

# Observing Thunderstorm Downbursts over the Chesapeake Bay Region

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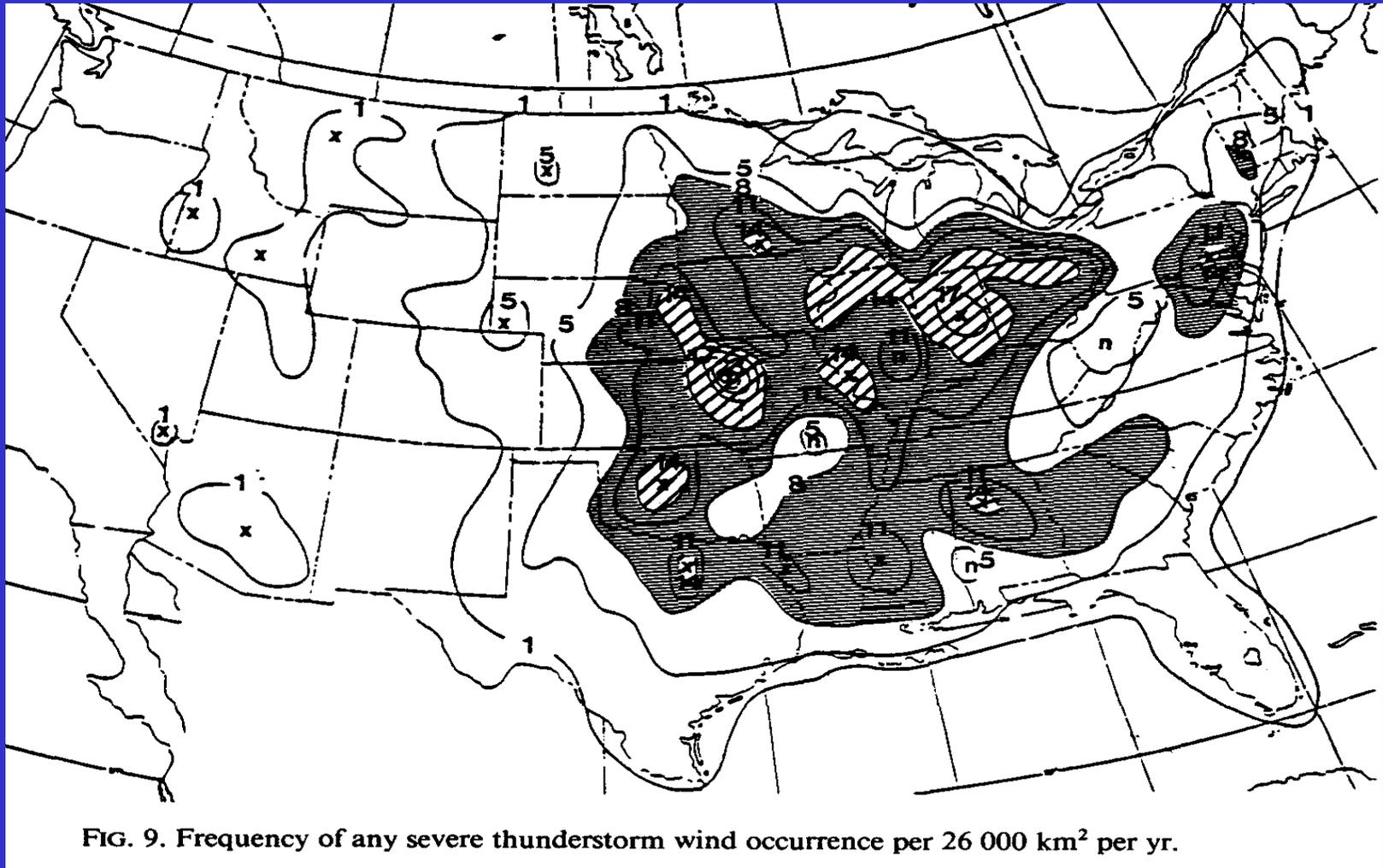


# Topics of Discussion

- Importance of downburst detection and prediction in the Chesapeake Bay region.
- Introduction to thunderstorm downbursts.
- Introduction to downburst prediction products
- Case Studies: 10 and 13 June 2013 Squall Lines
- Conclusion



# Severe Thunderstorm Wind Climatology



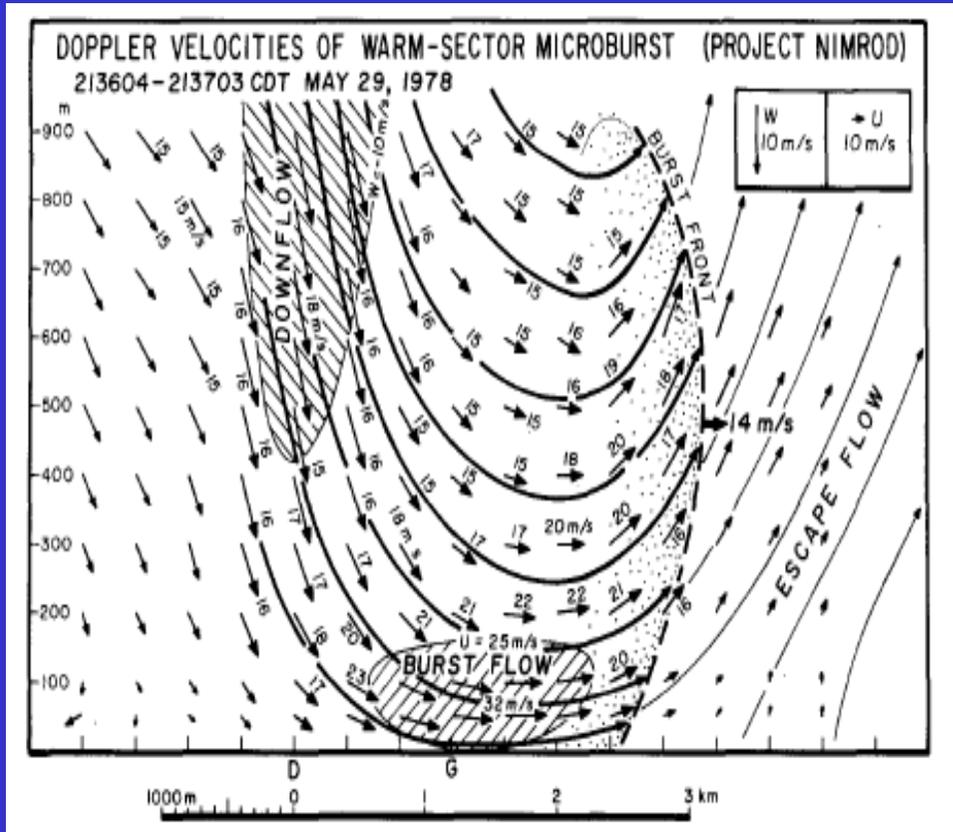
From Kelly et al (1985)

