

**As the Accuracy of Computer Models
Increases, the Role of the
Meteorologist Is Changing From
Scientist to “Communicologist”**

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Sr. Meteorologist
AccuWeather

PHM

2013

AccuWeather Operations



Introduction

1. The Computer Models from the '70s to Now
2. The Changing Role of the Meteorologist
3. The Business of Weather
4. Communicating Hurricane Sandy
5. Future of the Communicologist

The '70s: The Difax Age

- * Few Models
- * Programming Changes to Models Quarterly
- * You Learned the Biases of the Models
- * 3-Day Forecasts Was It!



The '80s to '90s: Computer Age Starts

- * New Models Introduced
- * Models Shown on Computers
- * More Frequent Runs
- * Extended Runs to 10 Days
- * 5-10 Day Forecasts



The 2000s: The Work Station Age

- * More Models Developed and Implemented
- * More Frequent Programming Updates to Models ☹️
- * Paper Gone, Everything on Computers
- * Instant Information. Overload!
- * 10-45 Day Forecasts



Today We Have Everything

global

GFS add
GFS Rapid Update add
CMC add
ECMWF Deterministic add
ECMWF EPS Control add
ECMWF EFI add
Old ECMWF add
JMA add
NAVGEM add
UKMET add
NCEP GFS add
Lightning Wizard GFS add
UW GFS add
FNMOC GFS add
FNMOC NAVGEM add
UQAM ECMWF add
ECMWF (from ECMWF web site) add
AMPS ECMWF add
AMPS ECMWF (old) add
AMPS ECMWF EPS Control Run add
AMPS UKMET add
AMPS GFS add
AMPS GFS minus ECMWF add
AMPS Canadian Global add
GFS/ECMWF/UKMet mean add
ECMWF/UKMet mean add
GFS/UKMet mean add
GFS/ECMWF mean add
ECMWF/GFS Ensemble mean add
UQAM UKMET add
UQAM Global GEM add
Global GEM (Environment Canada) add
EWALL GFS add
EWALL Global GEM add
EWALL UKMET add
AMPS UFDB add
EWALL ECMWF add
NCEP GFS test add

regional

NAM (WRF-NMM) add
NAM Rapid Update add
COAMPS add
DGEX add
RAP add
WRF-NMM 4km East add
WRF-ARW 4km East add
WRF-NMM 4km West add
WRF-ARW 4km West add
NCEP NAM add
UW NAM add
AMPS NAM add
AMPS RAP 13km add
GFS/NAM mean add
Regional GEM add
Regional GEM (Environment Canada) add
SUNY 12 km MM5 add
SUNY 36 km MM5 add
EWALL NAM add
EWALL NAM 4 km add
EWALL WRF NMM/ARW comparison add
EWALL GFS/NAM Comparison add
CANSAC 4 km MM5 add
CANSAC 2 km WRF add
UWA 36 km MM5 (NAM init) add
UWA 12 km MM5 (NAM init) add
UWA 36 km WRF add
UWA 12 km WRF add
UWA 4 km WRF add
NWS MLB WRF 8km for Florida add
NWS MLB WRF 3km for Florida add
NWS MLB WRF 9km for Florida add
Mexican Regional add

ensemble

NAEFS add
GEFS add
SREF add
AMPS GFS Ensemble mean add
EWALL RSM add
EWALL SREF add
EWALL GFS Ensemble add
EWALL CMC Ensemble add
NCEP GFS Ensemble add
SPC SREF add

seasonal

CFS add
ECMWF Seasonal add

specialty

NDFD add
NDGD add
AccuModel add

tropical

NHC Wind Probability add
GFDL add
HWRF add
NCEP GFDL Hurricane Model add
NCEP Hurricane WRF add

marine

WaveWatch III add
Great Lakes Wave add
Atlantic Wave add
RTOFS add

Model Confusion!

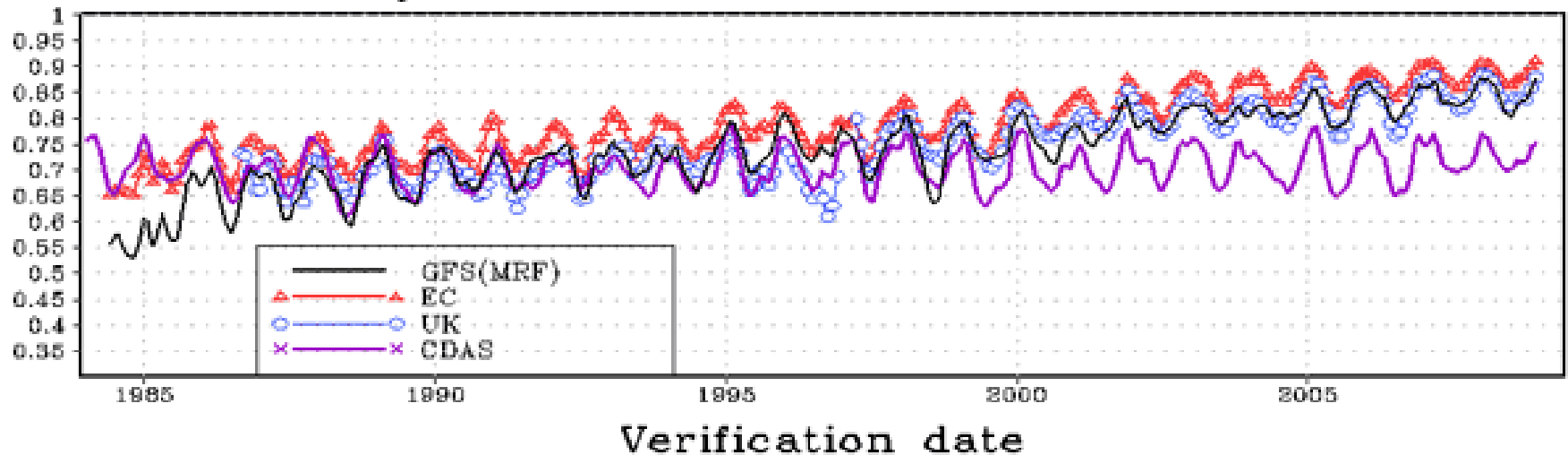
- * Too Many Models With Too Many Solutions
- * Contradictions Between Models Leads to Uncertainty
- * Changes to Models More Frequent so Biases Wiped Out Quickly

Are the Models Really Inaccurate?

- * Lack of Computing Power
- * Initialization of Data
- * Bugs in the Programs
- * Model Bias

Model Accuracy Since 1985

Anom Corr dy 5 Z 500mb 1:2:1 smooth lat 20-80N



GFS vs ECMWF Model

- * Graph Shows ECMWF is Better, Why?
 - * ECMWF Has Better Initialization Data
 - * The ECMWF Initialization Data Improved the GFS Forecast
- * BUT! Only Run the Model Twice a Day!

But Models Are Better

- * Better Resolution
- * More Frequent Daily Updates
- * Short-Range Models Show Amazing Details
- * Long-Term Models Getting Much Better
- * Seasonal Models Very Good

Models Made the Communicologist

- * In the short range, models are very accurate
- * Longer range beyond 5 days, model accuracy goes down!
- * Communicate impacts, try not to out-predict the models in the short-range
- * Proper communication on impacts means a lot to a company

The Business of Weather

It's all about communicating the
impacts of the weather

Advances in Meteorology

- * Dual Pole Radar
 - * Improved Weather Hazard Differentiation
- * TDWR Radar
 - * Improved Coverage Around Major Cities
- * Mesoscale Models at 2.5 miles Resolution. (We can fit a thunderstorm in the model grids now!)
 - * Improved Short Term Forecasts
- * Predictive Radar Advances
 - * Min by Min Forecast Improvement

Business Model of the Meteorologist

- * Let Models Predict the General Forecasts
- * Meteorologist Focus on Impacts
- * Site Specific Forecasts
- * Advance Preparation Time
- * Clarity of Communications
- * No Unnecessary False Alarms
- * Warnings Created by Meteorologist
- * SAVE LIVES, PROPERTY, TIME and MONEY

Today's Communicologist



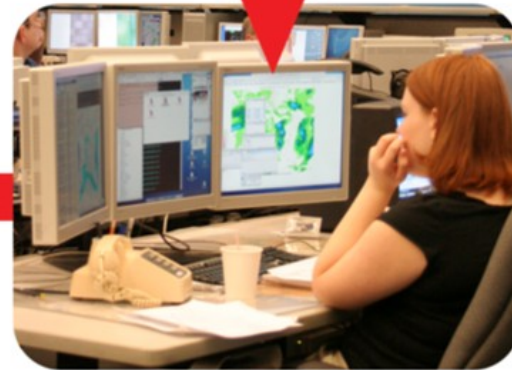
AccuWeather meteorologists monitor the weather at your exact location



Warnings are sent using the most effective methods for your operations, including email, web, mobile, voice and more

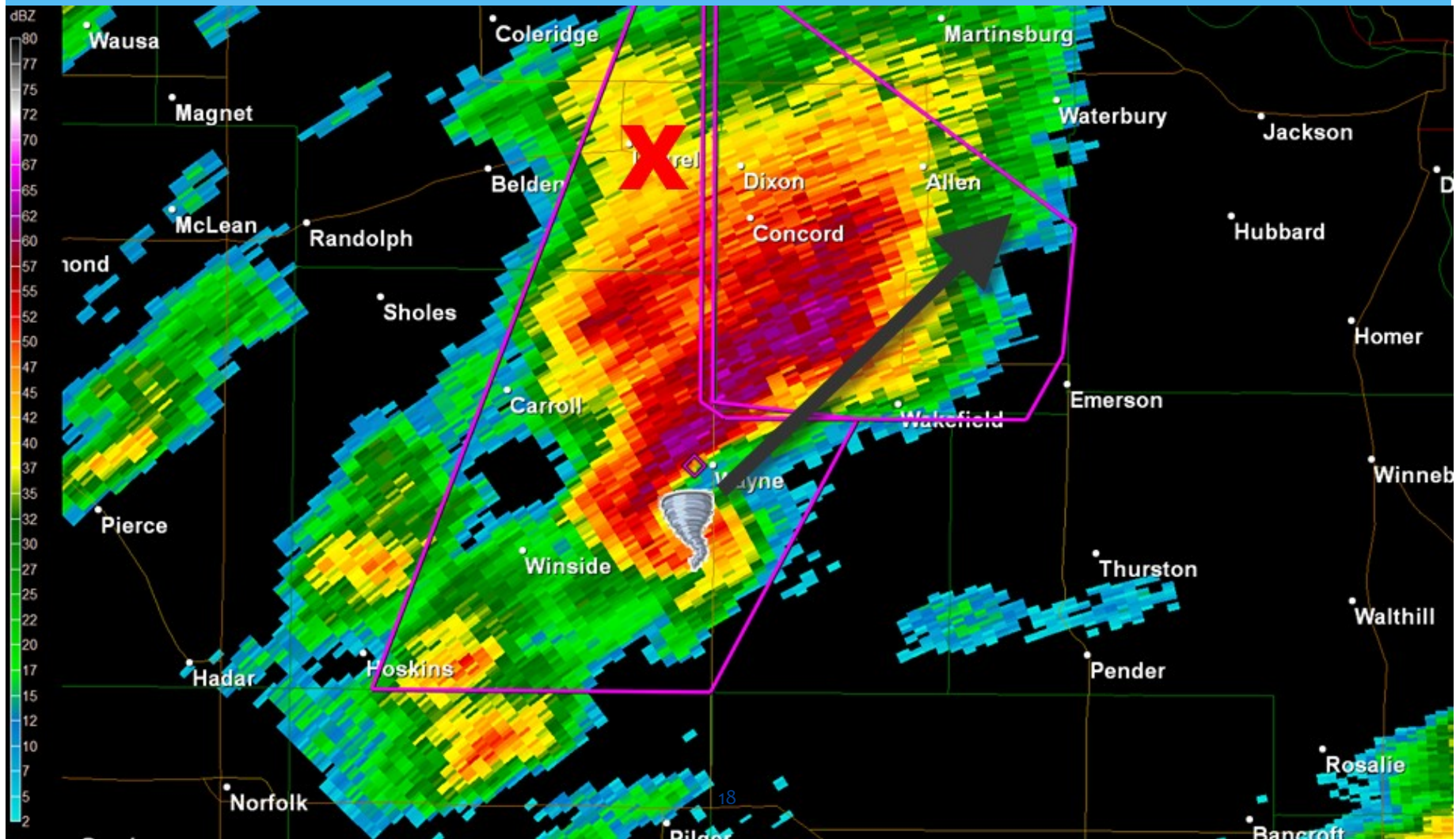


Severe weather occurs



Confirmations are monitored and, if necessary, follow-up phone calls are made by AccuWeather meteorologists

Example of Tornado Warning



Study of Tornado Warnings Over 32 Months

| Auto Manufacturer | NWS Tornado Warning | Site Specific Tornado Warning | Hours of Production Time Saved |
|-------------------|---------------------|-------------------------------|--------------------------------|
| Company A | 203 | 25 | 131 |
| Company B | 54 | 14 | 31 |
| Company C | 133 | 14 | 93 |

