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

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PHM

2013

AccuWeather Operations

Introduction

1. The Computer Models form 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

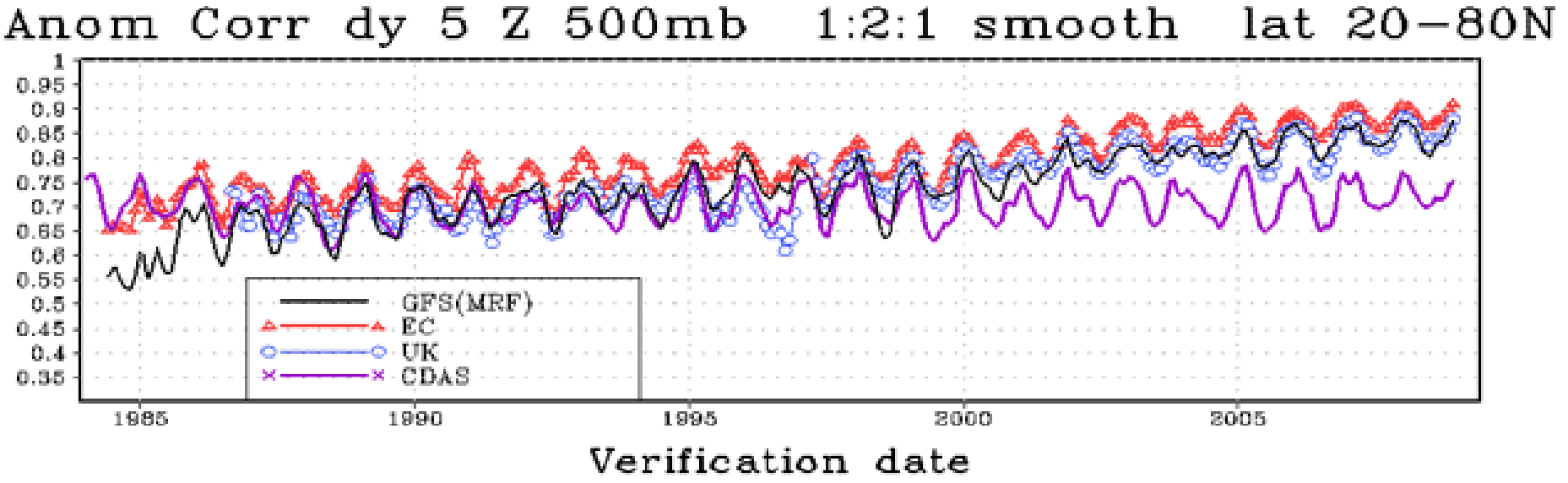
Model Confusion!

* 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



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

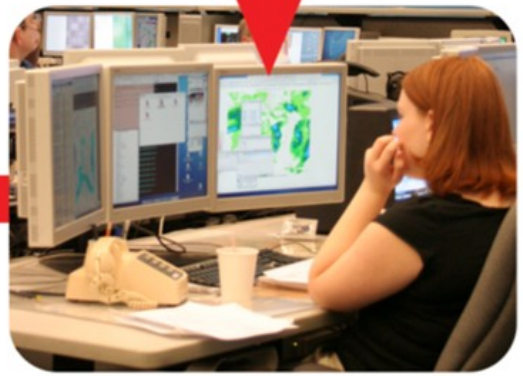
Business Model of the Meteorologist

* 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

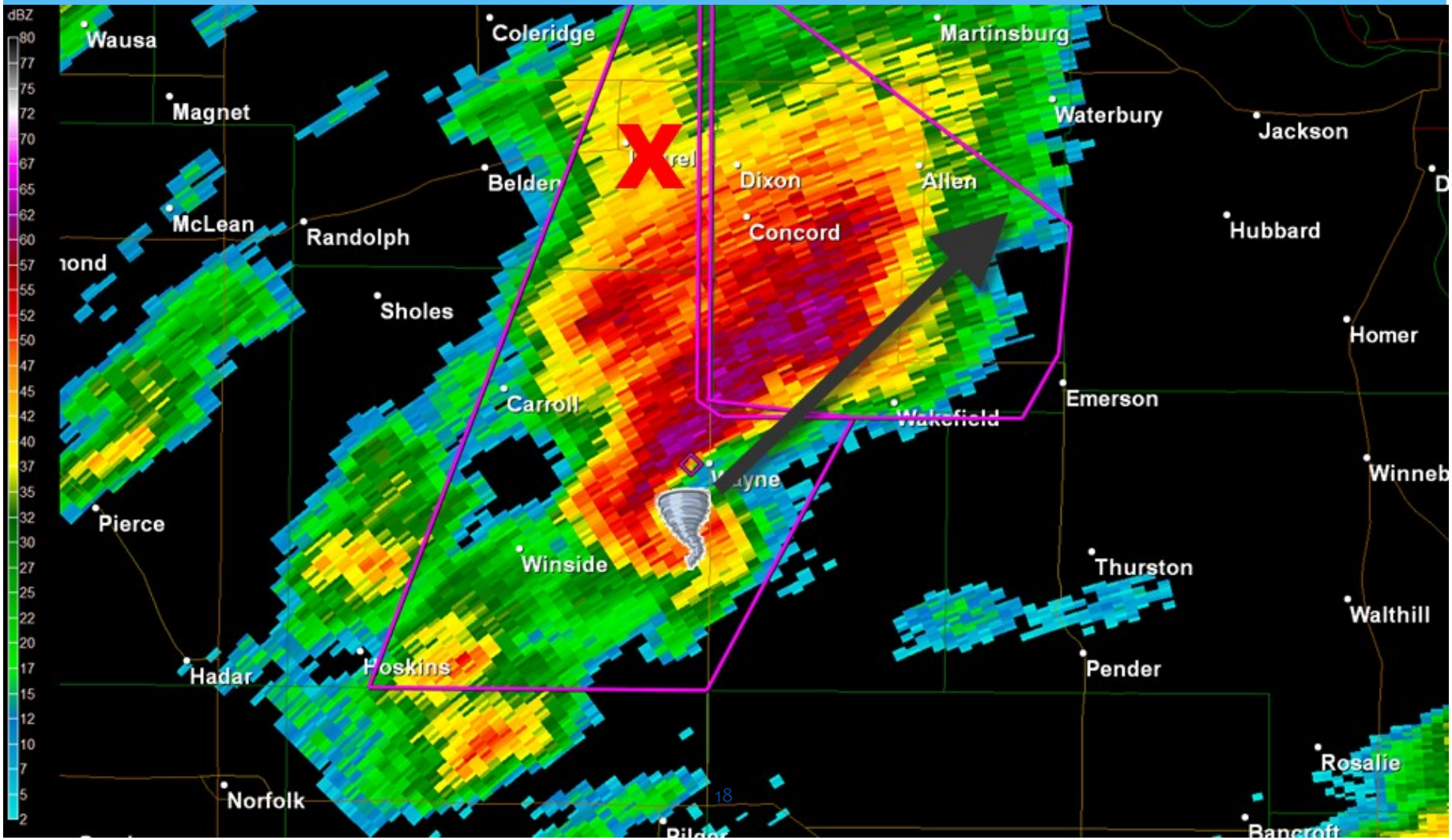
Warnings are sent using the most effective methods for your operations, including email, web, mobile, voice and more



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

Severe weather occurs

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

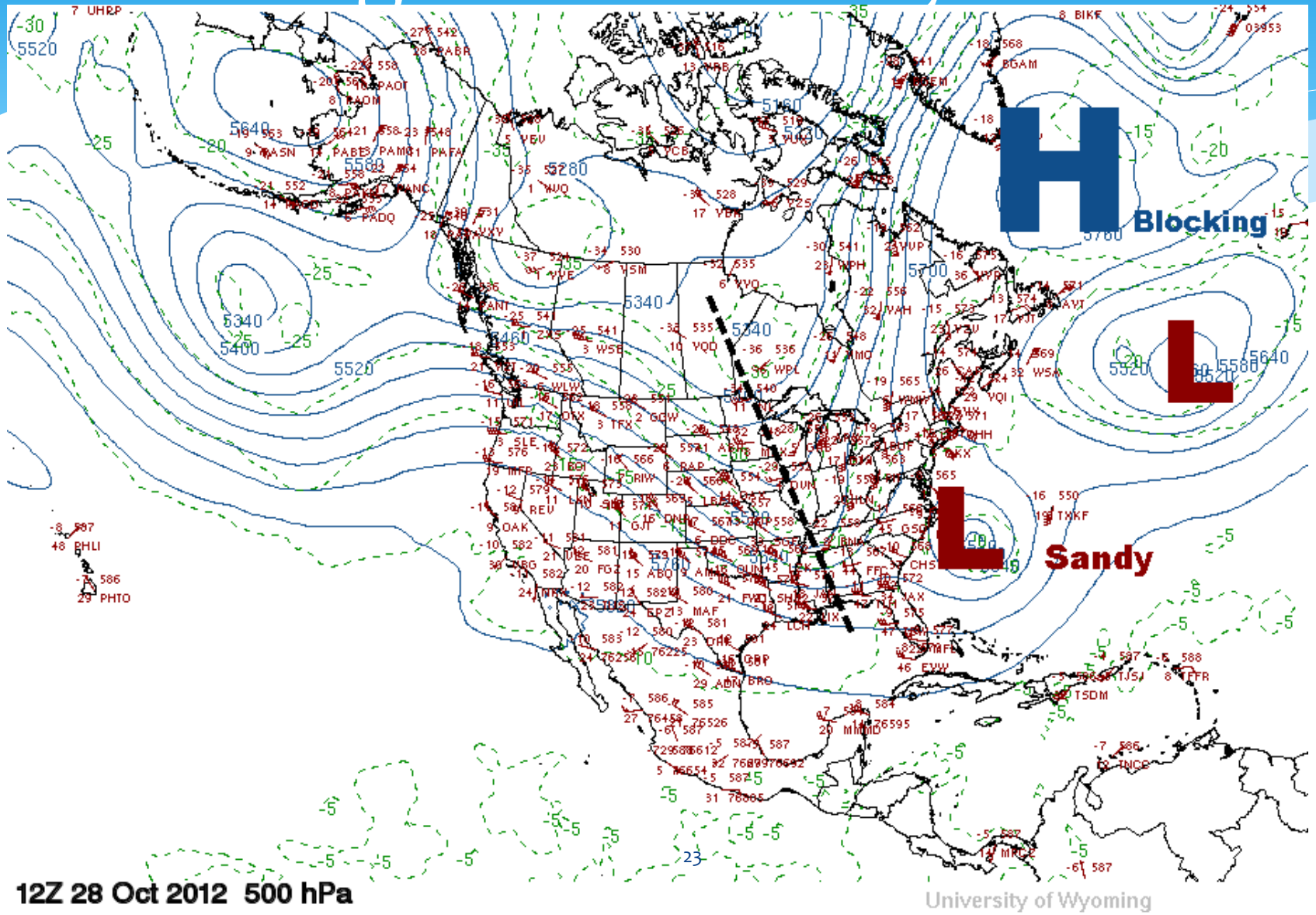
- **Track Forecast**
- **Rainfall Forecast**
- **Wind Forecast**
- **Snow Forecast**
- **Storm Surge Forecast**
- **What Went Wrong**

