Observation Denial and Performance of a Local Mesoscale Model

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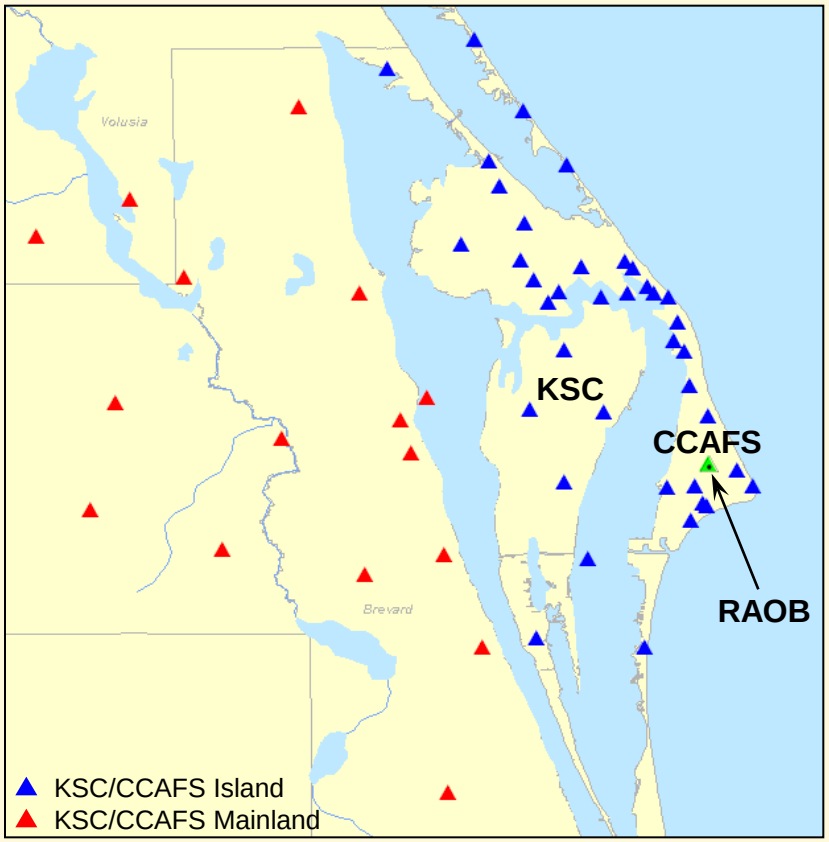
Outline

- Background
- Project Goal
- Methodology
- Candidate Days
- Model Configuration
- Subjective Analysis
- Objective Analysis
- Summary and Conclusions

Background

- Budget cuts may eliminate
  - East-central Florida mainland KSC/CCAFS wind towers
  - Some CCAFS rawinsondes (RAOB)
- Data loss may impact the ability to forecast wind events by:
  - 45th Weather Squadron
    - CCAFS, Florida
  - Spaceflight Meteorology Group
    - JSC, Houston, Texas
  - National Weather Service
    - WFO, Melbourne, FL



Project Goal

- Assess model capability to predict wind events by removing
  - Mainland wind towers
  - All but one CCAFS RAOB per day

Methodology

- Selective data denial to model initialization
- Four scenarios
  - Towers, RAOB
  - Towers, no RAOB
  - No towers, RAOB
  - No towers, no RAOB
- Compare outputs

Candidate Days

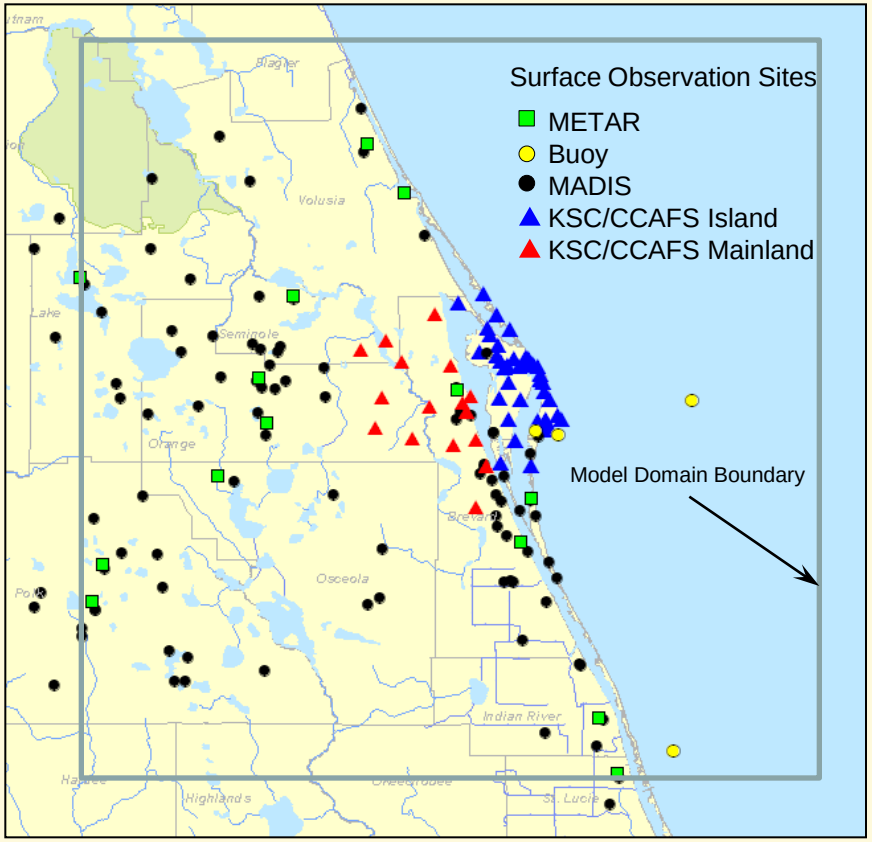
- Period of Record
  - Warm Season: Jun – Sep 07
  - Cool Season: Nov 07 – Jan 08
- Three criteria
  - 45 WS wind advisory or warning issued
  - Non-synoptic forcing (warm season only)
  - Mean winds > 18 kt observed at any wind tower at any height (12’ to 300’)

Candidate days and observed maximum peak wind speed recorded for the day.