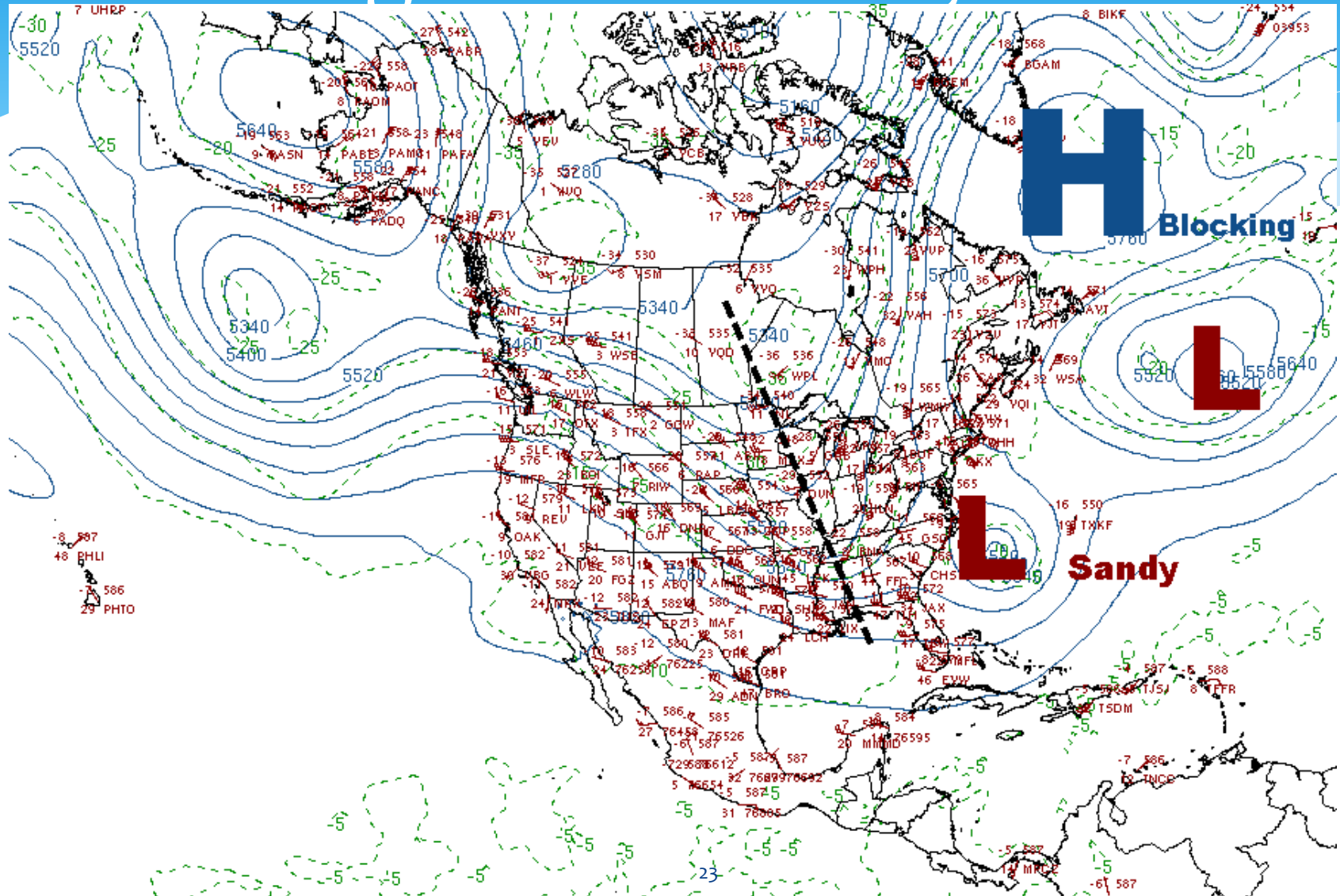
Communicologist and Superstorm Sandy

- **Track Forecast**
- **Rainfall Forecast**
- **Wind Forecast**
- **Snow Forecast**
- **Storm Surge Forecast**
- **What Went Wrong**

Impacts from Sandy

| Impacts | Winds | Rain | Snow | Record Press | Waves/Surge |
|---|--|--|--|---|--|
| <ul style="list-style-type: none"> 7.5 Million Without Power Over 100 Killed Many Towns Destroyed Jersey Coast Changed Thousands of Trees Down Massive Coastal Flooding | <p>Eatons Neck, N.Y.: 94 mph</p> <p>Montclair, N.J.: 88 mph</p> <p>Westerly, R.I.: 86 mph</p> <p>Madison, Conn.: 85 mph</p> <p>Cuttyhunk, Mass.: 83 mph</p> <p>Allentown, Pa.: 81 mph</p> <p>Highland Beach, Md.: 79 mph</p> <p>Chester Gap, Va.: 79 mph</p> | <p>Andrews AFB, Md.: 15.3" (unconfirmed)</p> <p>Easton, Md.: 12.55"</p> <p>Wildwood Crest, N.J.: 11.67"</p> <p>Virginia Beach, Va.: 9.57"</p> <p>Milford, Del.: 9.55"</p> <p>Maysville, W.Va.: 7.75"</p> | <p>Redhouse, Md.: 29"</p> <p>Clayton, W.Va.: 33.0"</p> <p>Champion, Pa.: 13"</p> <p>Haywood County, N.C.: 24"</p> <p>Norton, Va.: 24"</p> <p>Mt. Leconte, Tenn.: 34"</p> <p>Payne Gap, Ky.: 14"</p> <p>Bellefontaine, Ohio: 3.5"</p> | <p>Atlantic City, N.J.: 948.3 mb (28.00" Hg)</p> <p>Philadelphia, Pa.: 953mb (28.23" Hg)</p> <p>Harrisburg, Pa.: 963mb (28.46" Hg)</p> <p>Scranton, Pa.: 971mb (28.69" Hg)</p> <p>Trenton, N.J.: 958mb (28.31" Hg)</p> <p>Baltimore, Md.: 965mb (28.49" Hg)</p> <p>Harrisburg, Pa.: 964mb (28.46" Hb)</p> | <p>TOP WAVES: 39.67 feet 500 miles southeast of Atlantic City, N.J.</p> <p>32.5 feet just outside New York Harbor entrance</p> <p>21.7 feet lower Lake Michigan</p> <p>TOP STORM SURGES: The Battery, N.Y.: ~9 feet above normal</p> <p>Kings Point, N.Y.: ~12.5 feet above normal</p> <p>New Haven, Conn.: ~9 feet above normal</p> |

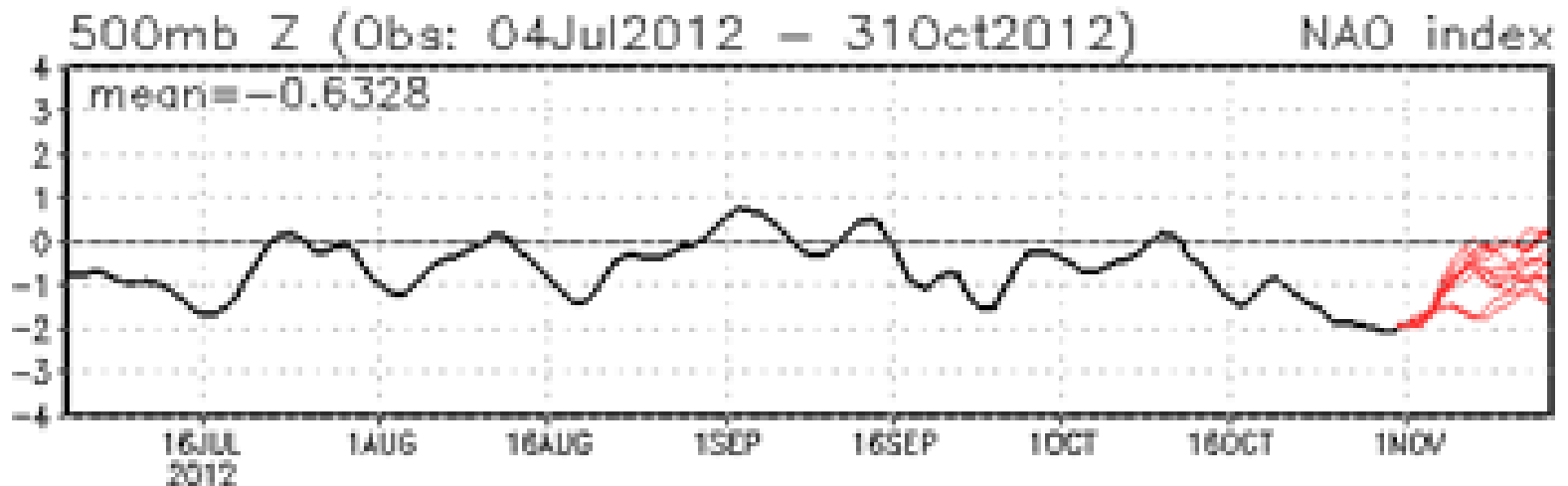
Blocking Caused Sandy to Hit NJ



12Z 28 Oct 2012 500 hPa

Blocking Index

NAO: Observed & ENSM forecasts



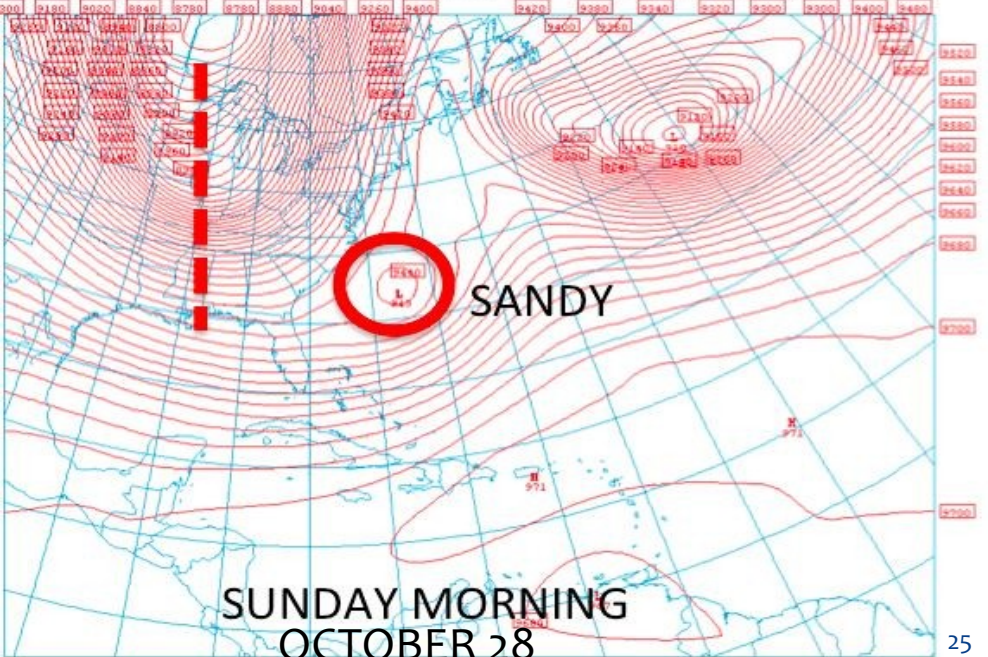
UPPER-LEVEL TROUGHS WILL HELP GUIDE SANDY NORTHWARD



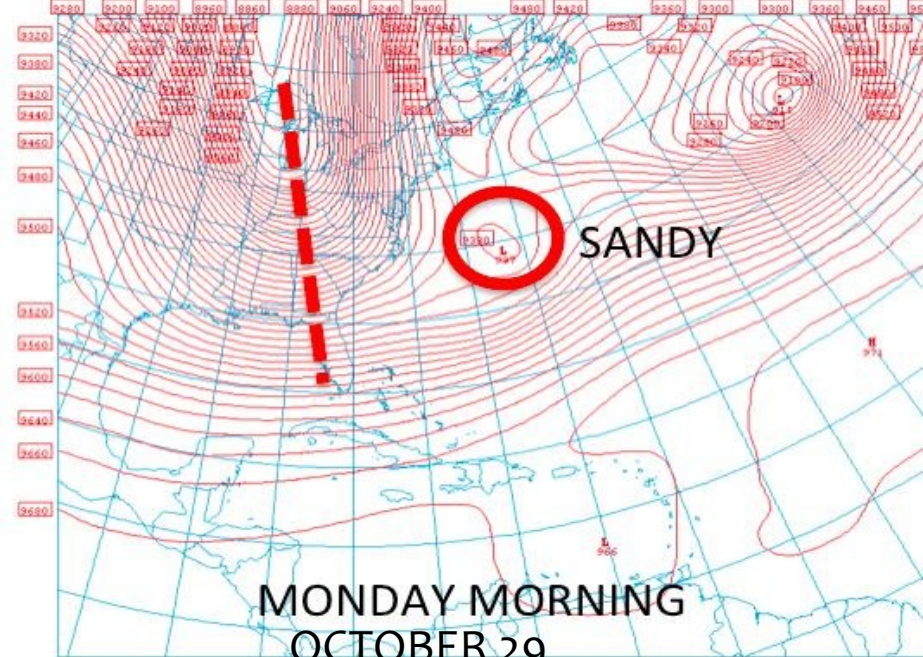
*HEIGHTS (DM)
Max: 9705.33 Min: 8788.23 Mean: 9469.00
GFS 1 Degree 300 MB
6HR VALID 06Z THU 25-OCT-12
BASED ON 00Z 25-OCT-12 RUN
PRESS <RETURN> TO CONTINUE
©2012 ACCU-WEATHER, INC. REDISTRIBUTION PROHIBITED



*HEIGHTS (DM)
Max: 9724.90 Min: 8729.04 Mean: 9450.70
GFS 1 Degree 300 MB
6HR VALID 12Z FRI 26-OCT-12
BASED ON 00Z 25-OCT-12 RUN
PRESS <RETURN> TO CONTINUE
©2012 ACCU-WEATHER, INC. REDISTRIBUTION PROHIBITED



*HEIGHTS (DM)
Max: 9713.97 Min: 8840.25 Mean: 9439.47
GFS 1 Degree 300 MB
84HR VALID 12Z SUN 28-OCT-12
BASED ON 00Z 25-OCT-12 RUN
PRESS <RETURN> TO CONTINUE
©2012 ACCU-WEATHER, INC. REDISTRIBUTION PROHIBITED