History of Sandy

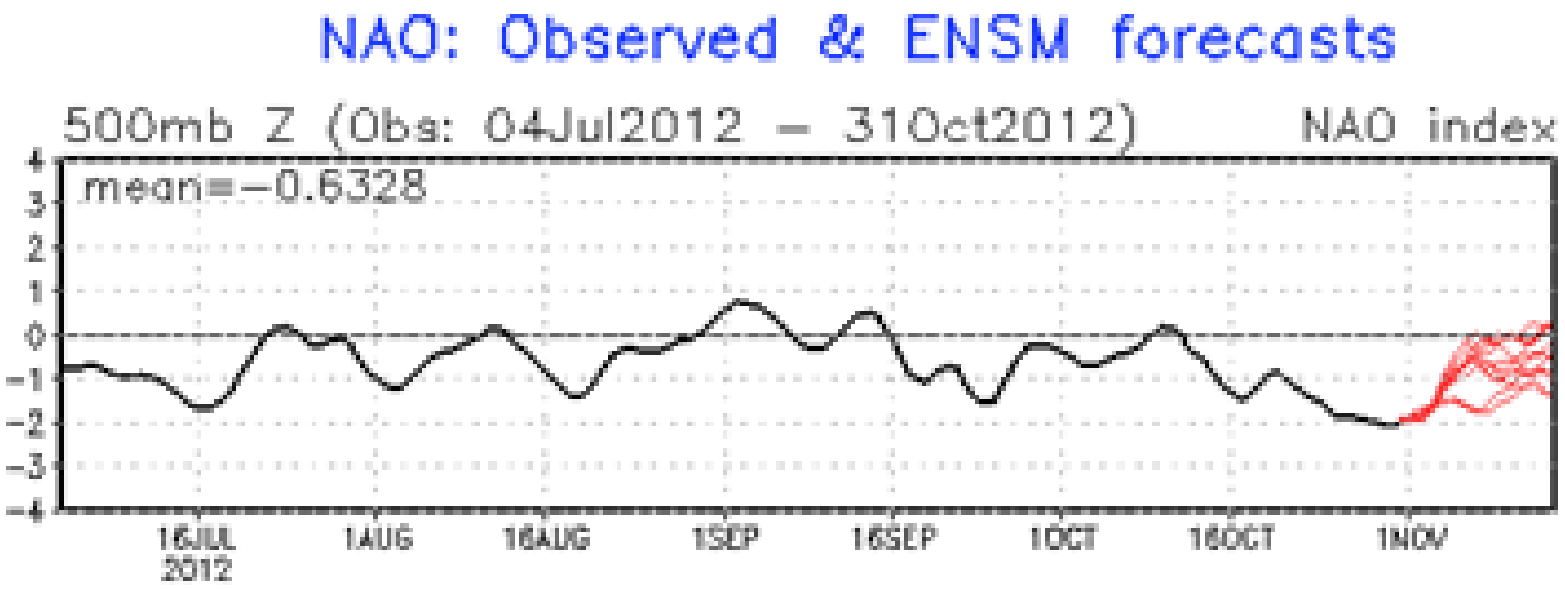
Impacts from Sandy

Impacts	Winds	Rain	Snow	Record Press	Waves/Surge
• 7.5 Million Without Power • Over 100 Killed • Many Towns Destroyed • Jersey Coast Changed • Thousands of Trees Down • Massive Coastal Flooding	Eatons Neck, N.Y.: 94 mph Montclair, N.J.: 88 mph Westerly, R.I.: 86 mph Madison, Conn.: 85 mph Cuttyhunk, Mass.: 83 mph Allentown, Pa.: 81 mph Highland Beach, Md.: 79 mph Chester Gap, Va.: 79 mph	Andrews AFB, Md.: 15.3" (unconfirmed) Easton, Md.: 12.55“ Wildwood Crest, N.J.: 11.67“ Virginia Beach, Va.: 9.57“ Milford, Del.: 9.55“ Maysville, W.Va.: 7.75"	Redhouse, Md.: 29“ Clayton, W.Va.: 33.0“ Champion, Pa.: 13“ Haywood County, N.C.: 24“ Norton, Va.: 24“ Mt. Leconte, Tenn.: 34“ Payne Gap, Ky.: 14“ Bellefontaine, Ohio: 3.5"	Atlantic City, N.J.: 948.3 mb (28.00" Hg) Philadelphia, Pa.: 953mb (28.23" Hg) Harrisburg, Pa.: 963mb (28.46" Hg) Scranton, Pa.: 971mb (28.69" Hg) Trenton, N.J.: 958mb (28.31" Hg) Baltimore, Md.: 965mb (28.49" Hg) Harrisburg, Pa.: 964mb (28.46" Hb)	**TOP WAVES:** 39.67 feet 500 miles southeast of Atlantic City, N.J. 32.5 feet just outside New York Harbor entrance 21.7 feet lower Lake Michigan **TOP STORM SURGES:** The Battery, N.Y.: ~9 feet above normal Kings Point, N.Y.: ~12.5 feet above normal New Haven, Conn.: ~9 feet above normal