Warm Season		Cool Season	
Candidate Day	Peak Wind (kt)	Candidate Day	Peak Wind (kt)
12 Jun 07	40	11 Nov 07	29
20 Jun 07	38	16 Dec 07	47
28 Jun 07	33	21 Dec 07	29
05 Jul 07	25	03 Jan 08	38
10 Jul 07	28	17 Jan 08	43
11 Jul 07	35	20 Jan 08	41
15 Jul 07	35	25 Jan 08	35
19 Jul 07	34	27 Jan 08	29
24 Jul 07	45		
11 Sep 07	23		
12 Sep 07	27		
26 Sep 07	32		

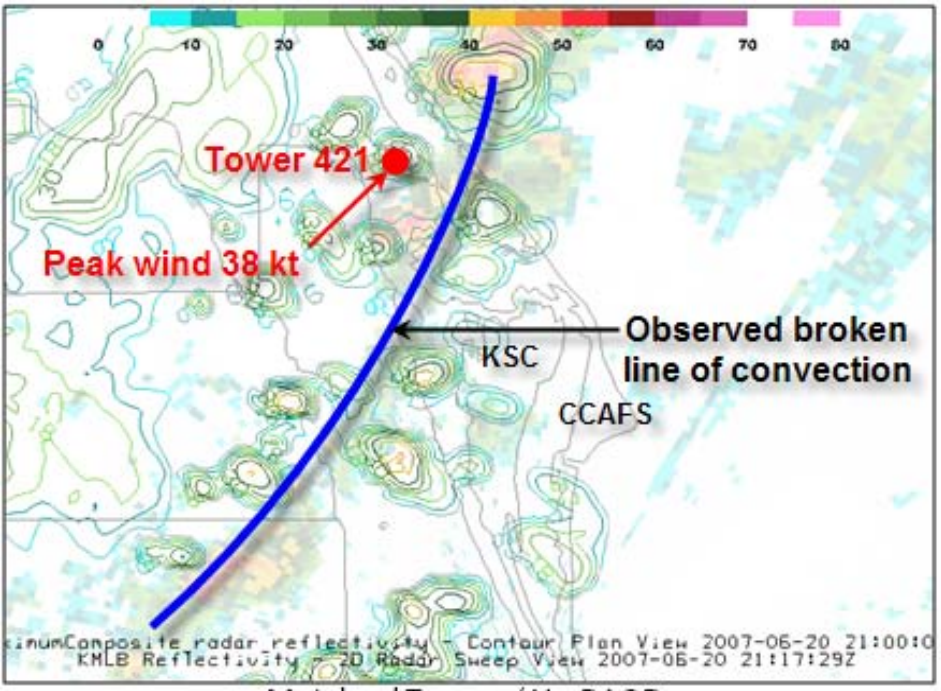
Model Configuration

- WRF EMS – start at 0900 UTC
  - ARW core
  - 1.3 km horizontal grid
  - 40 vertical sigma levels
  - 12 km NAM BC
- LAPS “hot-start” initialization
  - Level II KMLB WSR-88D
  - GOES visible and IR imagery
  - MADIS data
  - KSC/CCAFS wind towers
  - CCAFS RAOB
  - 0600 UTC cold start 3-km WRF background model