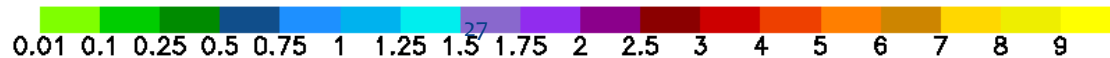
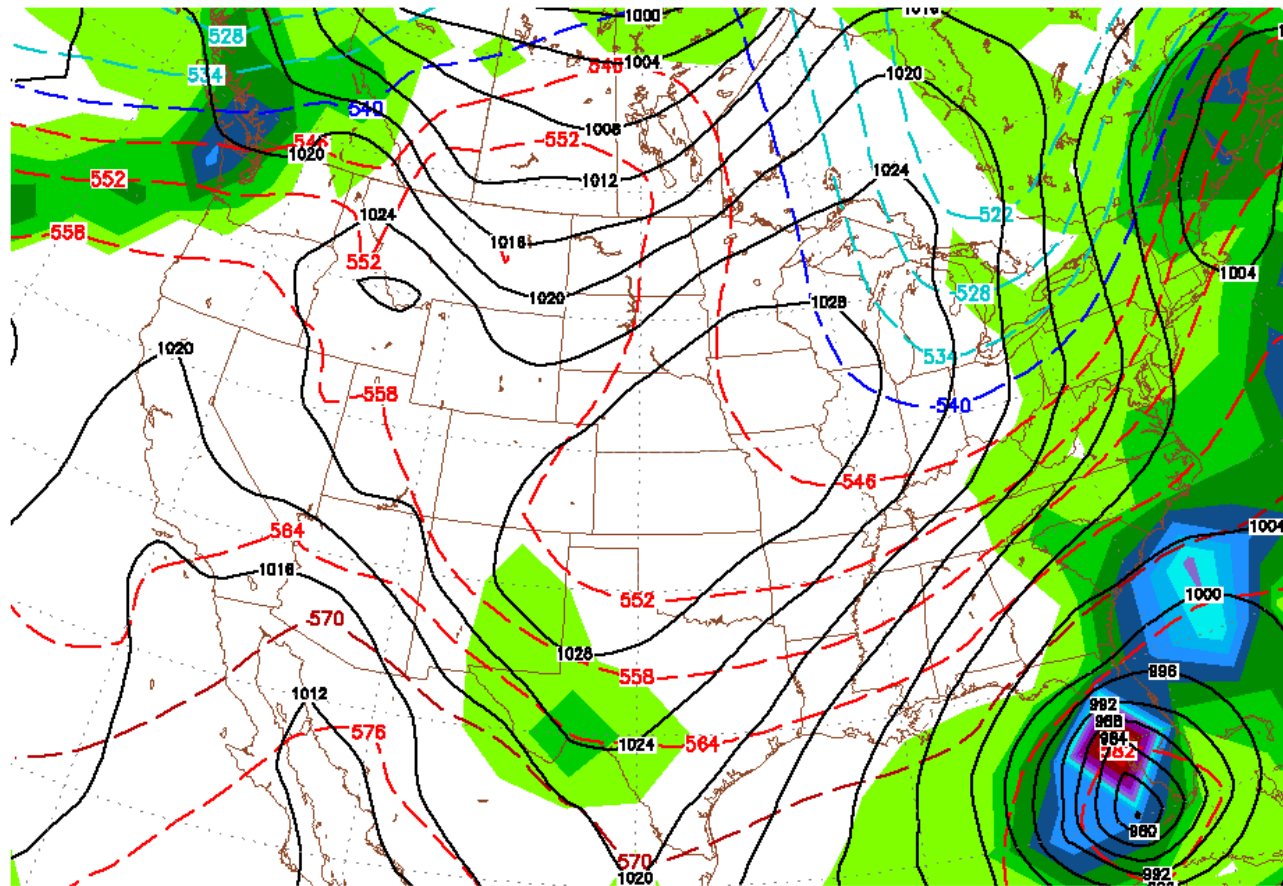
*HEIGHTS (DM)
Max: 9713.90 Min: 8840.25 Mean: 9436.40
GFS 1 Degree 300 MB
108HR VALID 12Z MON 29-OCT-12
BASED ON 00Z 25-OCT-12 RUN
PRESS <RETURN> TO CONTINUE
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Track Forecast

384 Hours From Landfall

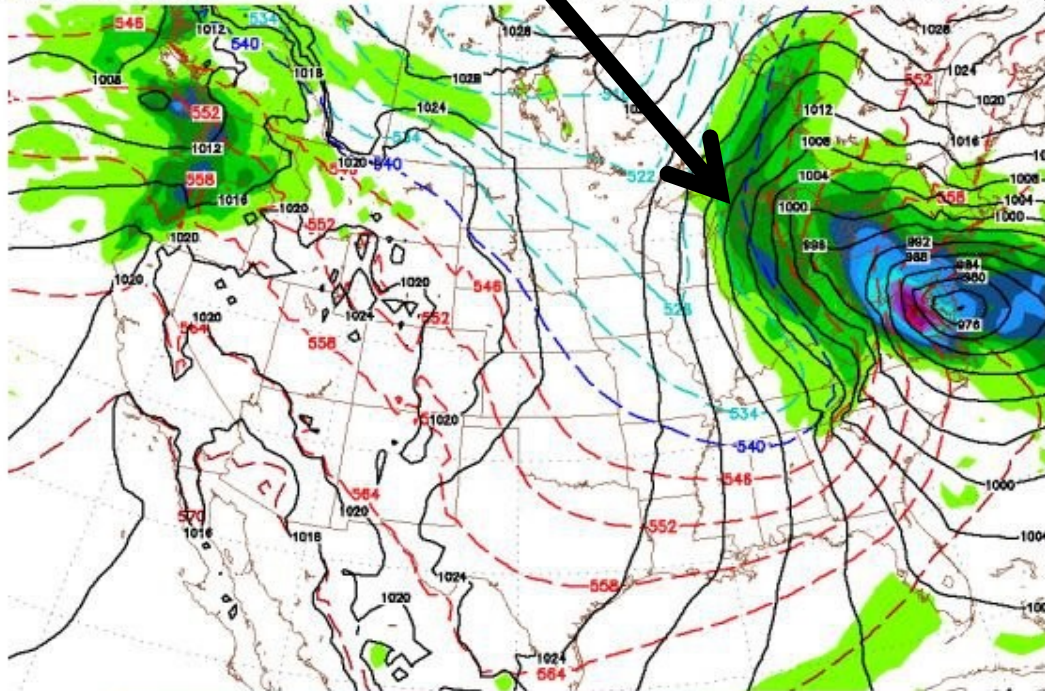
MSLP (MB), 1000–500 thickness (DM), and 12-hour QPF (inches)
Pro.AccuWeather.com

384 hour gfs384 valid 06Z01NOV2012 Thu



ECMWF vs GFS Forecast

MSLP (MB), 1000-500 thickness (DM), and 6-hour QPF (inches)
Pro.AccuWeather.com

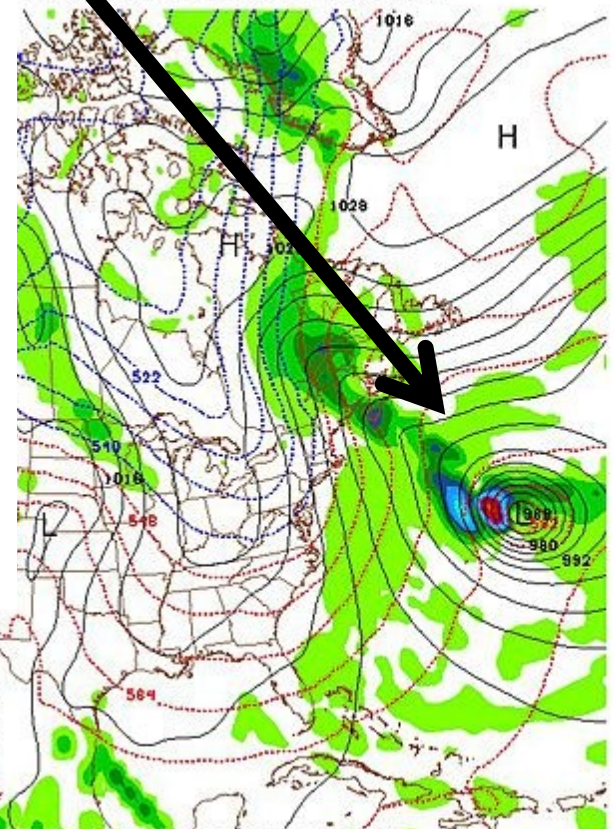


0.01 0.1 0.25 0.5 0.75 1 1.25 1.5 1.75 2 2.5 3 4 5 6 7 8 9

1.50
1.25
1.00
0.75
0.50
0.25
0.10
0.01

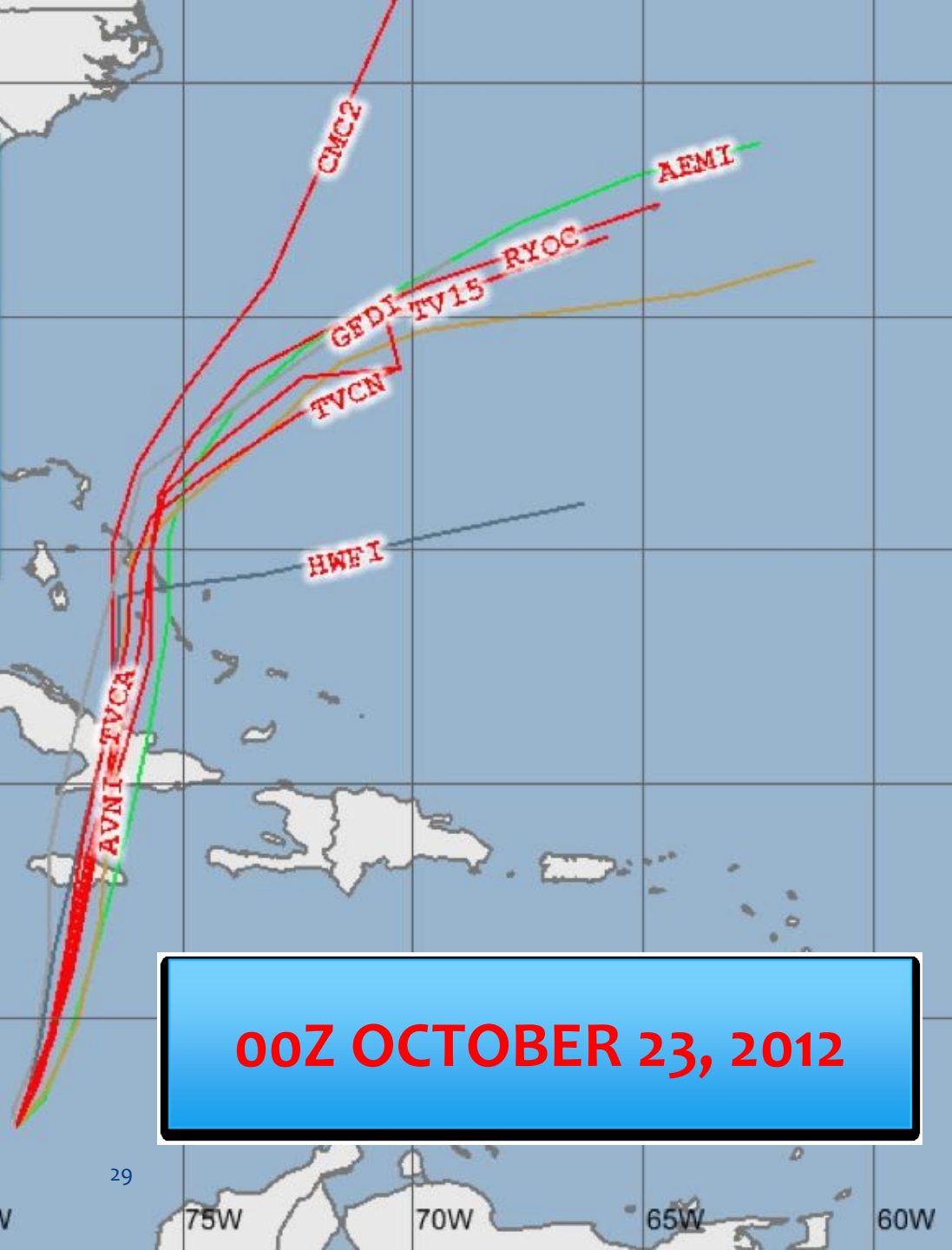


FCST VALID TUE 10/30/12 00UTC NCEP/NWS/MDAA



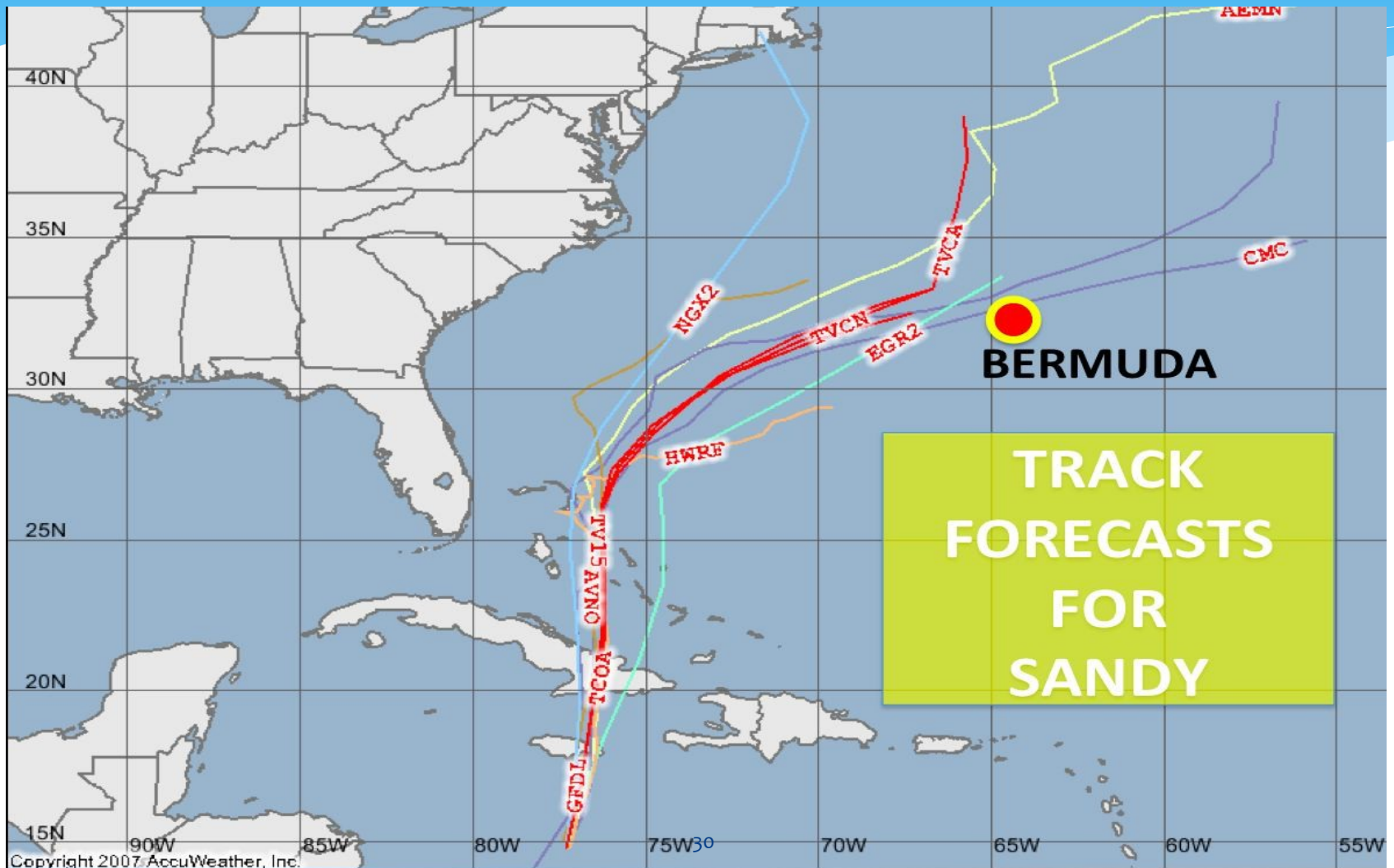
121030/0000V156 GFS MSLP-06HR PCPN (IN)-1000-500MB THICK