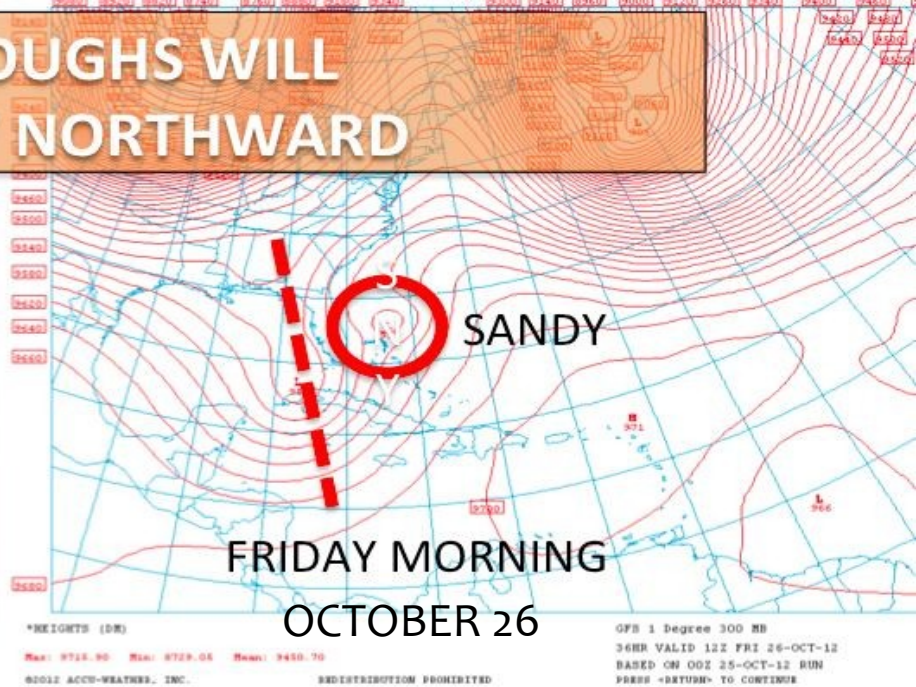
Blocking Caused Sandy to Hit NJ

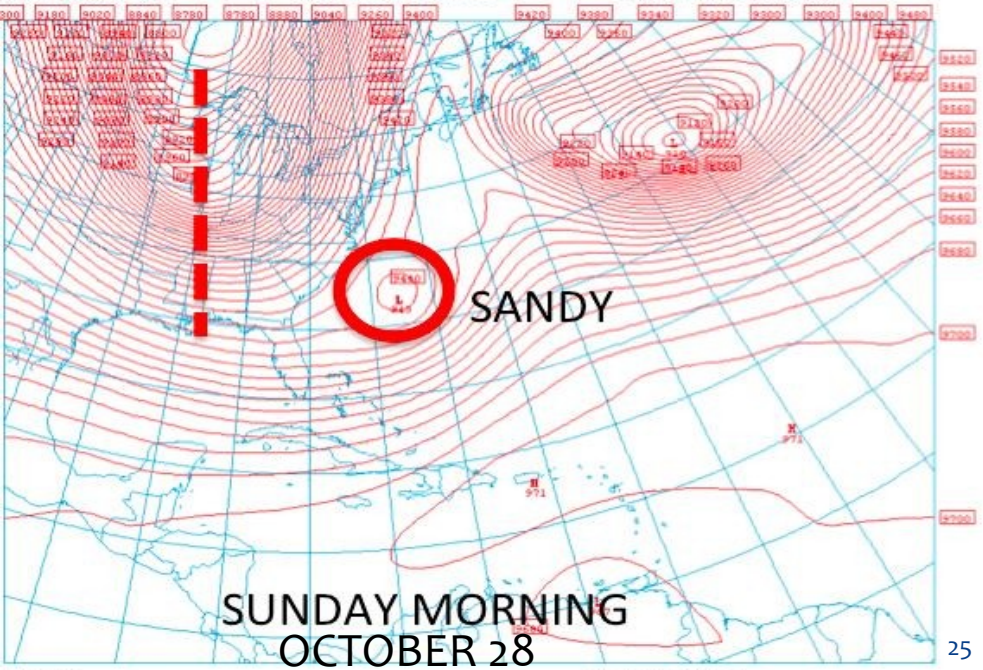


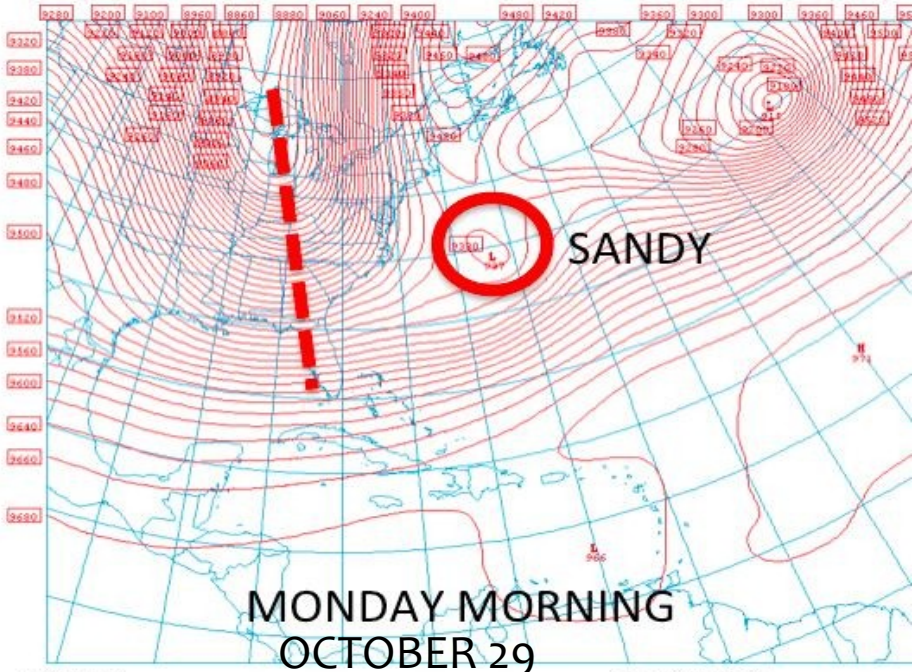
Blocking Index



UPPER-LEVEL TROUGHS WILL HELP GUIDE SANDY NORTHWARD

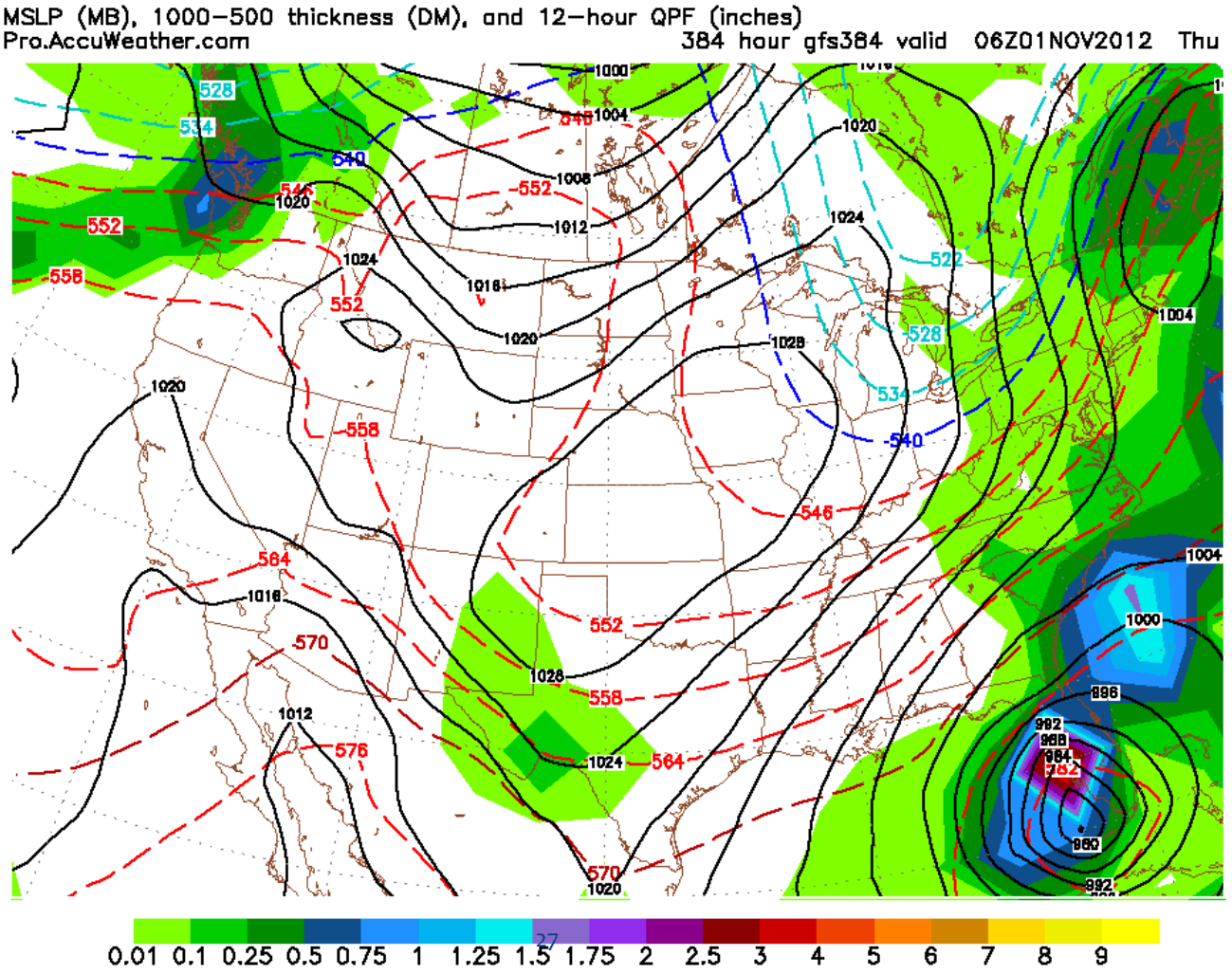




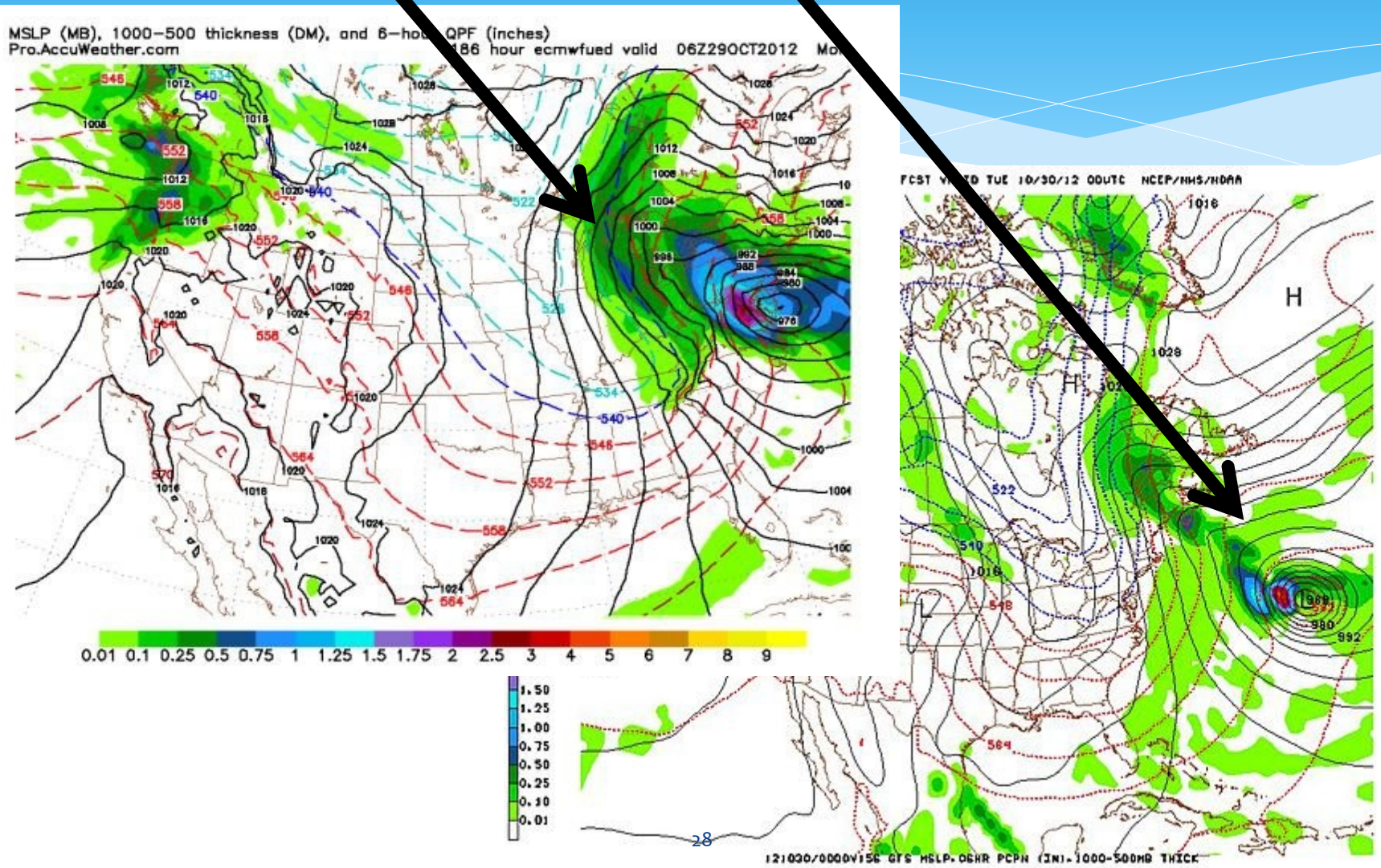


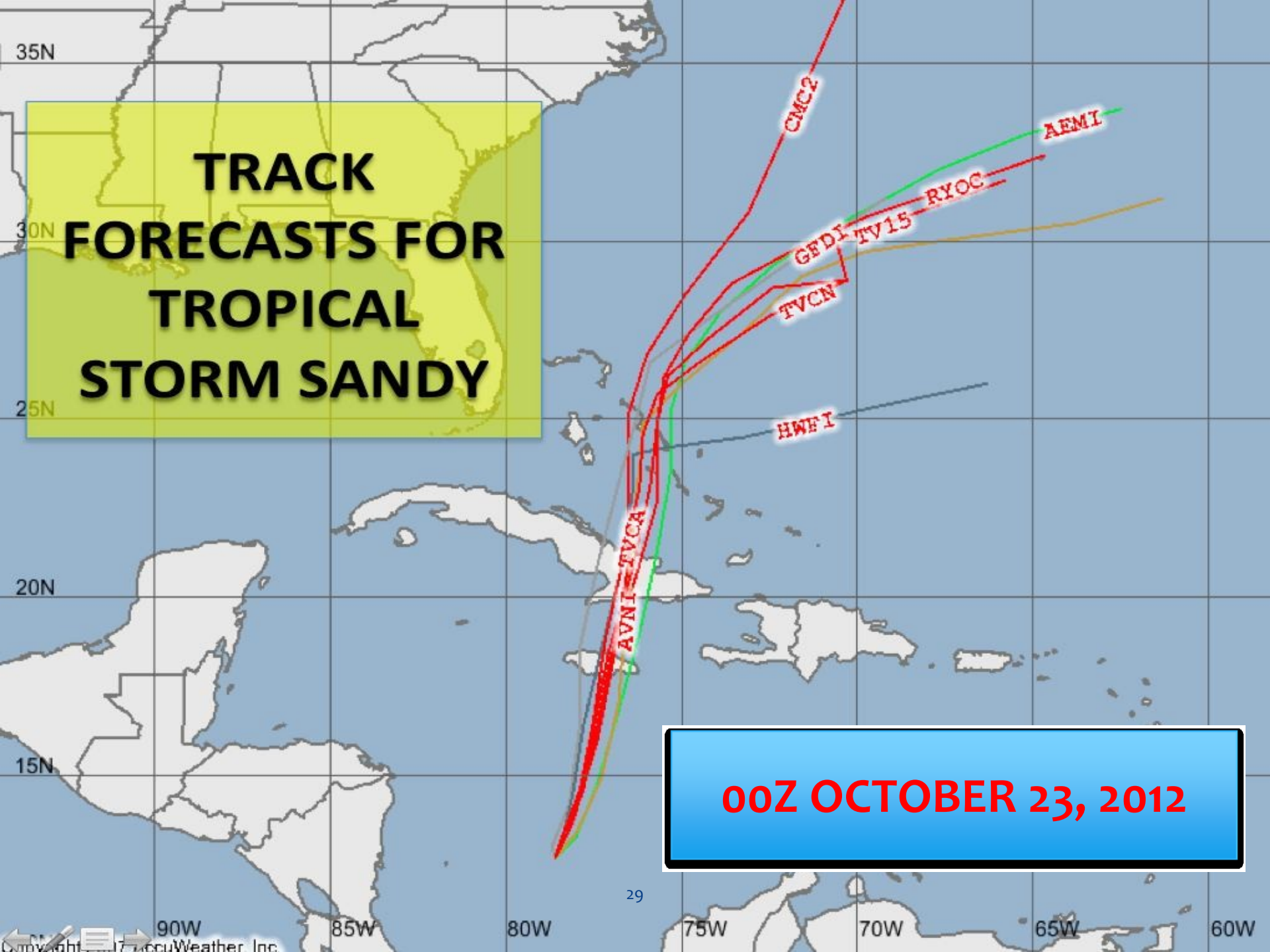