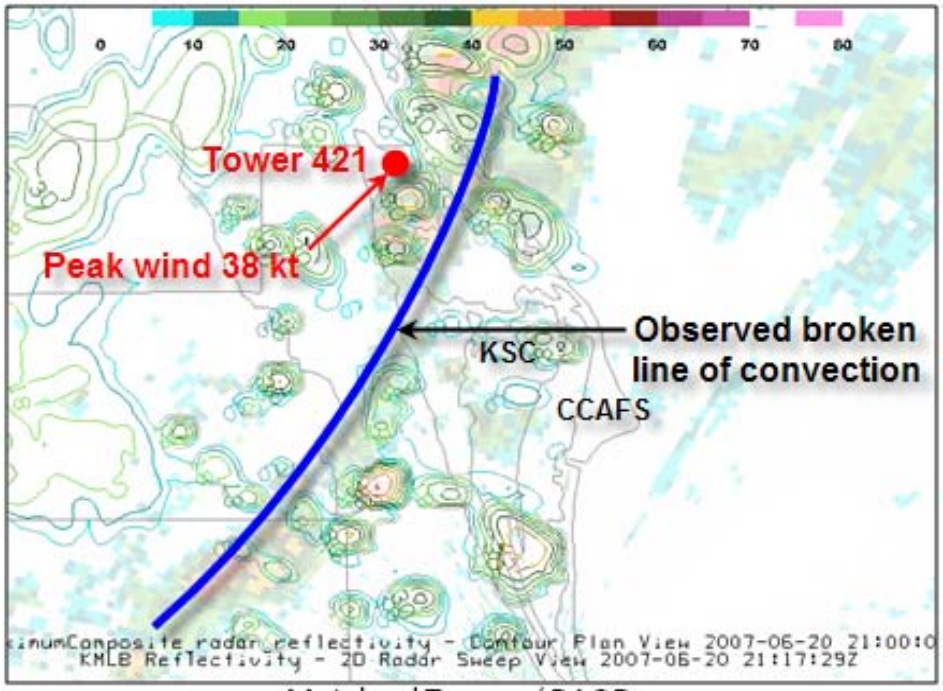


Subjective Analysis

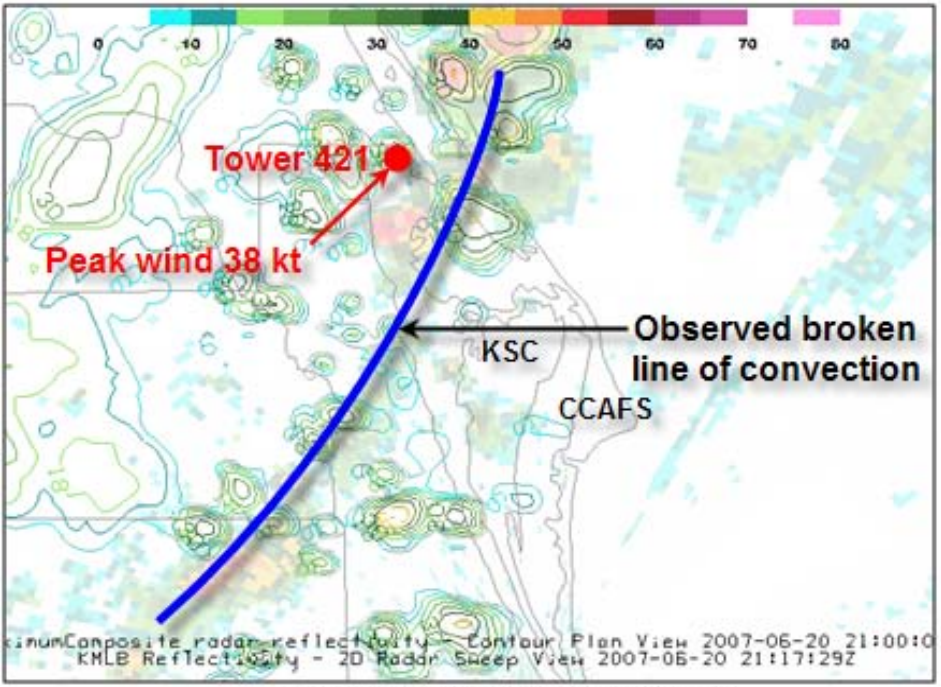
- Model output of peak and average winds compared to corresponding wind tower observations
- Warm season
  - Model radar reflectivity also assessed because its location and strength was highly correlated with WRF peak wind forecasts
  - Little difference among four scenarios
  - Model forecast average speeds provided no useful information
- Cool season
  - Synoptic scale gradient flow primary cause of high wind events
  - No cool season events associated with convection
  - Little difference among four scenarios
  - WRF peak wind forecasts better in cool season