**TRACK
FORECASTS FOR
TROPICAL
STORM SANDY**

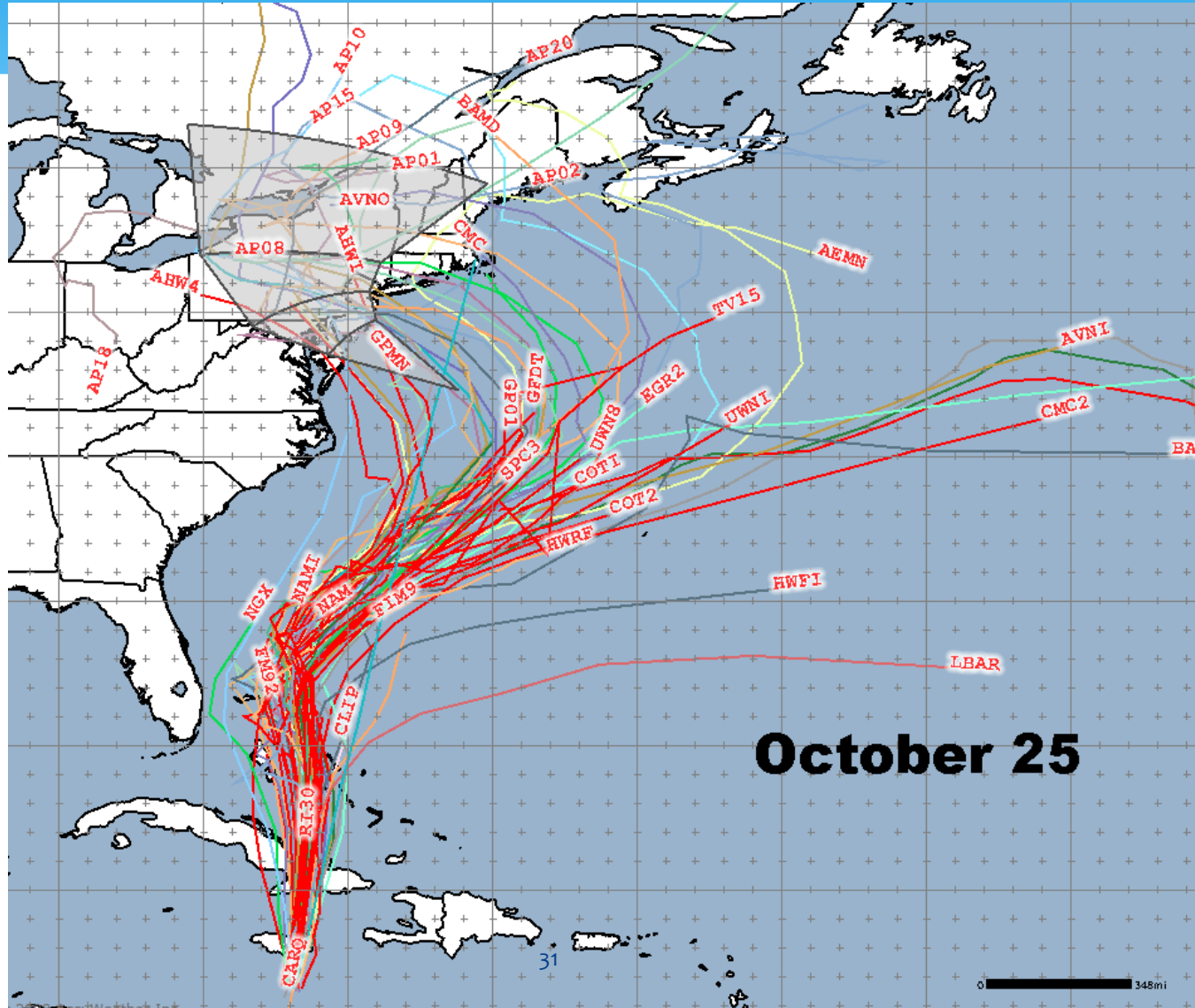


00Z OCTOBER 23, 2012

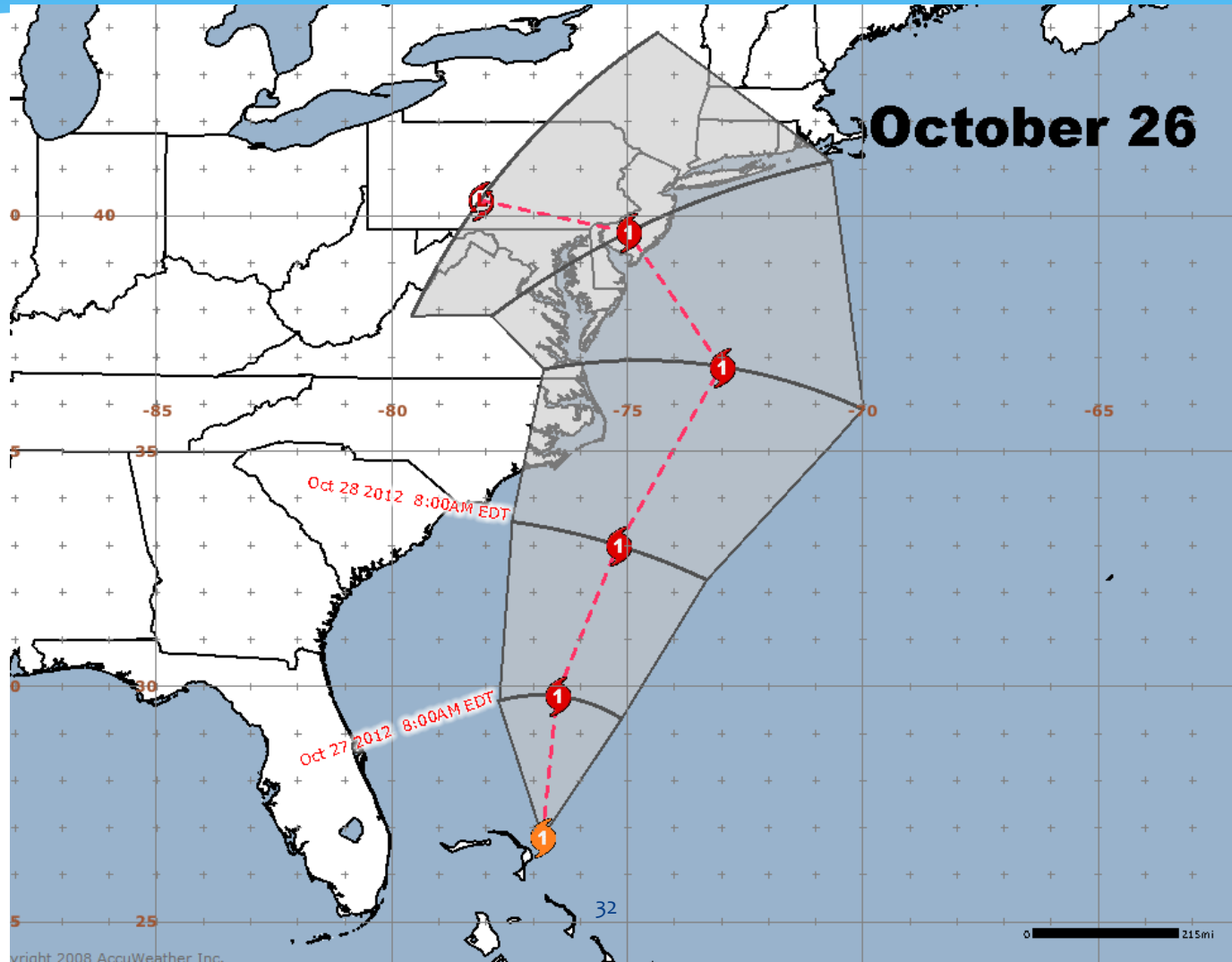
Five Days From Landfall



Hurricane Models



AccuWeather Forecast Oct 26



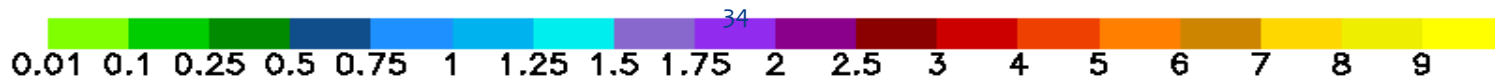
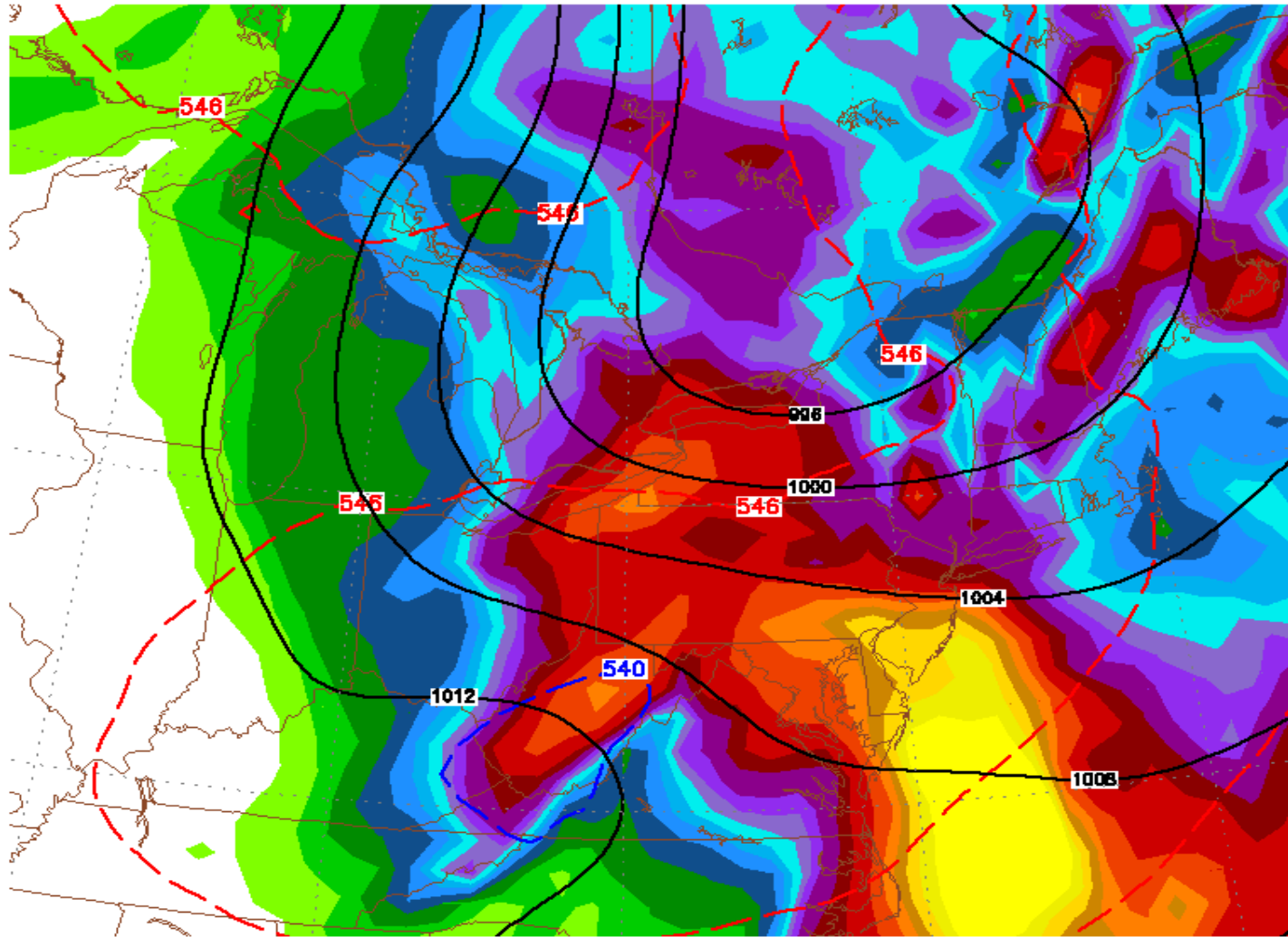
Rainfall Forecast

00z SUN GFS Total Precip

MSLP (MB), 1000–500 thickness (DM), and 120-hour QPF (inches)

Pro.AccuWeather.com

120 hour gfs valid 00Z02NOV2012 Fri

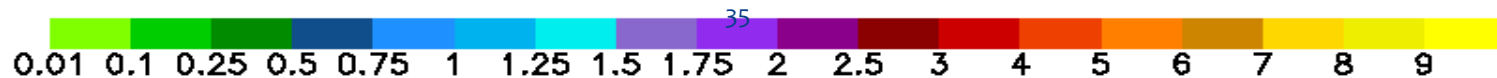
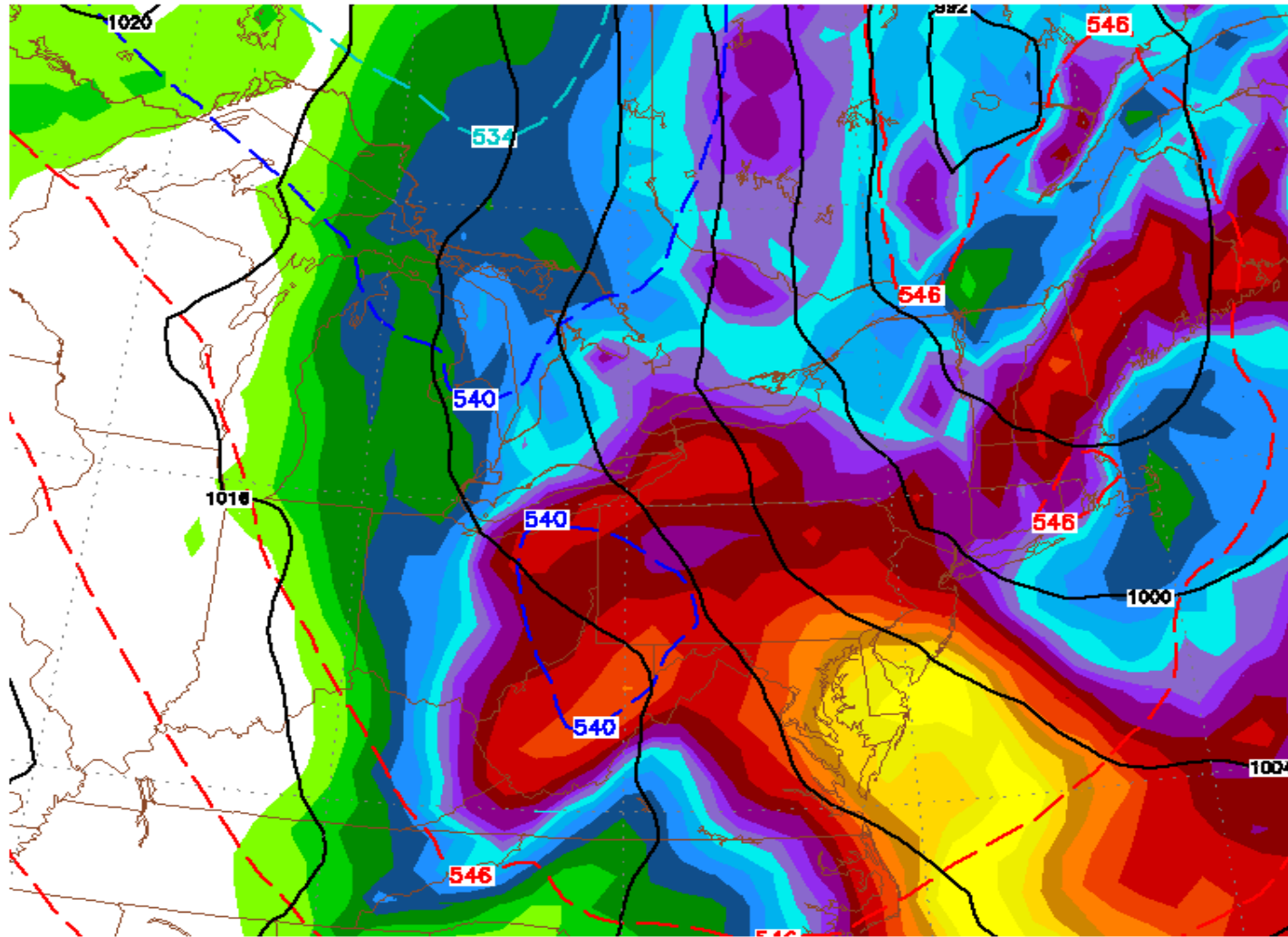