Track Forecast

384 Hours From Landfall

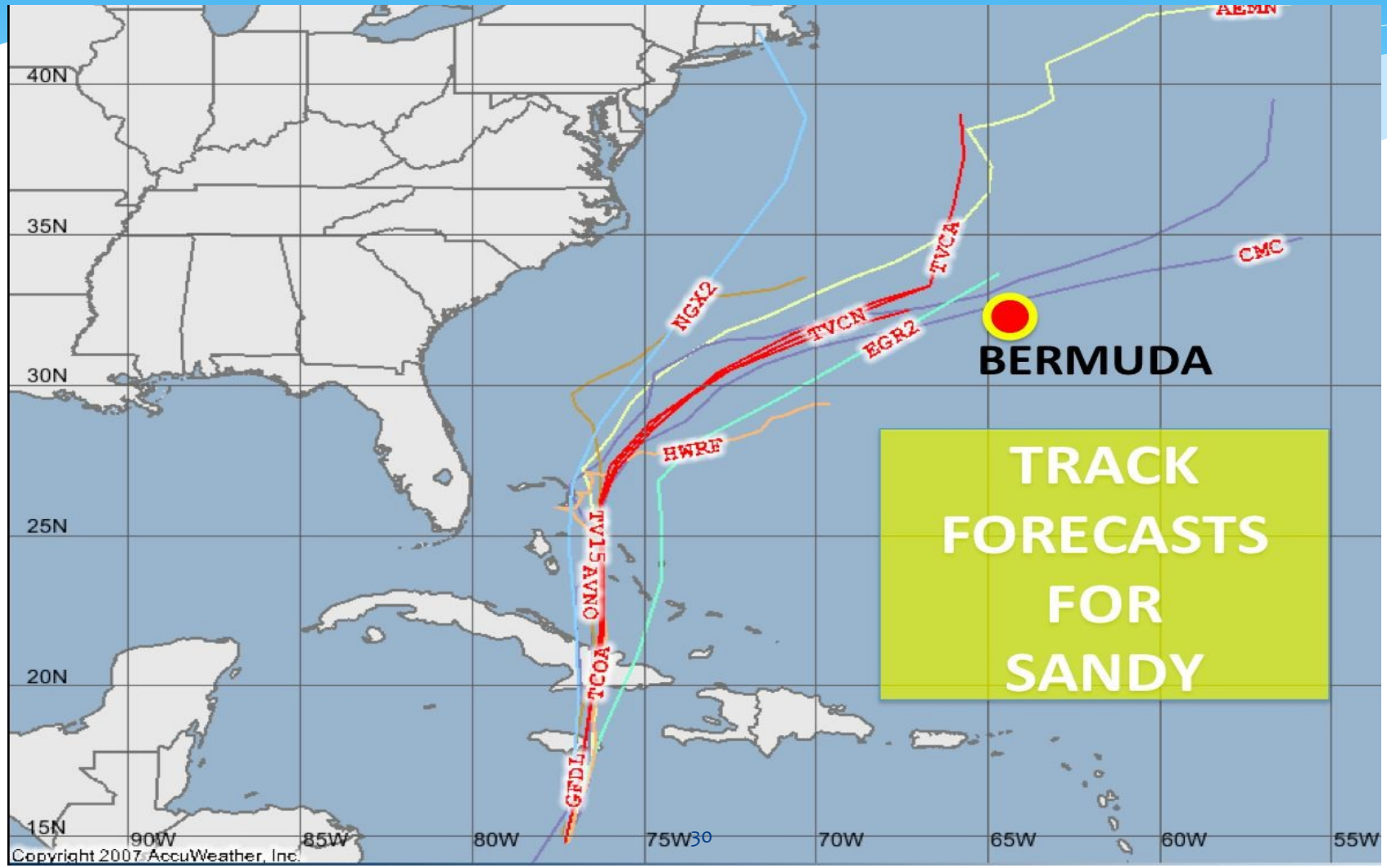


ECMWF vs GFS Forecast

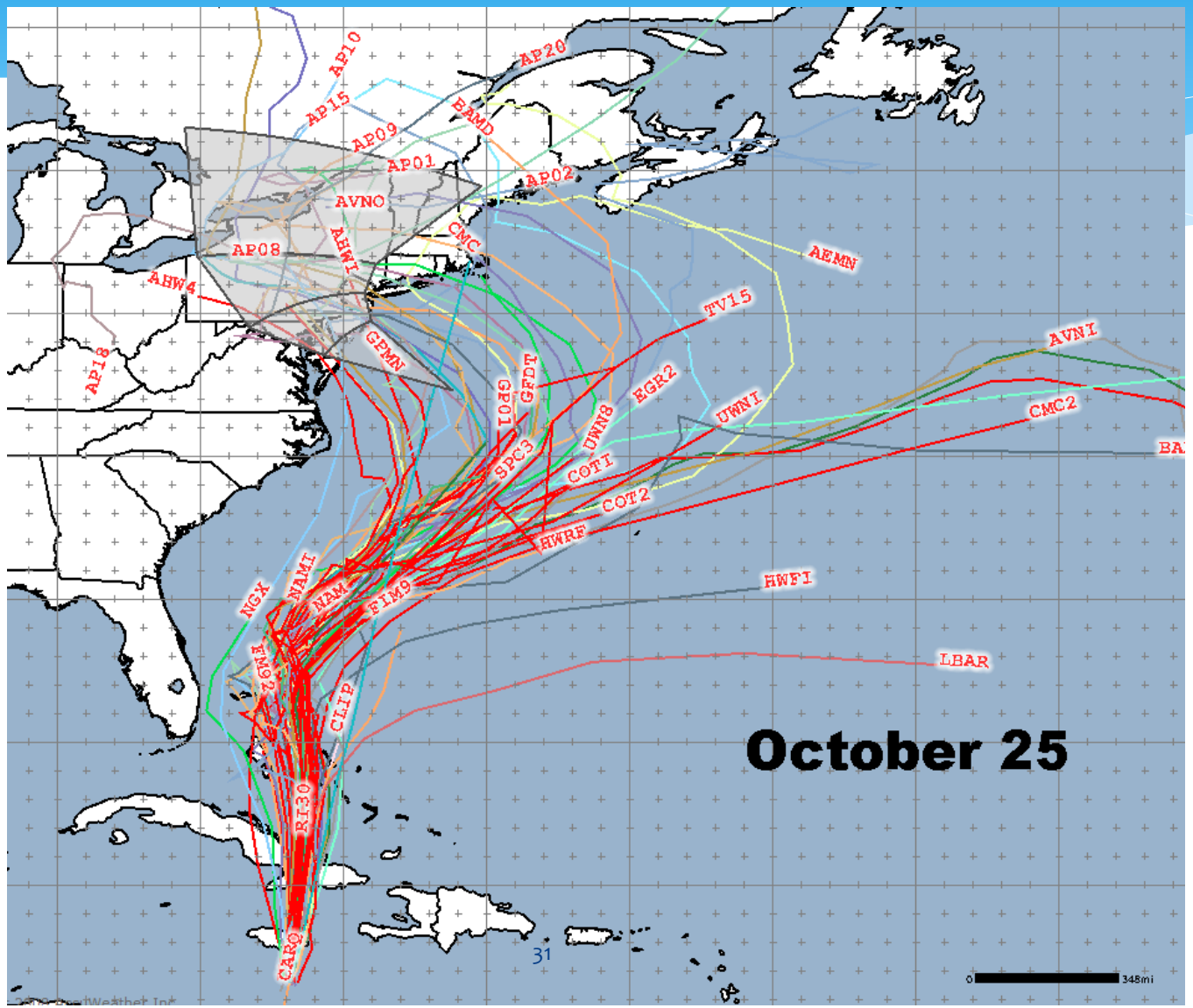




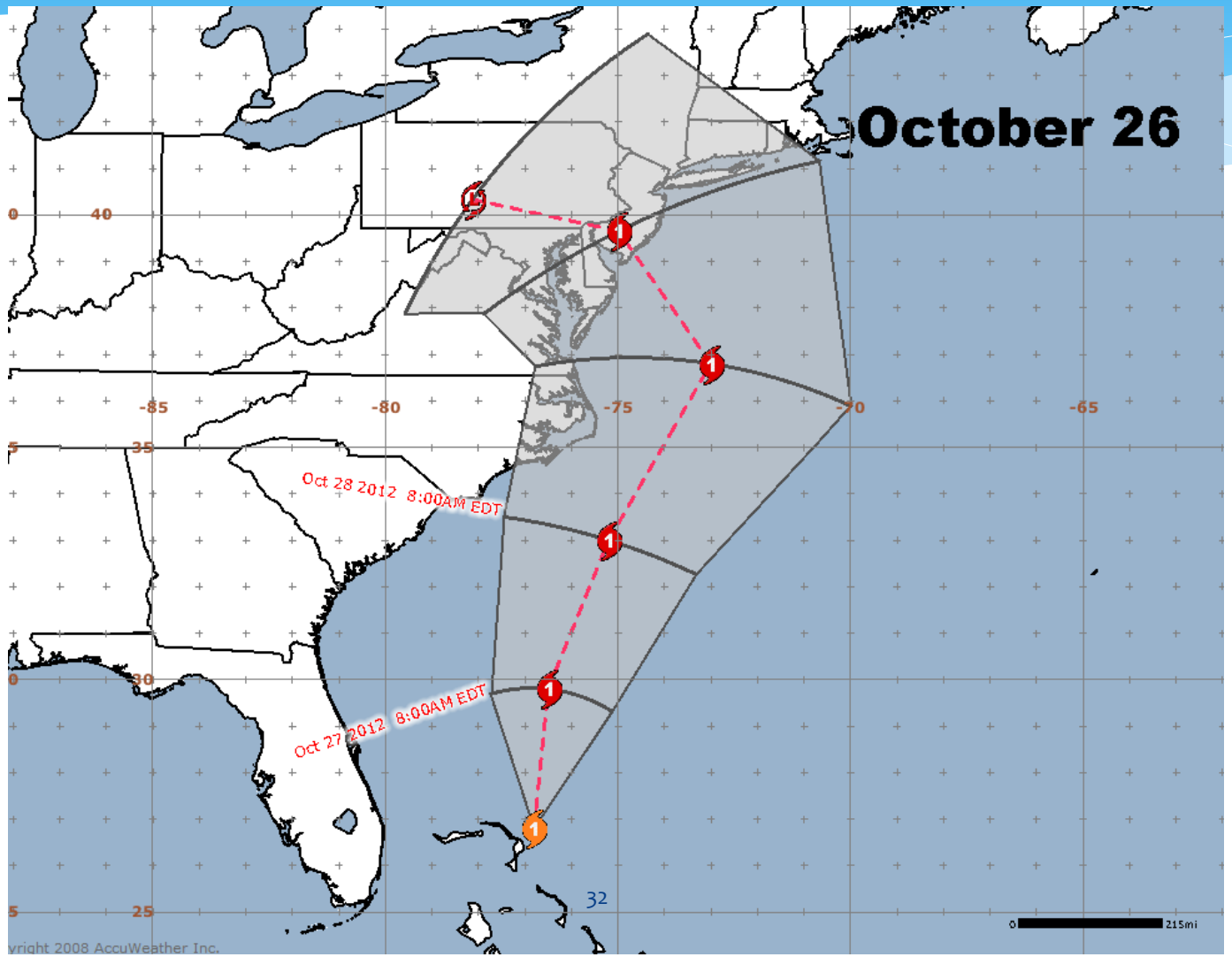
Five Days From Landfall



Hurricane Models

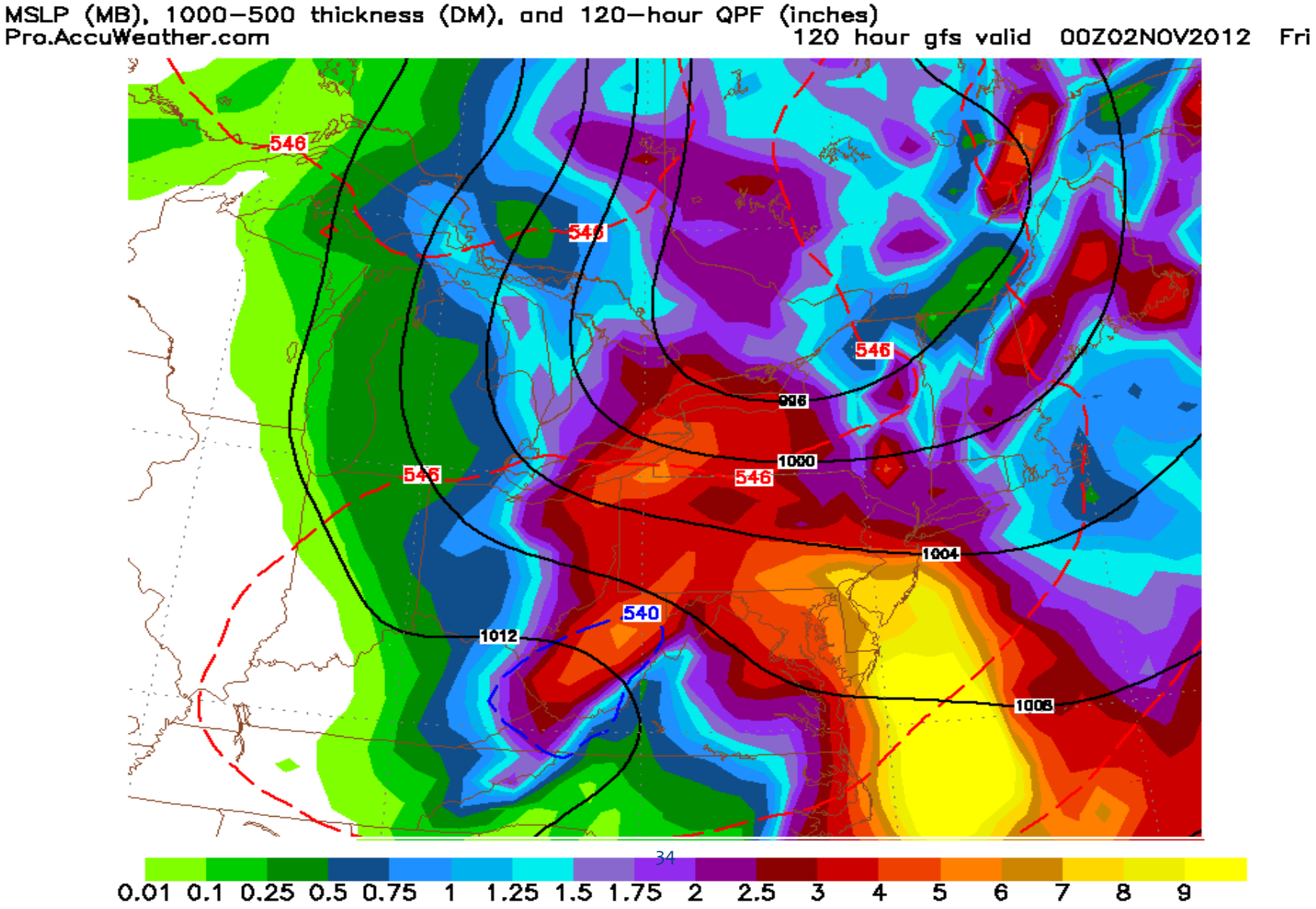


AccuWeather Forecast Oct 26