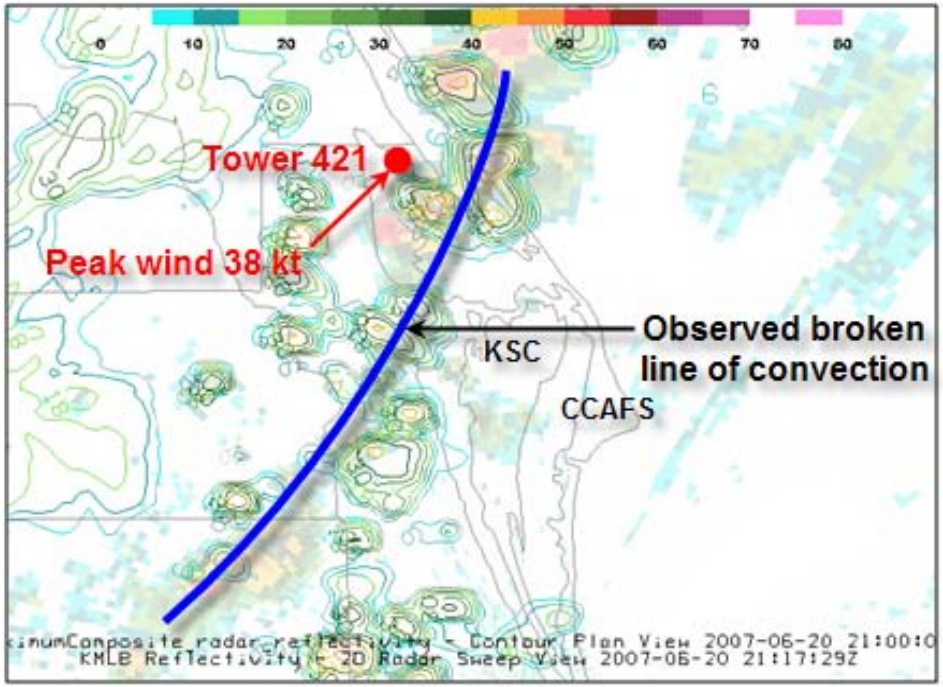
Mainland Towers / No RAOB



Mainland Towers / RAOB

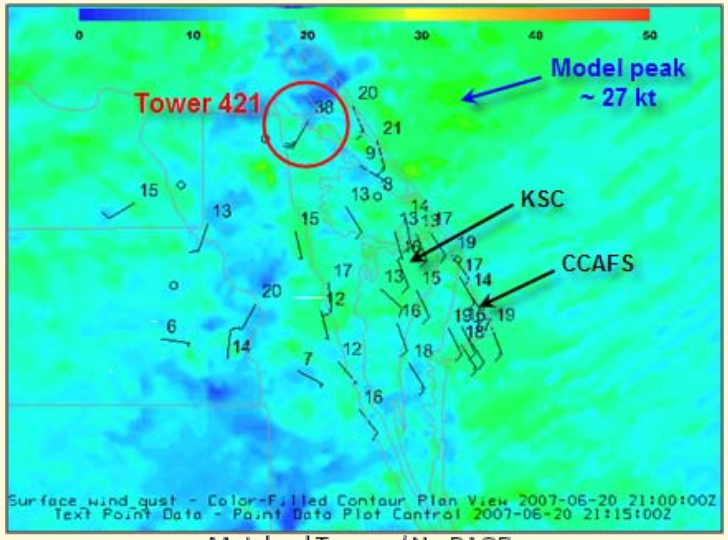


No Mainland Towers / No RAOB

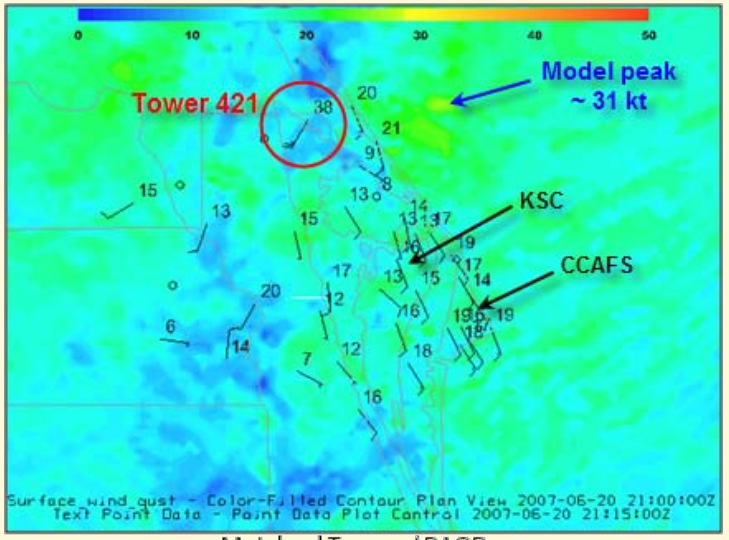


No Mainland Towers / RAOB

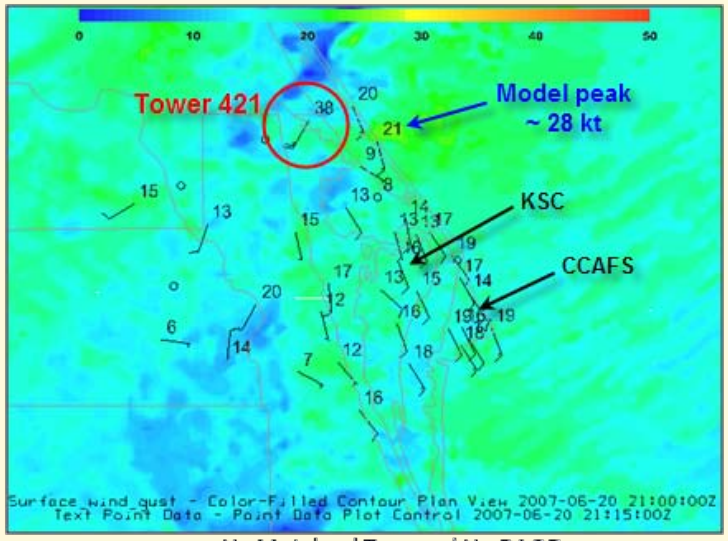
Subjective Analysis – Warm Season



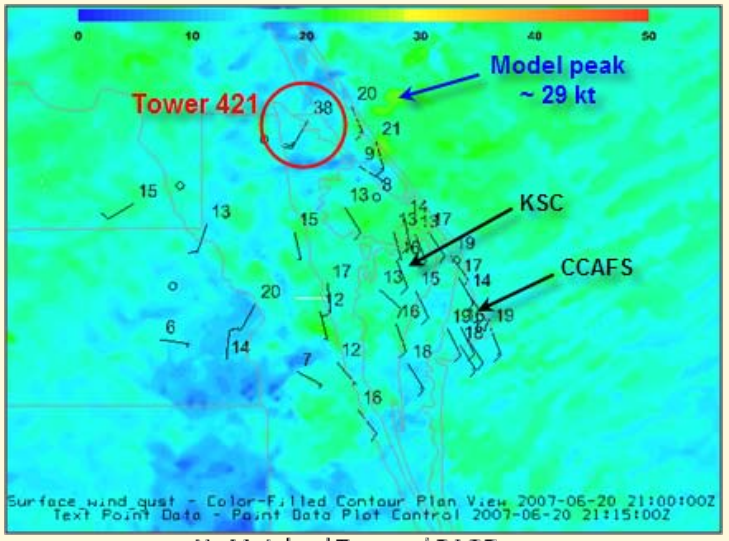