00z SUN EURO Total Precip

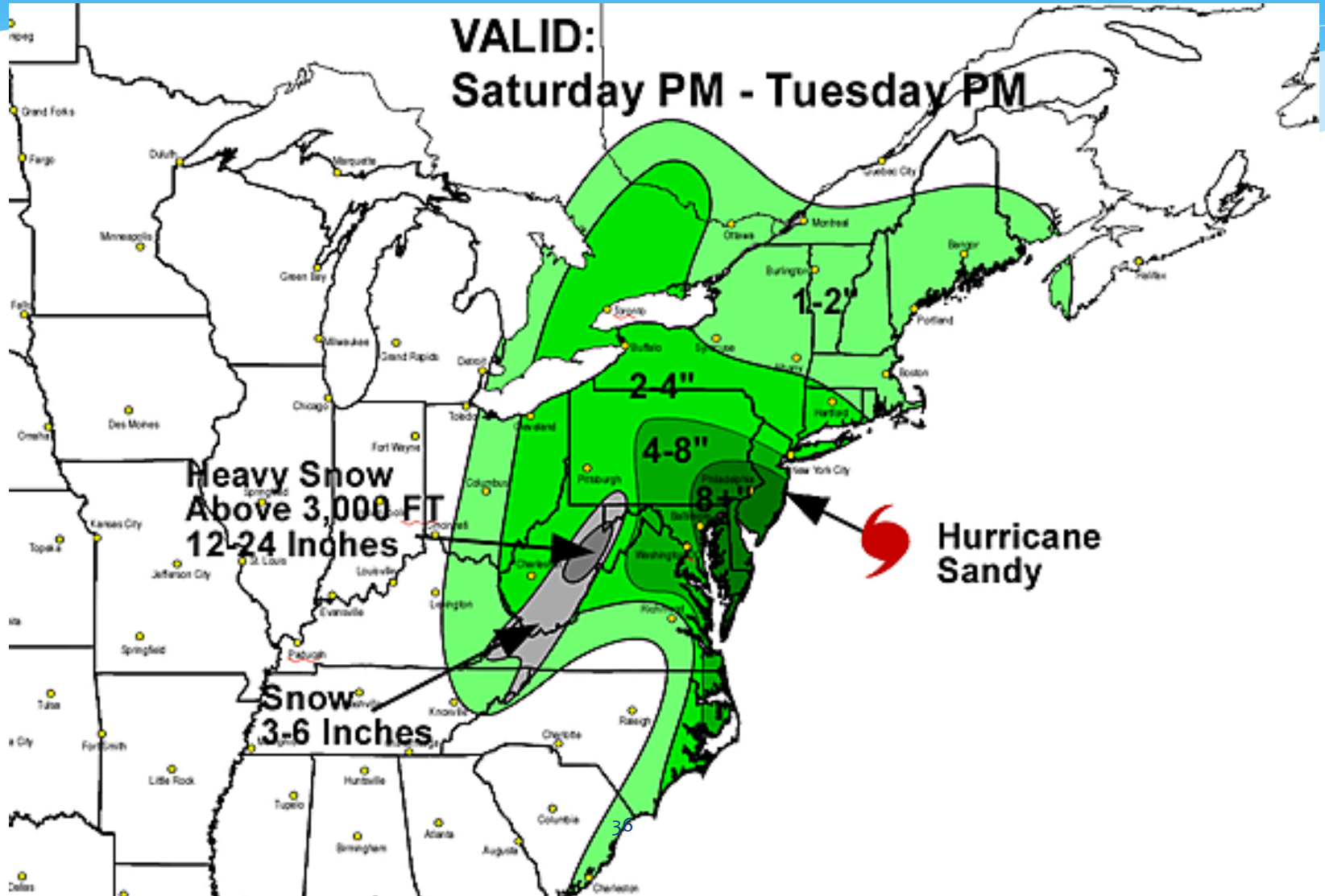
MSLP (MB), 1000–500 thickness (DM), and 120-hour QPF (inches)

Pro.AccuWeather.com

120 hour ecmwfuwd valid 00Z02NOV2012 Fri



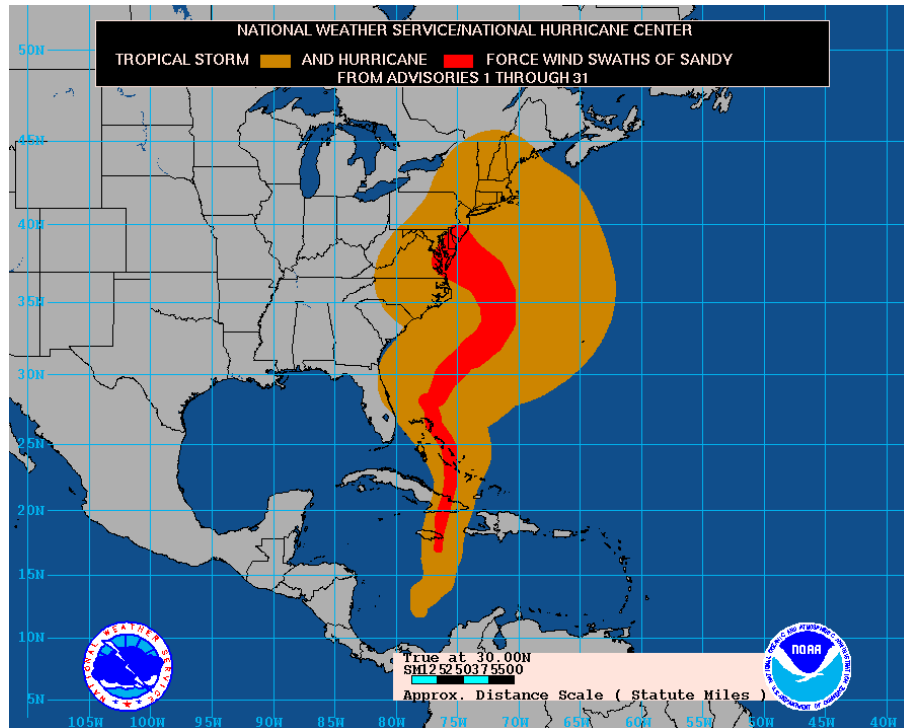
Rainfall Forecast



Wind Forecast

The bottom of the slide features a decorative graphic consisting of several overlapping, wavy lines in shades of light blue and white, creating a sense of movement and depth.

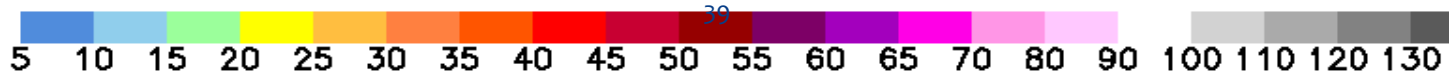
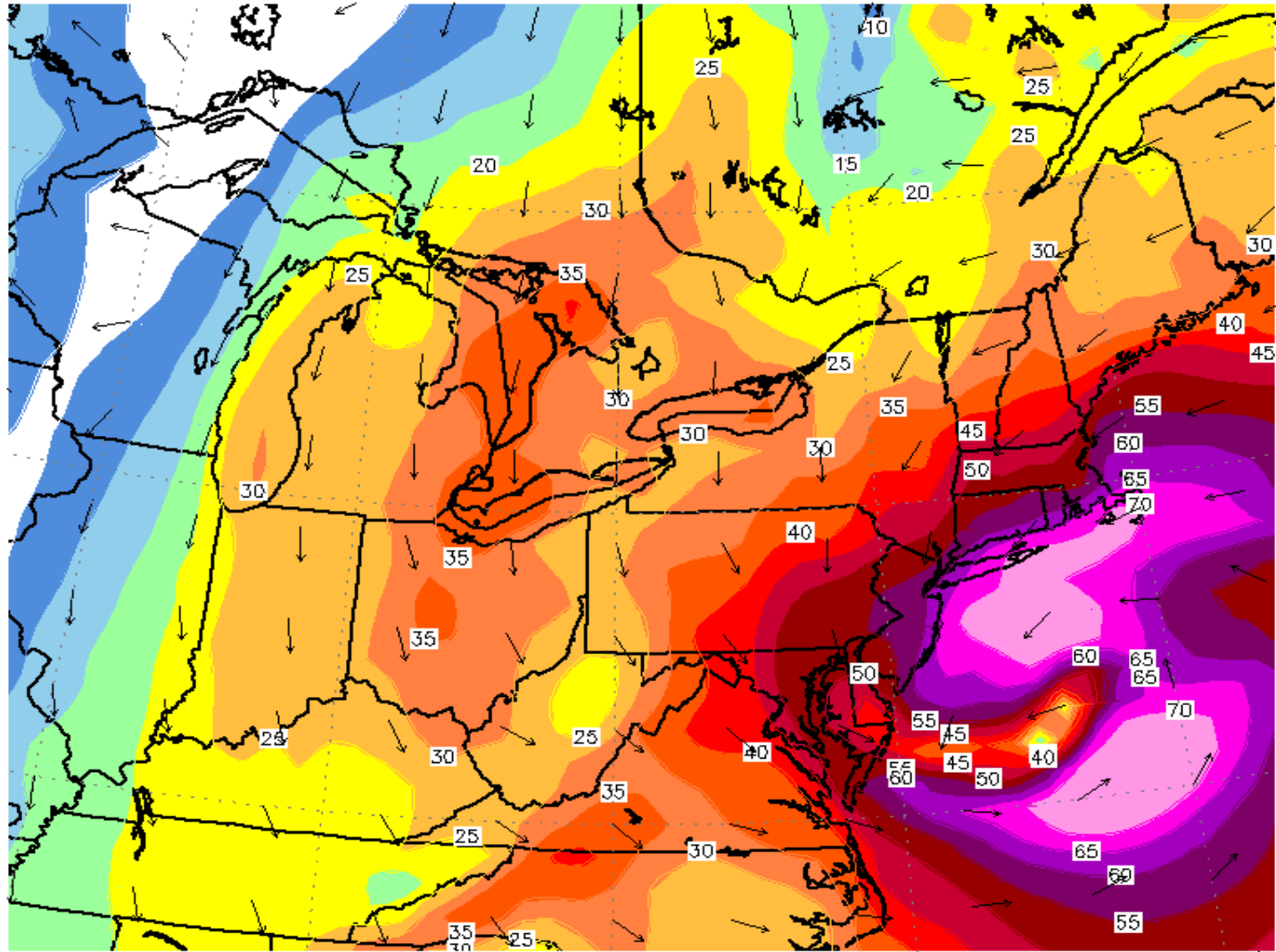
Expanding Wind Field