# Thunderstorm Downburst

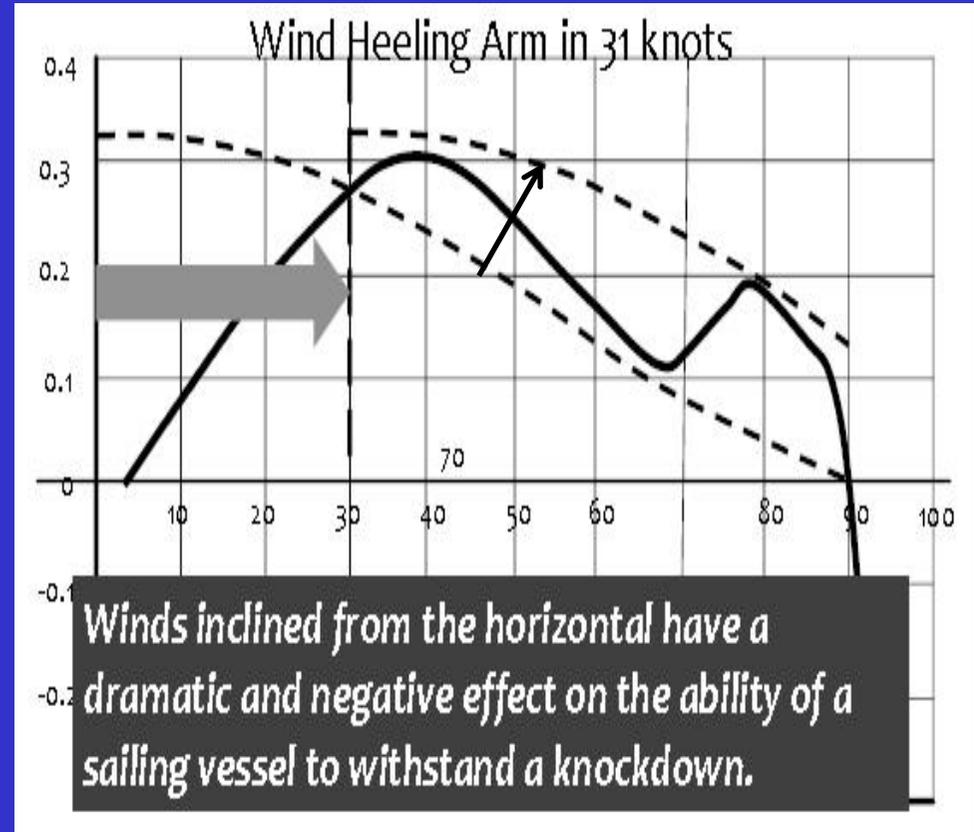


- Strong downdraft produced by a convective storm (or thunderstorm) that causes **damaging winds** on or near the ground. (Fujita and Wakimoto 1981)
- Serious hazard to sailing vessels due to inclined winds that can cause a knock-down.

# Downburst Maritime Hazards



From Fujita (1981)



From Canadian TSB report



# Introduction

- Downburst prediction algorithms, employing data from geostationary satellites (GOES) and numerical weather prediction (NWP) models have been developed to address the need for improved monitoring and warning capability over coastal and open ocean waters. Two downburst prediction products are currently being tested and validated over the Chesapeake Bay region:
  - **Microburst Windspeed Potential Index (MWPI)**
  - **GOES water vapor (WV) – infrared (IR) channel temperature difference (BTD)**



# GOES Microburst Products

- Generated hourly at the NOAA Center for Weather and Climate Prediction (NCWCP).
- Available on the GOES Microburst Products web page at the following URL:

**<http://www.orbit.nesdis.noaa.gov/smcd/opdb/aviation/mb.html>**



# Wet-type Downburst

Date & Time: Sat Aug 21 18:54:23 CDT 2010  
Position: +035.2074° / -097.3022°  
Altitude: 0m  
Azimuth/Bearing: 292° N68W  
Elevation Angle: +08.0°  
Horizon Angle: +03.0°  
Zoom: 1X



# Microburst Windspeed Potential Index (MWPI)

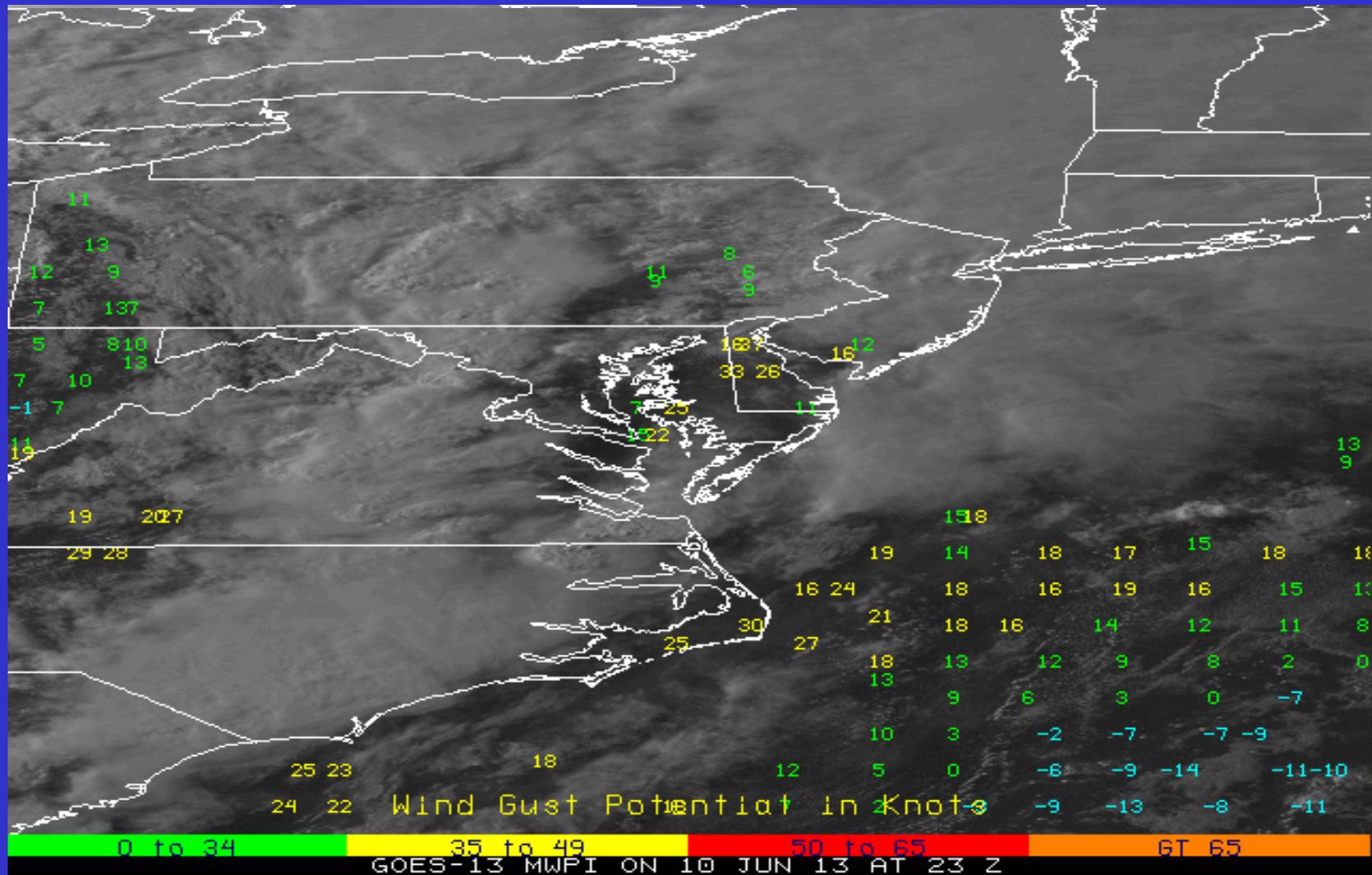
$$\text{MWPI} = \text{CAPE}/100 + \Gamma + (T - T_d)_{850} - (T - T_d)_{670}$$