Mainland Towers / No RAOB



Mainland Towers / RAOB

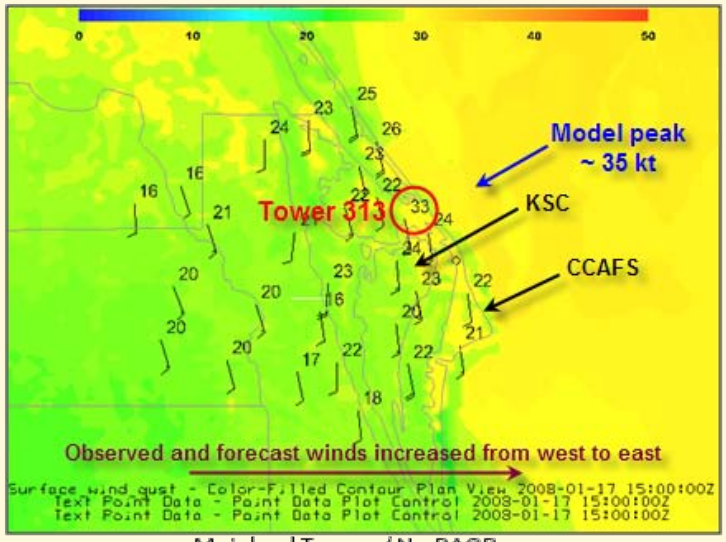


No Mainland Towers / No RAOB

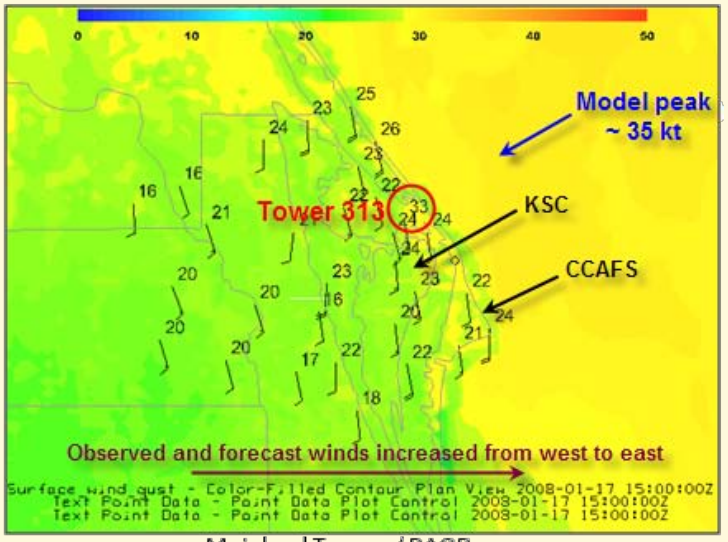


No Mainland Towers / RAOB

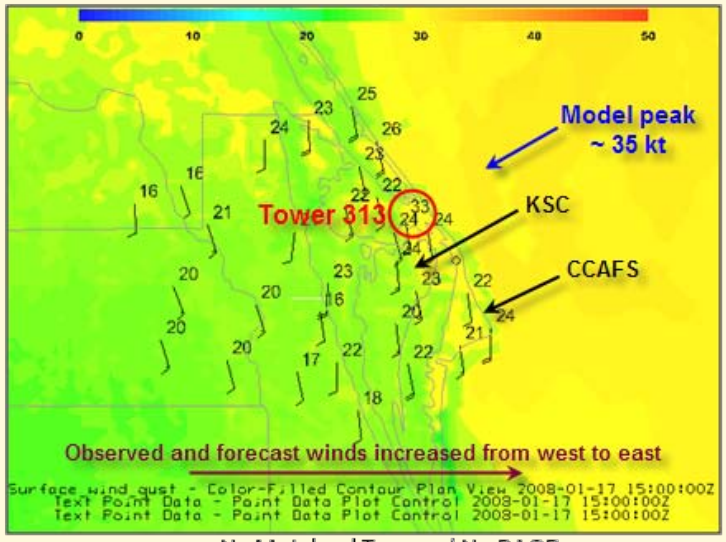
Subjective Analysis – Cool Season



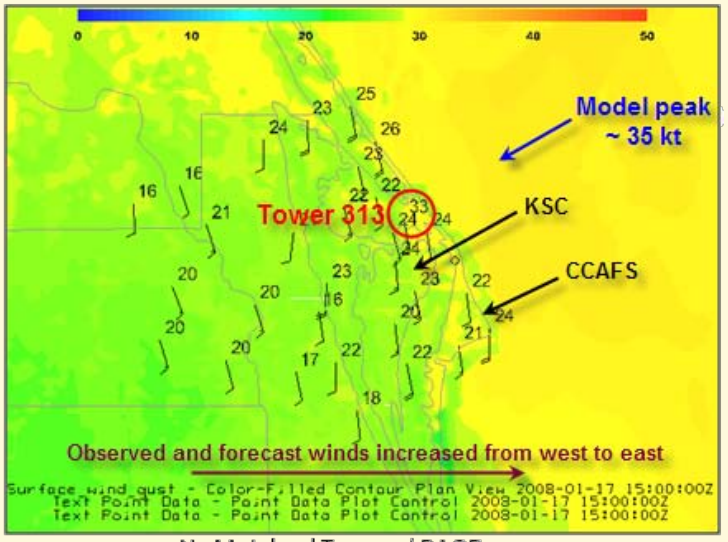
Mainland Towers / No RAOB



Mainland Towers / RAOB