12z/SUN GFS 18 HR GUST valid 18z MON

10m Wind Gust Vectors (kts)
Pro.AccuWeather.com

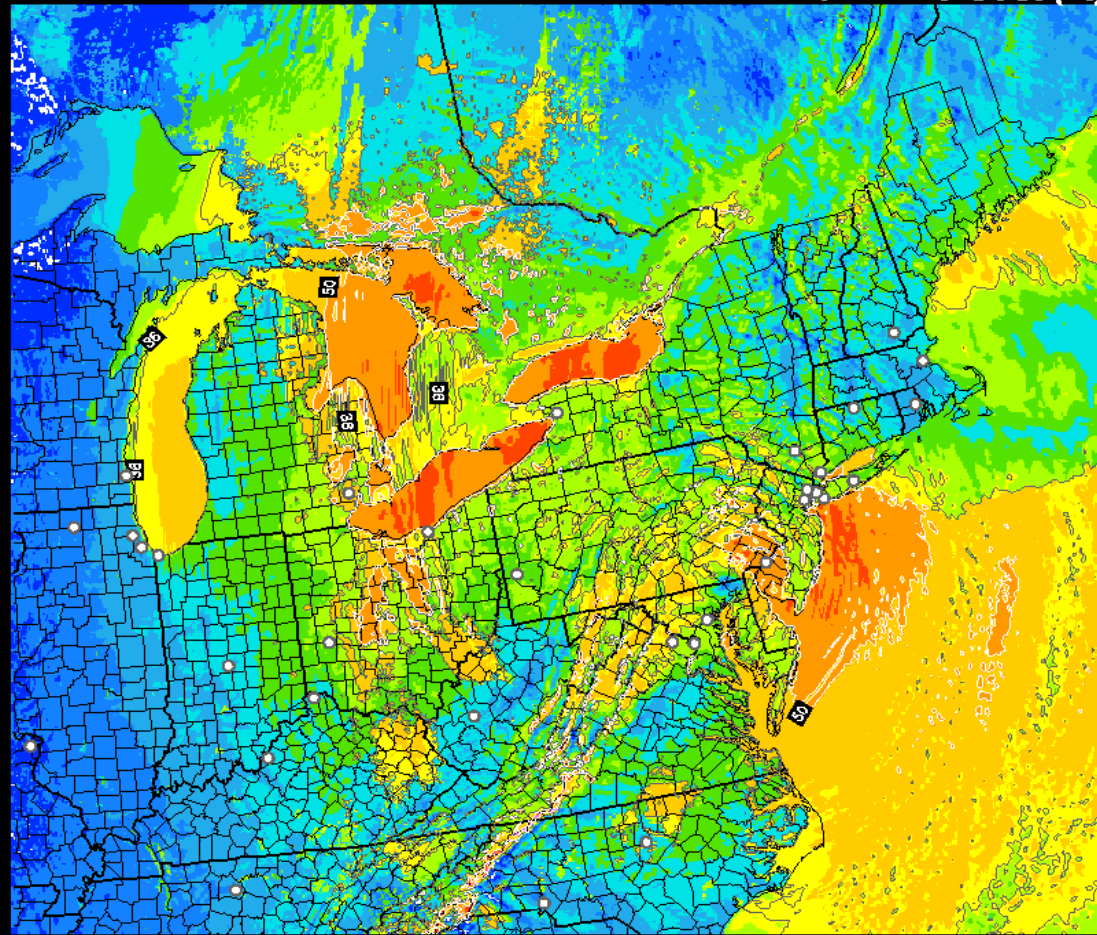
18 hour gfs valid 18Z29OCT2012 Mon



Short-Range Wind Forecast

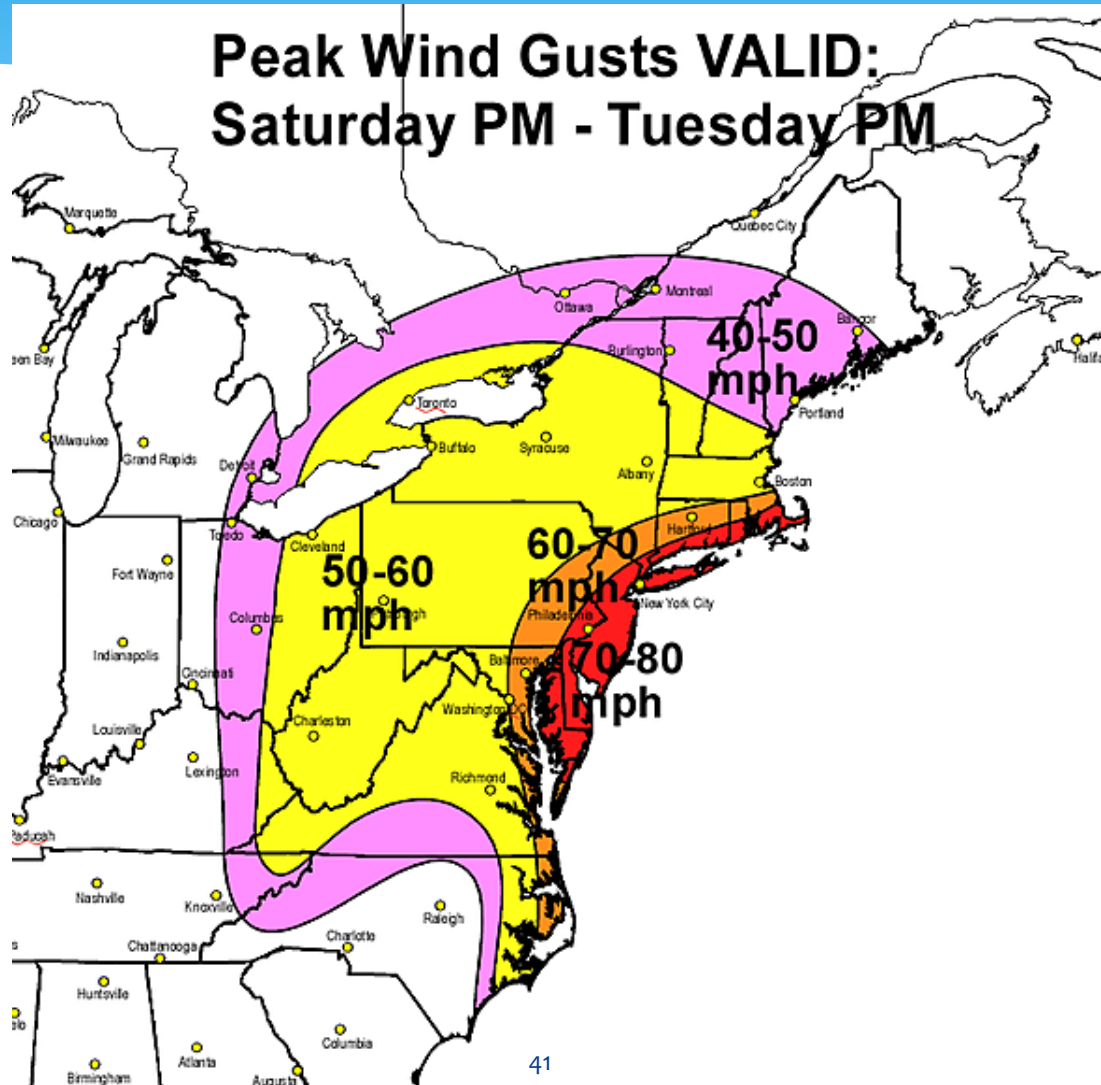
HRRR 10/29/2012 (19:00) 10h fcst - Experimental

Valid 10/30/2012 05:00 UTC
10m Wind Gust (kt)

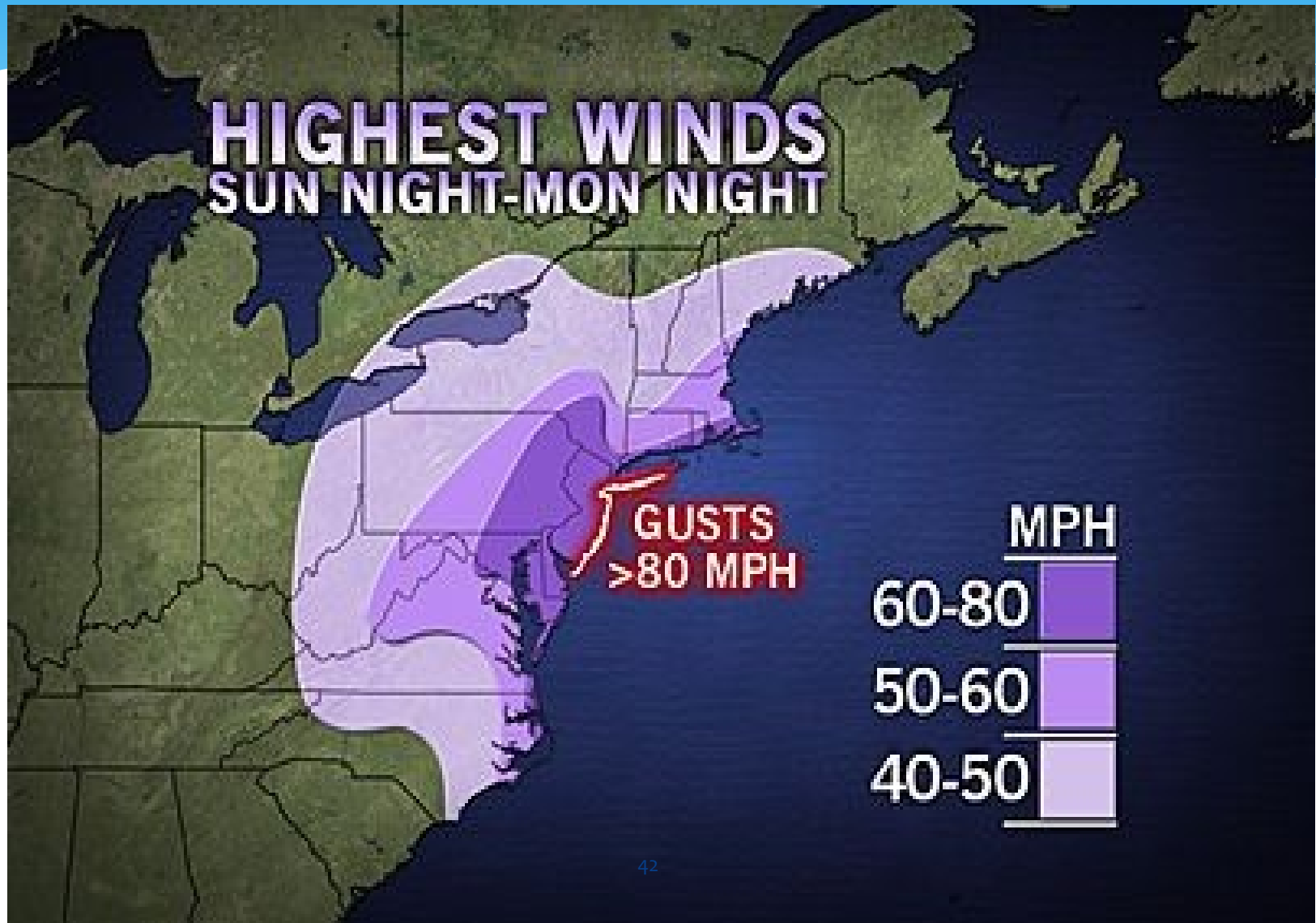


5 10 15 20 25 30 35 40 50 60 70 80

Wind Forecast



Wind Forecast for Sandy



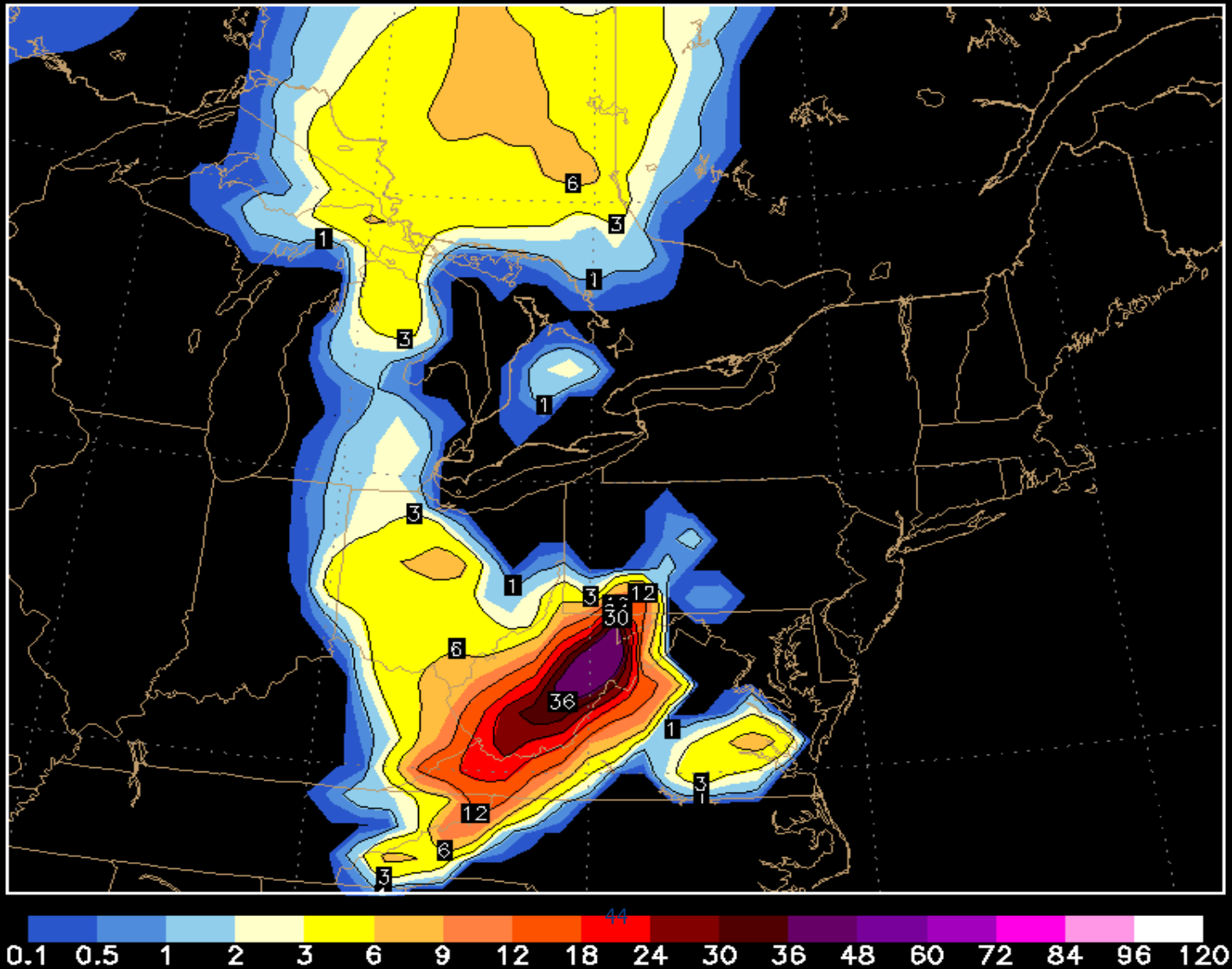
Snow Forecast

The bottom of the slide features a decorative graphic consisting of several overlapping, wavy lines in shades of light blue and white, creating a sense of movement and depth.