(Pryor 2011)

- $\Gamma$  = temperature lapse rate ( $^{\circ}\text{C km}^{-1}$ ) from 850 to 670 mb
- $T$  = temperature ( $^{\circ}\text{C}$ )
- $T_d$  = dew point temperature ( $^{\circ}\text{C}$ )
- Severe microbursts may occur when the **MWPI > 50**

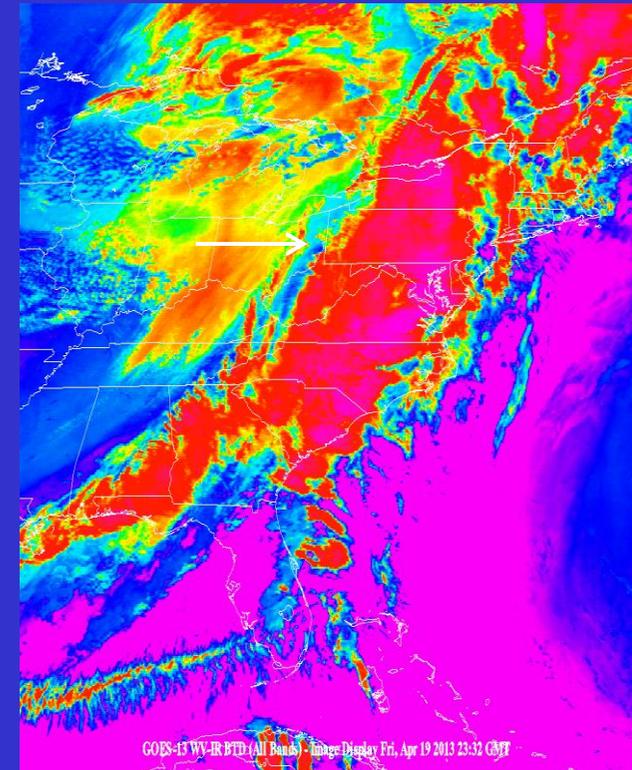
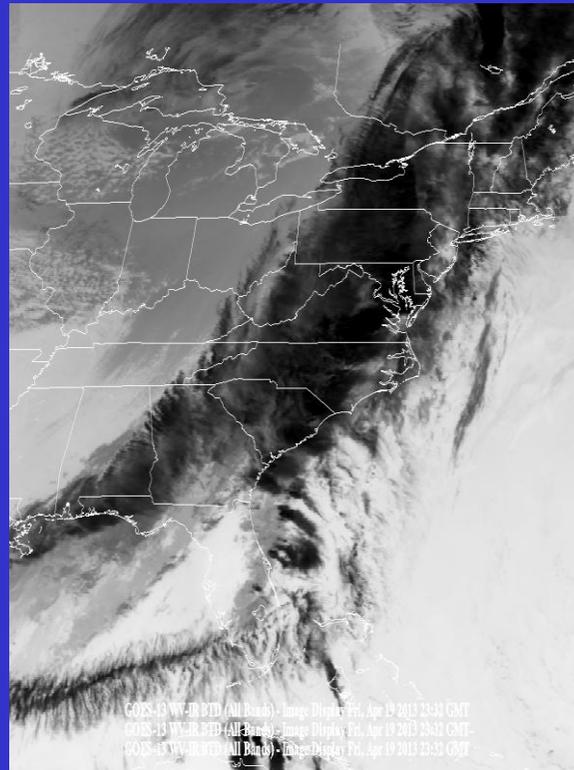
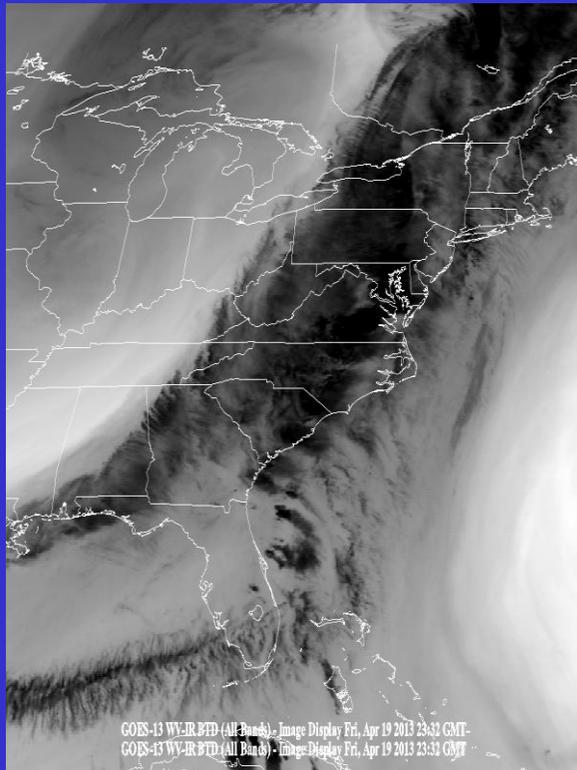


# Microburst Windspeed Potential Index (MWPI)



# GOES-East Imager Product

- Enhanced band 3 – 4 BTD image showing well-defined dry air notches.