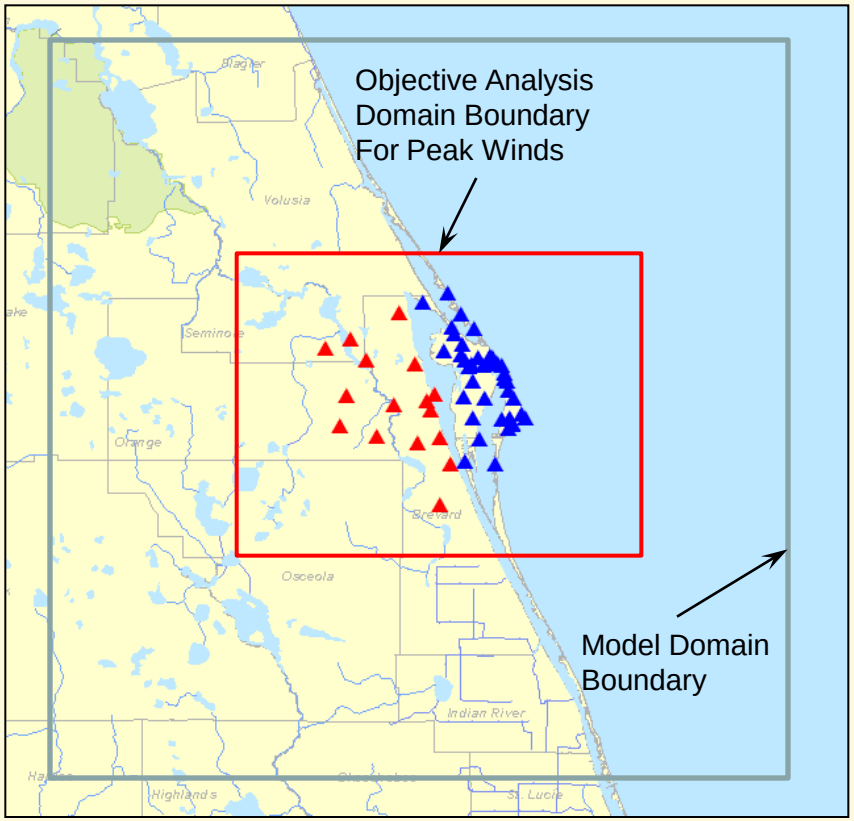
No Mainland Towers / No RAOB



No Mainland Towers / RAOB

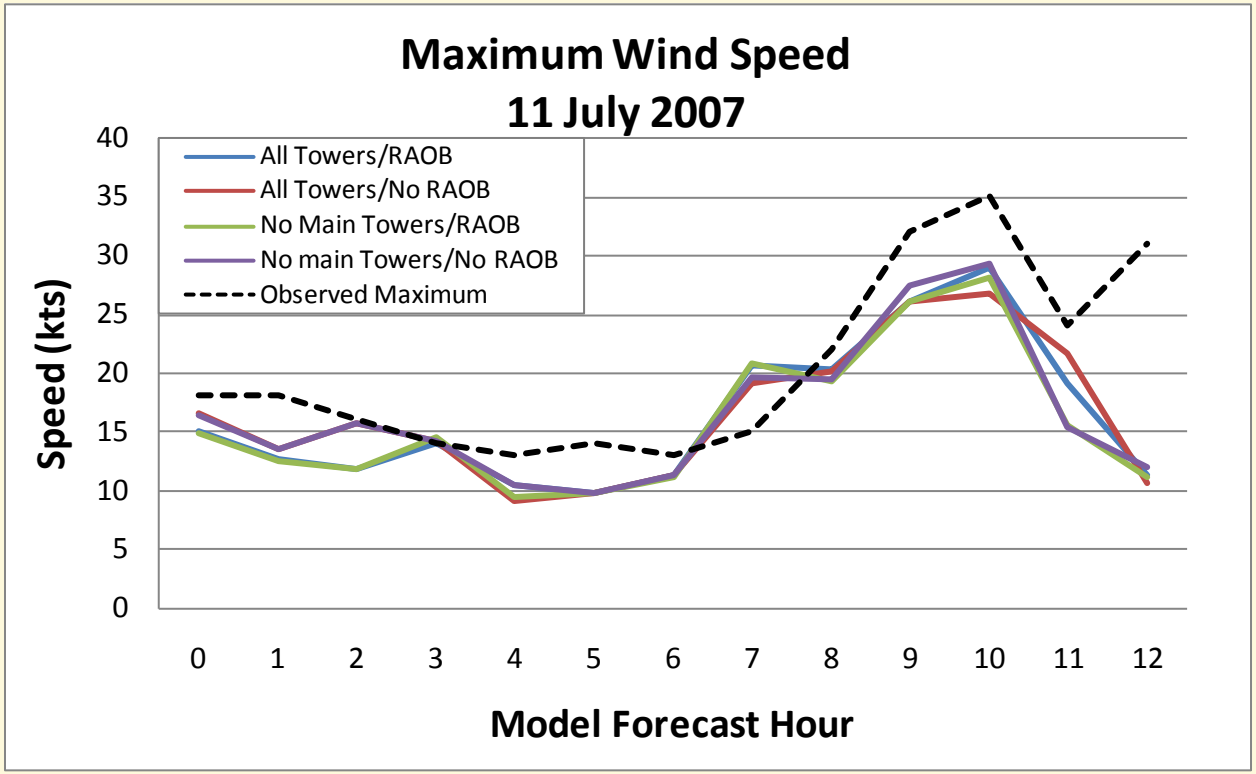
Objective Analysis

- Peak winds only
- Identified maximum model-domain peak wind speed for each output time
- Compared WRF four scenarios to each other
- Compared WRF to observed maximum peak wind speed