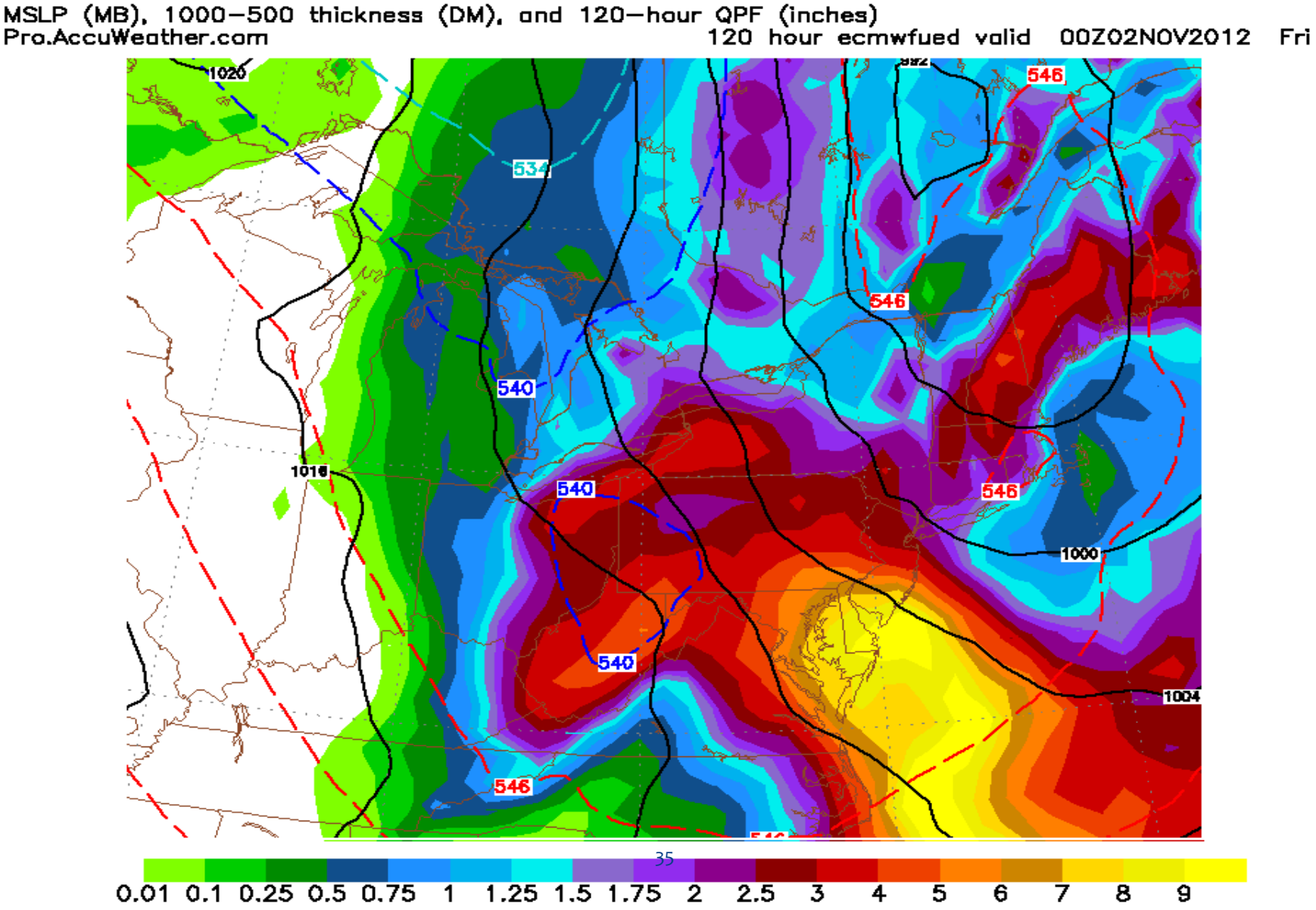


Rainfall Forecast

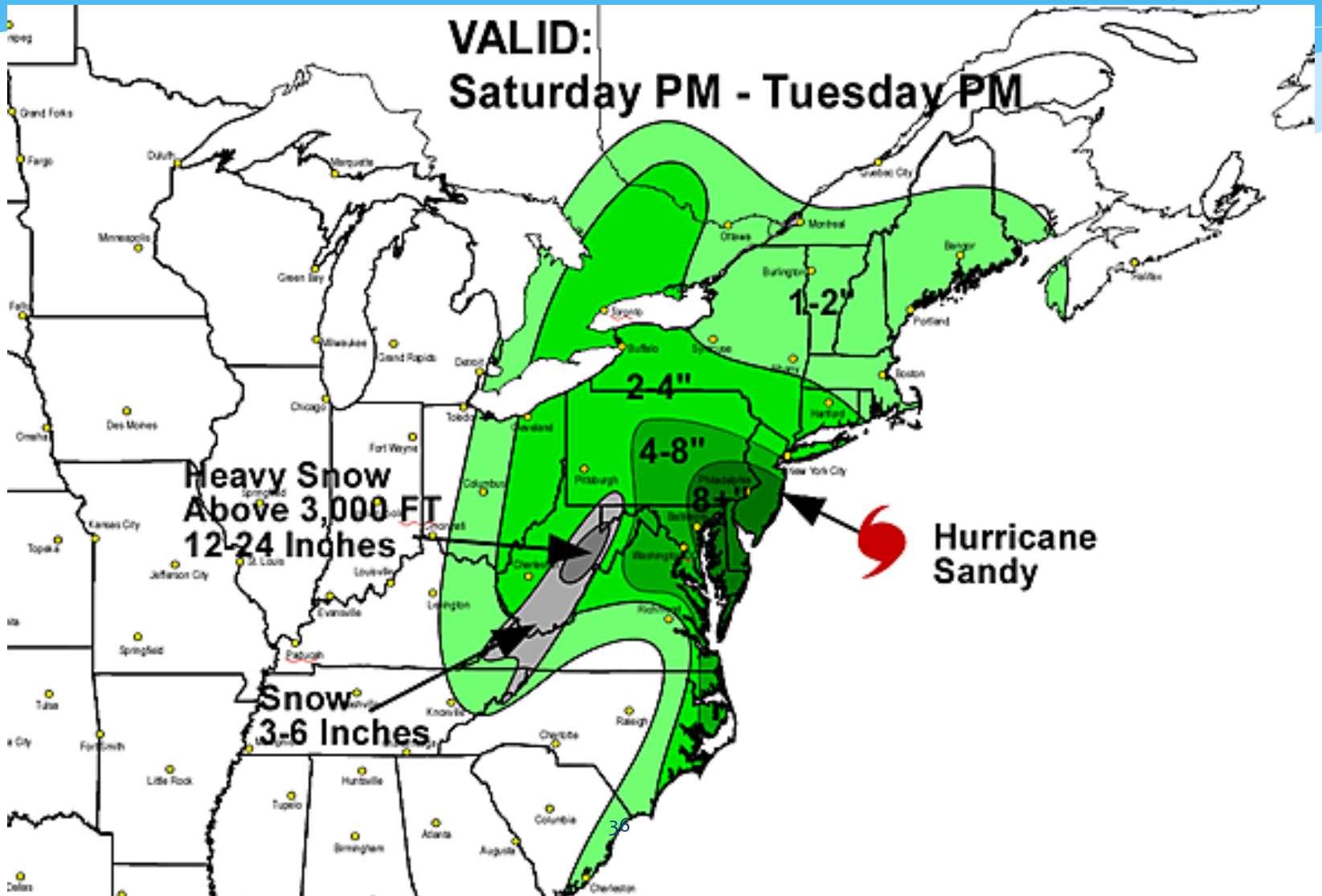
00z SUN GFS Total Precip



00z SUN EURO Total Precip

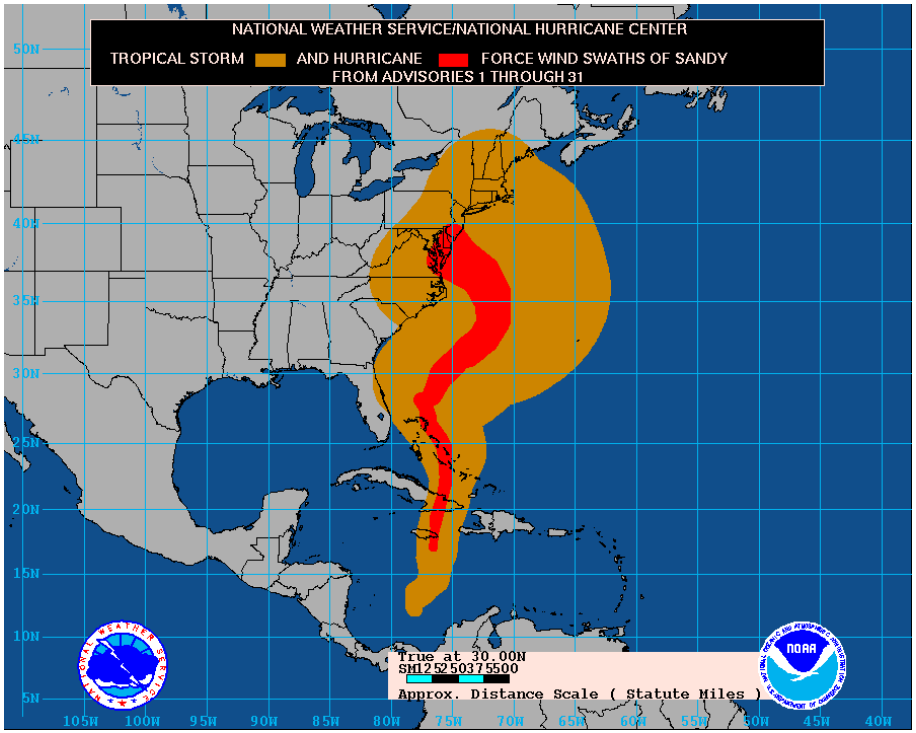


Rainfall Forecast

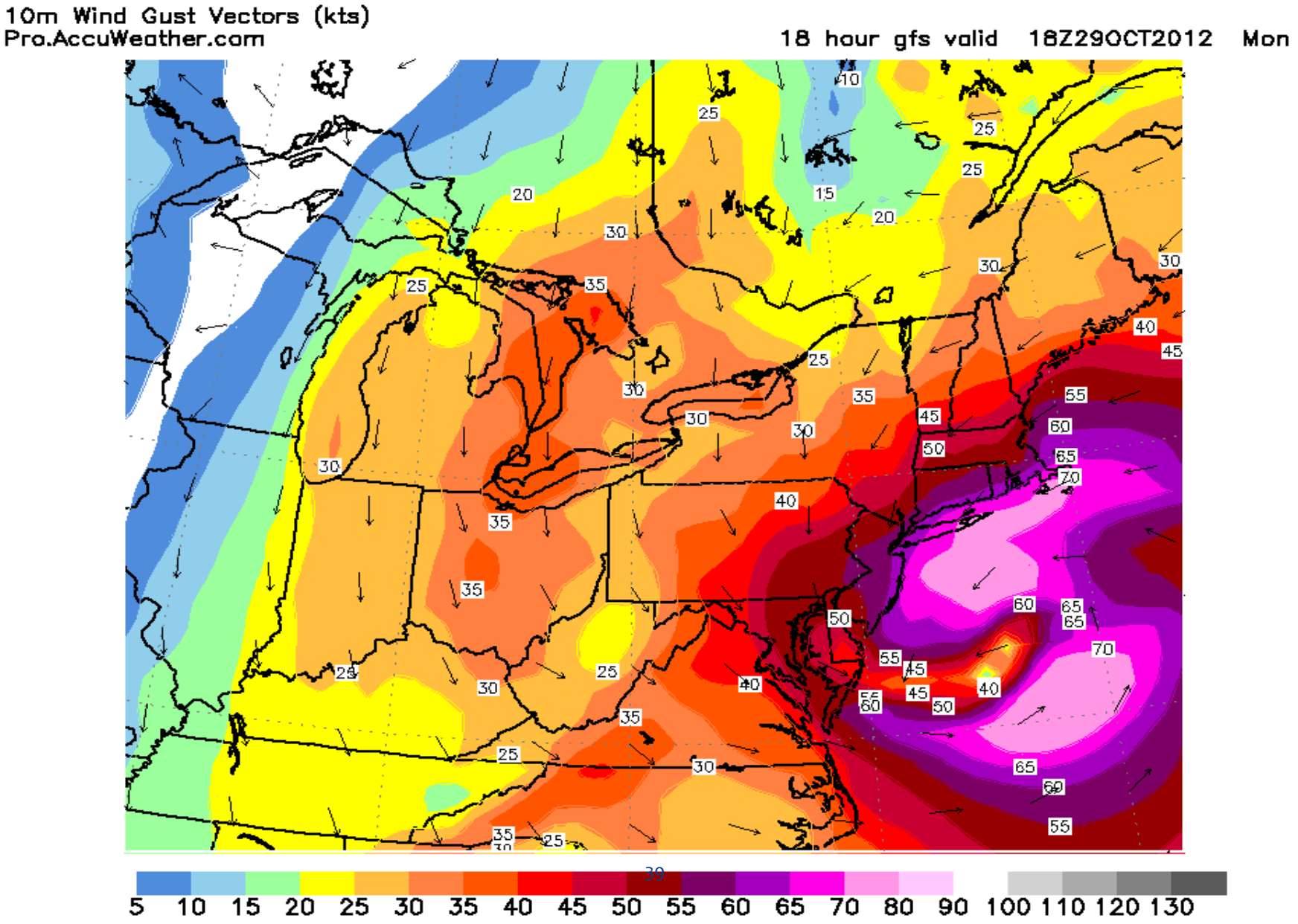


Wind Forecast

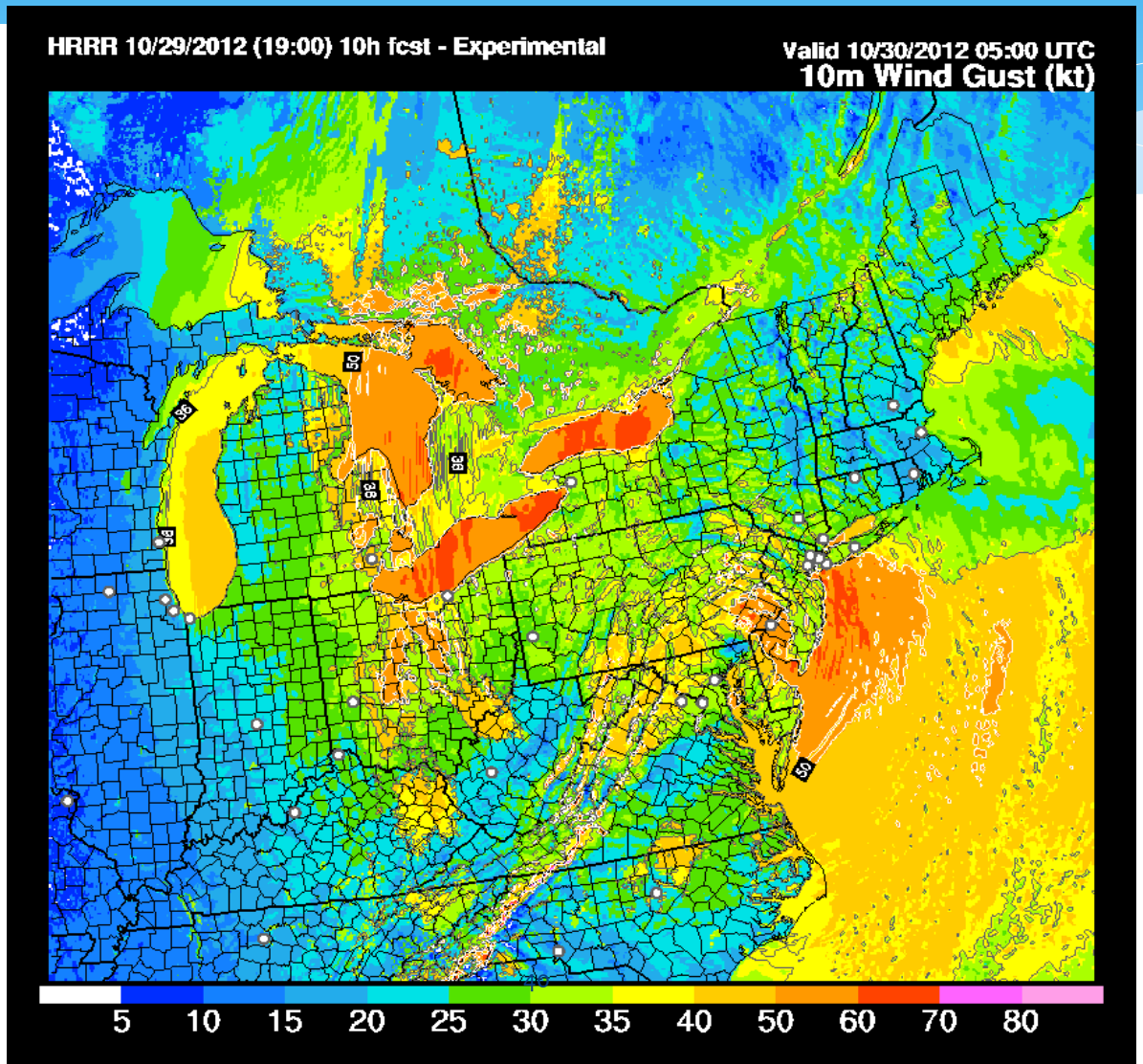
Expanding Wind Field