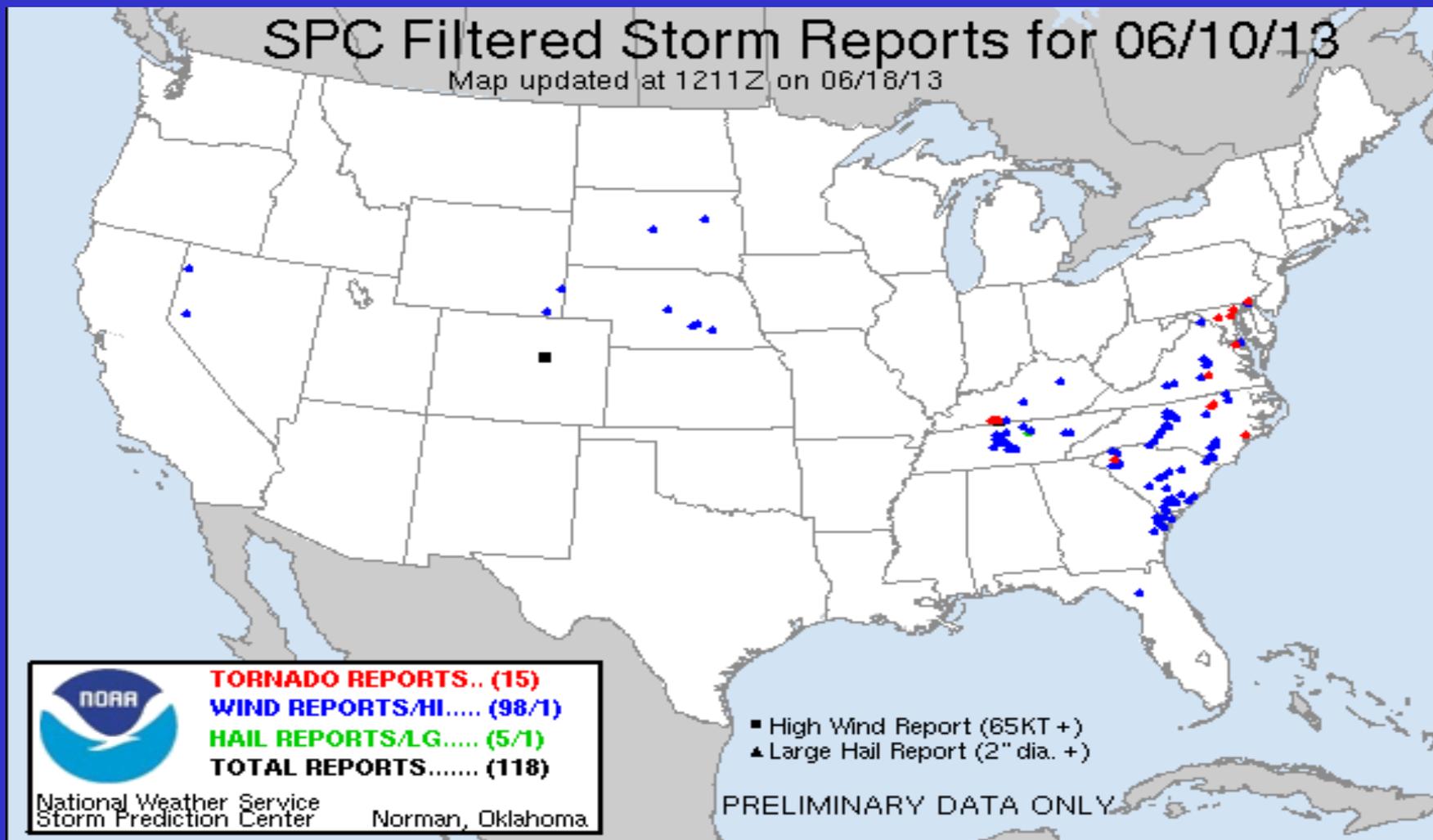


$$\text{WV BT} - \text{IR BT} = \text{BTD}$$

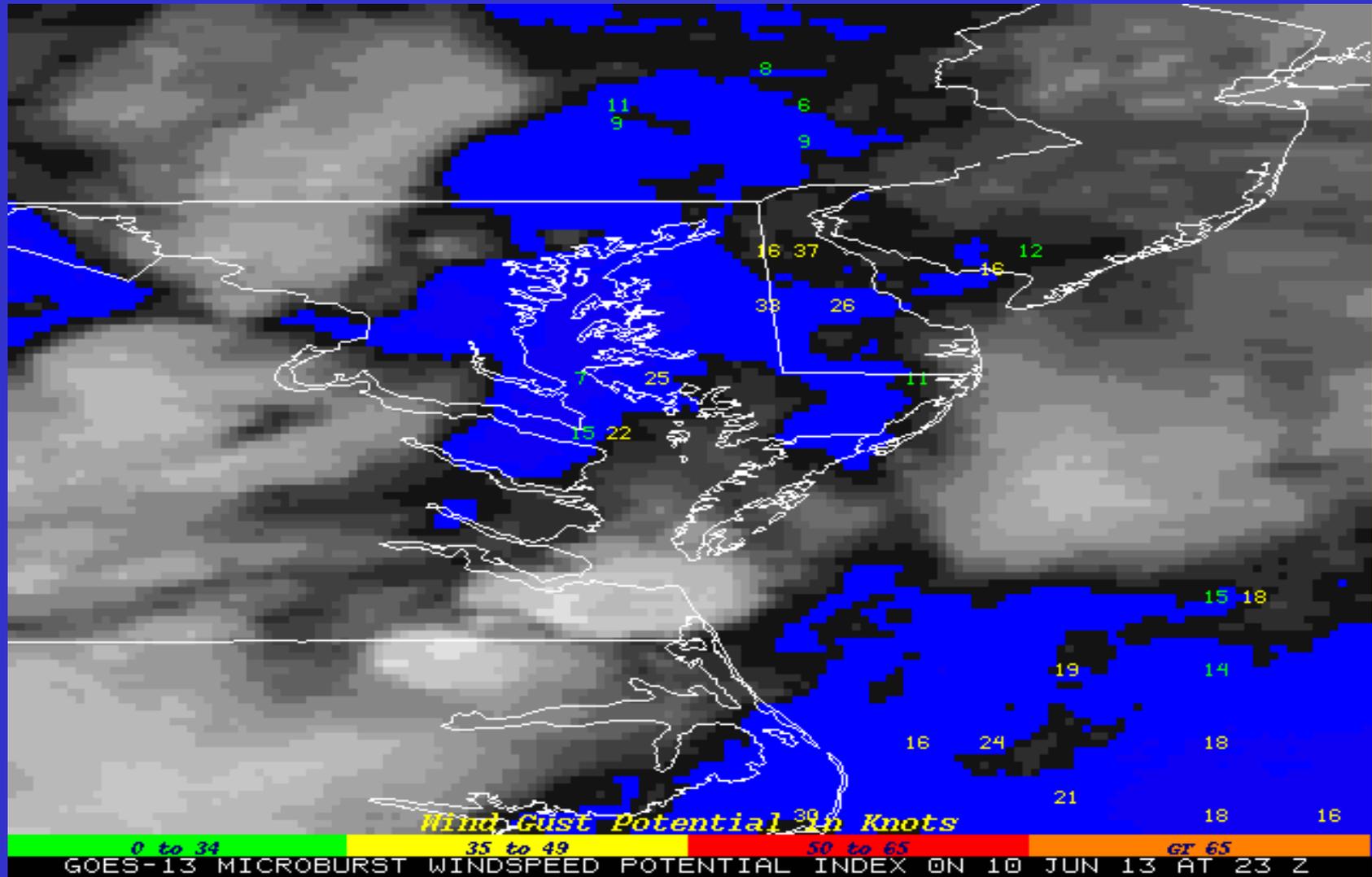


<http://www.star.nesdis.noaa.gov/smcd/opdb/kporyor/mburst/mbimg.html>