12z MON EURO Total Snowfall

Total Snowfall to Forecast Hour (Based on Snow:Water Ratio of 10:1)
Pro.AccuWeather.com

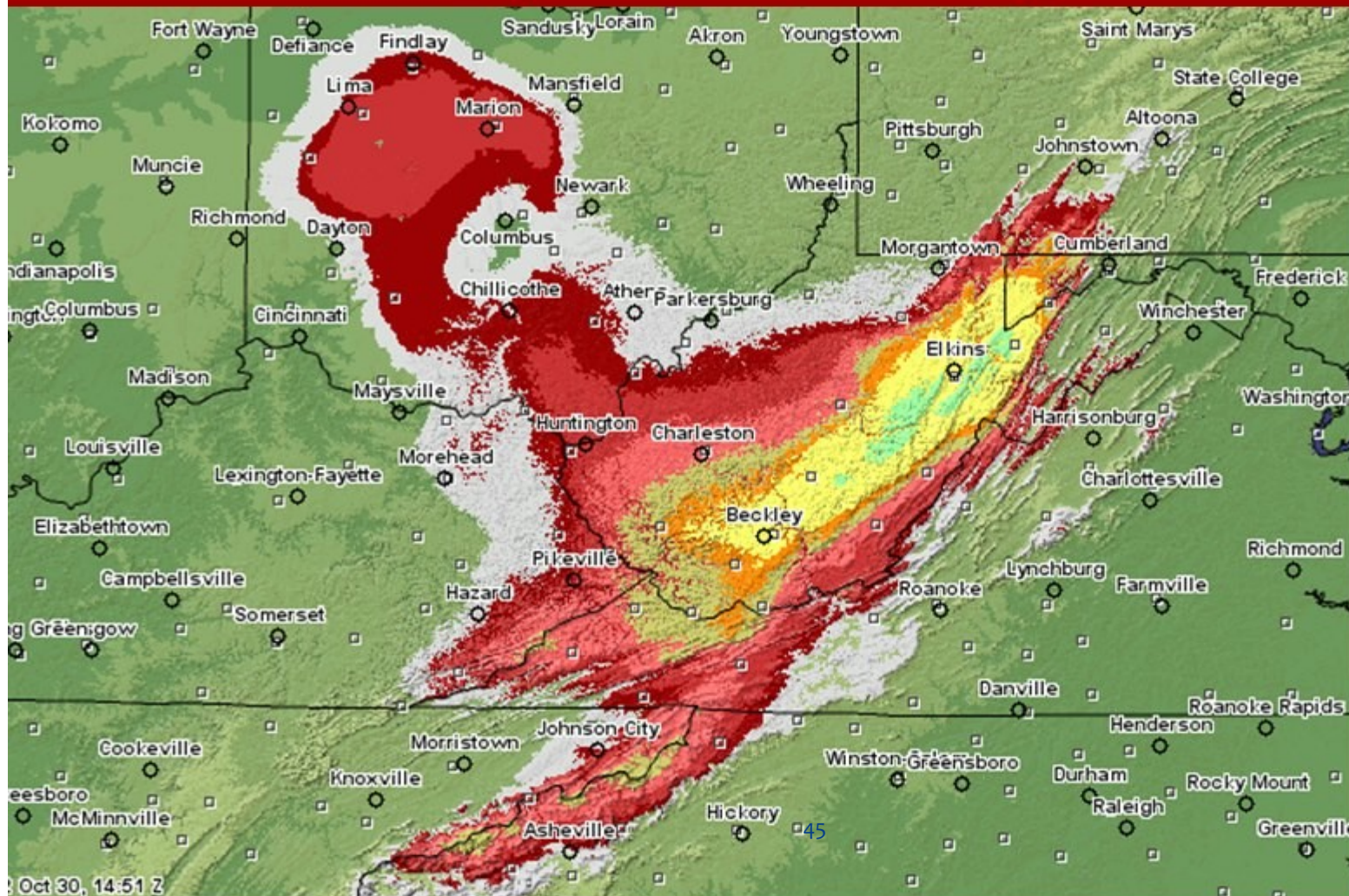
72 hour ecmwfued valid 12Z01NOV2012 Thu



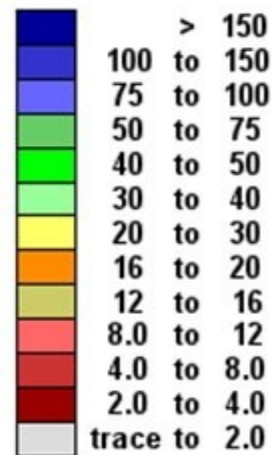
Snow depth through Tuesday PM

SNOW DEPTH ANALYSIS

2 pm October 30, 2012

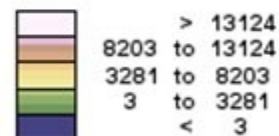


Inches of depth



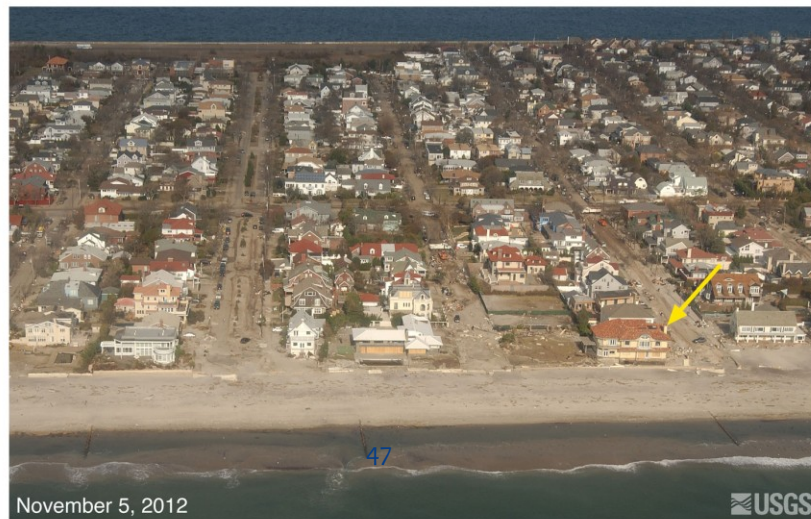
Not Estimated

Elevation in feet



Storm Surge Forecast

Sandy's Storm Surge



STORM SURGE FORECAST SATURDAY NIGHT

Results

Settings

NHC Forecast

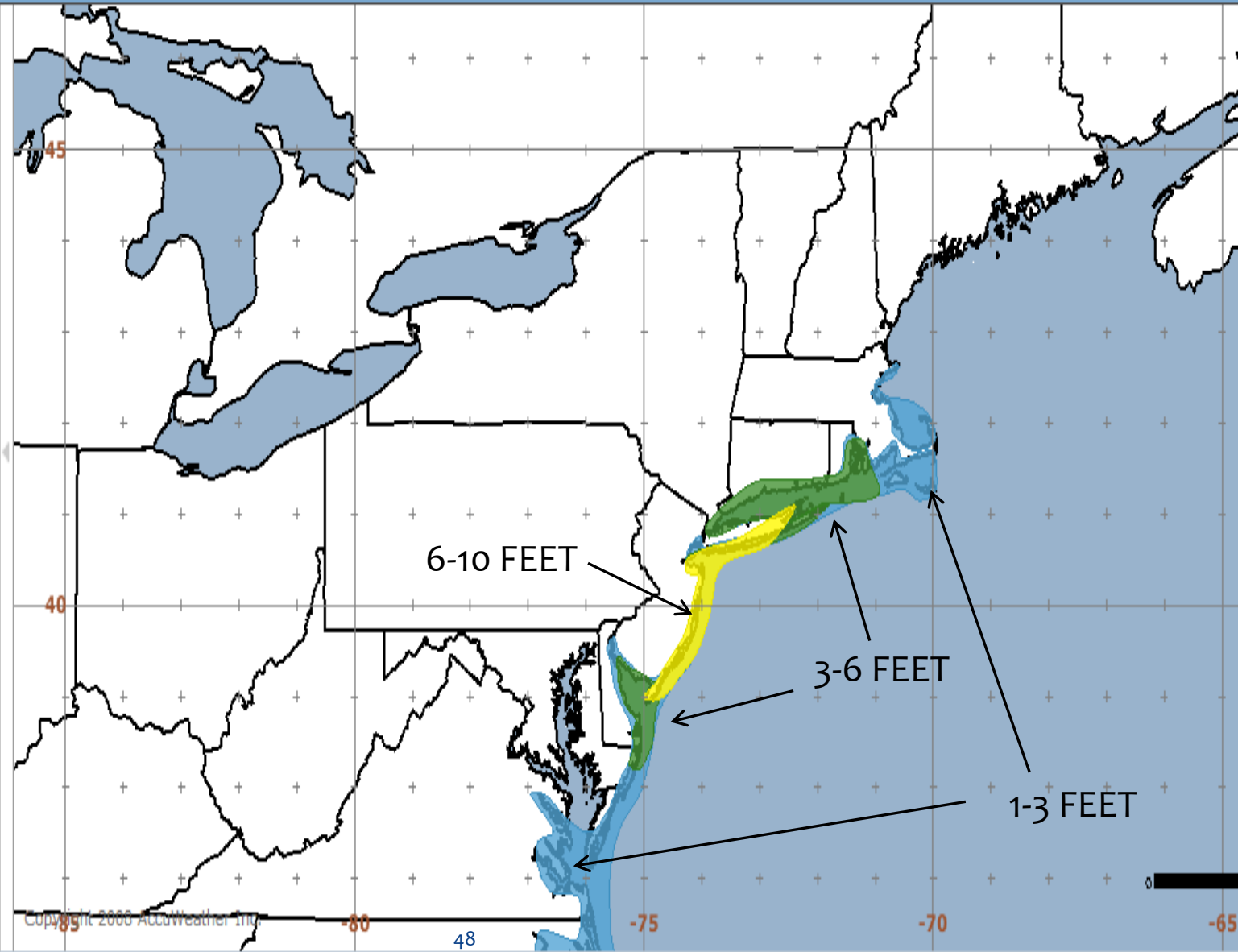
- Current Position
- Watches Warnings
- Past Track

F.T.: Oct 29 2012 11:00PM EDT

Forecast

AccuWeather Forecast

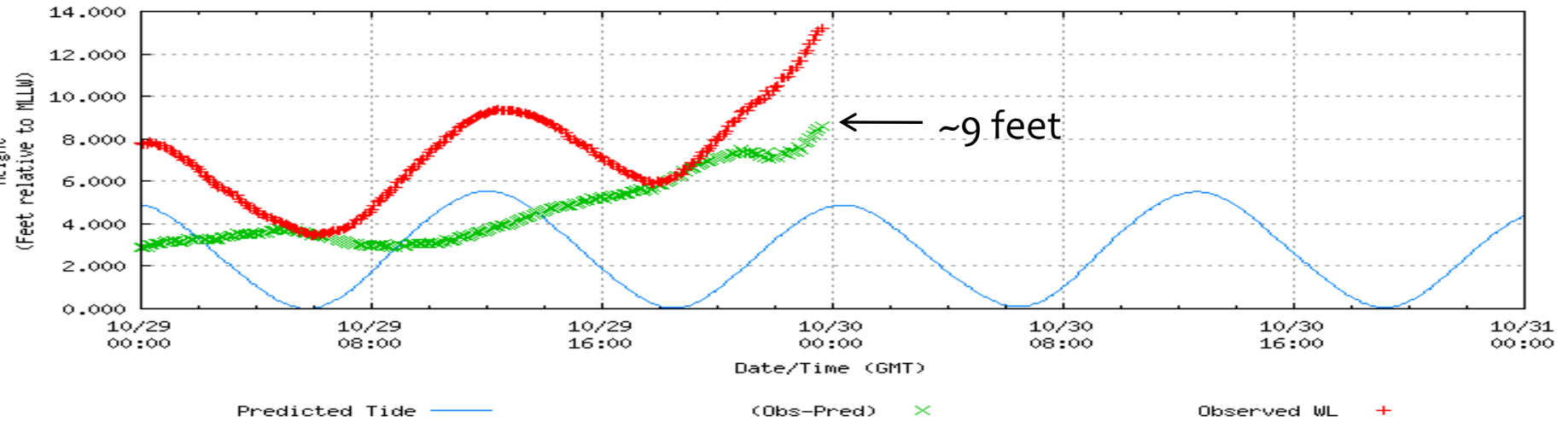
- Current Position
- F.T.: Oct 27 2012 11:00PM EDT
- Forecast Points
- Forecast Track
- Forecast Time Arc
- Window
- Tropical Storm Radii
- Hurricane Radii
- Watches Warnings
- Prob of Hurricane Force Winds
- Storm Surge
- Rainfall Potential
- Dick Assessment



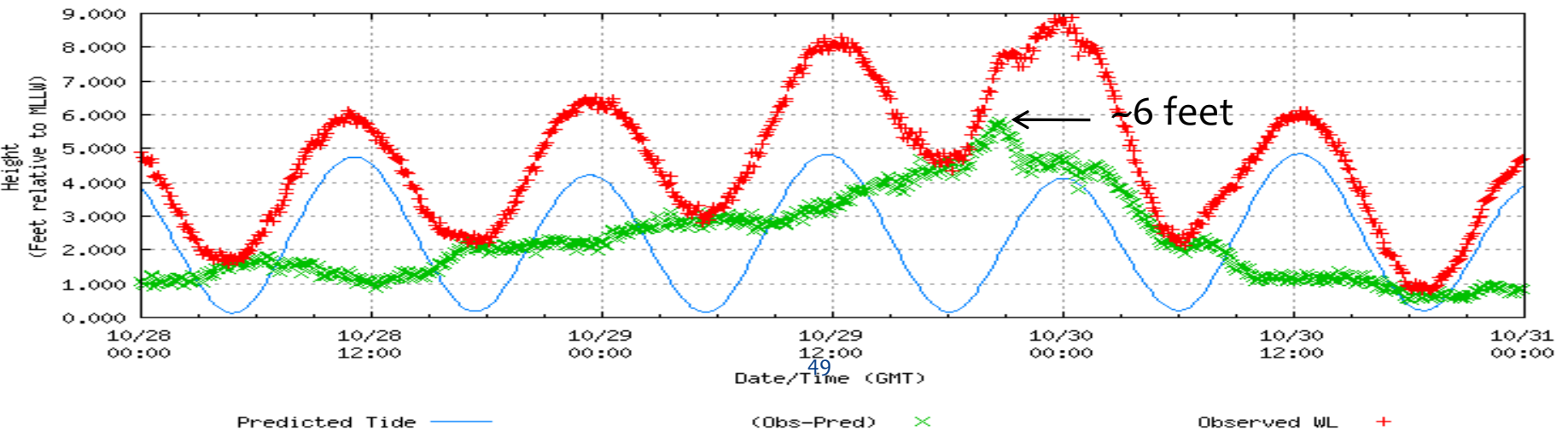
Sandy Hook, NJ , before malfunctioning (top)

Atlantic City, NJ (bottom)

NOAA/NOS/CO-OPS
 Verified Water Level vs. Predicted Plot
 8531680 Sandy Hook, NJ
 from 2012/10/29 - 2012/10/30



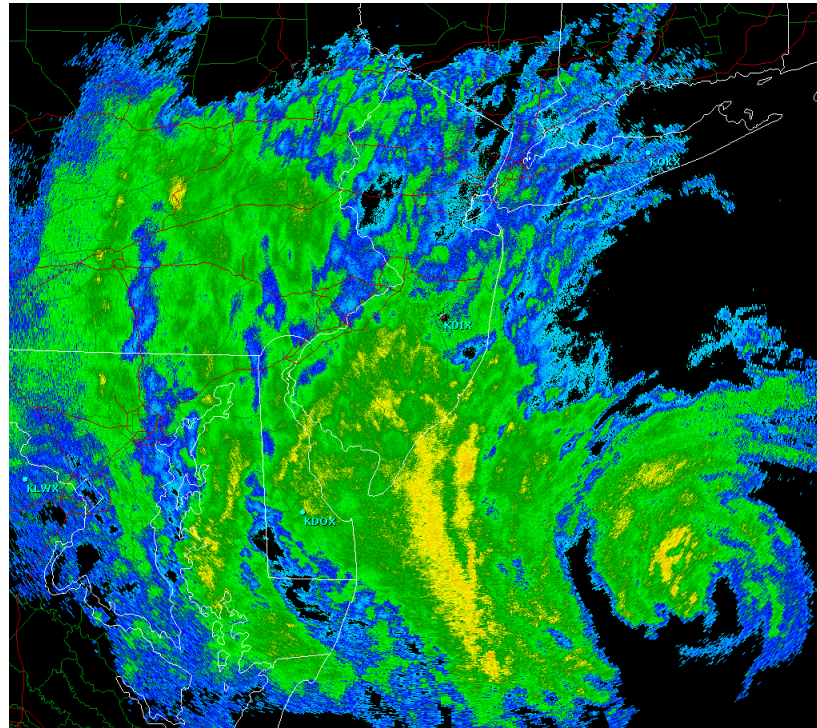
NOAA/NOS/CO-OPS
 Verified Water Level vs. Predicted Plot
 8534720 Atlantic City, NJ
 from 2012/10/28 - 2012/10/30