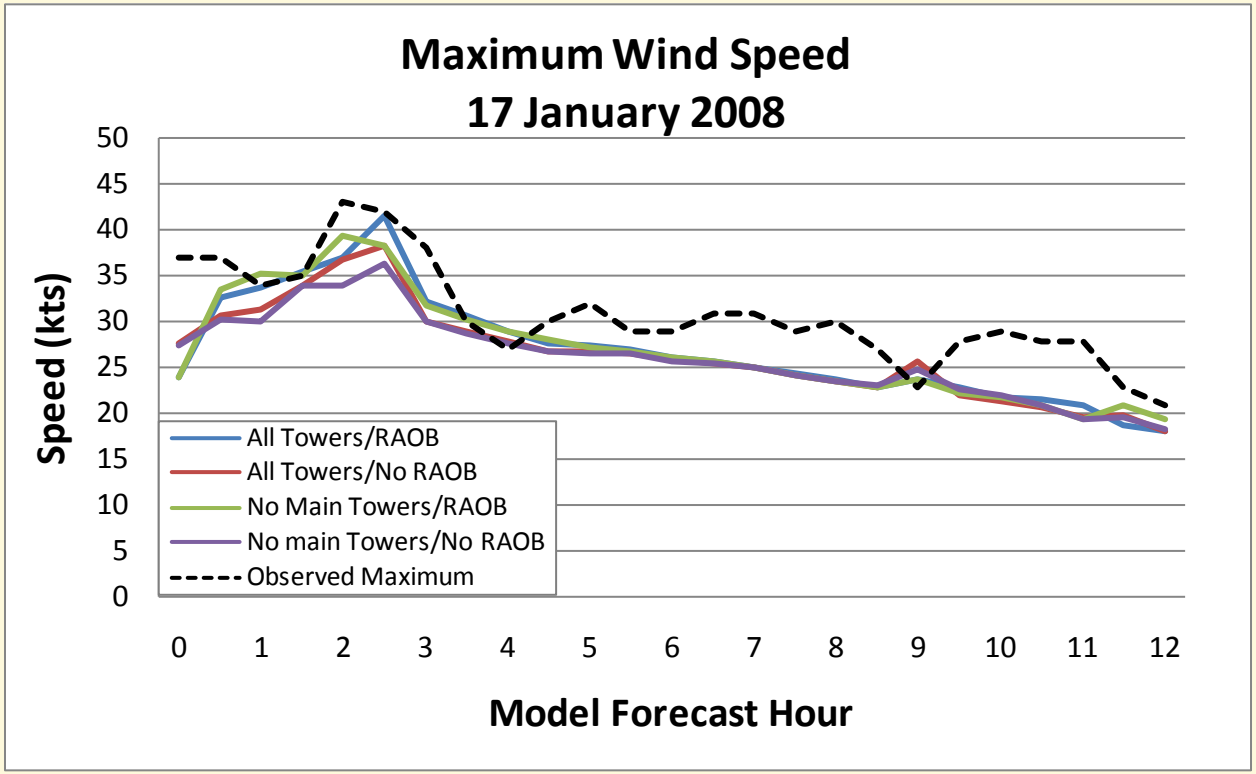
Objective Analysis – Warm Season

- All four model runs were consistent with each other
- Model forecasts matched the trend of the observed maximum peak wind speed in the domain