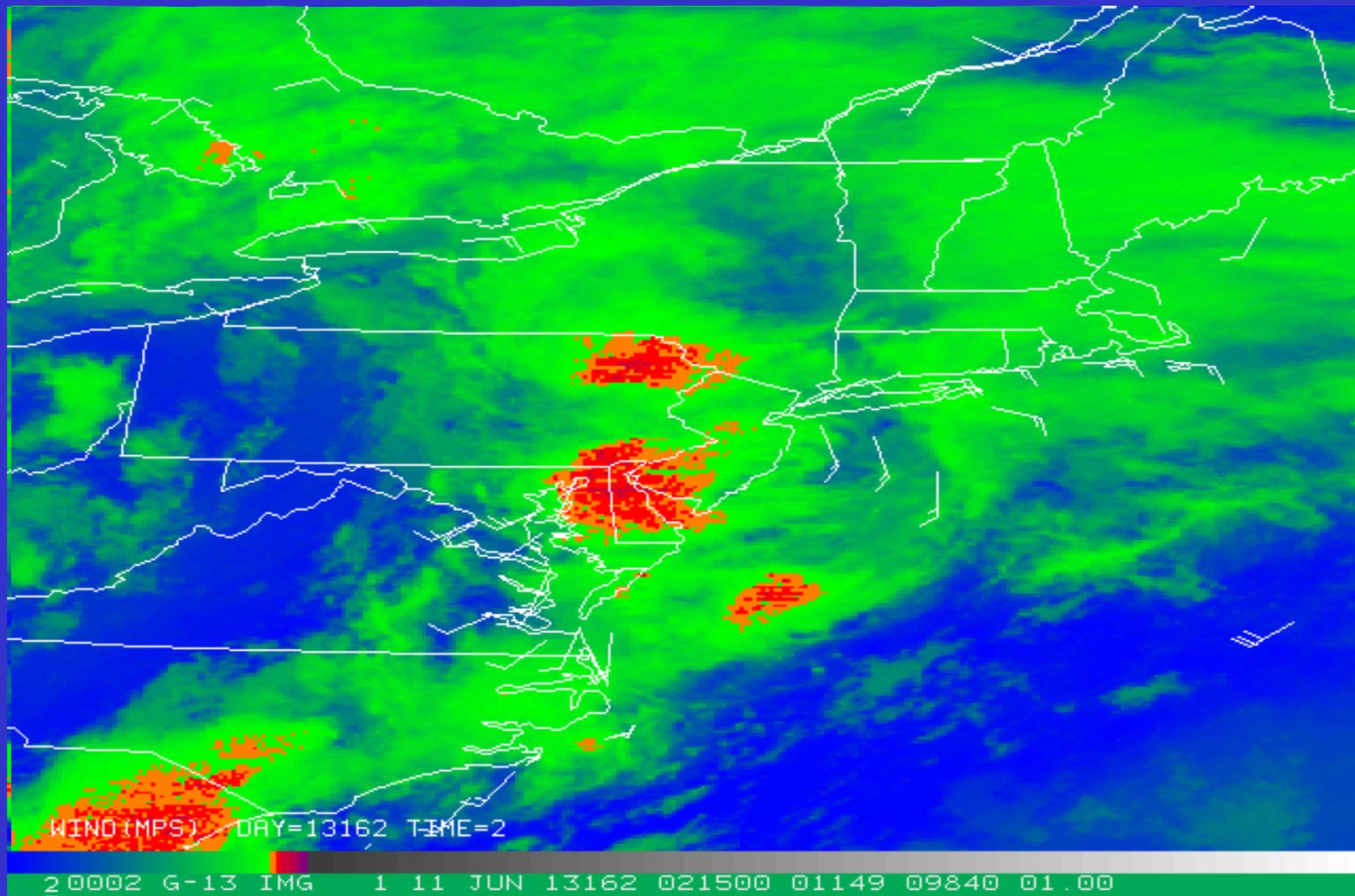
# 10 June 2013 Squall Lines/Downbursts



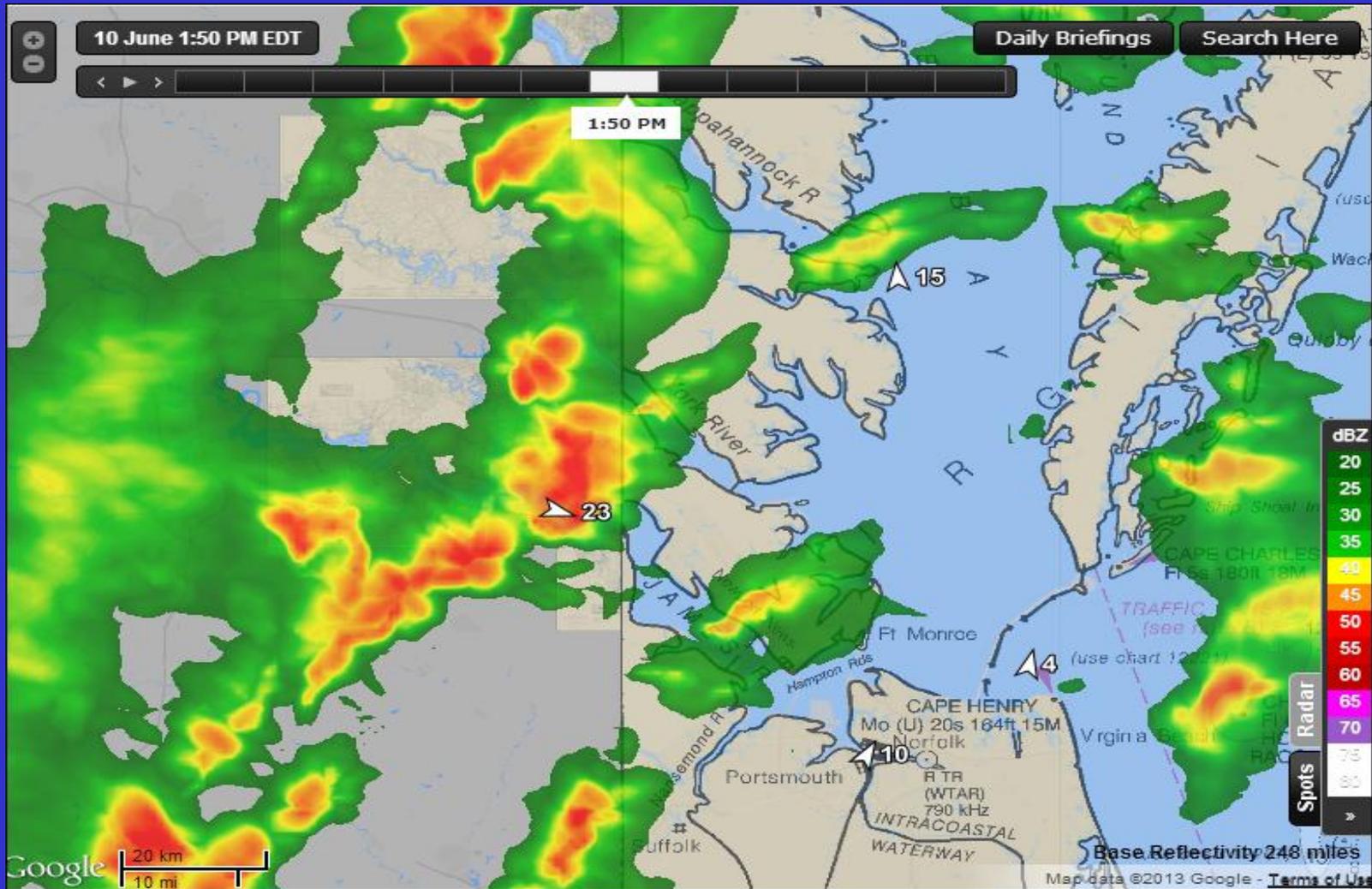
# Microburst Windspeed Potential Index (MWPI)