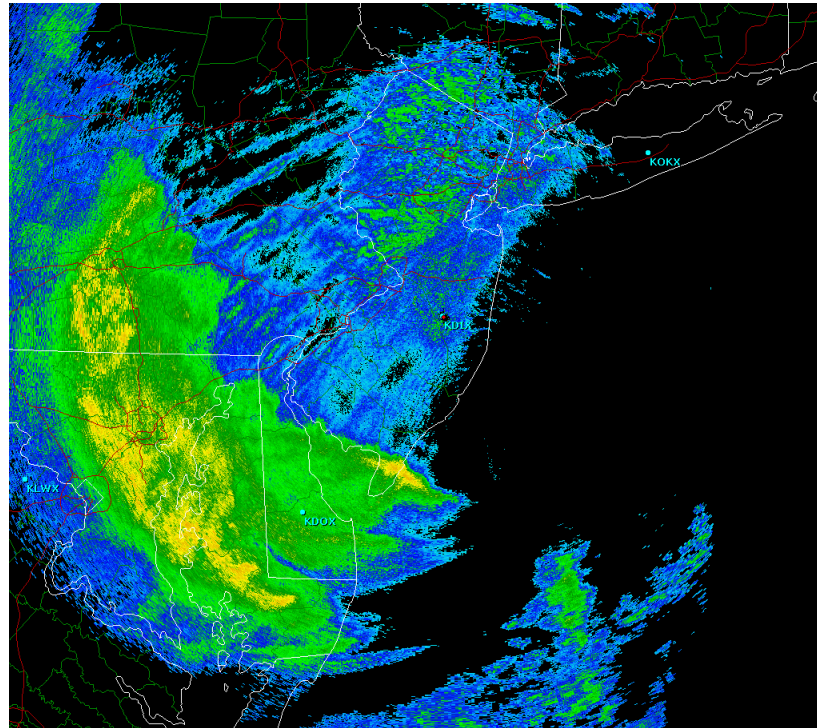
Communication Problems with Sandy

- * Downgrading Sandy to POST-TROPICAL CYCLONE
- * Too Many Warnings
- * Bad Social Media Reports
- * Poor Storm Surge Forecasts

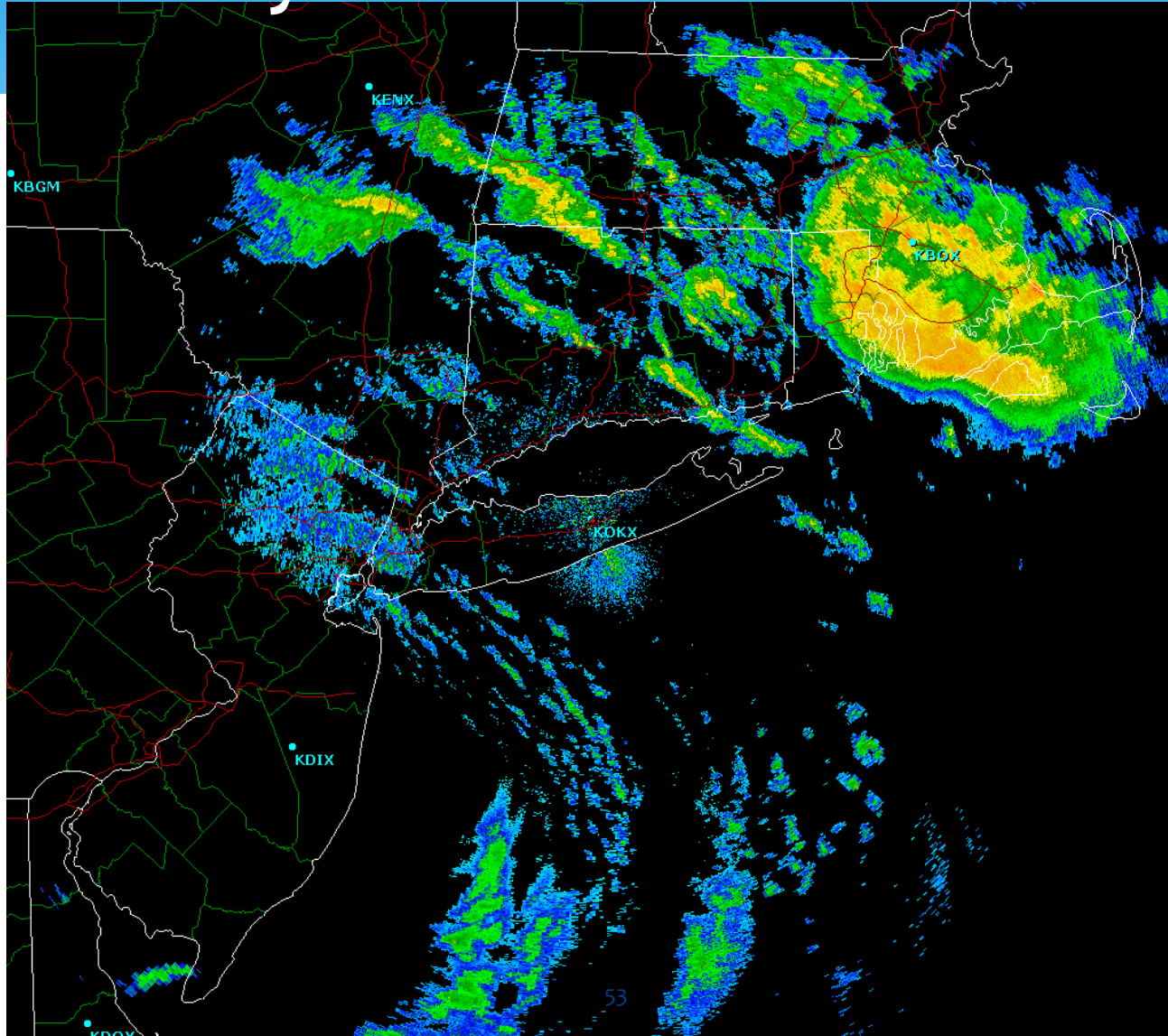
Sandy Monday Afternoon



Sandy at Landfall



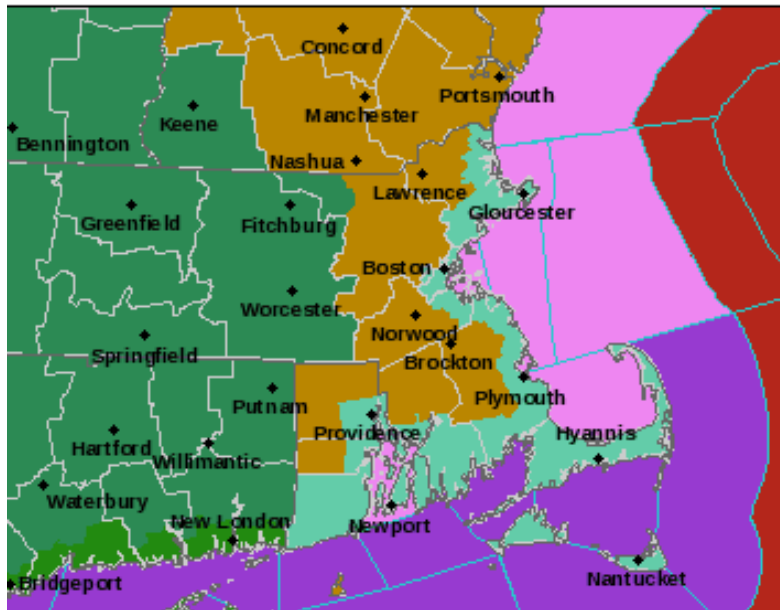
Sandy Landfall Radar NYC



NWS Downgrades Sandy Before Landfall

- * AS INDICATED IN THE 5 PM DISCUSSION...SATELLITE...RADAR...AND AIRCRAFT DATA INDICATE THAT SANDY HAS CONTINUED TO LOSE TROPICAL CHARACTERISTICS. NHC IS NOW DESIGNATING SANDY AS A POST-TROPICAL CYCLONE.
- * IN ADDITION...THE MAXIMUM WINDS HAVE DECREASED SLIGHTLY AND ARE NOW NEAR 85 MPH...140 KM/H. NATIONAL OCEAN SERVICE TIDE GAUGES HAVE RECENTLY REPORTED STORM SURGE HEIGHTS OF 12.4 FEET AT KINGS POINT NEW YORK...AND 7.2 FEET AT THE BATTERY NEW YORK...AND 7.5 FEET AT SANDY HOOK NEW JERSEY. TOTAL WATER LEVELS WILL BE EVEN HIGHER WHEN HIGH TIDE OCCURS.
- * A WIND GUST TO 82 MPH WAS RECENTLY REPORTED AT ISLIP NEW YORK. A SUSTAINED WIND OF 45 MPH WITH A GUST TO 67 MPH WAS RECENTLY REPORTED AT JFK INTERNATIONAL AIRPORT IN NEW YORK.

Too Many Watches and Warnings



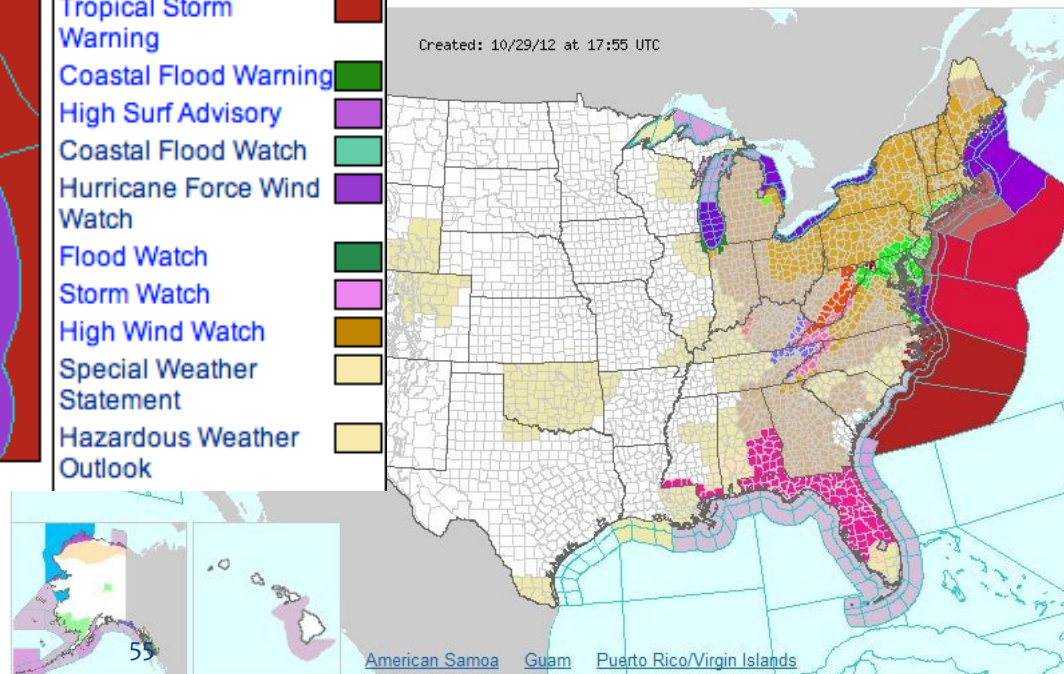
Last map update: Sat, Oct. 27, 2012 at 10:16:09 pm EDT

Read watches, warnings & advisories

Zoom Out

- Tropical Storm Warning
- Coastal Flood Warning
- High Surf Advisory
- Coastal Flood Watch
- Hurricane Force Wind Watch
- Flood Watch
- Storm Watch
- High Wind Watch
- Special Weather Statement
- Hazardous Weather Outlook

Created: 10/29/12 at 17:55 UTC



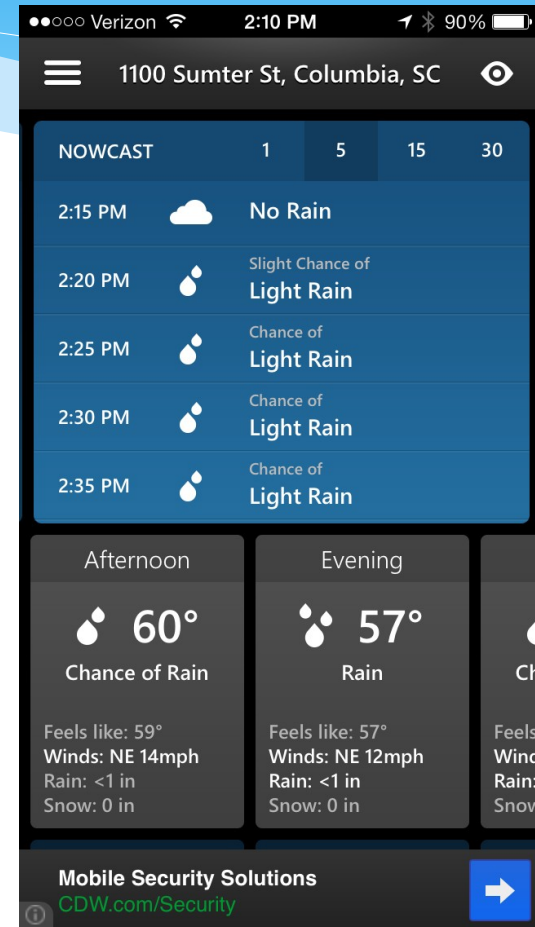
What's the Future Hold for the Communicologist?

Challenges for Future Communicologist

- * Data Overload – Too much data to quickly and ultimately blur judgement.
- * Understanding Impacts at All Levels – What are the customer needs and how do they change
- * What Risks Are Involved – What are new risks for poor communication versus great communication?
- * Using Social Media for Instant Information

Communicating in New Ways

- * **Site Specific Forecast Models on Your Smart Phone**
- * **Push Notifications of Impactful Weather Events**
- * **Tailored Impact Statements to Your Locations**
- * **Improved Lead Time of Impactful Events**
- * **Min-by-Min Forecasts**



Thank You.
Questions?