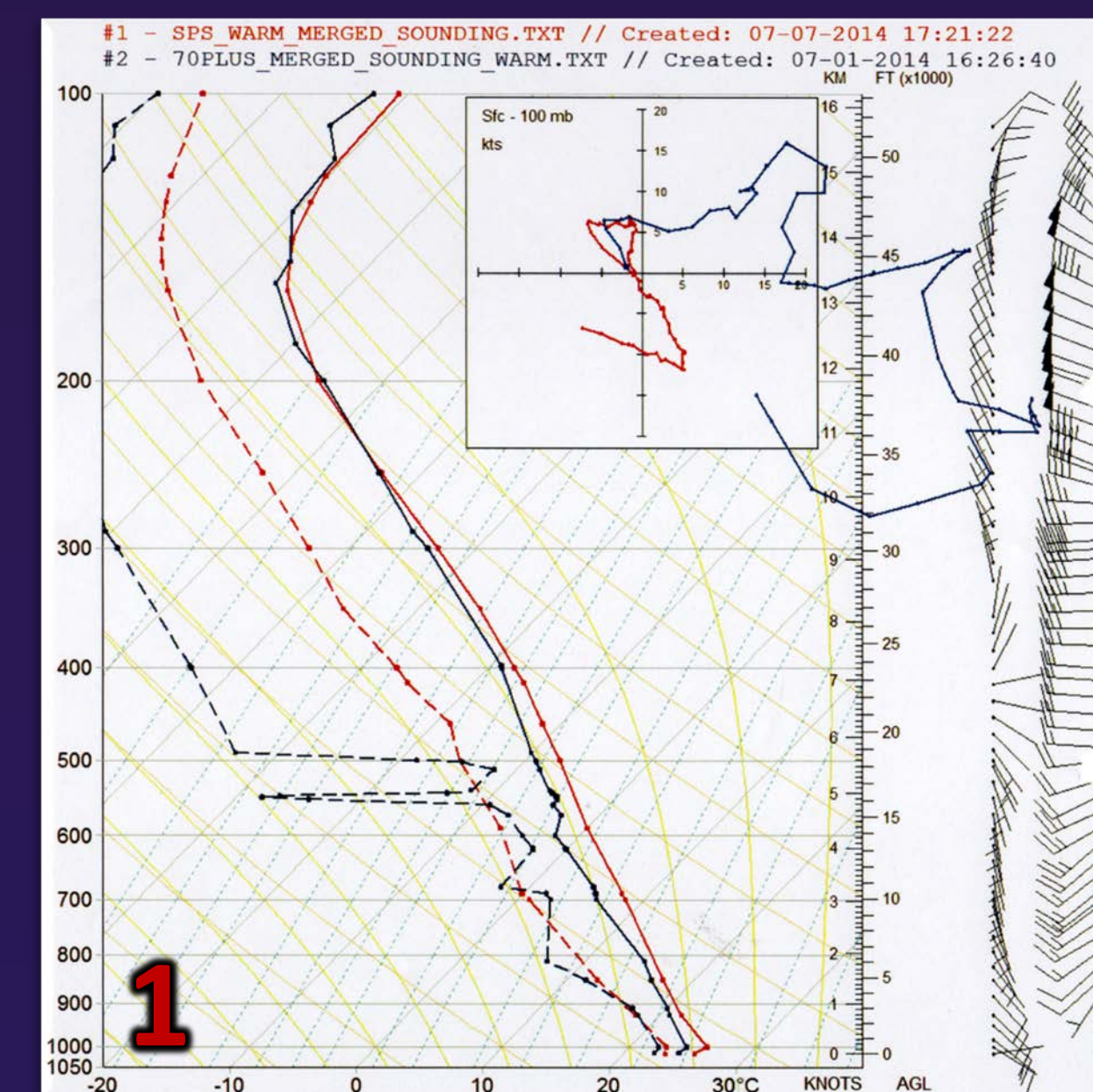
## Methods

1. Categorize 12 UTC soundings into:
  - (1) WFO issued SPS with no severe wind gust reported, and (2) days that reported severe wind gusts.
2. Days with severe wind gusts separated into two groups
  - i. Severe 58 – 70 mph
  - ii. Significant Severe > 70 mph
3. Separate soundings by warm and cool seasons
4. Generate composite soundings by averaging all sounding data into a single sounding, utilizing the RAOB program
5. Perform statistical t-Test to determine confidence intervals of various wind related parameters

## Results

Sounding Parameter t-Test (95% Confidence Interval)

|   | 700-500 MB LAPSE RATE | 800-600 MB LAPSE RATE | DELTA THETA-e   | MDPI             | WINDEX           | WMSI            | 500 MB TEMP     |
|---|-----------------------|-----------------------|-----------------|------------------|------------------|-----------------|-----------------|
| 1 SPS_WARM VS. SEVERE_WARM 70+          | Significant           | Not Significant       | Not Significant | Not Significant  | Not Significant  | Not Significant | Significant     |
| 2 SPS_WARM VS. SEVERE_WARM 58-70        | Significant           | Significant           | Significant     | Very Significant | Not Significant  | Not Significant | Significant     |
| 3 SEVERE_WARM 70+ VS. SEVERE_WARM 58-70 | Significant           | Not Significant       | Significant     | Significant      | Not Significant  | Not Significant | Not Significant |
| 4 SEVERE_COLD 70+ VS SEVERE_COLD 58-70  | Not Significant       | Not Significant       | Not Significant | Not Significant  | Very Significant | Not Significant | Not Significant |



## Conclusions

The inclusion of composite sounding analysis using the RAOB program is now part of the severe wind gust determination and the overall convective assessment at WFO Miami. This includes previous analysis of severe vs. and non-severe cases. The results of this research show distinct differences and characteristics of the upper-air conditions for each of the composite soundings. The comparison of the severe/SPS composite soundings reveals that dry air above 500 mb is needed to generate severe wind gusts in South Florida. In addition, the 800 to 600 mb lapse rate is steeper in the severe composite sounding. The WINDEX and WMSI indices are not significant when discriminating severe vs. non-severe events. A distinct signature of SW winds with low level S or SE is present for the severe wind gust cases. Small differences are significant when it comes to the convective assessment and are important to forecasters.