# GOES-13 WV-IR BTD

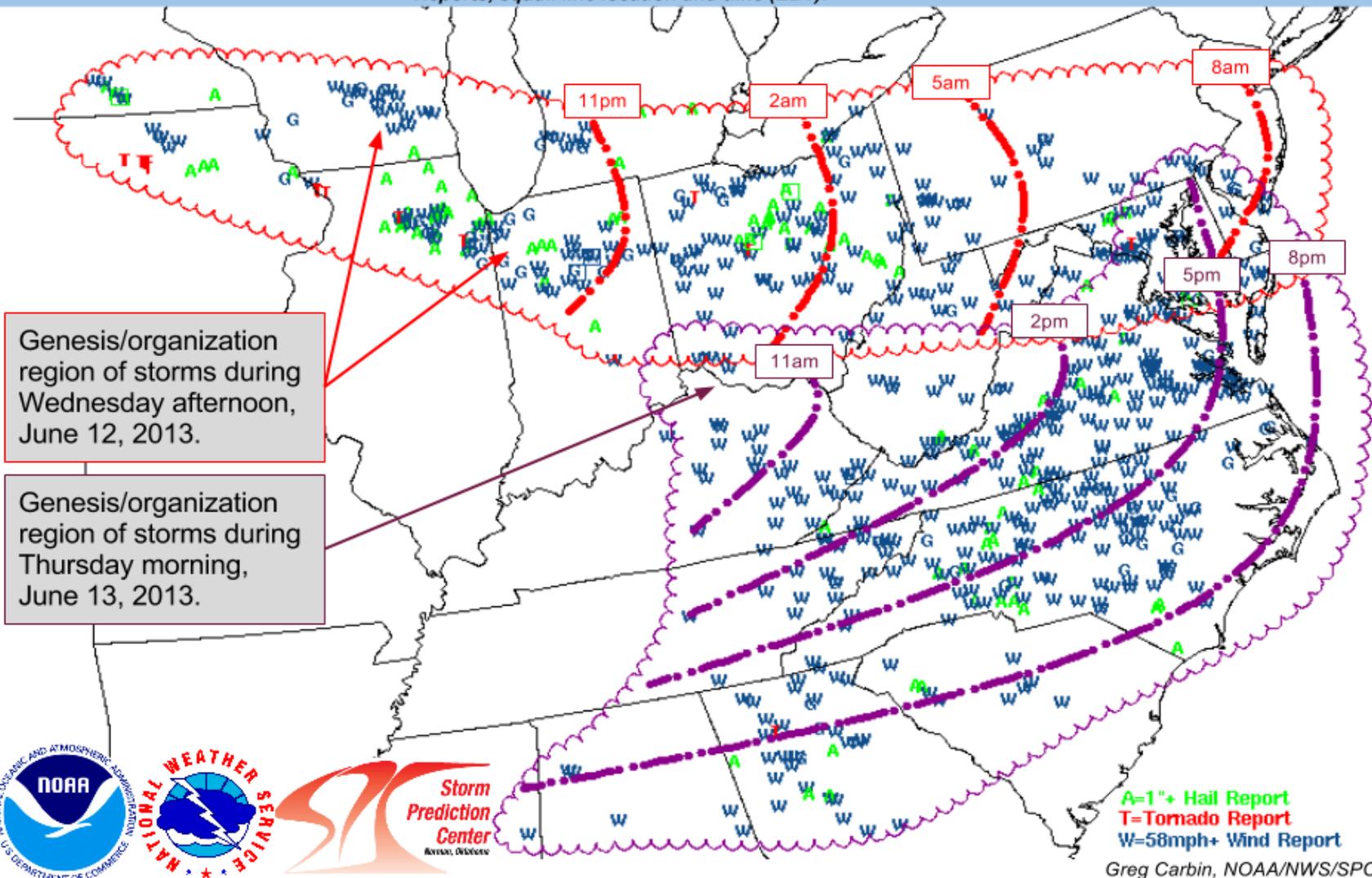


# Jamestown Downburst

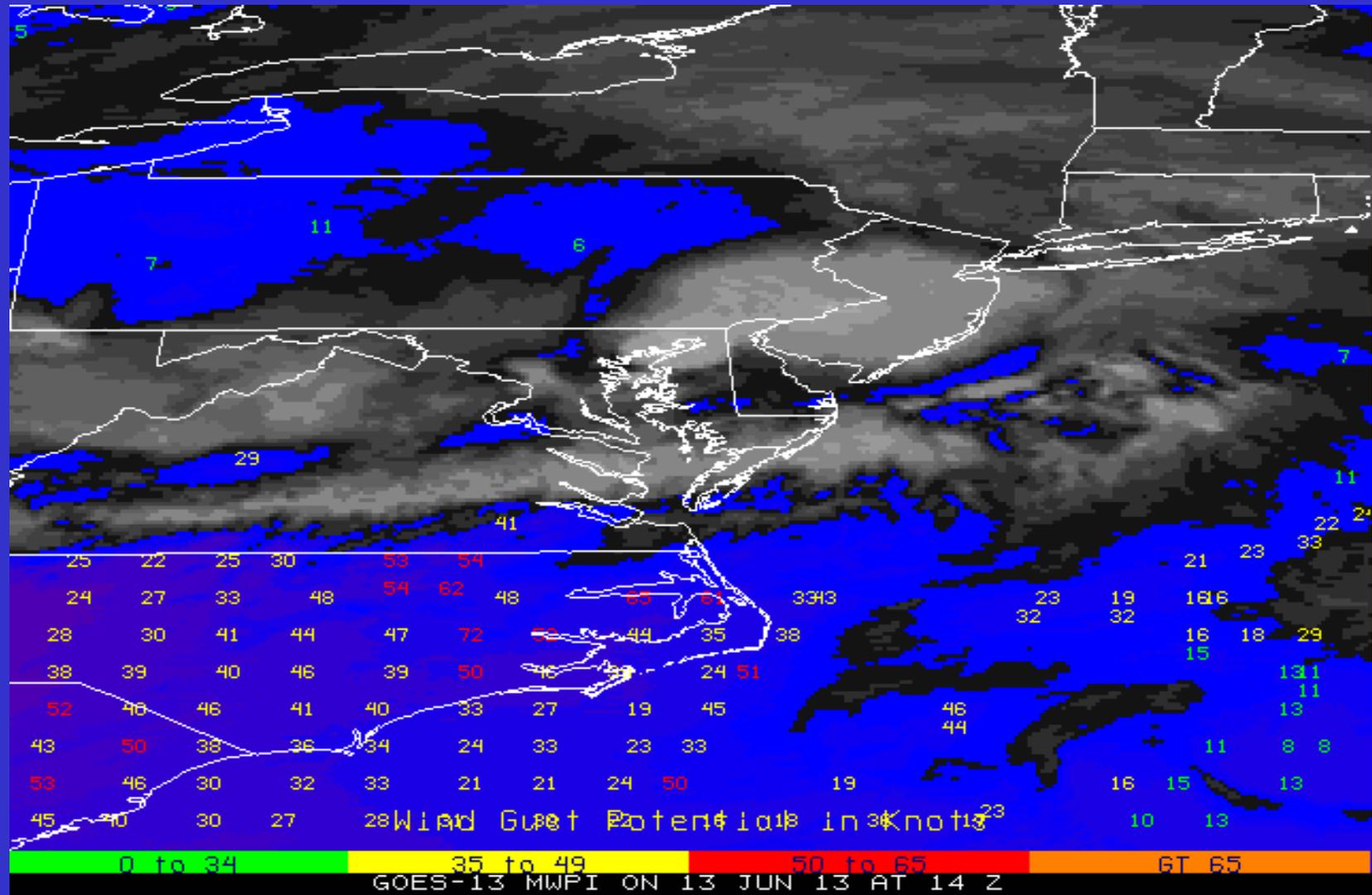


# June 12 and 13, 2013 Severe Wind/Derecho Events Midwest and Mid Atlantic

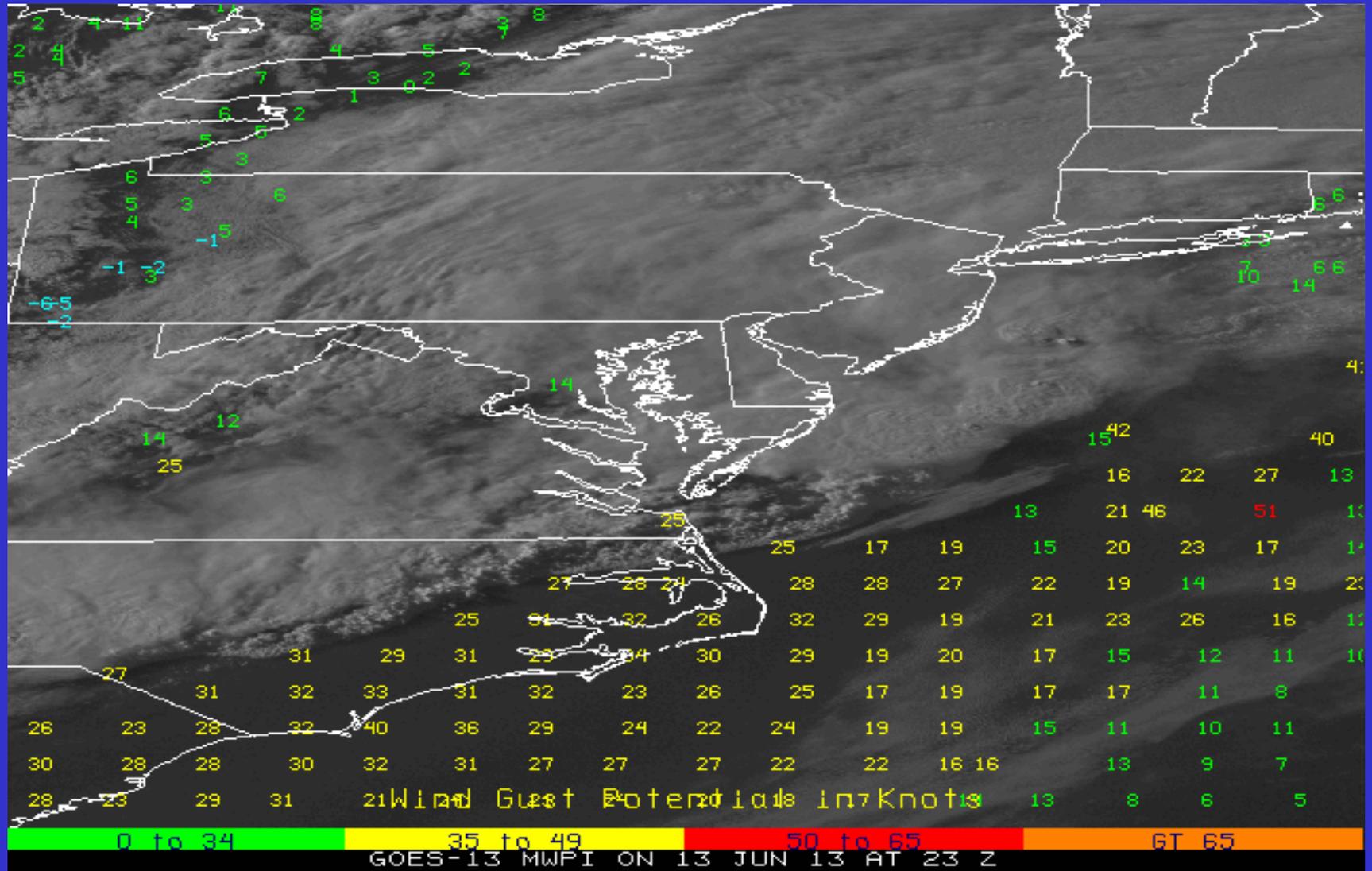
Reports, squall line location and time (EDT): —••—