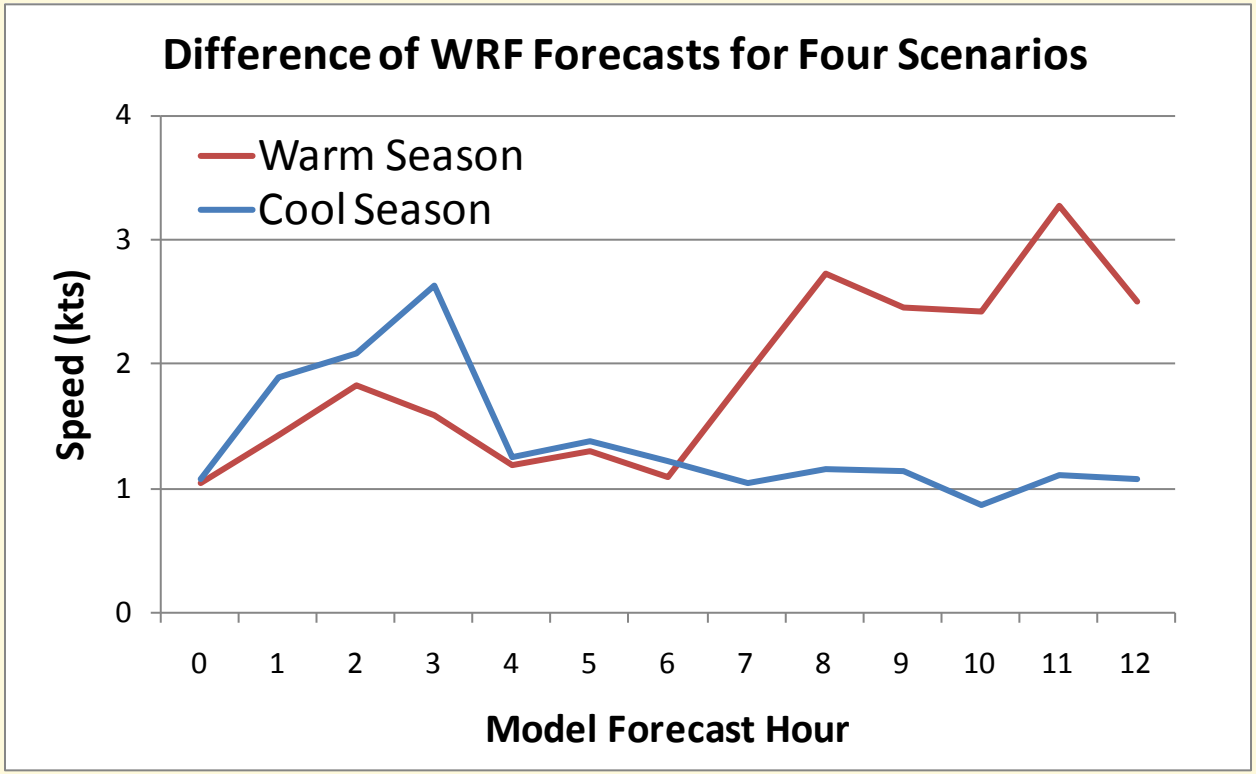
Objective Analysis – Cool Season

- All four model runs were consistent with each other
- Model forecasts matched the trend of the observed maximum peak wind speed in the domain



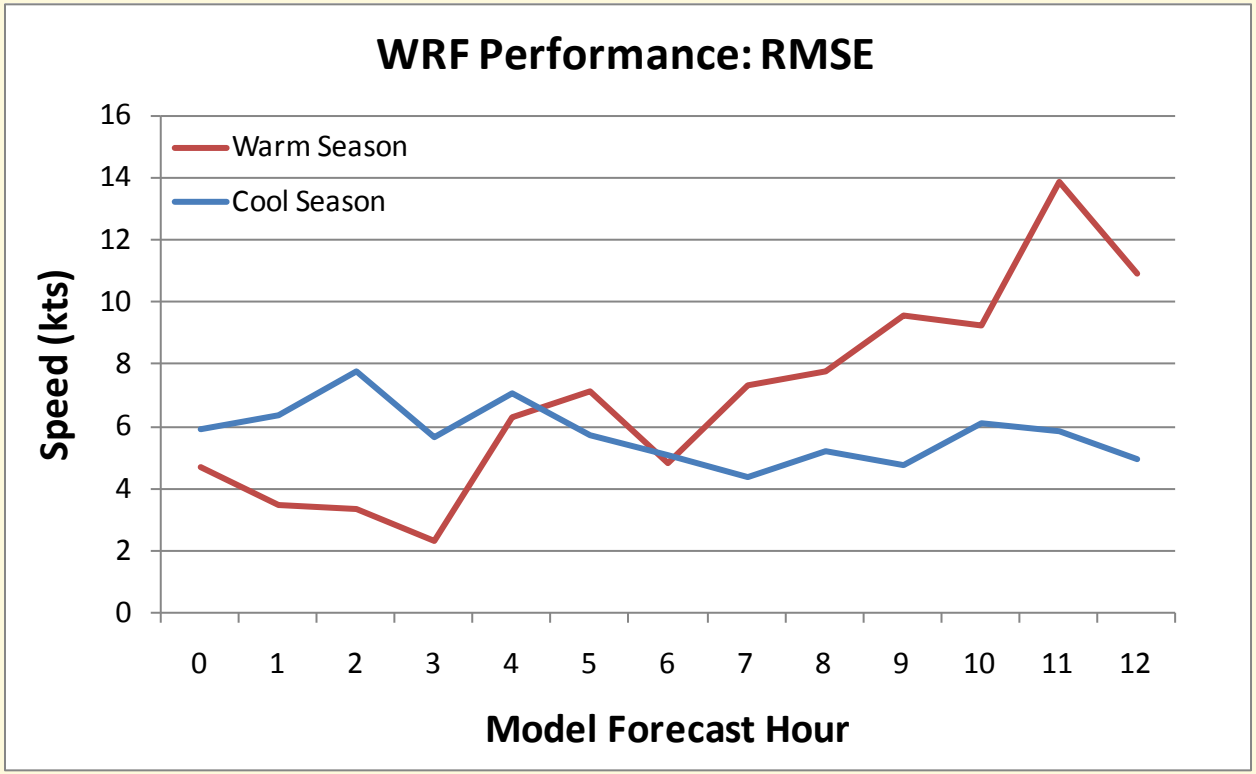
Objective Analysis – Four Scenarios

- Did any one scenario perform better than the others?
- Average difference between the maximum and minimum WRF forecast for each forecast hour in each case



Objective Analysis – WRF vs Obs

- Was WRF able to predict maximum peak wind speeds?
- WRF did better in the cool season
- WRF bias about -3.5 kt



Summary and Conclusions

- Budget cuts may eliminate mainland wind towers and some RAOBs
- Forecasters use wind tower and RAOB observations to:
  - Issue and verify wind advisories and warnings
  - Initialize local models
  - Support Space Shuttle landings
- Assessed model capability to predict wind events by removing mainland wind towers and all but one RAOB per day
- Conducted subjective and objective analyses
  - Little difference among the four WRF model scenarios
  - WRF performed better in the cool season
  - WRF could predict the threat of wind advisory or warning criteria
  - Provides added value to the forecaster's daily planning forecast