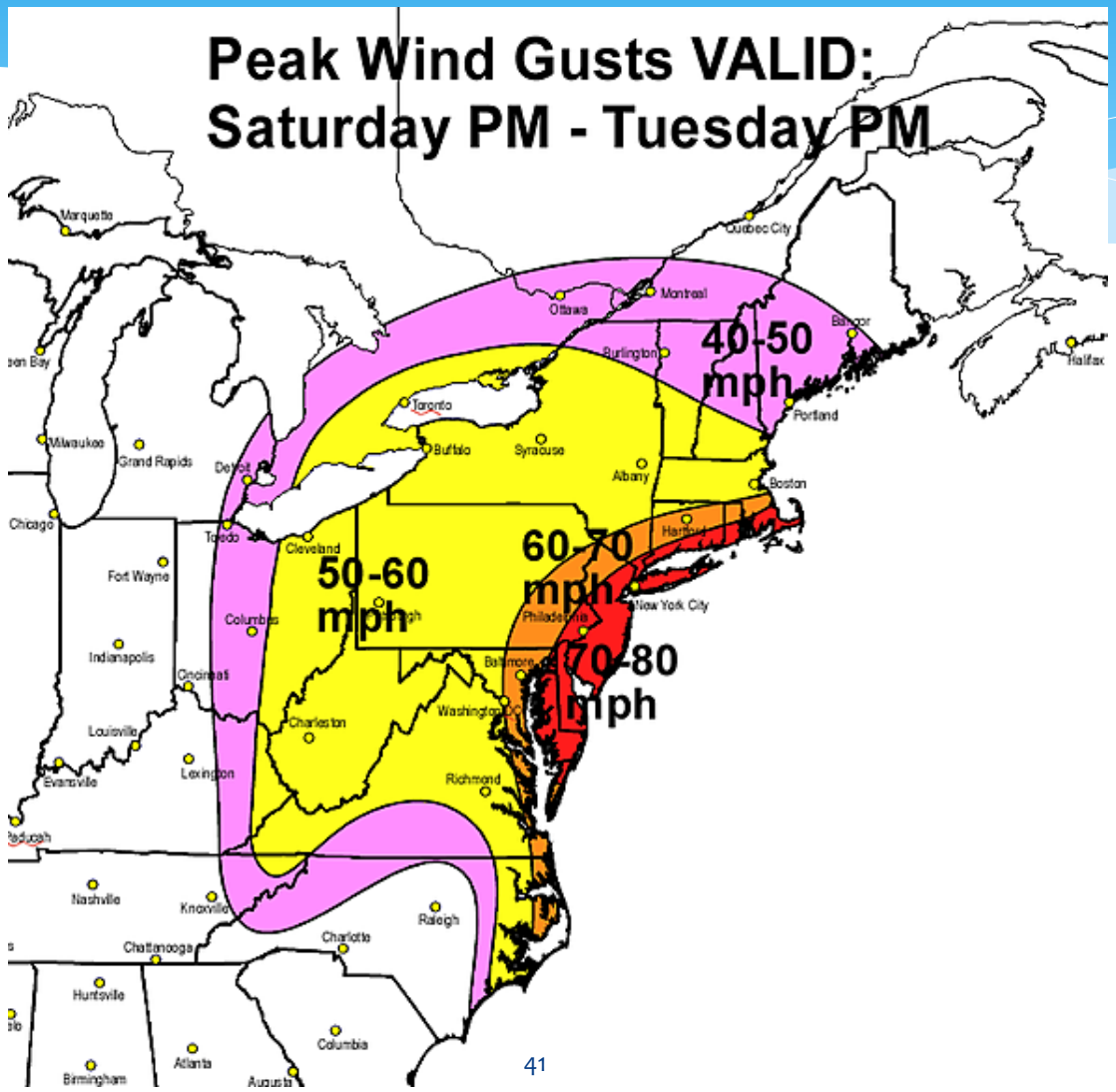
12z/SUN GFS 18 HR GUST valid 18z MON



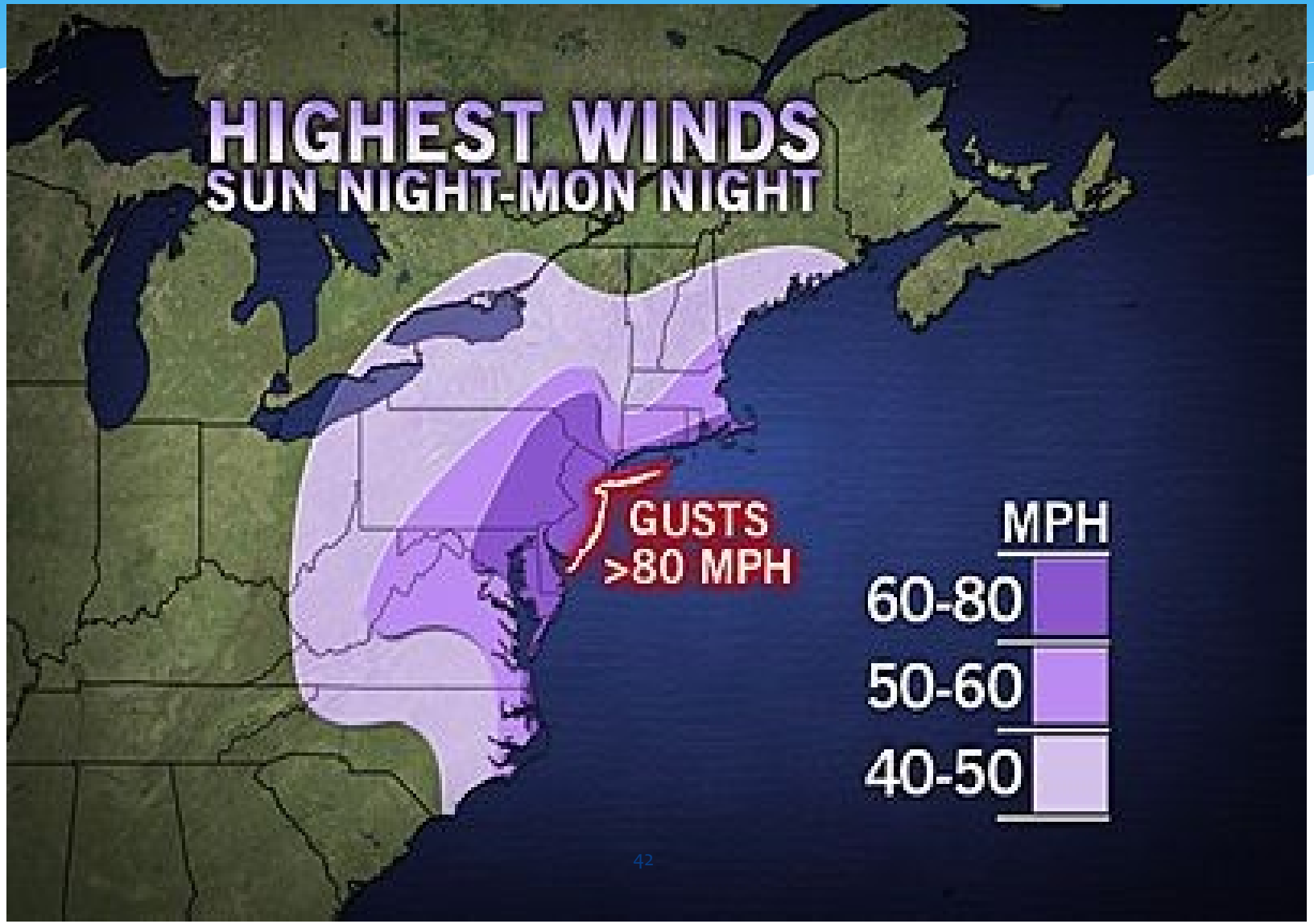
Short-Range Wind Forecast



Wind Forecast

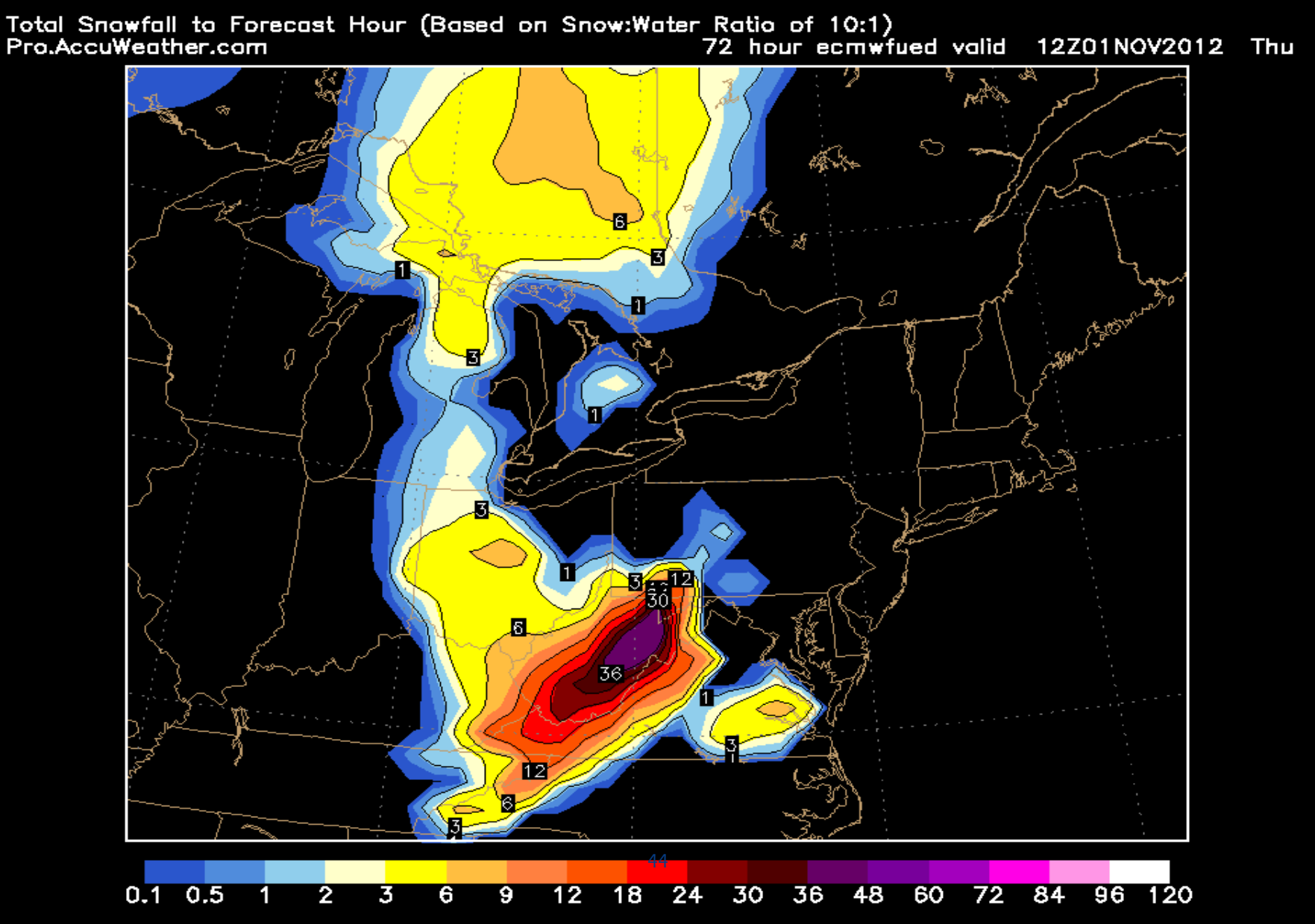


Wind Forecast for Sandy

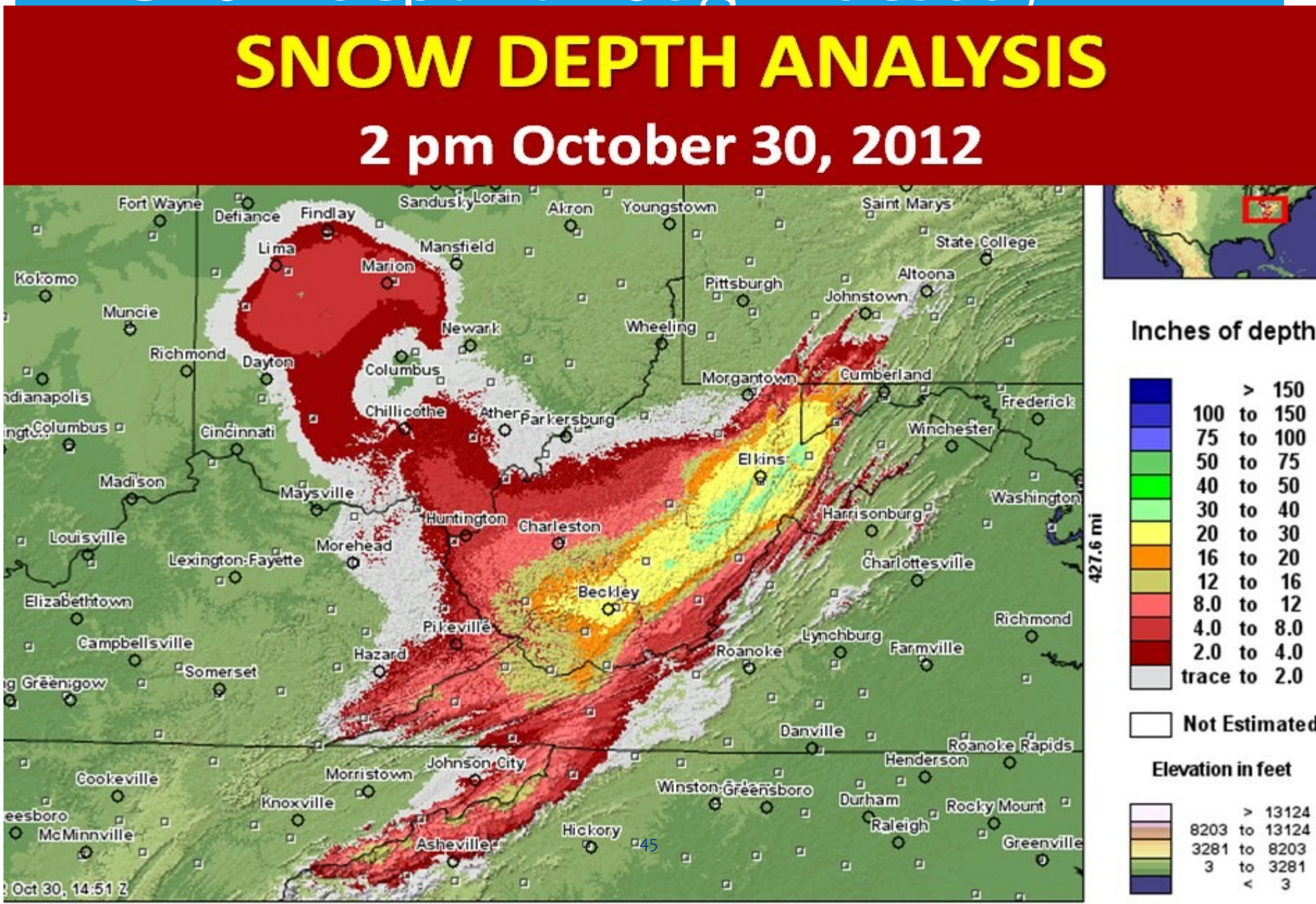


Snow Forecast

12z MON EURO Total Snowfall