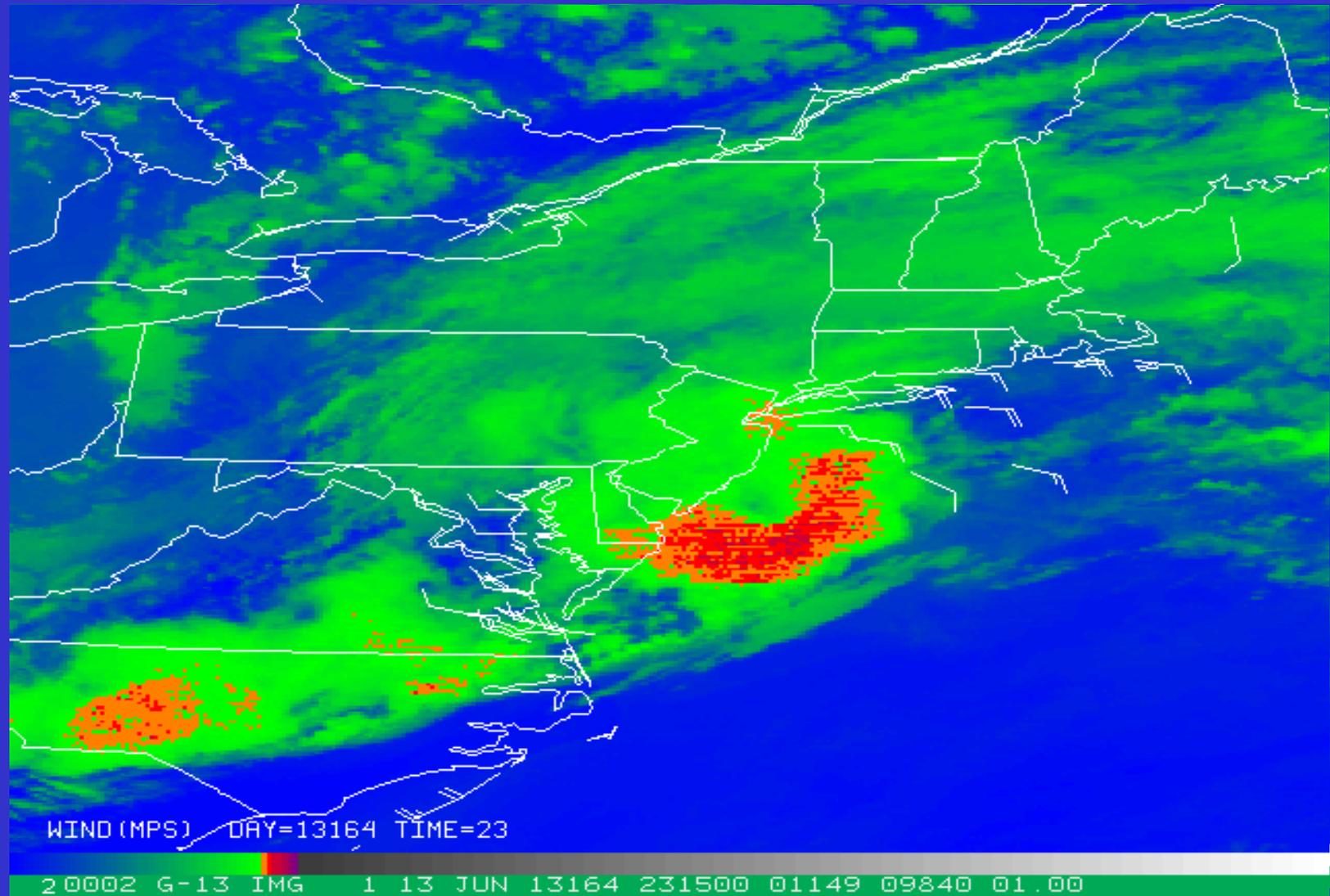
# 13 June 2013 Morning Squall Line



# 13 June 2013 Afternoon Squall Line



# GOES-13 WV-IR BTD



# Conclusions

- Over 60 confirmed downburst events documented between 2010-2012 thunderstorm seasons over Chesapeake Bay region.
- Coastal/marine surface observing platforms, including Chesapeake Bay Interpretive Buoy System (CBIBS), provided important severe wind observations with the passage of the 13 June 2013 squall lines.
- GOES MWPI product effectively indicated wind gust potential associated with the squall lines that impacted the Chesapeake Bay region on 10 and 13 June 2013.