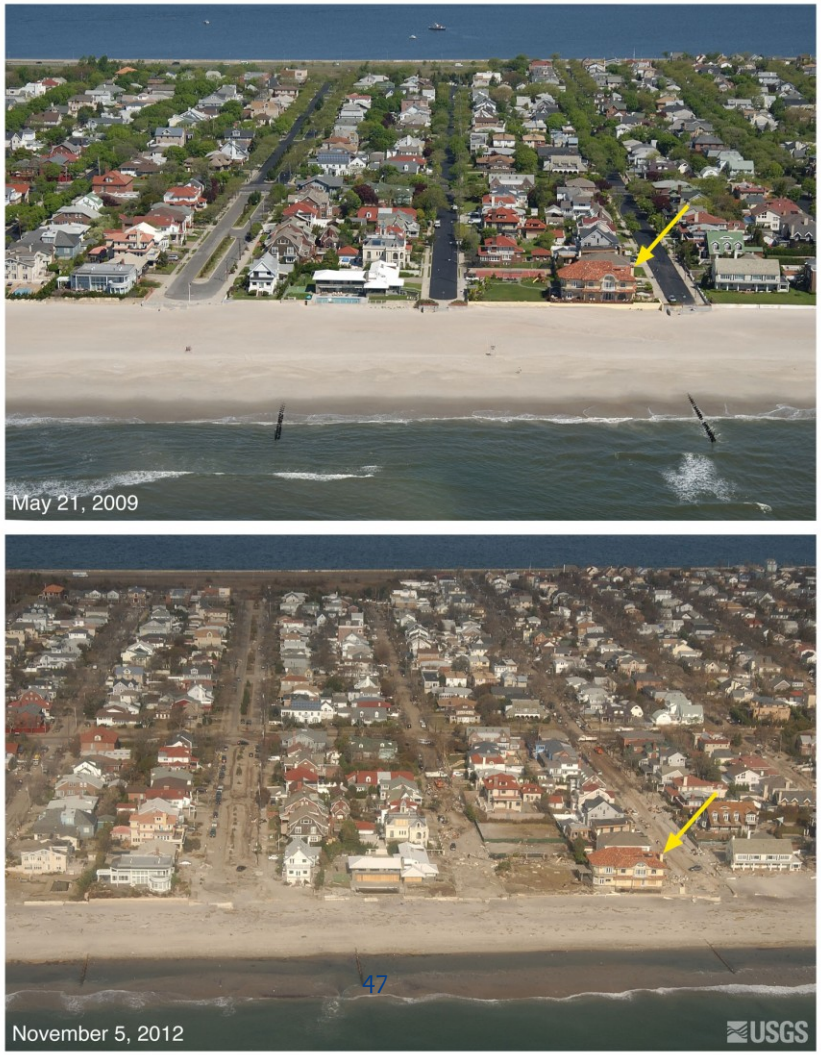


Snow depth through Tuesday PM

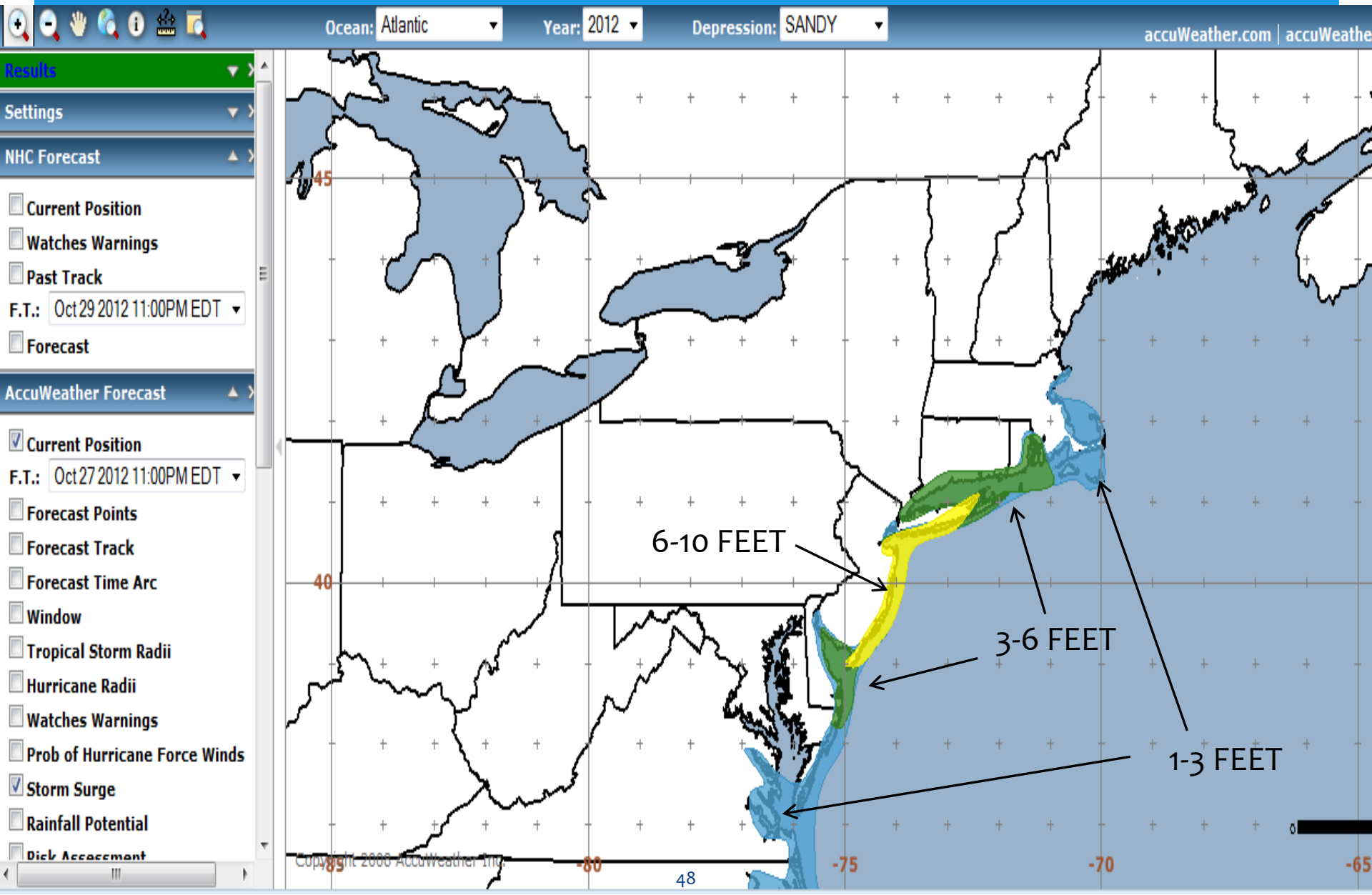


Storm Surge Forecast

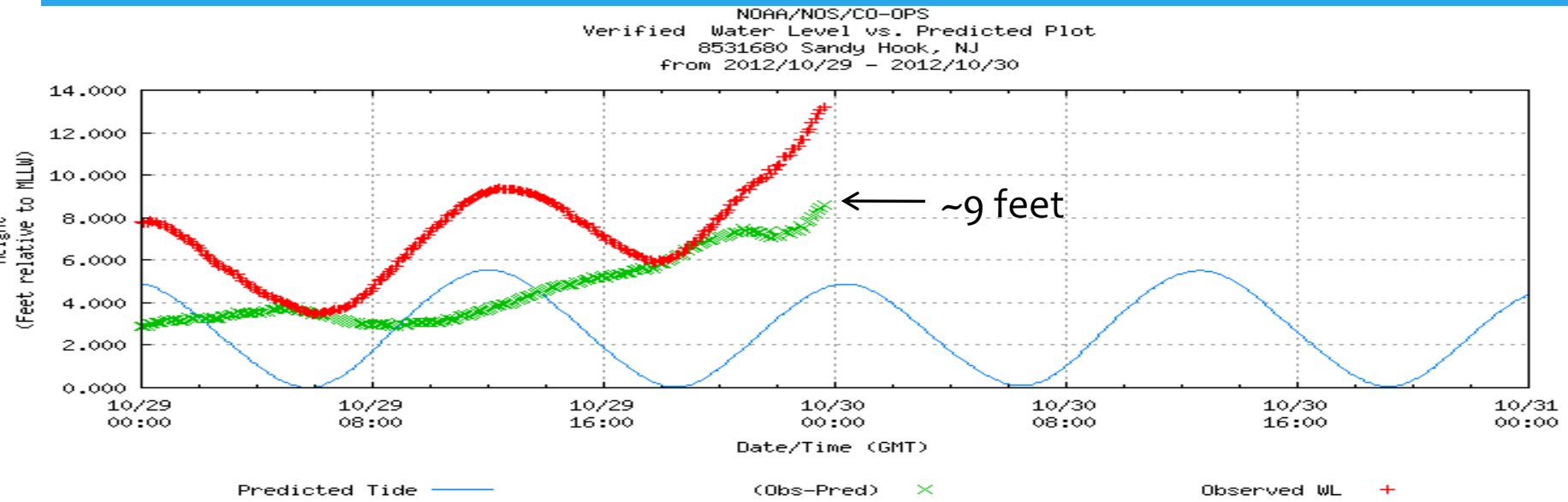
Sandy's Storm Surge

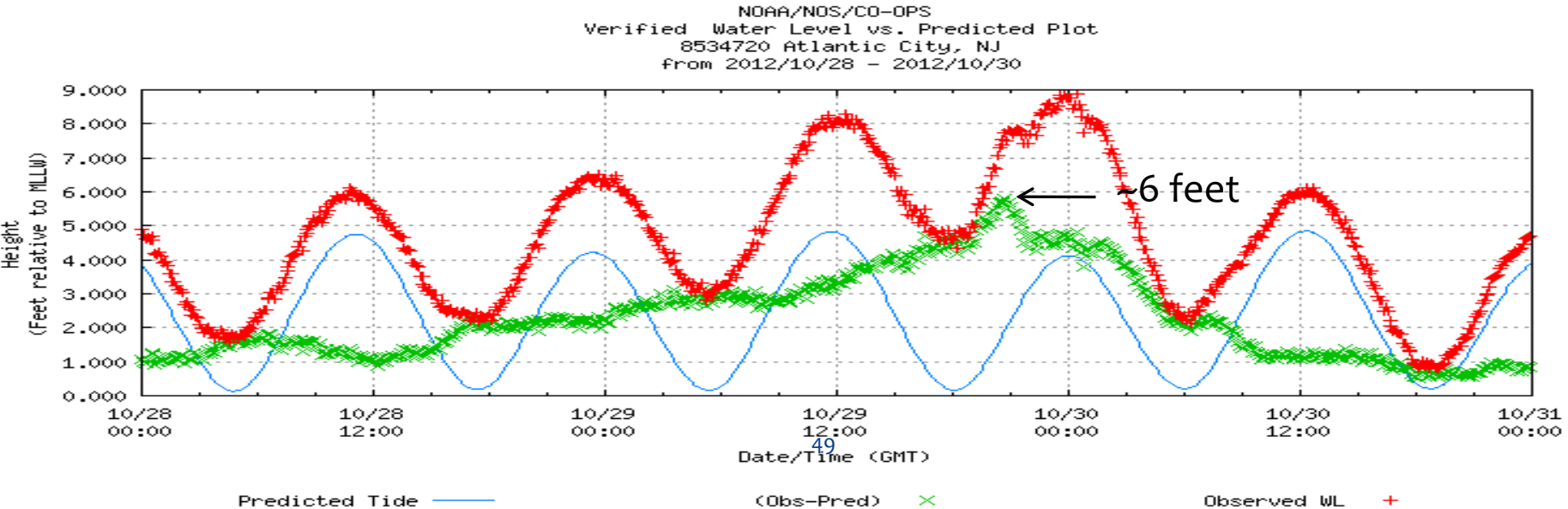


STORM SURGE FORECAST SATURDAY NIGHT



Sandy Hook, NJ , before malfunctioning (top)
Atlantic City, NJ (bottom)

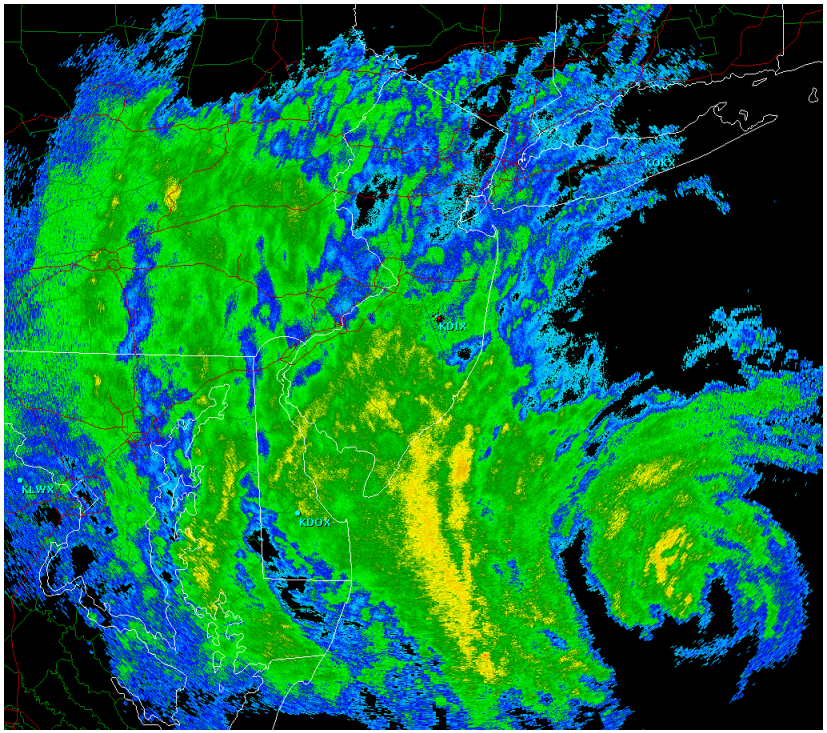




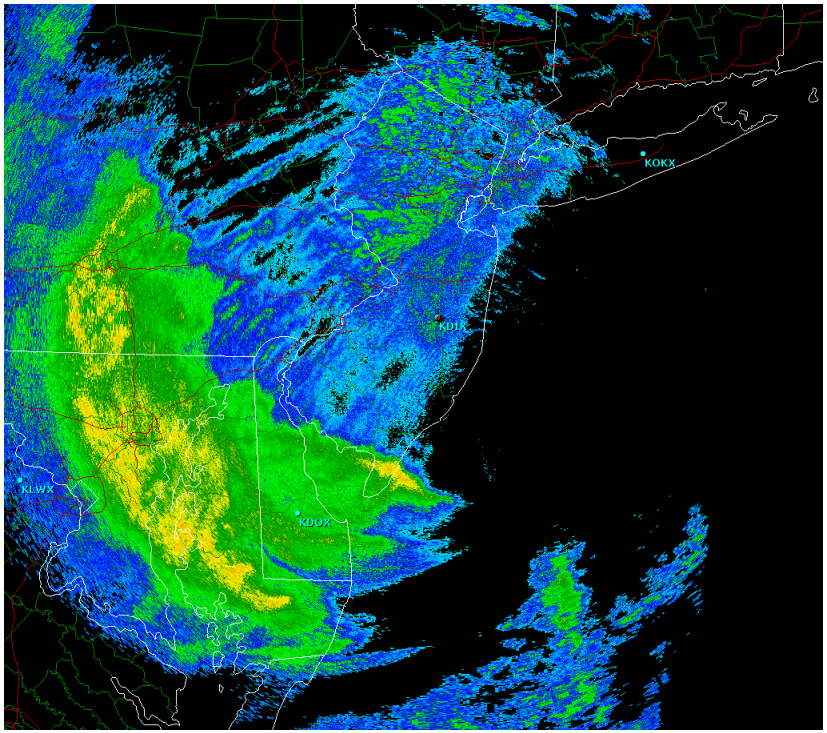
Communication Problems with Sandy

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

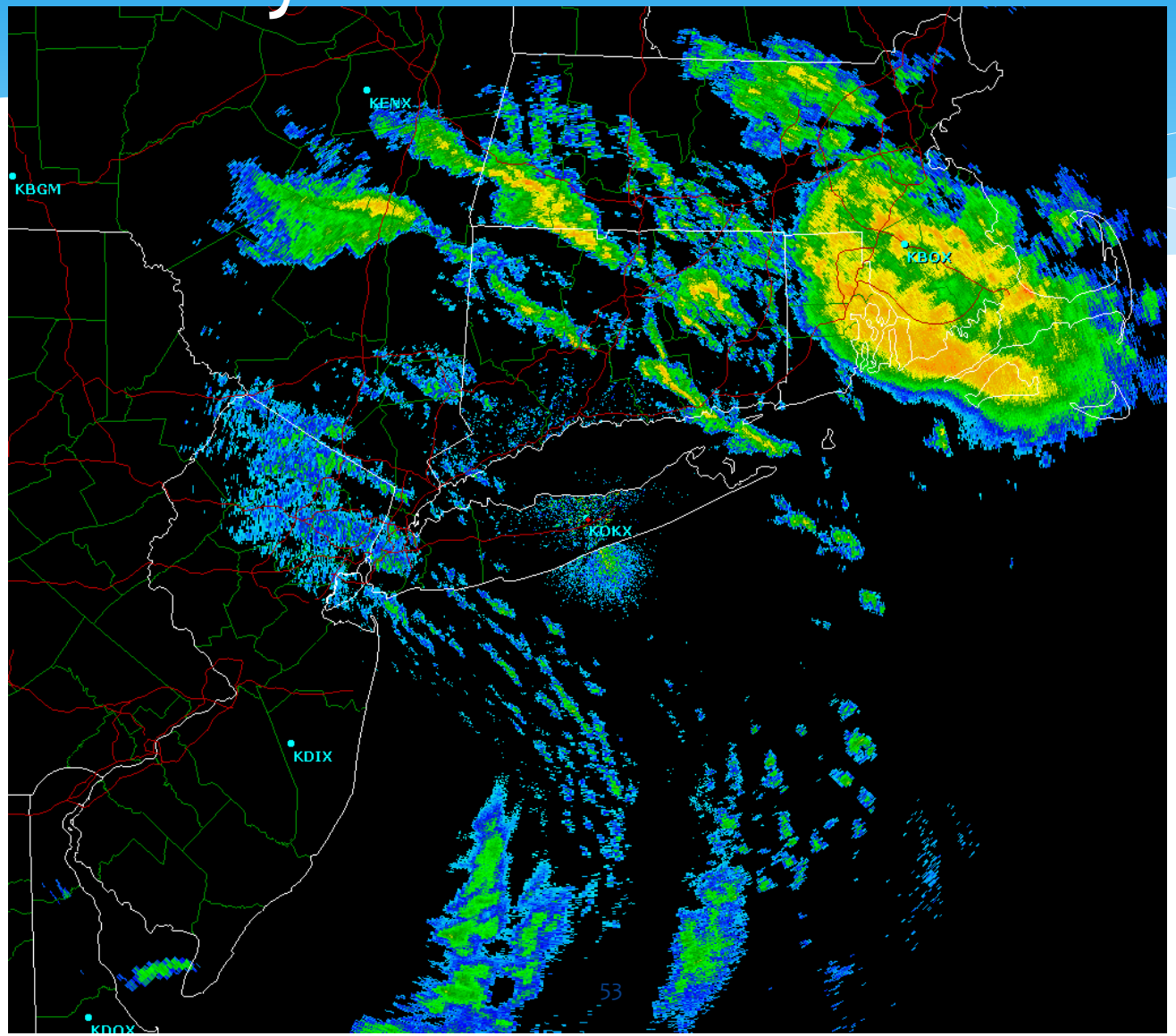
Sandy Monday Afternoon



Sandy at Landfall



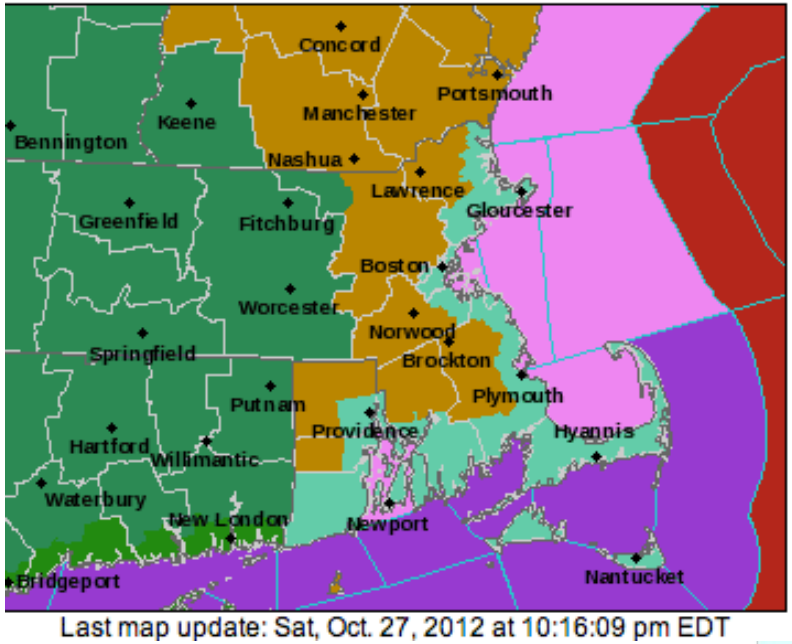
Sandy Landfall Radar NYC



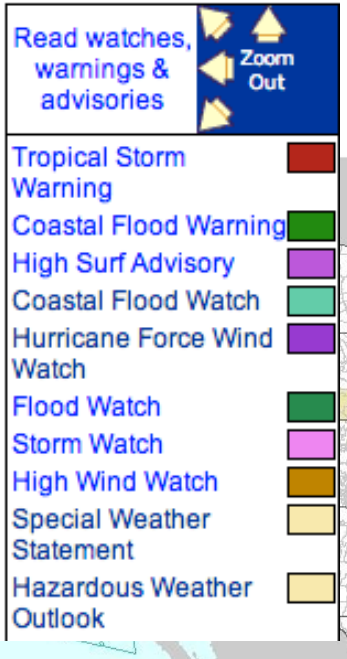
NWS Downgrades Sandy Before Landfall

* 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



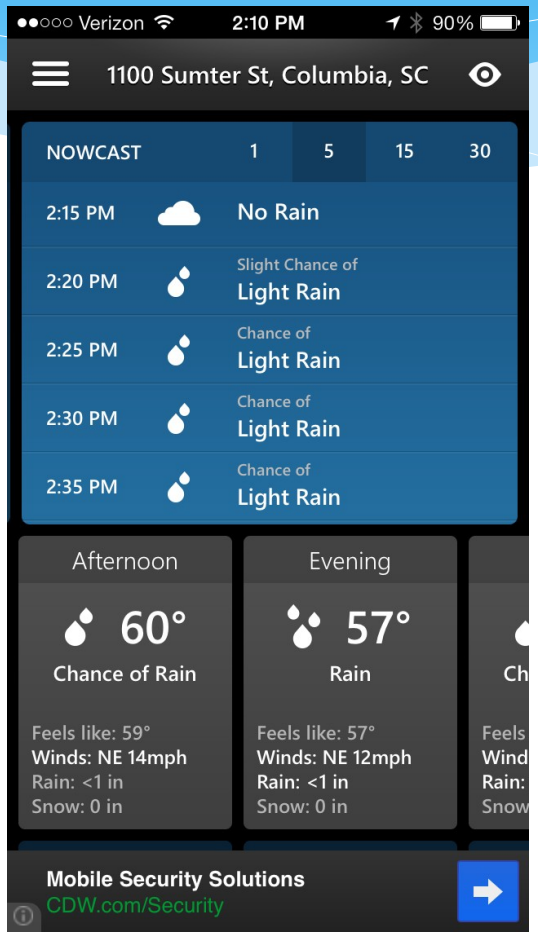
What's the Future Hold for the Communicologist?

Challenges for Future Communicologist

* Data Overload – Too much data to quickly an 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 verses 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?